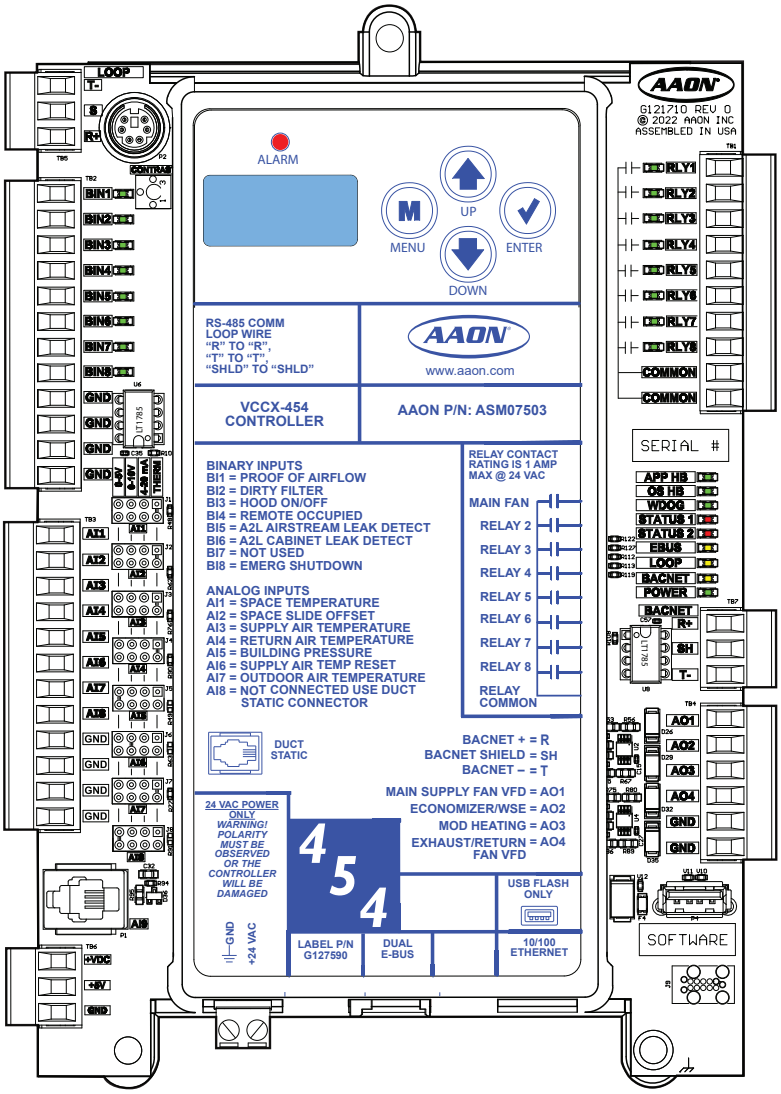
Compatible with
VCCX-454
Series

VCCX-454 Controller Technical Guide

ASM07503

Software SS1188



VCCX-454 CONTROLLER TECHNICAL GUIDE	
REVISION AND DATE	**CHANGE**
Rev. A, June 21, 2024	Original
Rev. B, July 9, 2024	Updated A2L MC information
Rev. C, December 5, 2024	Updated A2L Leak Alarms (Air stream and Cabinet) and BACnet points. Updated A2L Leak Detection Sequences for Air Stream Sensors only, Gas Heat Sensors only, and both air Stream and Gas Heat Sensors. Added support for ASM01900 (SMTS-L)
Rev. D, February 26, 2025	Updated Failure Mode Alarm, removed obselete hand held device information
Rev. E, May 16, 2025	Updated Single and Multi-loop diagrams,

This manual is available for download from www.aaon.com

AAON, Inc.
2425 South Yukon Ave.
Tulsa, OK 74107-2728
www.aaon.com
Factory Technical Support Phone: 918-382-6450
Controls Support Phone: 866-918-1100

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Features

CAUTION: This controller is intended to only function with units operating with R-454B refrigerant.

The VCCX-454 Controller is designed with eight analog inputs, four analog outputs, eight binary inputs, and eight relay outputs (seven configurable). It also has on-board BACnet ports for connection to an MS/TP or IP network. The VCCX-454 contains a 2 x 8 LCD character display and four buttons that allow for status and alarm display, force modes, and BACnet configuration.

The VCCX-454 Controller's capabilities are expanded with modules including the RM454 series refrigeration modules, A2L Mitigation Controller, BD-3PI, MHGRV-X, MODGAS, EM1 and 12 Relay Expansion Module.

It has an on-board ethernet port for connection to BACnet/IP network, a terminal block for BACnet/MSTP connection, and retains a wattcomm connection.

There are two EBUS expansion ports to allow communication to the modules and sensors.

The VCCX-454 also has an on board USB port for updating the controller.

The VCCX-454 Controller provides for the following applications: constant air volume (CAV), variable air volume (VAV), single zone VAV, make-up air (MUA), dedicated outdoor air system (DOAS), and space temperature control of high percentage outdoor air.

Other features of the VCCX-454 include:

- Controls up to eight digital compressors
- Controls up to four variable frequency drive (VFD) compressors
- Controls up to 12 stages of heat
- Modulating cooling output for chilled water valve control
- Modulating heating output (hot water valve, steam valve, SCR electric heat control)
- Advanced dehumidification capabilities
- Air-to-air heat pump and water source heat pump applications
- Airflow monitoring of outdoor air, supply air, return air, and exhaust air streams with approved EBTRON, GreenTrol, or Paragon Airflow MicroTransEQ Monitoring Stations
- Airflow control of outdoor air damper
- Single zone VAV control with optional CAV heating
- Primary/secondary heating control
- Remote forced occupied, cooling, heating, and dehumidification control
- Remote supply air temperature reset signal
- Adaptive supply air temperature reset
- Selectable mode enable sensor
- Fan proving
- Dirty filter alarm
- Emergency shutdown input (smoke detector/firestat or other shutdown conditions)
- Drybulb/wetbulb/dewpoint/comparative enthalpy control of economizer operation
- Waterside economizer capability
- Building pressure control strategies
- Indoor air quality economizer reset
- Title 24 economizer (FDD)
- Seven-day, two-events-per-day scheduling
- 14 holiday event scheduling
- Daylight Saving Time adjustment
- Trend logging
- Static pressure control
- Heat wheel capabilities
- Head pressure control

Important Wiring Considerations

WIRING DETAILS				
Control Device	**Voltage**	**VA Load**	**Temp**	**Humidity (Non-Condensing)**
VCCX-454 Controller	18-30 VAC	15	-22°F to 158°F	0-95% RH
Evaporative Condenser, RM454-D, RM454-V, RM454-Z, and RM454-SC	18-30 VAC	18	-22°F to 158°F	0-95% RH
EM1 Expansion Module	18-30 VAC	5	-22°F to 158°F	0-95% RH
12 Relay E-BUS Expansion Module	18-30 VAC	15	-22°F to 158°F	0-95% RH

Table 1: Voltage and Environment Requirements

General

Correct wiring of the VCCX-454 Controller is the most important factor in the overall success of the controller installation process. In general, most VCCX-454 Controllers are installed and wired at the AAON factory. It is also possible to purchase these controllers through a local AAON representative for installation in the field. Some of the following information pertains to field wiring and may not apply to the installation if it was pre-wired at the factory. However, if troubleshooting of the controller is required, it is a good idea to be familiar with the system wiring, no matter if it was factory or field wired.

Controller Mounting

When the controller is to be field mounted, it is important to mount the controller in a location that is free from extreme high or low temperatures, moisture, dust, and dirt. See **Table 1, this page**, for a list of the required operating conditions for the VCCX-454 Controller and associated expansion modules.

The VCCX-454 Controller is housed in a plastic enclosure. It is designed to be mounted by using the three mounting holes in the enclosure base. The VCCX-454 Controller needs to be installed in an environment which can maintain a temperature range between -22°F and 158°F not to exceed 95% relative humidity levels (non-condensing). Be careful not to damage the electronic components when mounting the controller.

Wiring

The VCCX-454 Controller and expansion modules must be connected to a 24 VAC power source of the proper size for the calculated VA load requirements. All transformer sizing should be based on the VA rating listed in **Table 1, this page**.

WARNING: When using a single transformer to power multiple controllers or expansion modules, the correct polarity must always be maintained between the boards. Failure to observe correct polarity will result in damage to the controller and expansion modules.

Please carefully read and apply the following information when wiring the VCCX-454 Controller, refrigeration modules, and expansion modules.

- Auxiliary Power Out electrical ratings:
  +VDC is 28-31 VDC at 200mA, +5V is 5 VDC at 100mA.
- All wiring is to be in accordance with local and national electrical codes and specifications.
- 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.
- The minimum wire size for 24 VAC wiring is 18-gauge.
- The minimum wire size for all sensors is 24-gauge. Some sensors require two-conductor wire, and some require three-or four-conductor wire.
- The minimum wire size for 24 VAC thermostat wiring is 22-gauge.
- Be sure 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.
- When wiring VCCX-454 Controllers together or to connect to other communication devices, WattComm wiring dictates the 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. If desired, Belden #82760 or equivalent wire may also be used. BACnet MS/TP wiring is to be in accordance with ASHREA Standard 135-2016 or later.
- Before applying power to the VCCX-454 Controller, recheck all wiring connections and terminations thoroughly.

Powering Up

When the VCCX-454 and connected modules are first powered up, the POWER LED should light up and stay on continuously. If it does not light up, verify the 24 VAC is connected to the controller, the wiring connections are tight, and they are wired for the correct polarity. The 24 VAC power must be connected so 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.

A2L Leak Detection Sequences

NOTE: The following sequences are only applicable with a VCCX-454 connected to an A2L Mitigation Controller. Refer to the A2L Mitigation Controller Technical Guide for stand-alone sequences.

NOTE: The A2L Leak Detect alarms will stay active on the VCCX-454 even if the condition is cleared. Once the leak detection clears, the VCCX-454 will operate its regular sequence with the alarms active. The alarms can only be manually cleared by power cycling the VCCX-454 or by using the keypad and display on the VCCX-454.

Airstream Leak Detection Only

When the A2L Mitigation Board detects a leak in the airstream, all compressor operations cease immediately, and the A2L Airstream Leak Detect alarm will be activated.

If the unit is commanded to be occupied

It will operate as it would normally with the compressors locked out. If the supply fan is configured for variable speed it will ramp up to 100%.

If the unit is commanded unoccupied at any time while the alarm is active

- The unit fan will be forced to operate based on the current control method configured. If the supply fan is configured for variable speed it will ramp up to 100% in 90 seconds.
- Heating can operate as required; however, it will only operate to the unoccupied control temperatures.
- If the HVAC Mode is SAT Tempering, Outdoor Air (MUA), or DOAS Unit.
  - Operate the unit as if it were in Occupied Mode using regular setpointst.
- If the HVAC Mode is Supply Air, Return Air, Space Temp, Space Temp with High % OA, Single Zone VAV.
  - Operate the unit as if it were in Unoccupied Mode using setback setpoints.
  - If Night Setbacks are set to 30ºF (disabling unoccupied operation) run with Occupied setpoints.

Alarms related to compressors not operating should not be activated as there are no issues with the compressors.

Cabinet Leak Detection Only

When the A2L Mitigation Board detects a leak in the cabinet, the A2L Cabinet Leak Detect alarm will be activated. All compressor and gas heat operations will cease immediately. Electric, hot water, and steam heat sources will still be able to operate.

If the unit is a MUA and the supply air temperature drops below the Low SAT Cutoff setpoint it will shut the unit down immediately.

If the unit is off it will stay off.

Cabinet and Airstream Leak Detection

When the A2L Mitigation Board detects a leak in the cabinet and the airstream, both A2L Cabinet Leak Detect Alarms are activated.

If the unit is commanded to be occupied

It will operate as it would normally with the compressors and gas heat locked out. If the supply fan is configured for variable speed, it will ramp up to 100%.

If the unit is commanded unoccupied at any time while the alarm is active

- The unit fan will be forced to operate based on the current control method configured. If the supply fan is configured for variable speed it will ramp up to 100% in 90 seconds.
- The OA damper is not required to open unless configured to as a MUA or DOAS. If economizer cooling is allowed, it will only operate to the unoccupied control temperatures.
- If the HVAC Mode is SAT Tempering, Outdoor Air (MUA), or DOAS Unit.
  - Operate the unit as if it were in Occupied Mode using regular setpoints.
- If the HVAC Mode is Supply Air, Return Air, Space Temp, Space Temp with High % OA, Single Zone VAV.
  - Operate the unit as if it were in Unoccupied Mode using setback setpoints.
  - If Night Setbacks are set to 30ºF (disabling unoccupied operation) run with Occupied setpoints.

Alarms related to compressors not operating should not be activated as there are no issues with the compressors.

Applications

Variable Air Volume Unit

Units designed for VAV cooling-only applications with morning warm up. All other heating is from VAV boxes. The controller is configured to control the supply fan to maintain a Duct Static Pressure Setpoint.

Supply Air Tempering

Units requiring heating operation to heat to a cooling SAT setpoint. All other heating is from VAV boxes. The controller is configured to control the supply fan to maintain a Duct Static Pressure Setpoint.

Space Temperature Controlled

Space temperature-controlled units require the space temperature sensor as the mode enabling sensor.

Return Temperature Controlled

Return temperature-controlled units require the return temperature sensor as the mode enabling sensor. This application is used for a VAV voting system.

Space Temperature Control of High Percentage Outdoor Air Units

Units are configured to use the space temperature as the mode enable sensor. When the space temperature is satisfied, the controller will utilize the outdoor air temperature sensor as the mode enable sensor before entering vent mode to avoid dumping unconditioned air into the space.

Single Zone Variable Air Volume

Units are configured to use the space temperature as the mode enable sensor. The supply fan modulates based off of the space temperature for fan energy savings. This application can be configured with high percentage of outdoor air functionality.

Make-Up Air Unit

Units are configured to use the outdoor air temperature as the mode enable sensor. Dehumidification mode utilizes the outdoor air dewpoint.

Dedicated Outdoor Air System

Units are configured to use the outdoor air temperature as the mode enable sensor. Dehumidification mode utilizes the outdoor air dewpoint and resets the coil temperature based off the supply air dewpoint.

HVAC Mode by Binary Inputs

Units use binary inputs to initiate heating, cooling, vent and dehumidification modes of operation.

Part Number Cross Reference

PART NUMBER CROSS REFERENCE	
PART DESCRIPTION	**AAON**
VCCX-454 Controller	ASM07503
VCC-X EM1 Expansion Module	ASM01691
A2L MC	ASM07563
BD-3PI	ASM07771
RM454-V	ASM07718
RM454-D	ASM07716
RM454-Z	ASM07717
RM454-SC	ASM07719
12 Relay E-BUS Expansion Module	ASM01873
Building Static Pressure Transducer	ASM01832
CommLink 5/CommLink 6	ASM01874/ASM07420
Duct Static Pressure Transducer and Pickup Tube	ASM01640 and ASM02242
Duct Temperature Sensor - 6” or 12”	G051240 / G051250
E-BUS Cable Assembly E-BUS Power and Comm 1.5 ft., 3 ft., 10 ft., 25 ft., 50 ft., 75 ft., 100 ft., 150 ft., 250 ft., and 1000 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 (SPOOL)
E-BUS Adapter Hub	G033970
E-BUS Adapter Hub with 1.5 ft. EBC Cable	ASM01635
E-BUS Adapter Board	ASM01878
E-BUS CO_2 Space Sensor (wall or duct mounted)	ASM01829 / ASM01831
E-BUS Digital Room Sensor - LCD - Temp. or Temp and RH	ASM01819 / ASM01820
E-BUS Digital Room Sensor - No LCD - Temp and RH	ASM02221
E-BUS Horizontal Outdoor Air Temperature and RH Sensor	ASM01836
E-BUS Vertical Outdoor Air Temperature and RH Sensor	ASM01838
E-BUS Return Air Temperature and RH Sensor	ASM01840
E-BUS CO_2 Return Air Sensor Emulator Board	ASM01623
E-BUS CO_2 Space Sensor Emulator Board	ASM01622
E-BUS Outdoor Air Temp/RH Sensor Emulator Board	ASM01697
E-BUS Return Air Temp/RH Sensor Emulator Board	ASM01621
E-BUS Space Temp/RH Sensor Emulator Board	ASM01696
GPC-XP Controller	ASM01868
IP Module Kit	ASM01902
MHGRV-X Module / Reheat Expansion Module	ASM01670 / ASM01687
MiniLink Polling Device 5	ASM01626
MODGAS-X Module	ASM01668
MODGAS-XWR2 Module	ASM01695
Outdoor Air Temperature Sensor	G042230
PREHEAT-X Module / PREHEAT-X-EXT Module	ASM01688 / ASM01689
Standard Room Sensor - Plain or W/ Override	ASM02227 / ASM01638
Standard Room Sensor - with Setpoint Adjust or Setpoint Adjust and Override	ASM01642 / ASM01643
Strap-On Temperature Sensor Kit	ASM01624
Suction Pressure Transducer	ASM02222
USB-Link 2 Kit	ASM02244

VCCX-454 Controller Components

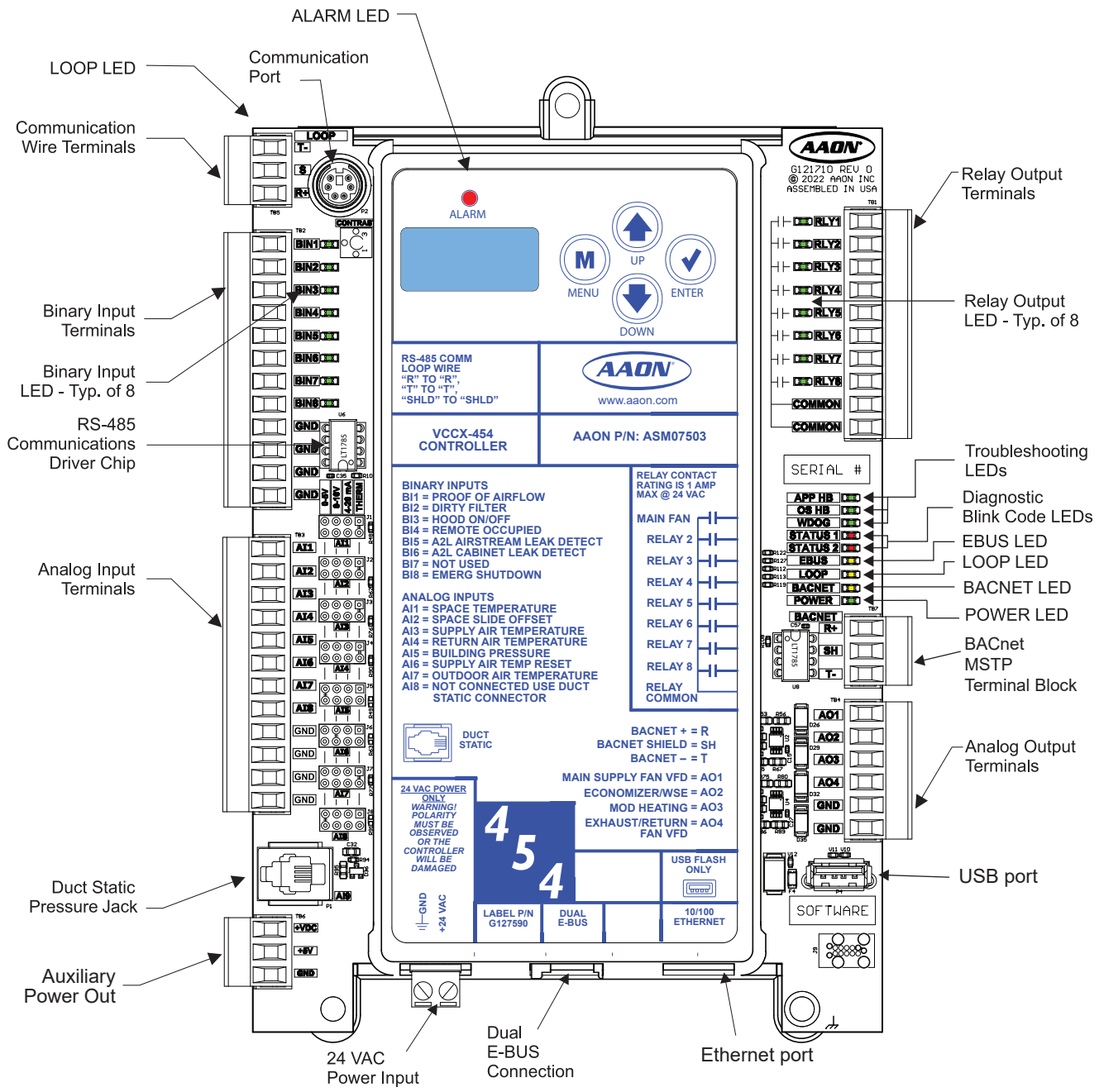


Figure 1: VCCX-454 Controller Components

VCCX-454 Controller

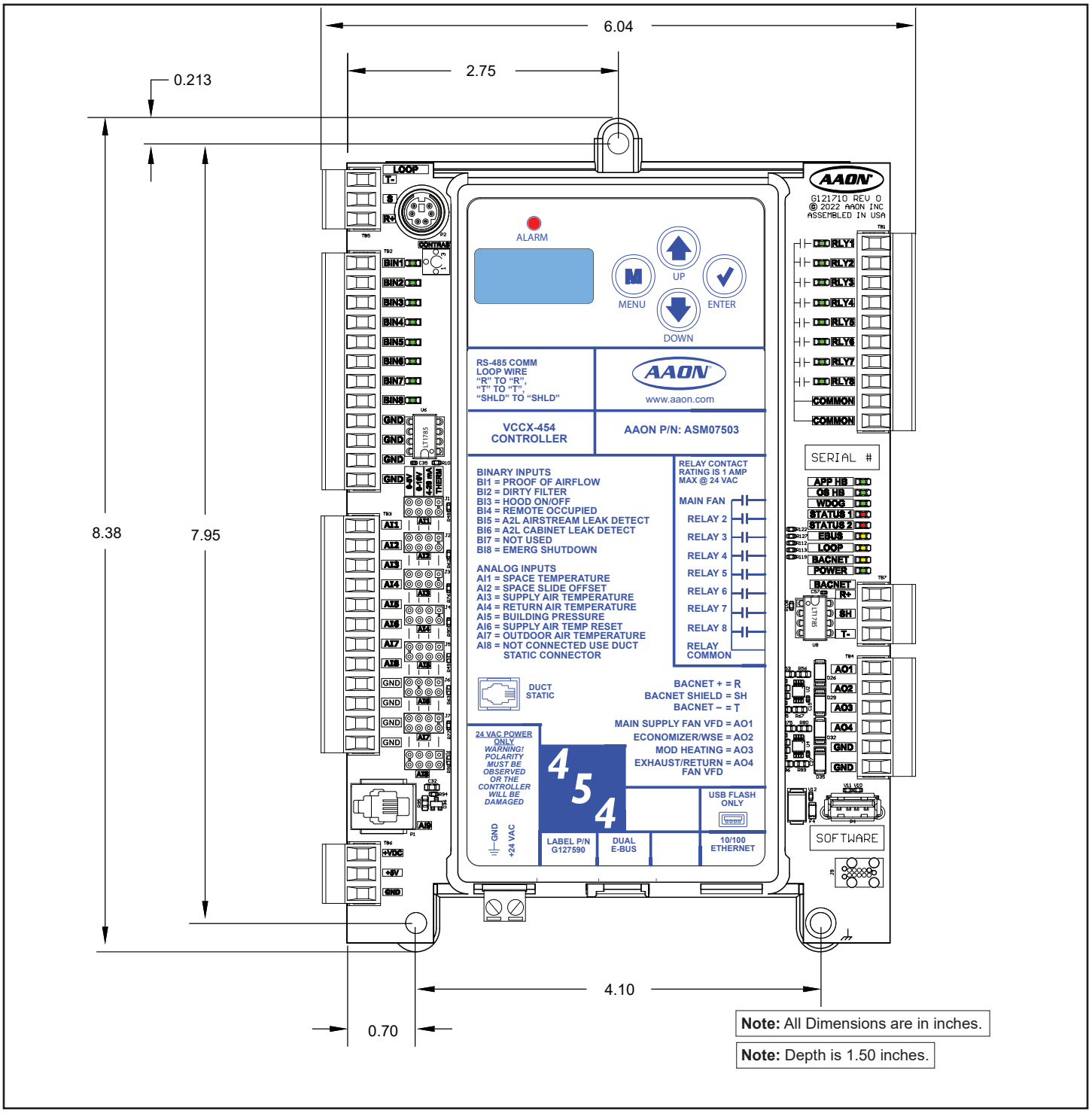
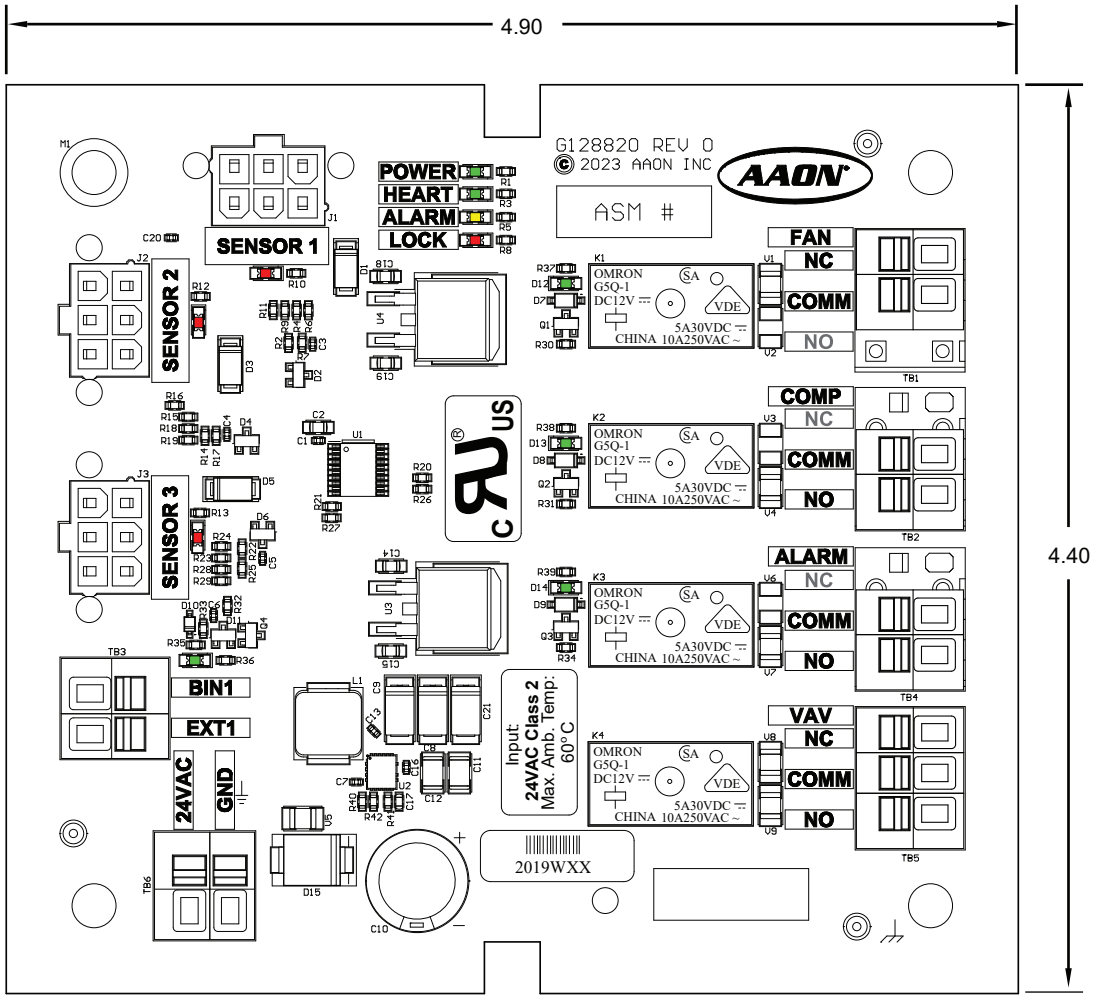


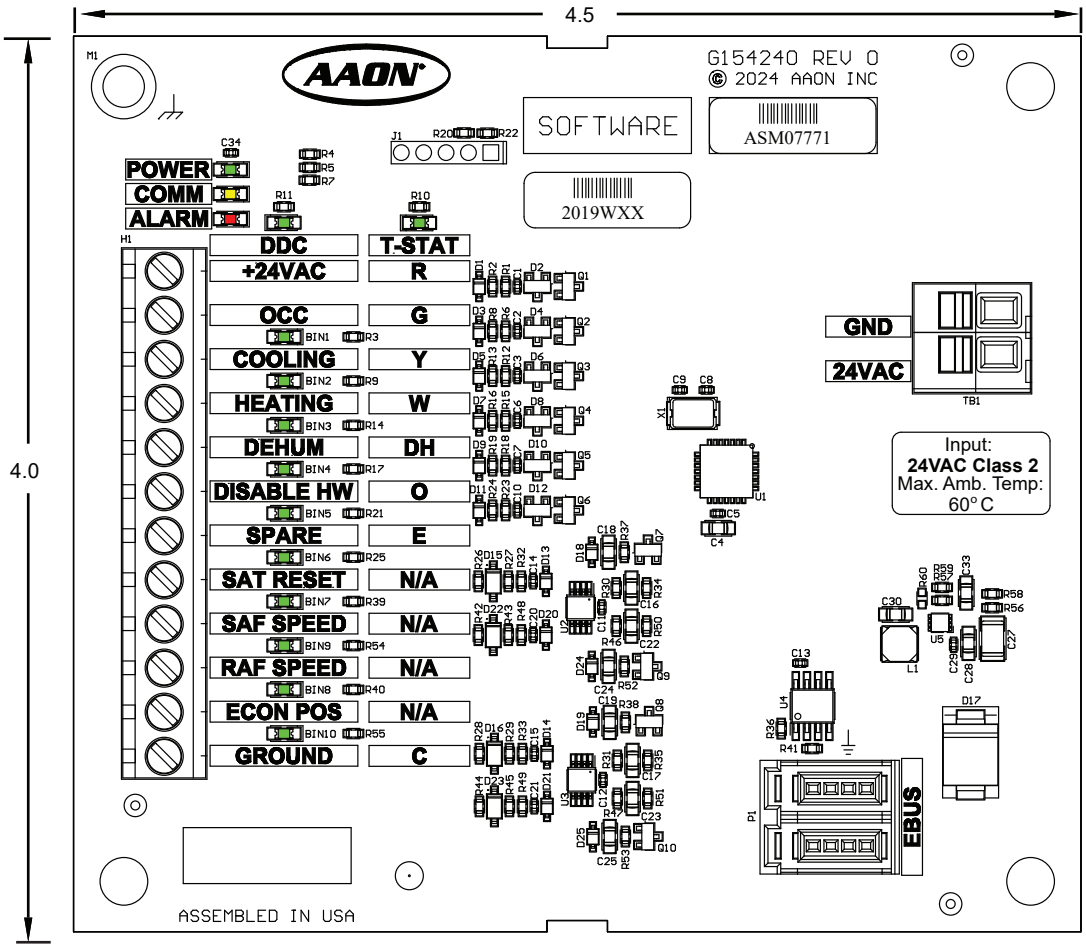
Figure 2: VCCX-454 Controller Dimensions



Note: All Dimensions are in inches.

Figure 3: A2L Mitigation Controller Components

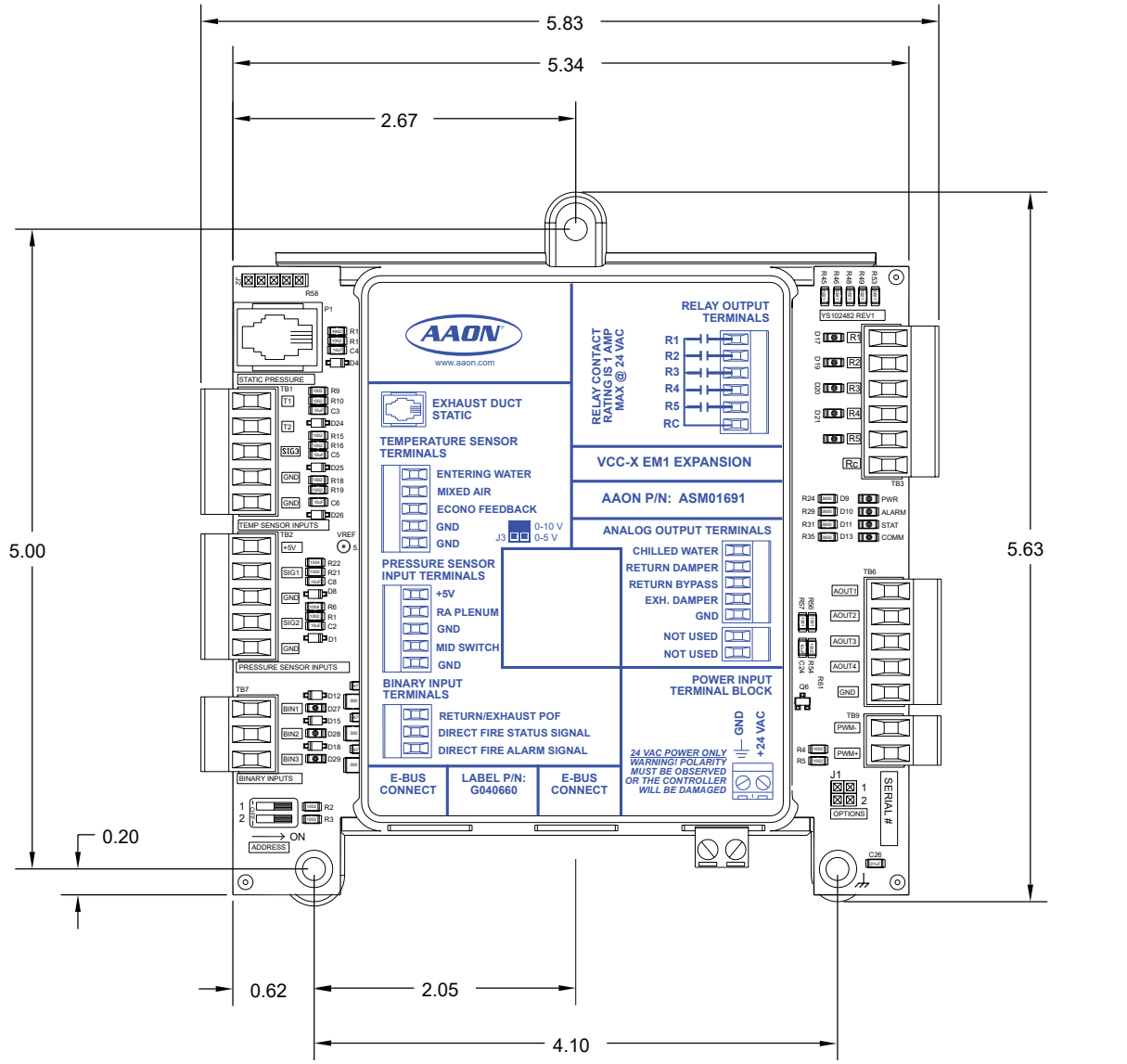
BD-3PI Third Party Interface Module



Note: All Dimensions are in inches.

Figure 4: BD-3PI Third Party Interface Dimensions

VCC-X EM1 Expansion Module

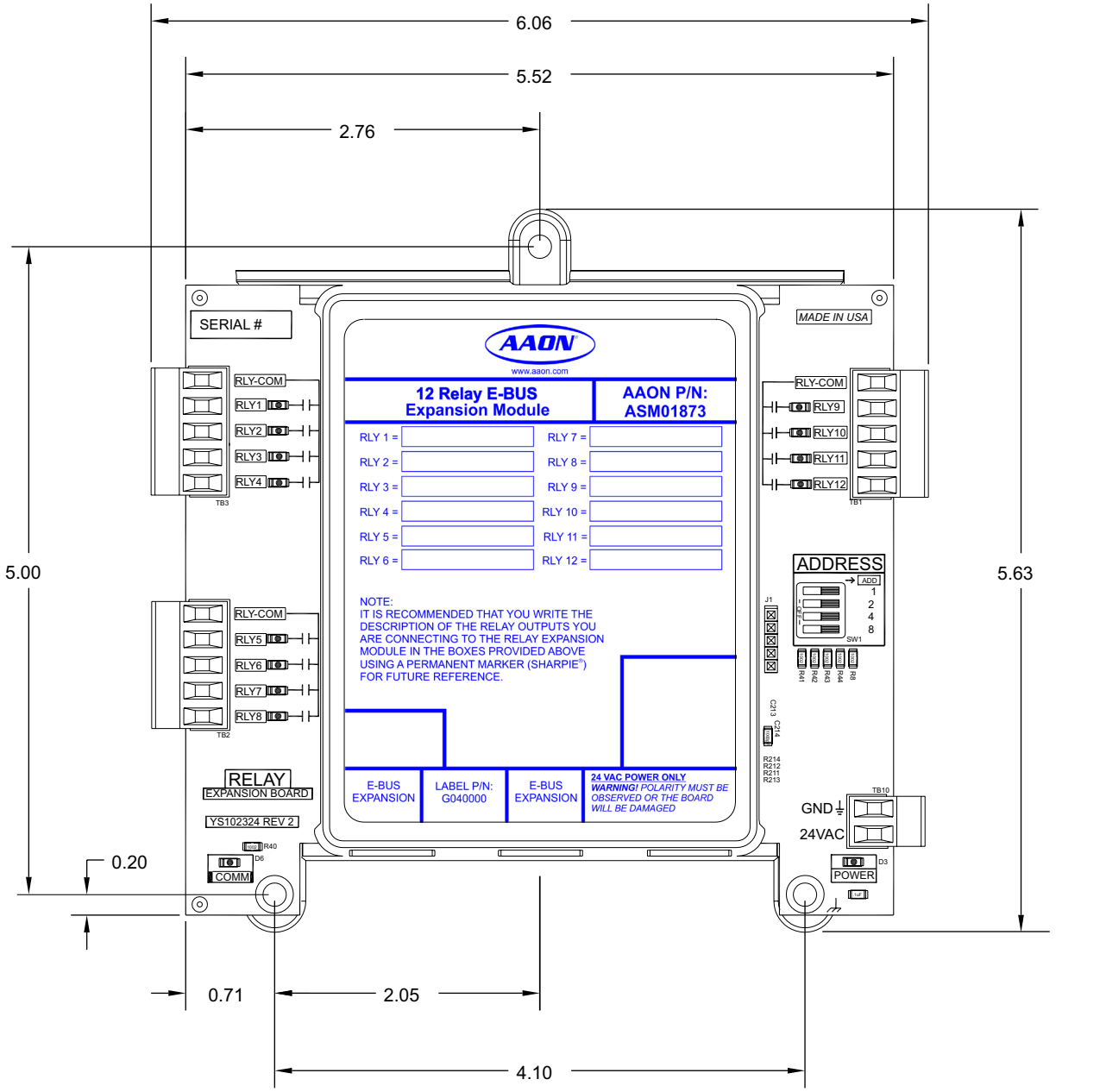


Note: All Dimensions are in inches.

Note: Depth is 1.50 inches.

Figure 5: VCC-X EM1 Expansion Module Dimensions

12 Relay E-BUS Module



Note: All Dimensions are in inches.

Note: Depth is 1.50 inches.

Figure 6: 12 Relay E-BUS Module Dimensions

VCCX-454 Controller

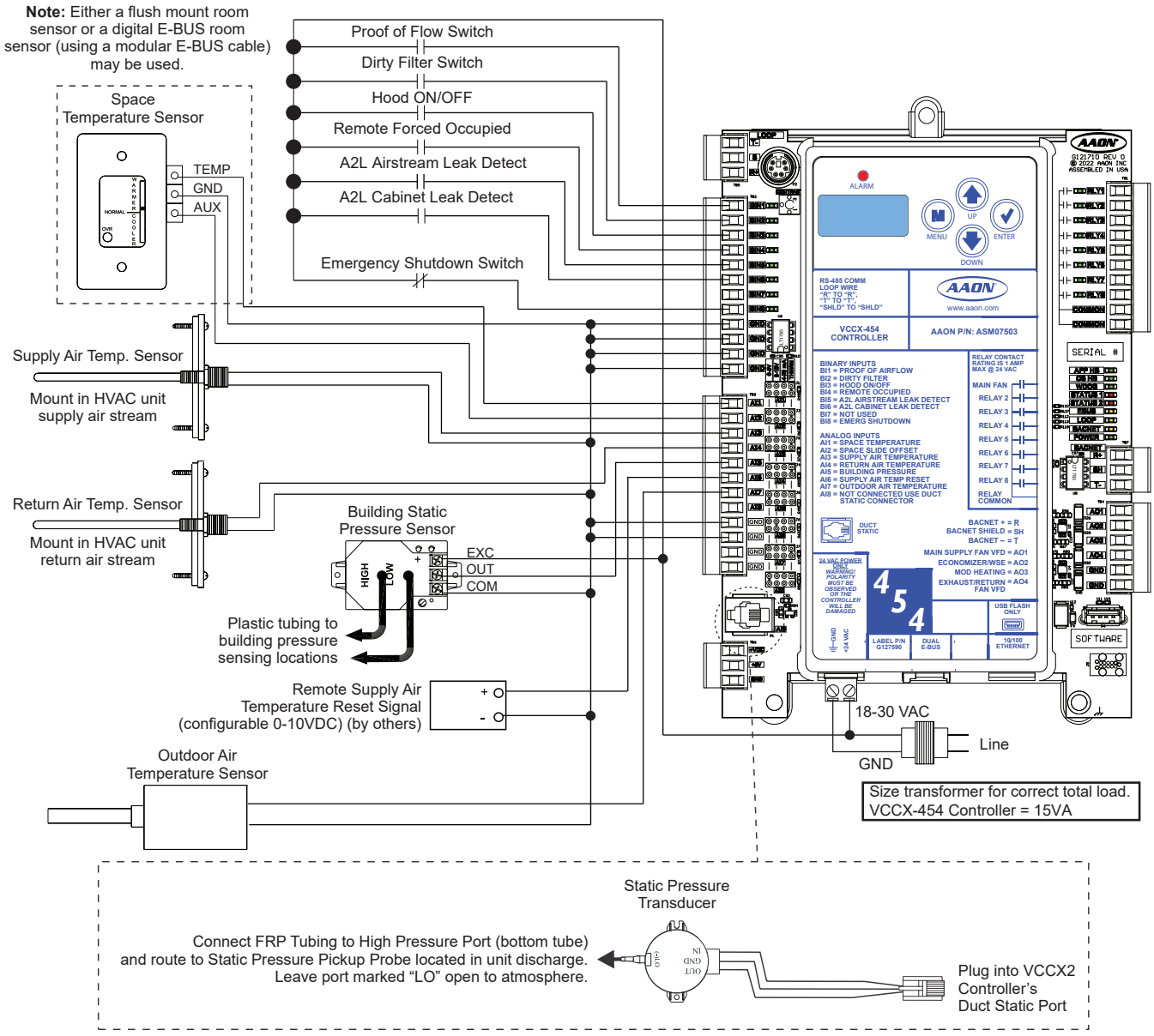


Figure 7: VCCX-454 Controller Input Wiring

Outputs

NOTE: Relay contacts for R2-R8 may be configured for:

1.) COOLING STAGES
2.) HEATING STAGES
3.) AUX HEAT
4.) EMERGENCY HEAT
5.) MOD HEAT ENABLE
6.) MOD COOL ENABLE
7.) MORNING WARM-UP
MORNING COOL-DOWN
8.) REHEAT
9.) PREHEAT
10.) LOW AMBIENT
11.) EXHAUST
12.) ECONOMIZER
13.) HEAT WHEEL
14.) OCCUPIED
15.) OVERRIDE
16.) ALARM
17.) A1 COMP RUN STATUS
18.) A2 COMP RUN STATUS
19.) B1 COMP RUN STATUS
20.) B2 COMP RUN STATUS
21.) CONDENSER PUMP
22.) SUMP HEATER
23.) SUMP PUMP DRAIN

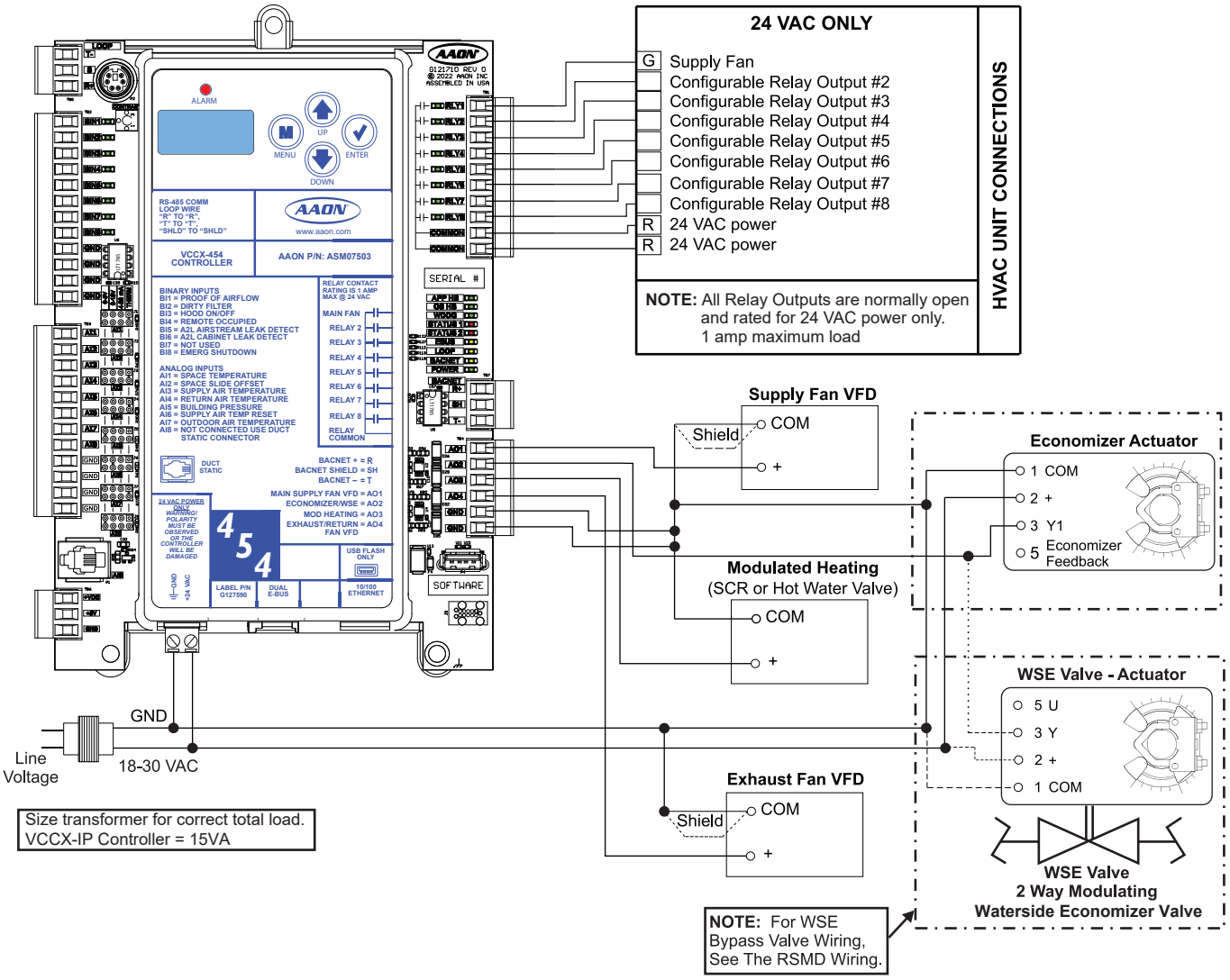


Figure 8: VCCX-454 Controller Output Wiring

A2L Mitigation Controller

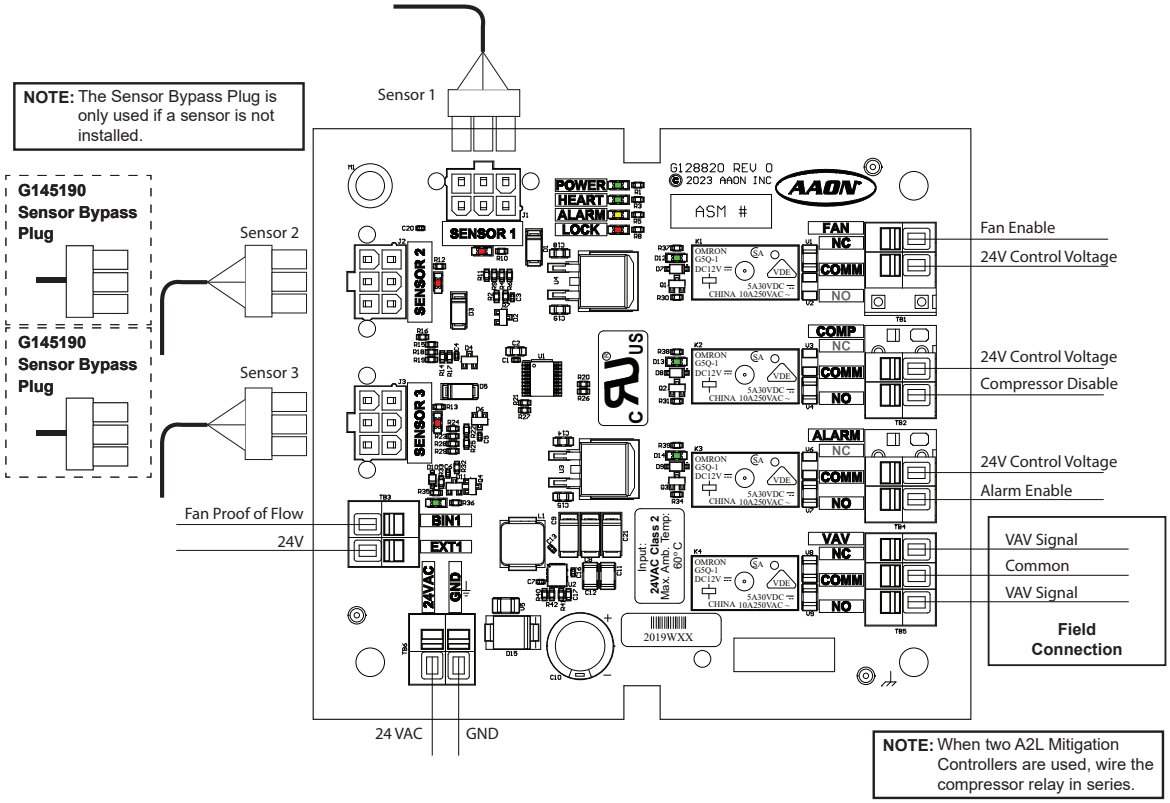


Figure 9: A2L Mitigation Controller Wiring Diagram - Air Flow

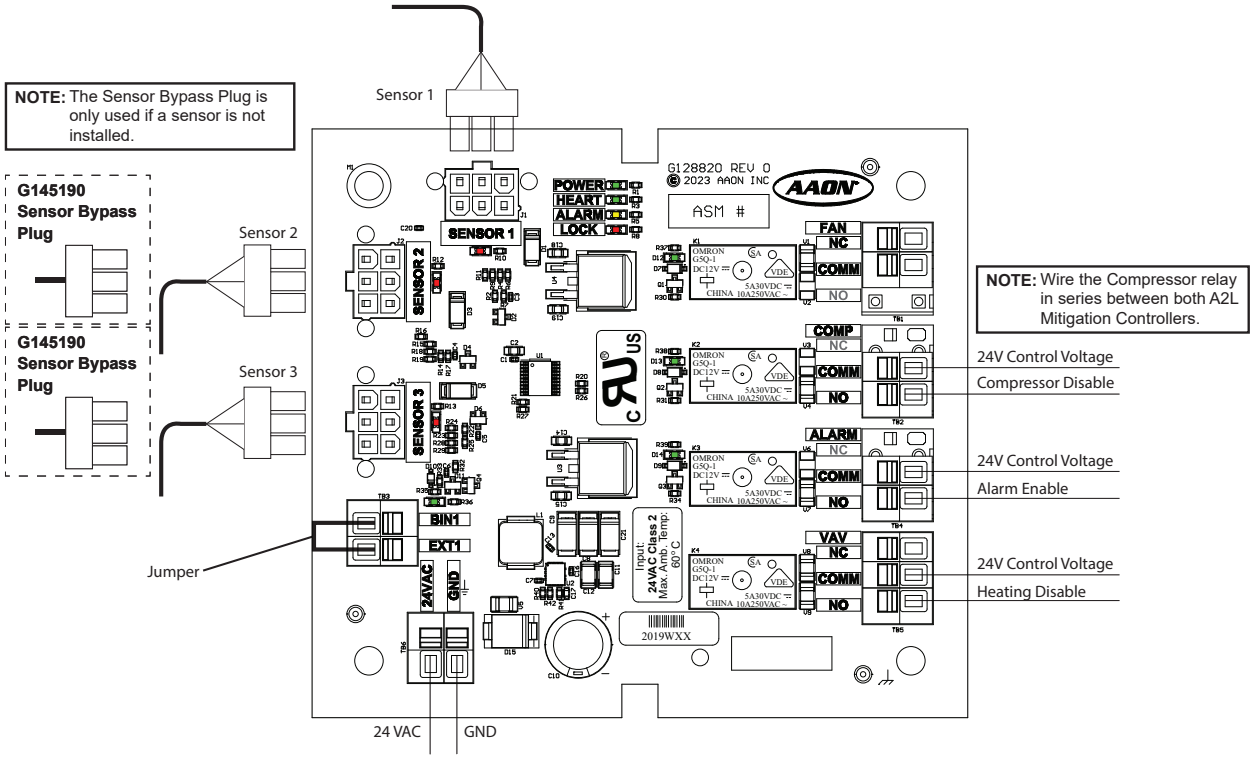


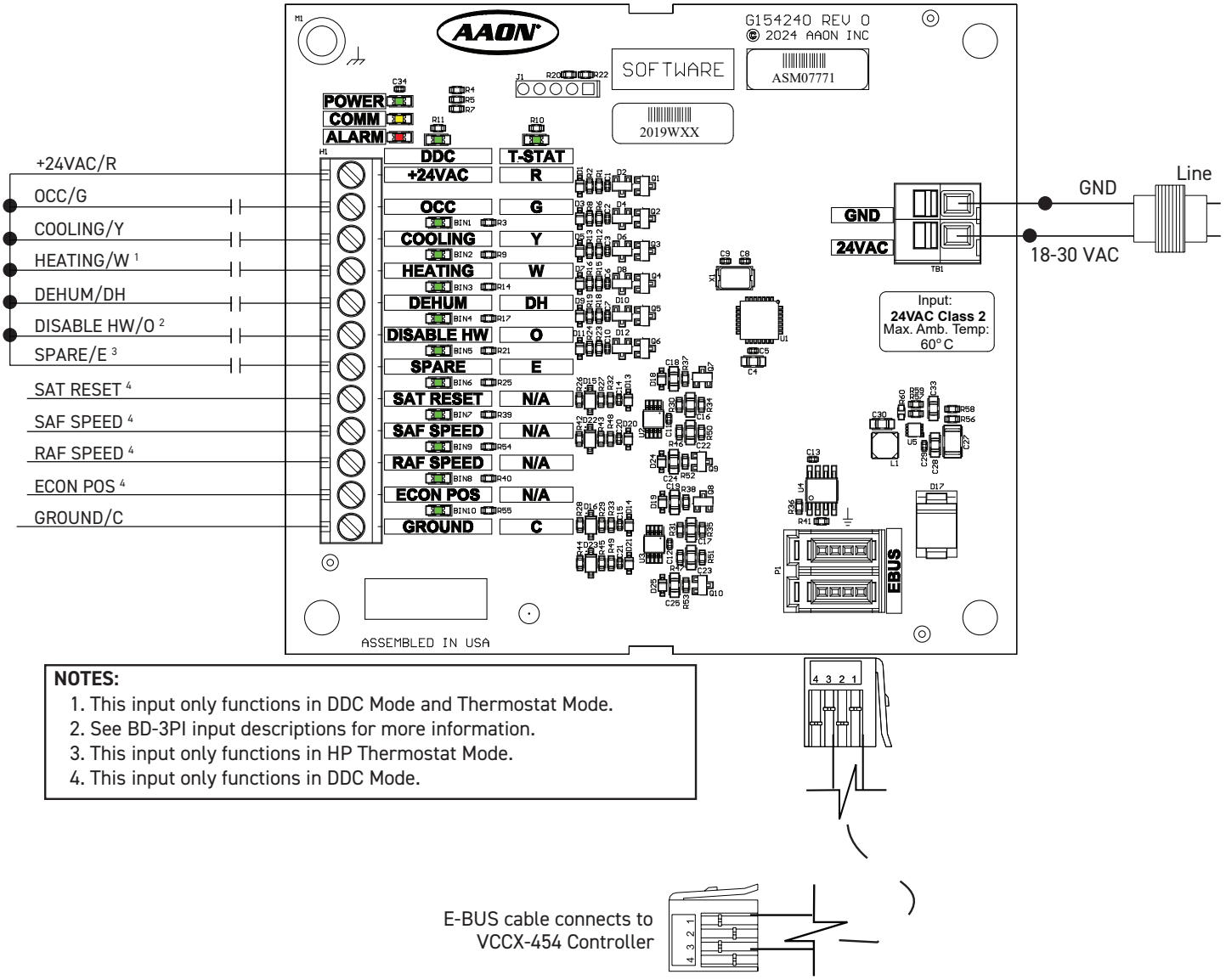
Figure 10: A2L Mitigation Controller Wiring Diagram - Cabinet

BD-3PI Third Party Interface Module

The BD-3PI Third Party Interface Module maintains supervisory and thermostat operation in conjunction with the VCCX-454 Controller. It is configured through Prism 2 and has the following modes:

- Supervisory Mode
- Thermostat Mode
- Heat Pump Thermostat Mode

- The BD-3PI uses the Omimate® Connector. See **Figure 12, page 22** for connect/disconnect instructions.



NOTES:

1. This input only functions in DDC Mode and Thermostat Mode.
2. See BD-3PI input descriptions for more information.
3. This input only functions in HP Thermostat Mode.
4. This input only functions in DDC Mode.

Figure 11: BD-3PI Third Party Interface Module Wiring

OMNIMATE® Connector

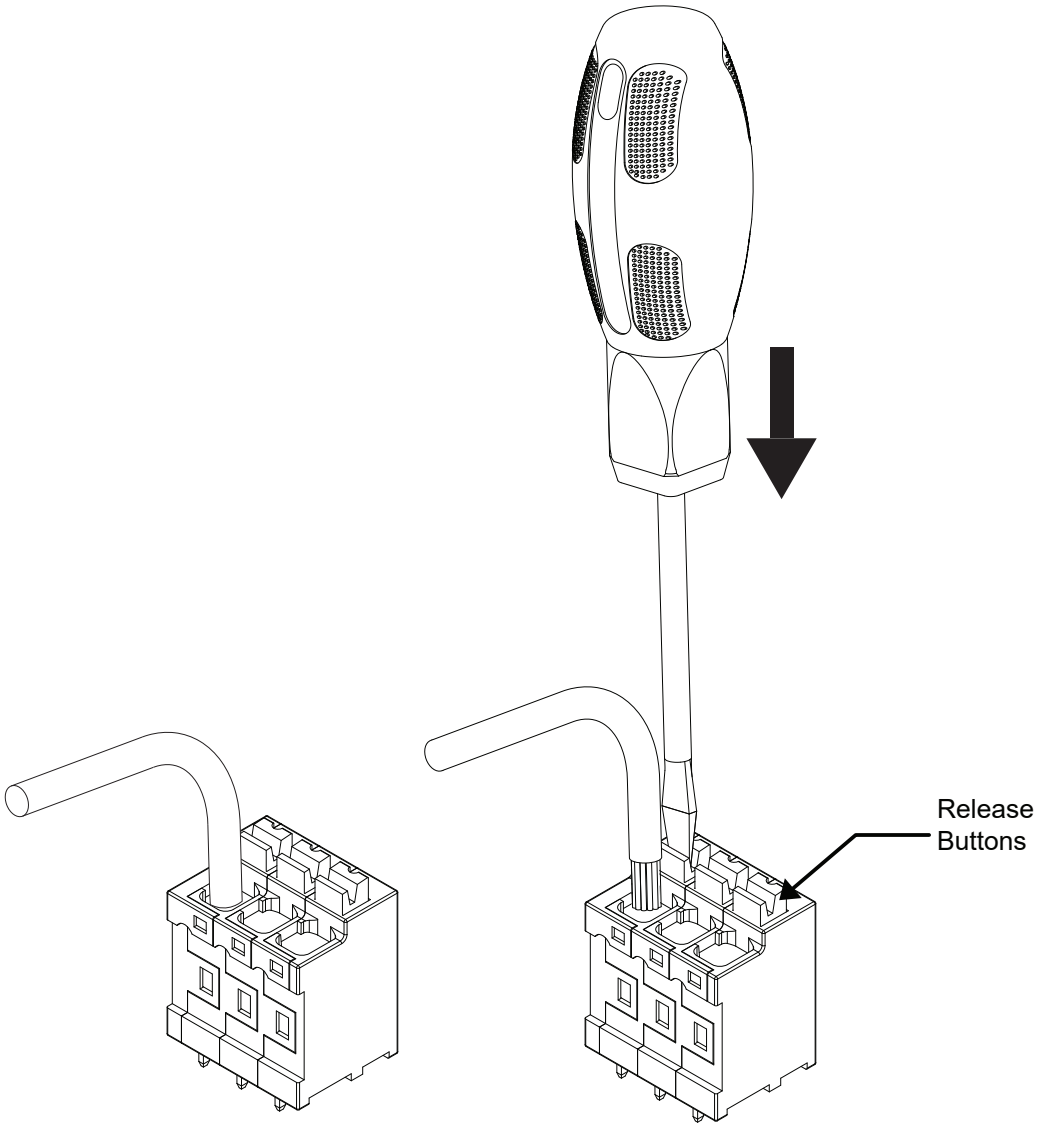


Figure 12: OMNIMATE Connector Instructions

EM1 Expansion Module

The EM1 Expansion Module connects to the VCCX-454 Controller with an E-BUS cable and adds an additional five analog inputs, five analog outputs, three binary inputs, and five configurable relay outputs.

The EM1 Expansion Module can be used in conjunction with the E-BUS 12 Relay Expansion Module. The expansion modules can be used individually or together to provide the required inputs and outputs for the specific applications.

WARNING: It is very important to be certain that all wiring is correct as shown in the wiring diagram below. Failure to observe the correct polarity will result in damage to the VCCX-454 Controller or Return Air Plenum Pressure Sensor.

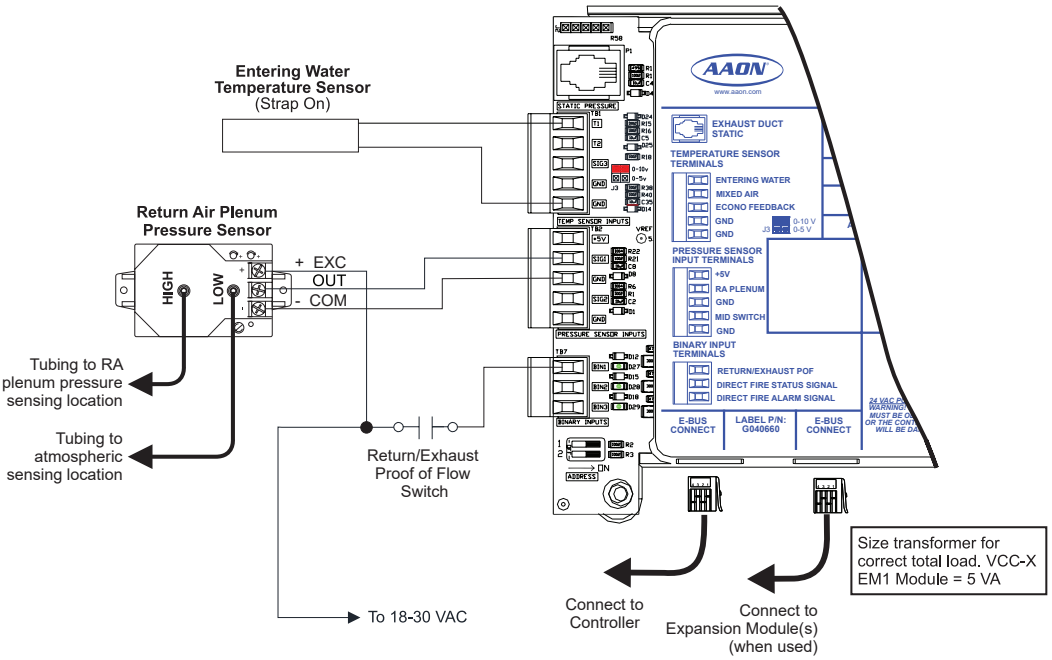


Figure 13: Entering Water Temperature Sensor, Return Air Plenum Pressure and Return/Exhaust Proof of Flow

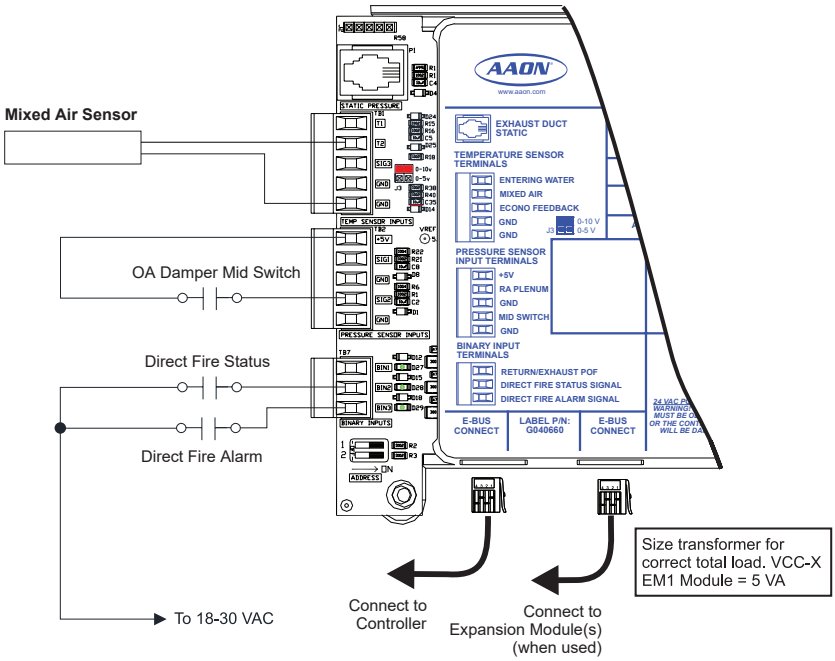


Figure 14: Direct Fire Wiring

EM1 Expansion Module

WARNING: Observe polarity! All boards must be wired with GND-to-GND and 24 VAC-to-24 VAC. Failure to observe polarity will result in damage to one or more of the boards. Expansion modules must be wired in such a way that the expansion modules and the controller are always powered together. Loss of power to the expansion module will cause the controller to become inoperative until power is restored to the expansion module.

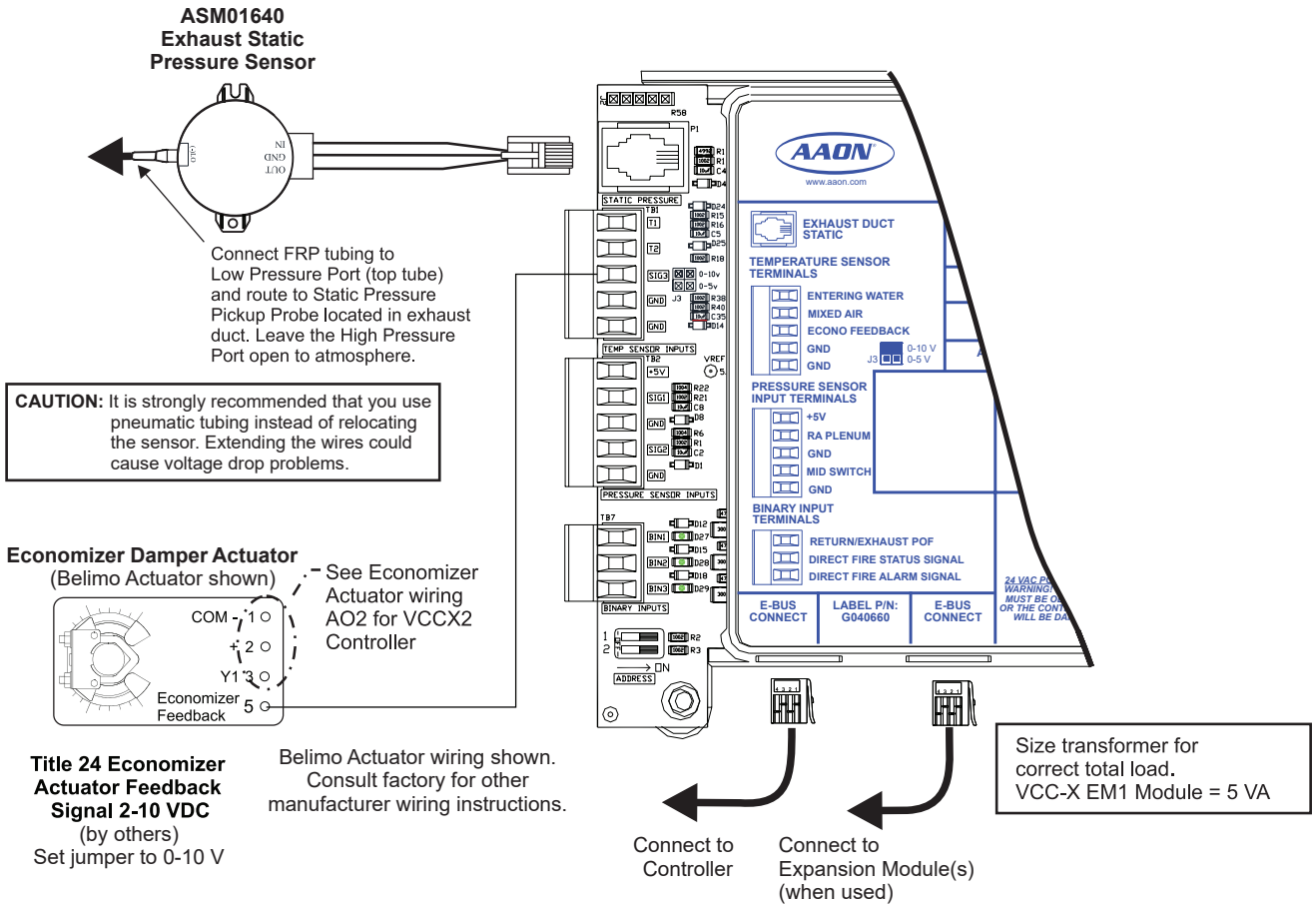


Figure 15: EM1 Exhaust Duct Static Pressure and Economizer Actuator Feedback Wiring

EM1 Expansion Module

Outputs

The EM1 Expansion Module must be connected to 24VAC as shown in the wiring diagram below. Please see **Table 1, page 8,** for correct VA requirements to use when sizing the transformer(s) used for powering the expansion module.

Also, please note that when wiring the EM1 Expansion Module, its contacts must be wired as wet contacts (connected to 24VAC).

See **Figure 16, this page,** for output wiring.

WARNING: Observe polarity! All boards must be wired with GND-to-GND and 24 VAC-to-24 VAC. Failure to observe polarity will result in damage to one or more of the boards. Expansion modules must be wired in such a way that the expansion modules and the controller are always powered together. Loss of power to the expansion module will cause the controller to become inoperative until power is restored to the expansion module .

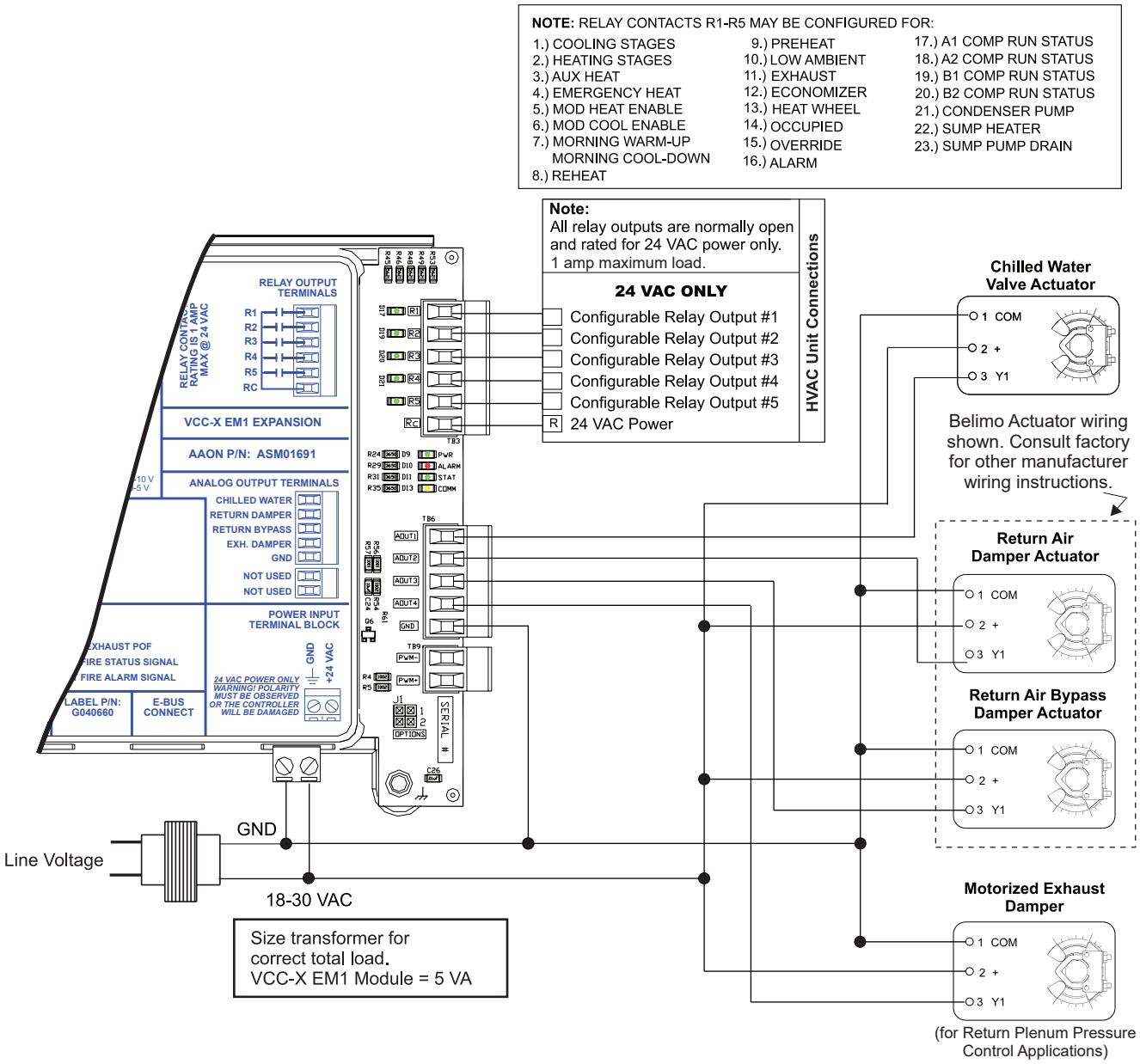


Figure 16: EM1 Expansion Module Output Wiring

12 Relay E-BUS Expansion Module

The ASM01873 12 Relay E-BUS Expansion Module provides 12 dry contact configurable relay outputs. See **Figure 17, this page**, for complete wiring details.

The 12 Relay E-BUS Expansion Module can be used in conjunction with the EM1 Expansion Module. The expansion modules can be used individually or together to provide the required inputs and outputs for the specific applications.

WARNING: Observe polarity! All boards must be wired with GND-to-GND and 24 VAC-to-24 VAC. Failure to observe polarity will result in damage to one or more of the boards. Expansion modules must be wired in such a way that the expansion modules and the controller are always powered together. Loss of power to the expansion module will cause the controller to become inoperative until power is restored to the expansion module.

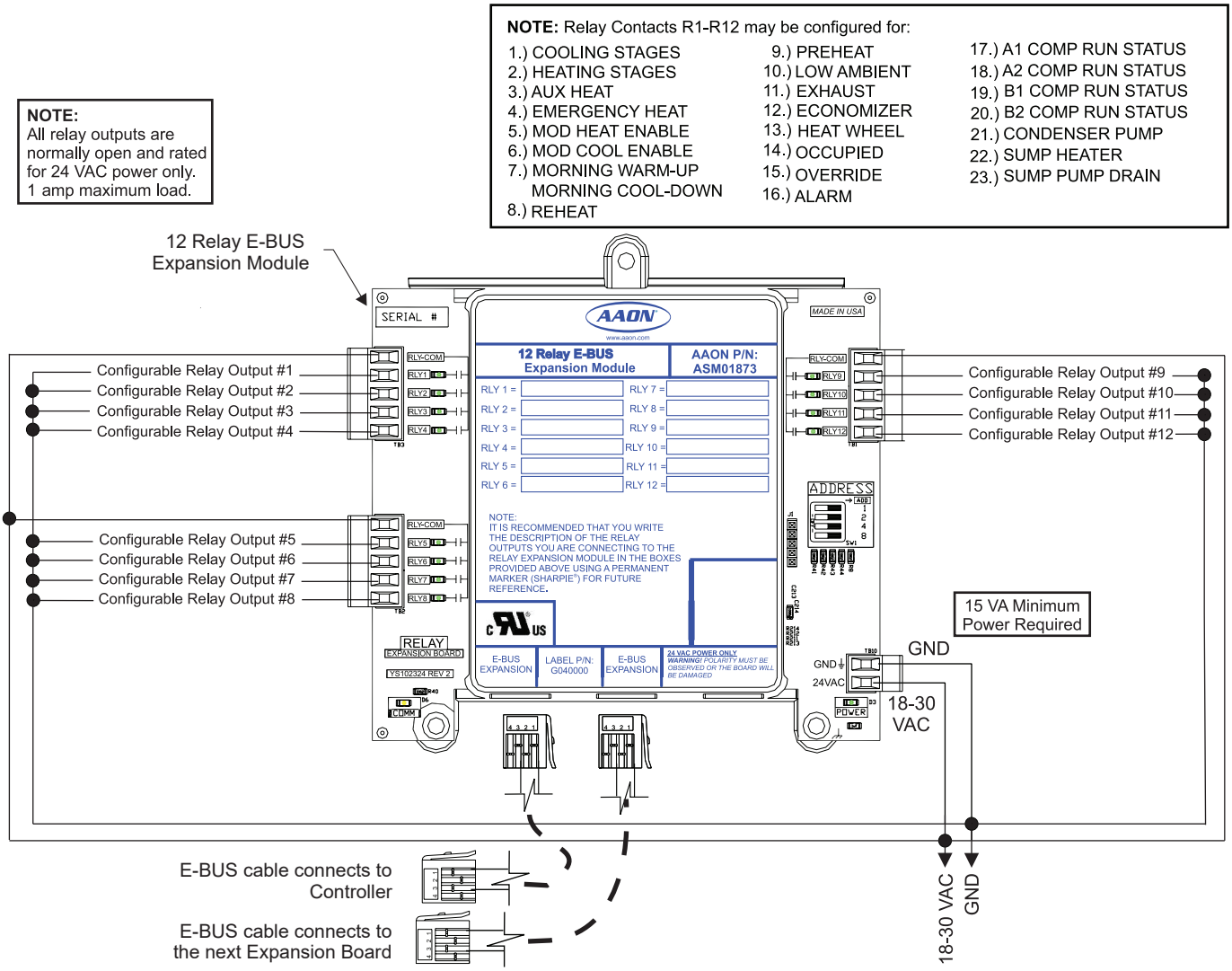


Figure 17: 12 Relay E-BUS Expansion Module Wiring

Airflow Station

The E-BUS Adapter Board attaches to the VCCX-454 Controller with an E-BUS cable. The Adapter Board is used for connecting the EBTRON, GreenTrol, or Paragon Airflow Measurement Digital Transmitter to the VCCX-454 Control System. Wire the airflow Measurement Digital Transmitter to the adapter board as shown in **Figure 18, this page**.

Up to four EBTRON, GreenTrol, or Paragon MicroTransEQ Airflow Measurement Digital Transmitters can be attached to each Adapter Board. Only one Paragon Multi-Trans Smart Ecosystem (MTSE) can be attached.

Only the EBTRON GTC116 or HTN104 series, GreenTrol GA-200-N Module (with GF series Airflow Station), Paragon MicroTransEQ or MTSE of MODBUS RTU transmitters are compatible with the VCCX-454 Controller. No other series of transmitters will work for this application. Contact AAON Controls for information on other airflow station options.

The Airflow Station's baud rate needs to be set to 19,200 in order to communicate with the VCCX-454 Controller (excludes Paragon MTSE).

When configuring the GTC116 or HTN104 Series, be sure to set the parity to "NO PARITY, 1 STOP BIT."

Paragon MTSE must be configured for MODBUS communication with baud rate set to 57,600 and its MODBUS ID set to "9".

WARNING: Observe polarity! All boards must be wired with GND-to-GND and 24 VAC-to-24 VAC. Failure to observe polarity will result in damage to one or more of the boards.

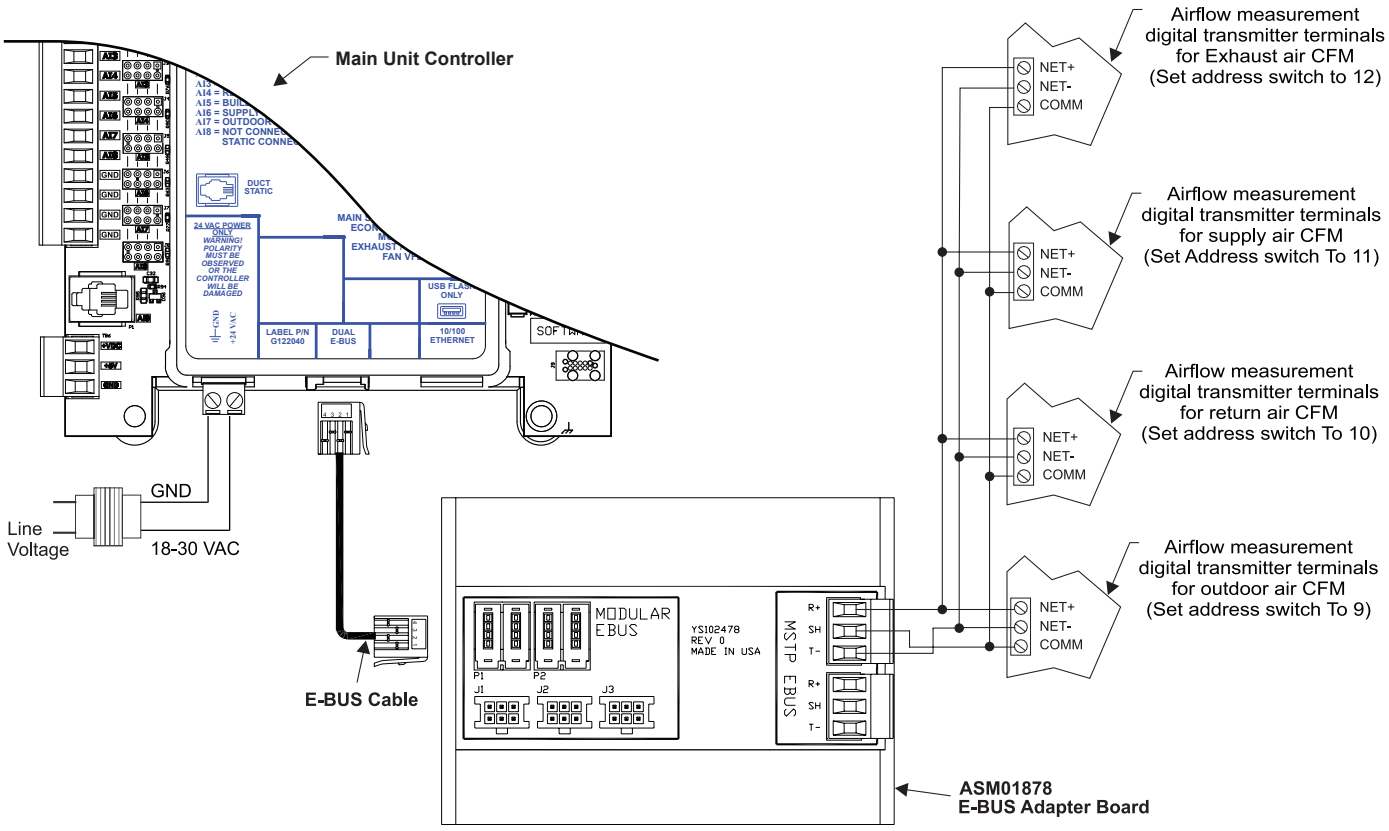


Figure 18: EBTRON GTC116 or HTN104 Series, GreenTrol GA-200-N Series, and Paragon MicroTransEQ Series Airflow Measurement Digital Transmitter Wiring

Powering Up and Configuration

Before Applying Power

In order to have a trouble free start-up, it is important to follow a few simple procedures. Before applying power for the first time, it is very important to run through a few simple checks.

Power Wiring

One of the most important checks to make before powering up the system for the first time is to confirm proper voltage and transformer sizing for each controller. Each VCCX-454 Controller requires 15 VA of power delivered to it at 24 VAC. Use separate transformers for each device (preferred) or power several devices from a common transformer.

WARNING: Observe polarity! All boards must be wired with GND-to-GND and 24 VAC-to-24 VAC. Failure to observe polarity will result in damage to one or more of the boards.

Check all wiring leads at the terminal block for tightness. Be sure that wire strands do not stick out and touch adjacent terminals. Confirm all sensors required for the system are mounted in the appropriate location and wired into the correct terminals on the VCCX-454 Controller.

After all the above wiring checks are complete, apply power to the VCCX-454 Controller.

Configuring the Controller

The next step is configuring the controller for specific requirements. In order to configure the VCCX-454 Controller, use Prism II.

NOTE: Use Prism II to configure units with RM454-D, RM454-V and RM454-Z modules.

AAON recommends proceeding with the programming and setup of the VCCX-454 Controller in the order that follows:

Configure the controller for the application.

1. Program the controller setpoints.
2. Set the controller current time and date.
3. Program the controller operation schedules.
4. Review the controller status screens to verify system operation and correct controller configuration.

NOTE: For BACnet Configuration, see **Appendix C**.

VCCX-454 Controller Inputs/Outputs Maps

ANALOG INPUTS (AI)	
INPUT	NAME
AI1	Space Temperature
AI2	Space Slide Adjust
AI3	Supply Air Temperature
AI4	Return Air Temperature
AI5	Building Pressure
AI6	Supply Air Temperature Reset
AI7	Outdoor Air Temperature
AI8	Not connected – use Duct Static Pressure Connector (Duct Static Jack)

Table 2: VCCX-454 Controller Analog Inputs

BINARY INPUTS (BI)	
INPUT	NAME
BI1	Proof of Airflow
BI2	Dirty Filter
BI3	Hood On/Off
BI4	Remote Forced Occupied
BI5	A2L Airstream Leak Detect
BI6	A2L Cabinet Leak Detect
BI7	Not Used
BI8	Emergency Shutdown

Table 3: VCCX-454 Controller Binary Inputs

ANALOG OUTPUTS (AO) (0-10 VDC)	
OUTPUT	NAME
AO1	Main Supply Fan VFD or Bypass Damper
AO2	Economizer (Outdoor Air Damper) or Waterside Economizer Actuator
AO3	Modulating Heating (Hot Water, Steam, or SCR)
AO4	Exhaust Fan VFD / Building Pressure Control Signal

Table 4: VCCX-454 Controller Analog Outputs

RELAY OUTPUTS (RLY) (24 VAC)	
OUTPUT	NAME
RLY1	Fan Relay
RLY2	Configurable Relay
RLY3	Configurable Relay
RLY4	Configurable Relay
RLY5	Configurable Relay
RLY6	Configurable Relay
RLY7	Configurable Relay
RLY8	Configurable Relay

Table 5: VCCX-454 Controller Relay Outputs

The following E-BUS sensors and modules are available to connect to the VCCX-454 Controller via E-BUS ports or E-BUS Expansion Modules:

- E-BUS Digital Room Sensor - LCD Display - Temp Only or Temp and Humidity
- E-BUS Digital Room Sensor - No LCD Display - Temp and Humidity
- E-BUS Space and Return Air CO_2 Sensors
- E-BUS connection to EBTRON, GreenTrol and Paragon airflow stations
- E-BUS Outdoor Air Temperature and Humidity Sensor
- E-BUS Return Air Temperature and Humidity Sensor

EM1 Inputs/Outputs Maps

ANALOG INPUTS (AI)	
INPUT	**NAME**
T1	Entering Water Temperature Sensor
T2	Mixed Air Temperature sensor
SIG1	Return Air Plenum Pressure (0-5V)
SIG2	Economizer Damper Midway Switch (5VDC)
SIG3	Economizer Actuator Feedback (0-5 or 0-10 V)
DUCT STATIC JACK	Exhaust Duct Static Pressure (Duct Static Jack)

Table 6: EM1 Expansion Module Analog Inputs

BINARY INPUTS (BI)	
INPUT	**NAME**
BI1	Return/Exhaust Proof of Flow
BI2	Direct Fire Status Signal (24VAC)
BI3	Direct Fire Alarm Signal (24VAC)

Table 7: EM1 Expansion Module Binary Inputs

ANALOG OUTPUTS (0-10 OR 2-10 VDC)	
OUTPUT	**NAME**
AO1	Chilled Water Valve
AO2	Return Air Damper
AO3	Return Air Bypass Damper
AO4	Motorized Exhaust Damper

Table 8: EM1 Expansion Module Analog Outputs

RELAY OUTPUTS (24 VAC)	
OUTPUT	**NAME**
RLY1	Configurable Relay
RLY2	Configurable Relay
RLY3	Configurable Relay
RLY4	Configurable Relay
RLY5	Configurable Relay

Table 9: EM1 Expansion Module Relay Outputs

A2L Mitigation Controller Inputs/Outputs Maps

ANALOG INPUTS		
SENSOR #	PIN	NAME
1	1	Power (+12VDC)
	2	Signal In
	3	Not Used
	4	Not Used
	5	Signal Out
	6	GND
2	1	Power (+12VDC)
	2	Signal In
	3	Not Used
	4	Not Used
	5	Signal Out
	6	GND
3	1	Power (+12VDC)
	2	Signal In
	3	Not Used
	4	Not Used
	5	Signal Out
	6	GND

Table 10: Analog Inputs Wiring

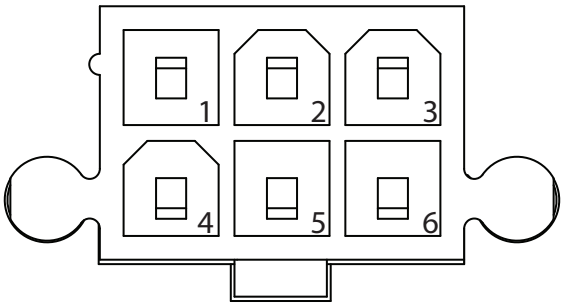


Figure 19: Analog Input Pin Diagram

BINARY INPUTS	
INPUT	NAME
BIN1	Fan Proof of Flow
EXT1	Fan 24V

Table 11: Binary Inputs Wiring

RELAY INPUTS		
NAME	PIN	NAME
FAN	NC	Fan - Normal condition held open
	COMM	Common
	NO	Not Available
COMP	NC	Not Available
	COMM	Common
	NO	Compressor - Normal condition held closed
ALARM	NC	Not Available
	COMM	Common
	NO	Alarm - Normal condition held closed
VAV	NC	VAV - Normal condition held open
	COMM	Common
	NO	VAV - Normal condition held closed

Table 12: Relay Inputs Wiring

BD-3PI Inputs/Outputs Maps

BINARY INPUTS	
PIN	NAME
2	OCC/G
3	COOLING/Y
4	HEATING/W
5	DEHUM/DH
6	DISABLE HW/O
7	SPARE/E

Table 13: BD-3PI Binary Inputs Wiring

ANALOG INPUTS	
PIN	NAME
8	SAT RESET
9	SAF SPEED
10	RAF SPEED
11	ECON POS

Table 14: BD-3PI Analog Inputs Wiring

VCCX-454 Controller Inputs/Outputs Descriptions

Analog Inputs

AI1 - Space Temperature Sensor Input
The Space Temperature Sensor initiates Occupied Heating and Cooling Modes if the unit is configured for space temperature control. It is always the sensor used to initiate Unoccupied Heating and Cooling Modes. If the Space Temperature Sensor used is equipped with the optional push-button override feature, this input detects user overrides and switches the unit from the Unoccupied Mode back to the Occupied Mode operation for a user-adjustable amount of time. The space temperature can also be configured to reset the Supply Air Temperature Setpoint.

AI2 - Space Temperature Sensor Slide Adjust
If the Space Temperature Sensor being used has the optional slide adjust feature, its AUX output is connected to this input. The slide adjust control is used to vary the HVAC Mode Heating and Cooling Setpoints by a user-configured maximum amount.

If the space temperature is configured as the supply air temperature reset source, the slide adjustment adjusts both the HVAC Mode Enable Heating and Cooling Setpoints and the Supply Air Temperature Reset Source Heating and Cooling Setpoints simultaneously by a user-configurable maximum amount.

AI3 - Supply Air Temperature Sensor Input
Once the unit is in the Heating or Cooling Mode (based on the temperature at the mode enable sensor), the unit controls the staging or modulation of the heating or cooling sources to maintain a heating or cooling Supply Air Temperature Setpoint. The HVAC unit must always have a Supply Air Temperature Sensor installed.

AI4 - Return Air Temperature Sensor Input
To generate occupied heating and cooling demands based on return air temperature, select this sensor as the HVAC Mode Enable Sensor. The Return Air Temperature Sensor is also used to initiate or cancel the morning warm-up/cool-down period on VAV configured units. If the Return Air Temperature Sensor is connected, the outdoor air temperature must be at least 5°F below the return air temperature to allow economizer cooling operation.

AI5 - Building Static Pressure Sensor Input
This sensor is only required if configuring the VCCX-454 Controller for building pressure control. Building pressure control can be accomplished by using one of two main control methods. One control method uses the 0-10 VDC signal to control an exhaust fan VFD or an exhaust damper actuator for direct acting pressure control applications. In addition, for reverse acting pressure control applications, it can control an outdoor air damper actuator (or in certain cases, the VFD supply fan). The other available control method is to configure one of the output relays as an exhaust fan output that activates the exhaust fan any time the building pressure is above the Building Pressure Setpoint.

AI6 - Remote Supply Air Temperature Reset Signal
If a remote supply air temperature reset signal is configured as the reset source, this input can be used to accept a configurable voltage input between 0-10 VDC (direct or reverse acting) to reset the Supply Air Temperature Setpoint.

AI7 - Outdoor Air Temperature Sensor Input
To conserve energy, the outdoor air temperature is used to lock out heating or cooling at set temperatures for each Mode of Operation. This sensor is also used to initiate Heating and Cooling Modes on a make-up air unit. The Outdoor Air Temperature Sensor can also be used for preheater operation and for low ambient protection operation.

NOTE: For AI1, AI3, AI4 and AI7, all temperature sensors must be Thermistor Type III which provide 77.0°F @ 10K ohms resistance.

AI8 - Supply Duct Static Pressure Sensor Input
This jack-style input connection accepts a Duct Static Pressure Sensor modular cable input. The Duct Static Pressure Sensor reading is used to determine current duct static pressure. This static pressure reading is used to control the output signal supplied to the supply fan VFD or zoning bypass damper actuator. If the HVAC unit is configured for CAV operation, this sensor is optional. If it is installed on a CAV unit, it can be used for filter loading VFD control or used for a status-only reading.

Binary Inputs

BI1 - Proof of Flow Input
A proof of flow switch (by others) that provides a wet contact closure whenever the HVAC unit supply fan is operating can be connected to this input. If the proof of flow switch contact opens while the supply fan is operating, all heating and cooling is suspended or disabled.

BI2 - Dirty Filter Contact Closure Input
This wet contact input is required for filter status indication and requires a differential pressure switch to initiate a dirty filter alarm.

BI3 - Hood On/Off Input
When this wet contact input closes (hood on), the VCCX-454 Controller switches from indoor air control to outdoor air control. This is typically used on CAV applications requiring CAV/MUA Dual Damper (Hood On/Off) Modes.

BI4 - Remote Forced Occupied Mode Input
When this wet contact input closes, it forces the VCCX-454 Controller into the Occupied Mode. When the remote forced occupied signal is removed, the controller reverts to the Unoccupied Mode of operation if no internal or external schedule has been configured or is in effect when this occurs.

BI5 - A2L Airstream Leak Detect
A wet contact closure on this input is used to provide an alarm for when there is an A2L refrigerant leak in the airstream.

BI6 - A2L Cabinet Leak Detect
A wet contact closure on this input is used to provide an alarm for when there is an A2L refrigerant leak in the cabinet.

BI7 - Not Used
This input is not currently used.

BI8 - Emergency Shutdown Input
This wet contact 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) contact is opened. The controller remains active and can initiate alarm relays.

NOTE: The binary inputs require wet contacts (24 VAC only) to recognize an active input. If only dry contacts are provided, the contact closure is not be recognized. All binary inputs are optional. This means the VCCX-454 Controller must be configured to recognize these input signals.

Analog Outputs

AO1 - Main Supply Fan VFD Control Signal or Bypass Damper Control Signal
This user-adjustable voltage signal is used to modulate the supply fan VFD in VAV, single zone VAV, filter loading applications, or reverse acting building pressure control using the VFD. In a volume and variable temperature zoning application, this output is used to control a bypass damper.

AO2 - Outdoor Air Damper Economizer Control Signal or Waterside Economizer Valve Signal

Outdoor Air Damper Economizer Control Signal
This user-adjustable voltage signal is used to control the outdoor air damper during economizer operation. It is also used to maintain the outdoor air damper at its minimum position during Occupied Mode when the outdoor air temperature is not suitable for economizer cooling purposes. This minimum position can be reset based on CO_2 override conditions.

This output is also used to control the outdoor air damper based on an Outdoor Airflow Setpoint if using an outdoor airflow monitoring station. This position can be overridden during economizer control.

Finally, this output can be used to control the outdoor air damper during reverse acting building pressure control to maintain a Building Pressure Setpoint.

Waterside Economizer Valve Signal
This 2-10 VDC signal is used to modulate the waterside economizer valve during waterside economizer operation.

AO3 - Modulating Heat Control Signal
This output can be configured with a user-adjustable voltage range of operation which can be set up to provide either a direct or reverse acting operation. This output is used to operate a Modulating Heating Device to maintain the Heating Supply Air Setpoint during the Heat Mode of operation.

AO4 - Exhaust Fan VFD Signal / Building Pressure Control Signal
This user-adjustable voltage signal is used to provide direct acting building pressure control using an exhaust fan VFD or a modulating exhaust damper.

NOTE: For reverse acting building pressure control using the outdoor air damper or supply fan VFD, the VCCX-454 Controller uses the outputs specific to those devices. On the main VCCX-454 Controller, AO2 controls the outdoor air damper and AO1 controls the supply fan VFD to maintain the Building Pressure Setpoint. Alternatively, this AO4 output will mirror those outputs and can be used as well.

Relay Outputs

RLY1 - Supply Fan (Enable)
This is a non-configurable output.

RLY2-RLY8 - User-Configurable Relays
These relays are configurable by the user. See **Table 15, page 37**.

BD-3PI Inputs/Outputs Descriptions

OCC/G
When this wet contact input closes, it forces the VCCX-454 Controller into the Occupied Mode. When the OCC/G signal is removed, the controller reverts to the Unoccupied Mode of operation if no internal or external schedule has been configured or is in effect when this occurs.

COOLING/Y
A wet contact closure on this input is used to provide a means for another building automation system or control device (by others) to force the unit into Cooling Mode.

HEATING/W
This input only functions in DDC Mode and Thermostat Mode, it has no function in HP Thermostat mode. A wet contact closure on this input is used to provide a means for another building automation system or control device (by others) to force the unit into Heating Mode.

DEHUM/DH
A wet contact closure on this input is used to provide a means for another building automation system or control device (by others) to force the VCCX-454 Controller into Dehumidification Mode. If dehumidification is configured for all modes on the VCCX-454 then the unit will go into dehumidification mode anytime this input is activated. If it is configured for vent mode only the heating and cooling calls will override the dehumidification call.

DISABLE HW/O
This input has different functionality for each configured mode:

- **DDC Mode**
  - This input when activated will force the heat wheel to stop operating.
- **Thermostat Mode**
  - This input has no function in this mode.
- **HP Thermostat Mode**
  - This input when activated along with the Y input will initiate heat pump heating operation. The thermostat should be configured for fail-to-cool to properly trigger this input. Note that the operation of this input in as fail-to-cool has no relation to whether the actual unit is built and operated as fail-to-heat or fail-to-cool, this only relates to how the signals from the HP Thermostat are interpreted.

SPARE/E
This input only functions in HP T-Stat. When active, this input will cause the emergency heat to operate on the unit, if available. Activation of this input will also disable any compressor heating that may be currently commanded.

SAT RESET
This input only functions in DDC mode. If a remote supply air temperature reset signal is configured as the reset source, this input can be used to accept a configurable voltage input between 0-10 VDC (direct or reverse acting) to reset the Supply Air Temperature Setpoint.

SAF SPEED
This input only functions in DDC mode. When enabled, the SAF will operate as if it is not being overridden by the 3PI if the range is 0 to 1VDC. If the input is in the range of 1VDC to 2VDC the VCCX-454 SAF analog output will supply the minimum fan voltage setting to the SAF. The SAF signal will vary from minimum to maximum as this input varies from 2VDC to 10VDC.

If the BACnet override is enabled, it will have precedent over this input.

RAF SPEED
This input only functions in DDC mode. If the input is in the range of 1VDC to 2VDC the VCCX-454 RAF analog output will supply the minimum exhaust voltage setting to the RAF. The RAF signal will vary from minimum to maximum as this input varies from 2VDC to 10VDC.

If the BACnet override is enabled, it will have precedent over this input.

ECON POS
This input only functions in DDC mode. When enabled, the ECON POS will operate as if it is not being overridden by the 3PI if the range is 0 to 1VDC. If the input is in the range of 1VDC to 2VDC the VCCX-454 Economizer analog output will supply the minimum economizer voltage setting to the damper actuator. The ECONO signal will vary from minimum to maximum as this input varies from 2VDC to 10VDC.

If the BACnet override is enabled, it will have precedent over this input.

NOTE: When referenced, minimum and maximum are referring to the min/max voltage settings under the "Analog Output Voltage Limits" heading in Prism.

VCC-X EM1 Expansion Module Inputs/Outputs Descriptions

Analog Inputs

T1 - Entering Water Temperature Sensor Input
The entering water is used to determine when to initiate waterside economizer operation. If the unit is in Cooling Mode and the entering water temperature drops 10˚F (adjustable) below the entering air temperature, the unit modulates the waterside economizer valve as part of the Cooling operation.

T2 - Mixed Air Temperature sensor Input
Used for direct fire, requires a 10k Type III Sensor. Note the actual sensor is an array of four sensors wired in a parallel/series configuration to look like a single sensor.

SIG1 - Return Air Plenum Pressure Sensor Input
The sensor is only required when controlling a motorized exhaust damper to maintain the Return Air Plenum Pressure Setpoint.

SIG2 – Economizer Damper Midway Switch
On units using Direct Fire, this is the status input of the OA damper midway switch.

SIG3 - Economizer Feedback
If economizer operation has been configured, this input will be used for the 2-10 VDC feedback signal from the economizer actuator.

Exhaust Duct Static Pressure Sensor Input
This jack-style input connection accepts a Duct Static Pressure Sensor modular connector input used for exhaust duct static pressure control. This static pressure reading is used to control the output signal (AO4 on the VCCX-454 Controller) supplied to the exhaust fan VFD.

Binary Inputs

BI1 - Return/Exhaust Proof of Flow
A proof of flow switch that provides a wet contact closure whenever the HVAC unit return fan or exhaust fan is operating can be connected to this input.

BI2 – Direct Fire Status Signal
Used for direct fire. A 24VAC signal from a direct fire controller is sent to indicate direct fire is active.

BI3 – Direct Fire Alarm Signal
Used for direct fire. A 24VAC signal is sent if there is an active alarm on the direct fire controller.

Analog Outputs

AO1 - Modulating Chilled Water Valve Actuator
This output is used to control a modulating chilled water valve actuator to maintain the Cooling Supply Air Temperature Setpoint. This output provides a 0-10 or 2-10 VDC direct acting signal.

AO2 - Return Air Damper Actuator Signal
This output signal is a direct acting 2-10 VDC output signal that is used to modulate a return air damper actuator in conjunction with a Return Air Bypass Damper actuator for AAON Precise Air Control or Digital Precise Air Control applications.

AO3 - Return Air Bypass Damper Actuator Signal
This output signal is a direct acting 2-10 VDC output signal that is used to modulate a Return Air Bypass Damper actuator in conjunction with a return air damper actuator for AAON Precise Air Control or Digital Precise Air Control applications.

AO4 - Motorized Exhaust Damper Actuator Signal
This output signal is a direct acting 2-10 VDC output signal that is used to modulate the motorized exhaust damper actuator.

Relay Outputs

RLY1-RLY5 - User-Configurable Relays
These relays are configurable by the user.

12 Relay E-BUS Expansion Module
These relays are configurable by the user.

User Configurable Relay Outputs

USER-CONFIGURABLE RELAY OUTPUTS		
NO.	RELAY DESCRIPTIONS	DETAILS
1	**Cooling Stage**	Configured for each fixed stage of cooling (except heat pump compressor).
2	**Heating Stage**	Configured for each fixed stage of heating.
3	**Aux Heat**	Configured for a fixed stage of aux heat in a heat pump unit.
4	**Emergency Heat**	Configured for a fixed stage emergency heat in a heat pump unit.
5	**Mod Heat Enable**	Configure if a 0-10 VDC modulating heat source needs a relay to enable it.
6	**Mod Cool Enable**	Configure if a 0-10 VDC modulating cool source needs a relay to enable it.
7	**Morning Warm-Up / Cool-Down (VAV Boxes)**	Configure (1) relay for morning Warm-Up/Cool-Down when non-Orion VAV/Zone Controllers are used.
8	**Reheat**	Configure (1) relay for on/off reheat when used.
9	**Preheat**	Configure for preheat operation.
10	**Low Ambient**	Configure for low ambient operation.
11	**Exhaust or Return Fan**	Configure (1) relay for enabling exhaust or return fan when building pressure control is used.
12	**Economizer Active**	If configured, this relay will energize if unit is in Economizer Mode and the damper has moved 5% above its Economizer Minimum Setpoint position or if the damper moves above a user-adjustable position setpoint.
13	**Heat Wheel**	Configure (1) relay that turns heat wheel on when in occupied operation and turns heat wheel off when in Economizer Mode.
14	**Occupied Active**	If configured, this relay will energize whenever the unit is in the Occupied Mode.
15	**Override Active**	If configured, this relay will energize anytime the space sensor push-button override is active.
16	**Alarm Active**	If configured, this relay will energize anytime a VCCX-454 alarm is active.
17	**A1 Comp Run Status**	Will enable when the RSM A1 compressor activates.
18	**A2 Comp Run Status**	Will enable when the RSM A2 compressor activates.
19	**B1 Comp Run Status**	Will enable when the RSM B1 compressor activates.
20	**B2 Comp Run Status**	Will enable when the RSM B2 compressor activates.
21	**Condenser Pump**	If configured, this relay will energize when the unit requires the evaporative condenser to be enabled.
22	**Sump Heater**	If configured, this relay will energize when the unit requires the sump heater to be enabled.
23	**Sump Pump Drain**	If configured, this relay will energize when the unit requires the sump pump drain to be enabled.

Table 15: User-Configurable Relay Outputs

Configuration Options

Supply Fan Operation

Any time the supply fan is requested to start, a one-minute minimum off timer must be satisfied. If the timer is satisfied, the supply fan relay is activated while all other outputs are held off until their minimum off timers have been met.

Upon going into the Occupied Mode or upon power-up, the controller will initiate a user-adjustable fan starting delay to provide a staggered start for systems with several HVAC units.

To protect the dampers on MUA systems on startup, dampers open then the fan starts after the fan starting delay setpoint time expires. On shut down, the fan turns off first. The dampers close after the fan starting delay setpoint time expires or fan proving is deactivated.

In Fan Cycle Mode or when going Unoccupied, the supply fan is held on for 10 seconds after Cooling has staged off or after Leaving Vent Mode and 90 seconds after the Heating has staged off.

Purge Mode

When going into Occupied Mode, an optional Purge Mode is initiated. The fan runs with the economizer closed, and all cooling and heating is de-energized. The length of the Purge Mode is user adjustable.

Occupied Mode

The supply fan can be configured to run continuously (default) or to cycle with Heating, Cooling, or Dehumidification.

Unoccupied Mode

Upon going Unoccupied, the Cooling or Heating will turn off immediately. The fan will then turn off in 30 to 60 seconds. Typically, thereafter, the supply fan will cycle on a call for Heating, Cooling, or Dehumidification. The supply fan can also be configured for continuous operation during Unoccupied Mode.

HVAC Source Configuration Options

The VCCX-454 Controller can be configured to have various HVAC source options that will determine the mode of operation (Heating, Cooling, or Vent Mode) of the unit. The following are descriptions of those options.

Space Temperature

Typical selection for CAV recirculating units.

Return Air Temperature

Optional selection for CAV recirculating units.

Single Zone VAV

Selected for a space temperature controlled single zone VAV application.

Single Zone VAV with High Outdoor Air %

Provides SZVAV operation on units with high percentage of outdoor air. By tempering the supply air during the Vent Mode of operation, the unit will try to prevent dumping of hot or cold air into the space.

Outdoor Air Temperature

Typical selection for 100% outdoor air (MUA) or high percentage outdoor air units.

Supply Air Temperature

Selected for Cooling Only. VAV units with optional morning Warm-Up/Cool-Down.

Supply Air Tempering

Selected for VAV units maintaining a Cooling Setpoint with cooling or heating as required that may need heat to temper the supply air temperature during very cold conditions.

Space Temperature with High Outdoor Air %

Provides space temperature (instead of outdoor air temperature) control of 100% or high percentage outdoor air units by tempering the air during the space Vent Mode of operation to prevent dumping of hot or cold air into the space.

DOAS Unit (Supply Air Dew Point Control)

Selected for DX-DOAS units using 100% outdoor air and have an EBUS supply air temperature and humidity sensor installed.

HVAC Mode Set by Remote Contact

Provides for wet contact closures to force the unit into Heating, Cooling, and Dehumidification Modes. If this option is selected, it applies to all three modes, and all three modes will only be initiated by these contact closures. If both the heating and cooling contacts are made, the unit will be in Vent Mode.

Occupied/Unoccupied Mode of Operation

The VCCX-454 Controller can utilize several methods for determining the Occupied Mode of Operation. These are as follows:

- Forced schedule
- Remote forced occupied signal
- Internal week schedule
- Push-button override signal
- Broadcast week schedule from GPC-XP

The VCCX-454 Controller can be forced into the Occupied Mode by inputting a forced schedule from any operator interface.

Configuration Options

Remote Forced Occupied Signal

This forced occupied input can be used in place of, or in conjunction with, the internal VCCX-454 schedule. When this wet contact input closes, it will force the VCCX-454 Controller into Occupied Mode. When the remote forced occupied signal is removed, the controller will revert to the Unoccupied Mode of operation, or if an internal VCCX-454 schedule is also being used, it will revert to the current scheduled mode.

Setting the internal week schedule to "0" will cause the controller to only look for the remote forced occupied signal for occupied/ unoccupied commands.

Internal Week Schedule

An internal week schedule, which supports up to two start/stop events per day and allows scheduling of up to 14 holiday periods per year is available for determining occupied and unoccupied schedules. It also allows for daylight saving configuration.

Broadcast Schedule

Eight external broadcast schedules are available with the use of the GPC-XP Controller.

Unoccupied Operation

Uses Unoccupied Setback Offset Setpoints for Heating and Cooling calls. If Unoccupied Setback Setpoints are left at the default 30°F, no Unoccupied Setback operation occurs, and the unit will be off.

The outdoor air damper will be closed except if the unit is in Unoccupied Economizer Free Cooling Mode.

If there is no call for Heating or Cooling, the unit will be off.

Modes of Operation

There are eight possible HVAC Modes of Operation. They are as follows:

- Cooling Mode
- Heating Mode
- Vent Mode
- Dehumidification Mode
- Purge Mode
- Defrost Mode (Heat Pump)
- Warm-Up Mode/Cool-Down Mode
- Off Mode

Cooling Mode

Occupied Cooling is enabled when the temperature at the Mode Enable Sensor rises one deadband above the Cooling Setpoint. Cooling is disabled when the mode enable temperature falls one deadband below the Cooling Setpoint. The setpoint and deadband are user adjustable.

Unoccupied Cooling operation is enabled when the space temperature rises above the Cooling Mode Enable Setpoint plus the unoccupied cooling offset.

Mechanical cooling is disabled if the outdoor air temperature falls 1°F below the Cooling Lockout Setpoint and will remain disabled until the outdoor air temperature rises 1°F above the Cooling Lockout Setpoint. If the outdoor air temperature disables mechanical cooling while it is currently operating, mechanical cooling will stage off as minimum run times and stage down delays are satisfied.

If the economizer is enabled, it will function as the first stage of Cooling.

Cooling with the Refrigerant System Modules

On units with digital or VFD compressors, the VCCX-454 Controller will utilize one or more refrigeration modules. Units with only fixed staged compressors that are doing dehumidification or that require head pressure control would also utilize a refrigeration module. Each module will control the compressors, condensers, and electronic expansion valves (on VFD compressor units) for one or two refrigeration circuits. Up to four refrigeration modules may be used in controlling up to eight circuits.

The RM454-D is used for digital compressor units. The RM454-V and RM454-Z modules are used for VFD compressor units. The RM454-V and RM454-Z modules can communicate with independent electronic expansion valve controllers.

In Cooling Mode, as the supply air temperature rises above the active Cooling Supply Air Temperature Setpoint, the compressors will stage on and modulate to maintain the active Supply Air Cooling Setpoint. Each RSM will independently control its compressors to achieve the most efficient cooling control. Each stage must meet its minimum off time (adjustable) before it is allowed to energize. Successive stages are subject to a cooling stage-up delay (adjustable).

Cooling stages will continue to run until the supply air temperature falls below the active Supply Air Temperature Setpoint minus the cooling stage control window and the Cooling will begin to stage off. Each stage must meet its minimum run time (adjustable) before it is allowed to stage off. Successive stages are subject to a cooling stage down delay (adjustable). See the appropriate RSM Technical Guide for a more detailed sequence of operation.

Staged Cooling without Refrigerant System Modules

A refrigeration module will not be used on units with fixed stage compressors that are not doing dehumidification and that do not require head pressure control, or on units with on/off chilled water.

In Cooling Mode, as the supply air temperature rises above the active Supply Air Cooling Setpoint, cooling will begin to stage on. Each stage must meet its minimum off time (adjustable) before it is allowed to energize, and successive stages are subject to a cooling stage-up delay (adjustable).

Cooling stages will continue to run until the SAT falls below the active Supply Air Temperature Setpoint minus the cooling stage control window at which point the Cooling will begin to stage off. Each stage must meet its minimum run time (adjustable) before it is allowed to stage off and successive stages are subject to a cooling stage down delay (adjustable).

Modulating Chilled Water Cooling Control

In the Cooling Mode, as the supply air temperature rises above the active Supply Air Cooling Setpoint. The modulating cooling proportional window is used to determine the signal to the chilled water valve and is user adjustable. The modulating cooling signal is calculated based on the differential between the supply air temperature and the active Supply Air Temperature Setpoint based on the modulating cooling proportional window.

The maximum signal adjustment per time period is 10% and is not user adjustable. The minimum signal adjustment per time period is based on the modulating cooling proportional window. The larger the modulating cooling proportional window, the smaller the signal adjustment will be per time period. The time period is the delay between another increase or decrease in the chilled water cooling signal and is user-adjustable. For example, if the modulating cooling proportional window is 5°F, the signal would adjust 2% per 1°F each time period above or below the active Supply Air Temperature Setpoint. When the supply air temperature is above or below the active Supply Air Temperature Setpoint by 5°F or more, the signal would adjust 10% each time period.

Heating Mode

Available heating options are staged gas, modulating gas, staged electric, on/off hot water, modulating hot water, and modulating SCR electric.

Occupied Heating is enabled when the temperature at the Mode Enable Sensor falls one deadband below the Heating Setpoint. Heating is disabled when the Mode Enable temperature raises one deadband above the Heating Setpoint.

Unoccupied Heating operation is enabled when the space temperature falls below the Heating Mode Enable Setpoint minus the unoccupied heating offset.

In the Heating Mode, as the supply air temperature falls below the active Supply Air Heating Setpoint, the heating will begin to stage on or to modulate. Each stage must meet its minimum off time (adjustable) before it is allowed to energize, and successive stages are subject to a heating stage up delay (adjustable).

Heating stages will continue to run until the supply air temperature rises above the active Supply Air Temperature Setpoint plus the heating stage control window at which point the heating will begin to stage off. Each stage must meet its minimum run time (adjustable) before it is allowed to stage off, and successive stages are subject to a heating stage down delay (adjustable).

Mechanical heating is disabled if the outdoor air temperature rises 1°F above the Heating Lockout Setpoint and will remain disabled until the outside air temperature falls 1°F below the Heating Lockout Setpoint. If the outside air temperature disables mechanical heating while it is currently operating, mechanical heating will stage off as minimum run times and stage down delays are satisfied.

Modulating Heating

The VCCX-454 supports various forms of modulating heat such as SCR electric heat, modulating hot water heat, and modulating steam heat. This references modulating heat that is controlled from AO3 on the VCCX-454 Controller with a user-adjustable voltage range between 0-10 VDC. Modulating gas, which is controlled by a MODGAS-X series module, is not included in this section. Whichever form of modulating heating is used, the VCCX-454 will modulate the heat source to achieve the active Supply Air Temperature Setpoint.

The modulating heating proportional window is used to determine the signal to the modulating heating source and is user-adjustable. The modulating heating signal is calculated by the differential between the supply air temperature and the active Supply Air Temperature Setpoint based on the modulating heating proportional window. The maximum signal adjustment per time period is 10% and is not user-adjustable.

The minimum signal adjustment per time period is based on the modulating heating proportional window. The larger the modulating heating proportional window, the smaller the signal adjustment will be per time period. The time period is the delay between another increase or decrease in the modulating heating source signal and is user-adjustable.

For example, if the modulating heating proportional window is 5°F, the signal will be adjusted 2% per 1°F each time period above or below the active Supply Air Temperature Setpoint. When the supply air temperature is above or below the active Supply Air Temperature Setpoint by 5°F or more, the signal will adjust 10% each time period.

Direct Fire Heating

The VCCX-454 supports the use of a direct fire heater. The VCCX-454 sends and receives signals from a direct fire heater controller made by another manufacturer. The modulating heating signal (AO3) on the VCCX-454 controller is wired to the direct fire controller to adjust the amount of heat it puts out. The VCCX-454 uses the same modulating heating setpoints that are used for other types of heat

When a direct fire heater is installed on a non-MUA unit it requires the addition of a mixed air sensor wired to the T2 input on the EM1 module. The VCCX-454 uses the mixed air sensor and the supply air sensor to determine the heat rise the direct fire heater is providing. The max heat rise limit is calculated based on the outdoor air damper position. If necessary, the VCCX-454 will limit the supply air setpoint it is trying to reach to prevent the heat rise from exceeding the max heat rise limit.

A 0-5000ppm CO_2 located in the return duct is also required on non-MUA units. If the measured return CO_2 rises above the Direct Fire CO_2 Max Level setpoint the direct fire heater will be disabled until the CO_2 drops below the CO_2 Accepted Level setpoint. If the max level is exceeded 3 times in one hour the direct fire heat will be locked out.

Binary inputs 2 and 3 on the EM1 module are used to monitor Direct Fire Status and Alarms from the direct fire controller. If the VCCX-454 doesn't receive a Direct Fire Status signal within 10 minutes of enabling the direct fire heater it will remove the call for heat and lockout the direct fire heater. It will also generate a lockout if a Direct Fire Alarm signal is active.

Before activating the heater, the VCCX-454 will go through a purge mode to verify the OA damper is moving. It will start opening the damper until it sees the mid-switch signal on the EM1 SIG 2 input switch state. Once it determines the damper is good it will put the damper at the OA Damper Position % setpoint value. If the damper is determined to be bad the direct fire heating will be locked out.

Primary Modulating Heat with Secondary Staged Heat

The modulating heat source can be modulating gas, modulating hot water, modulating steam, or SCR electric heat. In this case the modulating heat will be the first form of heat used and will attempt to achieve the active Supply Air Heating Setpoint. If the modulating heat reaches 100%, the heating stage up delay begins. If the primary heat source is still at 100% after the heating stage up delay expires, the secondary heat source will activate. The primary heat source can then modulate as necessary to achieve the active Supply Air Heating Setpoint. If there are additional stages of heat, they will stage up as described, with the primary heat source modulating as necessary.

If the secondary heat source is activated and the primary heat source has modulated to 0%, the heating stage down delay will begin. If the primary heat source is still at 0% after the heating stage down delay expires, the secondary heat source will deactivate. If there are multiple stages of secondary heat, they will stage off in the same manner. Then, if the supply air temperature rises above the active Supply Air Heating Setpoint plus the heating stage control window, the primary heat source will modulate to 0% to allow the supply air temperature to cool off.

Hot Water Coil Protection

NOTE: Unless the following sequence is utilized, the hot water valve is closed (regardless of configuration) when not being used for heating.

Fan On Mode

If anytime the fan is on, the supply air temperature falls below the user-adjustable Low Supply Air Temperature Cutoff Setpoint for at least one minute, the hot water valve will move to a user-adjustable position configured with the Hot Water Valve Protection Position Setpoint. If the supply air temperature rises above the low supply air cutoff by 5°F, the valve will return to its normal position.

If the supply air temperature remains below the Low Supply Air Temperature Cutoff Setpoint for 10 minutes, the unit will then shut down and the low supply air temperature cutoff alarm will be generated. If the supply air temperature rises above the low supply air cutoff by 5°F, the alarm (if generated) will clear and the unit will attempt to restart and resume normal operation.

Fan Off Mode

If anytime the fan is off, the outdoor air temperature falls below the user-adjustable Low Ambient Setpoint, the hot water valve will move to the user-adjustable Hot Water Valve Protection Position Setpoint. If the outdoor air temperature rises above the Low Ambient Setpoint, the valve will return to its normal position.

If the Hot Water Valve Protection Position Setpoint is left at the default of 0%, the controller will not initiate this protection sequence. This operation works during emergency shutdown.

Vent Mode

This mode is only available in the Occupied Mode of operation on units configured for continuous supply fan operation and is generated anytime there is no demand for heating or cooling. The fan will operate at the configured minimum vent speed.

Dehumidification Mode

On VAV, CAV, single VAV, and high percentage outdoor units with space temperature control, the Dehumidification Mode is initiated when the indoor humidity or dewpoint rises above the Indoor Humidity or dewpoint High Reset Source Setpoint. The unit will leave the Dehumidification Mode when the humidity or dewpoint falls below the Indoor Humidity or Dewpoint Low Reset Source Setpoint.

On 100% outdoor air (MUA) units with outdoor air temperature control, Dehumidification is initiated when the outdoor air dewpoint rises above the Outdoor Air Dewpoint Setpoint by 2°F. The unit will leave the Dehumidification Mode when the dewpoint falls 2°F below this setpoint. The outdoor air dewpoint is calculated using the outdoor air temperature and the outdoor air humidity.

Occupied Vent Mode Only

Dehumidification can only be initiated in the Occupied Mode when there is no call for Heating or Cooling. This creates a Vent Dehumidification Mode.

Both Occupied and Unoccupied Vent Mode

Dehumidification can be initiated in the Occupied and Unoccupied Modes when there is no call for Heating or Cooling. This creates a Vent Dehumidification Mode.

All Modes while Occupied

Dehumidification can be initiated anytime in the Occupied Mode during Cooling, Heating, or Vent Mode. This can create a Cooling Dehumidification Mode, a Heating Dehumidification Mode, or a Vent Dehumidification Mode.

All Modes while Occupied and Unoccupied

Dehumidification can be initiated anytime in the Occupied or Unoccupied Mode during Cooling, Heating, Vent, or Off Mode. This can create a Cooling Dehumidification Mode, a Heating Dehumidification Mode, or a Vent Dehumidification Mode. Any calls for Unoccupied Dehumidification use the same Dehumidification Setpoint as during the Occupied Mode.

NOTE: Do not use this option on a MUA unit that does not have return air and which is not configured for space controlled night setback operation. Damage to the unit could occur since the outdoor air damper remains closed in the Unoccupied Mode.

Dehumidification Operation on Chilled Water Units

For chilled water units, the VCCX-454 Controller will open the chilled water valve to a fixed 100% position to provide full moisture removal capability.

Dehumidification Operation on Direct Expansion Compressor Units

Any direct expansion unit doing dehumidification will utilize one or more RSMs. Each RSM will control the compressors, condensers, and electronic expansion valves (on VFD compressor units) for one or two refrigeration circuits. Up to four RSMs may be used in controlling up to eight circuits.

The RM454-D is used for digital compressor units, including heat pumps. The RM454-V and RM454-Z are used for VFD compressor units.

In the Dehumidification Mode, the compressors are controlled to maintain the Suction (Saturation) Temperature Setpoint. Each RSM will independently control its compressors to achieve the most efficient dehumidification control. See the appropriate RSM Technical Guide for a more detailed sequence of operation.

CAUTION: If the coil saturated temperature drops below 32˚F, any cooling remaining on will be forced to stage off.

During Dehumidification, the economizer will be held to its minimum position. If the unit will be using the CAV/MUA Dual Mode (hood on/off) Operation, Dehumidification will require the use of an Outdoor and Indoor Humidity Sensor.

NOTE: Compressor operation is subject to the outdoor air temperature cooling lockout during Dehumidification.

Reheat

During the Dehumidification Mode, the VCCX-454 activates Cooling to extract moisture from the supply air and utilizes either Modulating Hot Gas Reheat, On/Off Hot Gas Reheat, or Heating to reheat the supply air. Hot Gas Reheat is the standard form of reheat.

Reheat is always controlled to the active Supply Air Setpoint which will be different depending on whether the unit is in Cooling Mode Dehumidification, Heating Mode Dehumidification, or Vent Mode Dehumidification.

During Cooling Dehumidification, reheat is controlled to the active Cooling Supply Air Setpoint. During Heating Dehumidification, reheat is controlled to the active Heating Supply Air Setpoint. During Vent Dehumidification, reheat is controlled to a calculated setpoint that is halfway between the Heating and Cooling Mode Enable Setpoints.

If the unit is equipped with a MHGRV-X, during Dehumidification it will modulate the reheat valve to maintain the supply air temperature at the active Supply Air Temperature Setpoint.

If the unit is equipped with an on/off hot gas valve, then one of the relays will be configured for reheat. The reheat relay will be activated if the supply air temperature is less than the Supply Air Temperature Setpoint. The hot gas reheat relay will remain on during the Dehumidification Mode regardless of the supply air temperature. This is to ensure a steady supply air temperature.

The HVAC unit's heat source, heat pump auxiliary heat, or a heat source located in the supply air duct (which is used as the unit's heat source) can be used for reheat if the unit is not equipped with hot gas reheat or to supplement hot gas reheat.

WARNING: Simultaneous Heating and Cooling is not approved unless the HVAC unit has been specifically designed for this purpose. A Special Purchase Authorization (SPA) must be obtained from the AAON factory for these applications to avoid warranty and/or rating issues.

When unit heat is used for reheat instead of hot gas reheat, the VCCX-454 can activate the heat source(s) discussed in the Heating Mode section to maintain the supply air temperature at the active Supply Air Temperature Setpoint. When unit heat is used to supplement modulating hot gas reheat, the modulating hot gas reheat signal must reach 100% before Heating will be enabled to add additional reheat.

Coil Suction (Saturated) Temperature Reset

The indoor humidity or dewpoint can be used to reset the Coil Saturated Temperature Setpoint. A user adjustable range of indoor humidity or dewpoint values can be used to reset the Coil Saturated Temperature Setpoint between a user adjustable range of values. As the indoor humidity or dewpoint rises within its range the Coil Saturated Temperature Setpoint will be lowered within its range.

Return Air Bypass Damper Control

The Return Air Bypass Damper is only used on CAV units with space temperature or return air temperature configured as the HVAC Mode Enable Sensor. The Return Air Bypass Damper is only active during the Dehumidification Mode and is used as the first form of reheat. If the HVAC unit is equipped with modulating hot gas reheat, the Return Air Bypass Damper needs to be at 100% before the modulating hot gas reheat can be used. The Return Air Bypass Damper modulates from 0-100% as the space (or return air) temperature falls below the Cooling Setpoint. When the space (or return air) temperature is equal to the Cooling Setpoint, the Return Air Bypass Damper will be at 0%. When the space (or return air) temperature falls to halfway between the Cooling and Heating Setpoints, the Return Air Bypass Damper will be at 100%.

If the HVAC unit is equipped with separate actuators for the outdoor air and return air dampers, the return air damper will proportionally close more as the Return Air Bypass Damper opens. The rate at which the return air damper closes is user-adjustable. The purpose of closing the return air damper more as the Return Air Bypass Damper opens is to allow more air to bypass the evaporator coil through the Return Air Bypass Damper. If more air needs to pass through the Return Air Bypass Damper, enter a larger number in the Return Air Damper Factor Setpoint. If less air needs to pass through the Return Air Bypass Damper, enter a smaller number in the Return Air Damper Factor Setpoint.

When the "Modulate RAB to control Supply Air Temp" is checked the unit controller will modulate the Return Air Bypass damper to attempt to reheat the SAT back up to the SAT setpoint during RH mode. If the SAT is above the SAT setpoint the damper will be modulated closed and locked at 0% open. When the SAT is below the SAT setpoint in RH mode the controller will modulate the damper open using the Return Air Bypass (SAT) adjustable setpoints. The RAB Proportional Window sets the error calculation range of operations. The higher this setpoint is the further the SAT must be below setpoint to cause the control output to change from 0% to 100%. The RAB Control Rate is how often the calculation and modulation adjustments will be made. The Reheat Stage Delay setpoint is the amount of time the RAB damper must be at 100% while the SAT is below the SAT setpoint by at least the Staging Window amount before MHGRV will be allowed to operate.

When the RAB is at 100% and the SAT is below the SAT setpoint by at least the Staging Window amount a timer is started. If the SAT raises in temperature and is no longer below the SAT by the Staging Window then no adjustments will be made until the SAT once again goes below the SAT setpoint by the Staging Window amount and the Reheat Stage Delay timer has expired. When this occurs the RAB damper will be locked at 100% and the MHGRV will be enabled and modulated.

When the SAT rises above the SAT setpoint the MHGRV will modulate towards closed. When the MHGRV has modulated fully closed and the SAT is above the SAT setpoint by at least the Staging Window amount a timer is started. When the timer exceeds the Reheat Stage Delay amount the MHGRV is disabled and locked at 0%. Reheat Flush cycles are still allowed but the MHGRV will no longer modulate for SAT reheat. The RAB damper is unlocked so it can once again start modulating towards closed until the SAT compared to the SAT setpoint is satisfied. If the SAT once again falls below the SAT setpoint the cycle repeats.

Purge Mode

This is described under Supply Fan Operation on page 30.

Heat Pump

Air to Air Heat Pump Operation

Cooling Mode will operate in the same manner as described in the Cooling section.

A reversing valve relay output can be configured to activate with the first compressor stage in the Heating Mode or the Cooling Mode of operation.

In the Heating Mode, compressor heat, auxiliary heat, and emergency heat can be used to achieve the active Supply Air Heating Setpoint. auxiliary heat can be either a modulating or staged form of heat, or it can be a modulating form of heat followed by staged heat.

When auxiliary heat comes on in conjunction with a digital compressor heat stage, the digital compressor will be locked at 100% until the supply air temperature rises above the Supply Air Temperature Heating Setpoint plus the heat staging window. At that point, the auxiliary heat will stage off (after a stage-down delay) and the digital compressor heat will be allowed to modulate.

When the outdoor air temperature is below the heating lockout but above the outdoor air temperature compressor heating lockout, compressor heat will be used and can be supplemented by auxiliary heat.

When the outdoor air temperature is below the outdoor air temperature compressor heating lockout, compressor heat is locked out. Auxiliary heat will then be the primary heat and can be supplemented with stage(s) of emergency heat (if available). Emergency heat is only available when the outdoor air temperature is below the outdoor air temperature compressor lockout.

Heat Pump Standard Defrost Operation

If using the VCCX-454 Controller with an installed defrost coil temperature switch, a defrost cycle is available.

If the compressor(s) are operating in the Heating Mode and the defrost coil temperature switch closes, the unit will enter the Defrost Mode, provided the user-adjustable defrost interval timer has elapsed since the last defrost cycle.

In the defrost cycle, the reversing valve signal is switched to the opposite operation, and the compressors are brought to maximum capacity. Auxiliary heat will be used to attempt to maintain the Heating Supply Air Temperature Setpoint. Emergency heat cannot be used because it is locked out because the compressors are on.

The unit will leave the Defrost Mode after 10 minutes have elapsed or the defrost coil temperature switch opens. If the unit leaves the Compressor Heating Mode, the defrost interval will restart once the unit re-enters the Compressor Heating Mode.

Heat Pump Adaptive Defrost Operation

The adaptive defrost operation adjusts the time interval (adaptive defrost timer) in between Defrost Mode cycles.

The unit will leave the Defrost Mode after 10 minutes have elapsed or the defrost coil temperature switch opens. If the defrost cycle is terminated because the 10 minute timer runs out, the adaptive defrost timer value will be subtracted from the original defrost interval.

If the defrost cycle is terminated between the eighth and ninth minute, the defrost interval will not be changed.

If the defrost cycle is terminated before the eighth minute, this could be an indicator that the unit may need less defrost time. To address this issue, the adaptive defrost timer value will be inversely proportionally added to the original defrost interval as the termination time moves from eight minutes to zero minutes.

Adaptive defrost can be disabled by setting the adaptive defrost timer setpoint to zero.

Water Source Heat Pump Operation

A reversing valve relay output can be configured to activate with the first compressor stage in the Heating Mode or the Cooling Mode of operation.

In Heating Mode, auxiliary heat can be used with compressor heat to achieve the active Supply Air Heating Setpoint. Auxiliary heat can be:

- Modulating heat
- Staged forms of heat
- A modulating form of heat followed by staged heat

When auxiliary heat comes on in conjunction with a digital compressor heat stage, the digital compressor will be locked at 100% until the supply air temperature rises above the Supply Air Temperature Heating Setpoint plus the heat staging window. At that point, the auxiliary heat will stage off (after a stage- down delay) and the digital compressor heat will be allowed to modulate.

There is no Defrost Mode on a water source heat pump unit.

The unit can be configured for a percentage of glycol. The options are 0%-40% in 5% increments.

Warm-Up Mode/Cool-Down Mode

Morning Warm-Up Mode Operation

NOTE: Morning Warm-Up can be configured for any application but should not be used on 100% outdoor air units, since the outdoor air damper remains closed during warm-up.

When the VCCX-454 Controller is configured for Morning Warm-Up and switches to the Occupied Mode of Operation (not Override or Force Mode from an operator interface device), the unit compares the return air temperature to a Morning Warm-Up target temperature. If the return air temperature is below this setpoint, the Warm-Up Mode is initiated. Heating will then be controlled to the Warm-Up Supply Air Temperature Setpoint.

This mode remains in effect until the return air temperature rises above the target temperature or a user-adjustable time period expires. Warm-Up Mode is not initiated by push-button overrides or unoccupied heating demands. The outdoor air damper remains closed during Warm-Up Mode.

Once the Warm-Up Mode has been terminated, it cannot resume until the unit has been through a subsequent Unoccupied Mode. Only one Warm-Up Mode is allowed per Occupied cycle.

If stand-alone VAV boxes that need to be forced wide open during the Warm-Up Mode, configure one of the relay outputs to be used during this Mode. If the Warm-Up Mode is active, the relay is activated. This relay then becomes the Force Open Command for all VAV boxes to which it is wired.

Morning Cool-Down Mode Operation

When the VCCX-454 Controller is configured for Morning Cool-Down and switches to the Occupied Mode of Operation (not Override or Force Mode from an operator interface device), the unit compares the return air temperature to a Morning Cool-Down target temperature. If the return air temperature is above this Setpoint, the Cool-Down Mode is initiated. Cooling will then be controlled to the Cool-Down Supply Air Temperature Setpoint.

This mode remains in effect until the return air temperature drops below the target temperature or a user-adjustable time period expires. Cool-Down Mode is not initiated by push-button overrides or unoccupied cooling demands. The outdoor air damper remains closed during Cool-Down Mode.

Once the Cool-Down Mode has been terminated, it cannot resume until the unit has been through a subsequent Unoccupied Mode. Only one Cool-Down Mode is allowed per Occupied cycle.

If stand-alone VAV boxes that need to be forced wide open during the Cool-Down Mode, configure one of the relay outputs to be used during this mode. If the Cool-Down Mode is active, the relay is activated. This relay then becomes the Force Open Command for all VAV boxes to which it is wired.

Off Mode

Off Mode occurs in the Unoccupied Mode when there is no heating or cooling demand. The supply fan is off and the outside air damper is closed.

Off Mode can only occur in the Occupied Mode if the fan is configured to cycle with heating and cooling and there is no call for heating or cooling.

Economizer Operation

Economizer Operation (Standard)

The Economizer can operate as a sensible economizer if used with an outside air temperature sensor or as an enthalpy economizer with an E-BUS outdoor air temperature/humidity sensor.

Economizer operation is enabled when the outdoor air drybulb, wetbulb, or dewpoint temperature falls below the Economizer Enable Setpoint by 1°F and if the outdoor air temperature is at least 5°F below the return air temperature (if that value is available). Economizer operation is disabled when the outdoor air temperature rises 1°F above the Economizer Enable Setpoint.

The economizer acts as the first stage of cooling and controls to the active Supply Air Cooling Setpoint. An economizer minimum position can be programmed into the controller. During economizer operation, the economizer will modulate between this minimum position and 100%. If the economizer reaches 100% for two minutes and the supply air temperature is still above setpoint, mechanical cooling is then allowed to stage up while the economizer is held at the full open position. Any time cooling stages are currently running, and the economizer becomes enabled, it will immediately open to 100%.

During Heat and Vent Modes, the economizer will remain at its minimum position. The only exception to this can occur during VAV operation with outdoor air temperature control. During Unoccupied Mode, the economizer can be used for night setback free cooling; otherwise it will remain closed.

Indoor air quality (CO_2) override of the economizer simply resets the economizer minimum position higher.

If utilizing the Title 24 economizer option, an economizer feedback signal (0-10 VDC) can be wired into the EM1 Expansion Module for status monitoring. Several Title 24 alarm conditions can also be displayed.

Economizer Override Via BACnet

As stated earlier, the economizer must reach and remain at 100% before compressors will be allowed to stage on to meet the Cooling Supply Air Setpoint. When BACnet commands the damper fully closed using a value of 0% or commands the damper fully open using a value of 100% the compressors are allowed to operate if required. Other values between full open and full closed will be Economizer operating as first stage and compressors as second stage. A value of -1 will release the override.

To avoid the economizer being disabled but compressors are enabled, AV:49 (Minimum Economizer Position) can be used. This will change the minimum position, while allowing compressors to remain on. However, if using AV:49 and the economizer operation is enabled, the damper can open more than the minimum position for true economizer operation.

Comparative Enthalpy Economizer Operation

A comparative enthalpy economizer option is also available. The E-BUS Outdoor Temperature/Humidity Sensor and the E-BUS Return Air Temperature/Humidity Sensor must be used for this operation to be available.

If the outdoor enthalpy is below the Comparative Economizer Enable Setpoint by the comparative economizer enable deadband amount, and the outdoor enthalpy is less than the return air enthalpy by the comparative economizer enable deadband amount, then economizer operation will be enabled to act as the first stage of Cooling.

If the outdoor air enthalpy rises above the Comparative Economizer Enable Setpoint by the comparative economizer enable deadband amount, or if the outdoor air enthalpy rises above the return air enthalpy by the comparative economizer enable deadband amount, then economizer operation will be disabled.

Comparative enthalpy economizer with dry bulb limit is also an option. It combines the above comparative enthalpy operation with enabling the economizer using the outdoor air dry bulb. Both methods must be true for the economizer to be enabled. If either method is not true, the economizer operation will be disabled.

Remote Contact Control

A remote contact control option can be configured on the VCCX-454 Controller to initiate the HVAC Modes of operation. If this option is configured, all Heating, Cooling, and Dehumidification modes will only be initiated based on 24 VAC wet contact closures on the forced heating, forced cooling, and forced dehumidification inputs on the VCCX-454 Controller. This is a single configuration option that applies to all three modes.

If both the forced heating and forced cooling inputs are inactive or if both are simultaneously active, then the unit is in Vent Mode state. In this condition in the Occupied Mode, only the fan would be on for ventilation. In this condition in the Unoccupied Mode, the unit would be off.

If forced dehumidification is also being used, it will operate in conjunction with the forced heating and forced cooling inputs according to which dehumidification option that is configured.

Space Sensor Operation

Space sensors are available as a plain sensor, sensor with override, sensor with slide adjust, and sensor with override and slide adjust (this is the version that is factory supplied). An E-BUS Digital Space Sensor is also available with override and setpoint adjustment capability.

Sensors with slide adjust can be programmed to allow Space Setpoint adjustment of up to ± 10° F.

If the space temperature is the supply air temperature/reset source, then the slide adjust will adjust the HVAC Mode Enable Setpoints and the Supply Air Temperature/Reset Source Setpoints simultaneously.

During unoccupied hours, the override button can be used to force the unit back into the Occupied Mode (by pressing the button for less than three seconds) for a user-defined override duration of up to eight hours. Pressing the button between three to 10 seconds cancels the override.

Multiple Digital Space Sensors

Multiple (up to 10) Digital Space Sensors can be connected to the VCCX-454 Controller in applications where multiple spaces (not utilizing VAV boxes) could be served by a single unit. These sensors can be either the E-BUS Digital Space Temperature Sensor with Display or the E-BUS Digital Space Temperature/Humidity Sensor with Display.

The VCCX-454 can be configured to use temperature (high and low) to determine the Cooling or Heating Mode or average the space temperature values and use that value to determine the mode of operation – in both cases relative to the Space Temperature Setpoints. It would use the highest humidity value relative to the Space Humidity Setpoint to initiate Dehumidification Mode.

The digital sensors each need to be configured with unique addresses (#1 -10) and have an LCD display for this operation. In this arrangement, only the sensor at address #1 can utilize the slide adjust. All push-button overrides on the sensors will function. Each sensor can have its own calibration offset, if required.

Indoor Air Quality (CO_2) Control Operation

If the VCCX-454 Controller is configured to monitor and control CO_2 levels, the economizer operation will be modified as follows:

1. If the CO_2 levels remain below the Low CO_2 Level Setpoint, the economizer minimum position (or airflow minimum) will remain at its configured value.
2. As the level of CO_2 increases above the Minimum CO_2 Level Setpoint, the economizer minimum position (or airflow minimum) will begin to be reset higher. The economizer minimum position (or airflow minimum) will be proportionally reset higher as the CO_2 rises within the range set by the Minimum CO_2 Level Setpoint and the Maximum CO_2 Level Setpoint. If the CO_2 level reaches the High CO_2 Level Setpoint, the economizer minimum position (or airflow minimum) will be reset to the maximum reset position.
3. The Maximum Reset Position Setpoint is the highest the economizer minimum position (or airflow minimum) can be reset to during CO_2 control operation. This setpoint is user-adjustable and does not keep the economizer from opening further during economizer operation.

Supply Air Temperature Setpoint Reset

Various sources can be configured to reset the Supply Air Temperature Setpoint. The following reset source options are available:

- Space temperature
- Outdoor air temperature
- Return air temperature
- Fan VFD signal
- Remote supply air temperature reset signal

For whatever option is selected, a High and a Low Reset Source Setpoint must be configured that will correspond to configured Low and High Supply Air Temperature Setpoints. This must be done separately for the Cooling Mode Setpoints and for the Heating Mode Setpoints.

When the reset source is at its highest configured setpoint, the Supply Air Temperature Setpoint will be reset to its lowest configured setpoint. When the reset source is at its lowest configured setpoint, the Supply Air Temperature Setpoint will be reset to its highest configured setpoint.

In all cases, as the reset source value moves within its range established by the configured High and Low Reset Setpoints, the Supply Air Setpoint will be proportionally reset within its range established by the configured Low and High Supply Air Temperature Setpoints.

If a remote supply air temperature reset signal is configured as the reset source, a configurable voltage signal (between 0 and 10 VDC, direct or reverse acting) can be used to reset the Supply Air Temperature Setpoint. The voltage that corresponds to the Low Supply Air Temperature Setpoint and to the High Supply Air Temperature Setpoint in both the Heating and the Cooling Modes is user-configurable.

NOTE: This supply air temperature reset cannot be used on a single zone VAV unit.

Airflow Monitoring

Outdoor, supply, return and exhaust airflow can be monitored using the EBTRON GTC116 or HTN104 series, Paragon MicroTransEQ or MTSE series, or GreenTrol GA-200-N Module in conjunction with a GreenTrol GF series of airflow station. Contact AAON Controls for information on other airflow station options. The VCCX-454 will control the outdoor air damper to maintain an Outdoor Air Cubic Foot per Minute Setpoint. This operation can be overridden higher by normal economizer control.

On an MUA unit or a unit configured for space control of high percentage outdoor air, since the damper is typically at 100%, the VCCX-454 can be configured to modulate the supply fan VFD to maintain an Outdoor Cubic Foot per Minute Setpoint.

Preheater Operation

A preheat relay can be configured to energize anytime the supply fan is operating and the outdoor air temperature is below the Preheat Setpoint. This option allows preheating of cold outside air before it reaches the evaporator coils and is useful in hot water/chilled water applications or during CO_2 control of the economizer in low temperature conditions. This operation only occurs in the Occupied Mode.

If using the PREHEAT-X, an SCR Preheater and/or stages of preheat can be controlled. If the entering air temperature (sensor connected to the PREHEAT-X) falls below the Preheat Setpoint, then preheat will be controlled to either a Cooling, Heating or Vent Mode Preheater Leaving Air Setpoint — depending on if the VCCX-454 is currently in the Cooling, Heating, or Vent Mode. These setpoints are all set in the VCCX-454 Controller.

If using the PREHEAT-X in conjunction with the VCCX-454 Controller, the entering air temperature on the PREHEAT-X (instead of the Outdoor Air Temperature Sensor connected directly to the VCCX-454 Controller) will be used as the temperature that locks out compressors during heat pump heating mode. See the *PREHEAT-X Module Technical Guide* for more details.

Low Ambient Operation

A low ambient relay can be configured. Whenever the outdoor air temperature falls below the Low Ambient Setpoint, this low ambient relay will energize. This operation occurs in both the Occupied and Unoccupied Modes of Operation.

Heat Wheel

One of the relay outputs can be configured as a heat wheel relay. This relay will enable the heat wheel when the unit goes into the Occupied Mode. If the unit is a recirculating unit configured to use economizer free cooling, the relay will disable during economizer operation.

If the unit is a 100% outdoor air unit configured to use the Outdoor Air Sensor as the controlling sensor, then the heat wheel relay will disable in between the outdoor air Cooling and Heating Mode Enable Setpoints (Outdoor Air Vent Mode). Similarly, on a unit configured for space control of high percentage outdoor air, and the unit is in Outdoor Air Vent Mode, the wheel is disabled. The controller can also be configured to disable the heat wheel relay between High and Low Outdoor Air Enthalpy Setpoints.

Heat Wheel Defrost

A Defrost Mode will occur if the heat wheel relay is active, the outdoor air temperature is below the Heat Wheel Defrost Setpoint, and 30 minutes have elapsed since the last Defrost Mode. The Defrost Mode will disable the heat wheel relay for two minutes. Before the heat wheel relay disables, a two minute delay will occur while the economizer closes to a 10% position to allow the return air to have maximum defrost effect on the wheel. At the end of the Defrost Mode, the heat wheel relay will enable, and the economizer will return to its normal position. This 10% re-positioning will not occur on units configured for MUA control (Outdoor Air is the controlling sensor), or for units in hood-on operation, or for units that are configured for space temperature control of a high percentage of outdoor air.

Duct Static Pressure Control

If the VCCX-454 Controller has been configured for duct static pressure control, then anytime the supply fan is operating, the unit will be controlling to a Duct Static Pressure Setpoint. The static pressure control output signal can be used to control a supply fan VFD (direct acting operation), or a zoning or bypass damper actuator (reverse acting operation).

The Duct Static Pressure Setpoint, the setpoint deadband, the static pressure control signal, and the static control rate are all user-adjustable. The static control rate is the amount of time that elapses between each adjustment to the duct static pressure control output signal. The default period is 10 seconds and should not be changed unless close observation reveals that the supply fan or bypass damper is hunting and not maintaining a stable pressure reading.

For supply fan VFD operation, the output signal increases (increases the VFD speed) if the duct static pressure is below the Duct Static Pressure Setpoint by the deadband amount, and the output signal decreases (decreases VFD Speed) if the static pressure is above the Setpoint by the deadband amount.

For bypass damper operation, the VCCX-454 will reverse the logic of the output signal. The output signal decreases (closes the zoning bypass damper) if the duct static pressure is below the Duct Static Pressure Setpoint by the deadband amount, and the output signal increases (opens the zoning bypass damper) if the duct static pressure is above the Duct Static Pressure Setpoint by the deadband amount.

If the static pressure ever rises higher than 0.5" water column above the Duct Static Pressure Setpoint, the duct static pressure control output signal value will be reduced by a maximum adjustment of 15% every control period until the static pressure is brought under control or the VFD fan minimum has been met. This is to prevent damage to the ductwork if all the VAV boxes are closed or some other blockage occurs in the ductwork.

Any time the supply fan is off, the duct static pressure control output signal will remain at 0 V. If duct static pressure control is not configured, the static pressure can still be monitored if a Static Sensor is installed, however, no control will occur.

WARNING: The manufacturer does not assume responsibility for protecting the equipment from over-pressurization. Always install mechanical high static protection cutoffs to protect the system.

Duct Static Setpoint Reset

If the VCCX-454 Controller is being used with AAON VAV box controllers in a VAV system, the Duct Static Pressure Setpoint can be dynamically reset based on the most-open VAV box associated with that unit. As long as the most-open box is less than 80% open, the Duct Static Setpoint will decrease at a user-adjustable reset rate from the Max Static Pressure Reset Limit Setpoint down to the Minimum Static Pressure Reset Limit. Once the most-open box exceeds 80%, the setpoint will increase toward the Maximum Static Pressure Reset Limit Setpoint. A MiniLink PD 5 is required to poll the VAV boxes for their damper position.

Duct Static Pressure Control for Filter Loading

In order to maintain a constant cubic feet per minute through the supply air ducts on a mixed air constant air unit, the VCCX-454 can utilize a Duct Static Pressure Sensor (used to monitor the discharge pressure) in conjunction with a supply fan VFD. If the filters are getting dirty, the VCCX-454 will ramp up the VFD to compensate for the decrease in airflow. To utilize this feature, the unit must be configured to use VFD fan control. This feature cannot be used if this is a VAV or zoning application with typical duct static pressure control, or if this unit has been configured for single zone VAV operation.

Exhaust Duct Static Pressure Control of Exhaust Fan

The VCCX-454 Controller can control an exhaust fan based off of exhaust duct static pressure. This sequence will require the use of the EM1 Expansion Module which has a modular jack that the Duct Static Pressure Sensor will plug into. The building pressure output will be used to control the exhaust fan for this operation.

A standard pull-through exhaust fan creates negative duct static pressure. Since a Duct Static Pressure Sensor reads positive pressure, this sequence requires the tubing for the sensor to be reversed so that the low side is in the exhaust ductwork. So, although the user is actually controlling to a negative pressure, the VCCX-454 will be configured to use (and will display) an equivalent positive Exhaust Duct Static Pressure Value and Setpoint. So, if the duct static pressure is below setpoint, the control signal will ramp up.

See the *VCCX-454 Controller Operator Interfaces SD Technical Guide* for the setpoint and deadband ranges associated with this control. The control rate is the same as the control rate configured for the supply duct static pressure control.

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Building Pressure Control

The VCCX-454 can maintain building static pressure anytime the supply fan is operating. A building pressure transducer must be connected to the VCCX-454 Controller. The following are the available control options.

Direct Acting Building Pressure Control

On/Off Exhaust Fan

If an on/off exhaust fan is being used, a relay output must be configured for "Exhaust Fan". This relay will energize whenever the building pressure rises above the Building Pressure Setpoint by the deadband amount. The relay will de-energize when the building pressure falls below the Building Pressure Setpoint by the deadband amount.

Exhaust Fan VFD or Modulating Exhaust Damper

If configured for modulating exhaust, a user-adjustable voltage output (AO4 – Building Pressure Output) will be used to control this fan or damper. An exhaust relay can be configured if necessary to enable the fan or damper. Whenever the building pressure rises above the Building Pressure Setpoint by the deadband amount, the exhaust fan relay will energize and the modulating signal will activate to control to the Building Pressure Setpoint. If the building pressure falls below the Building Pressure Setpoint by the deadband amount, the modulating signal will modulate towards 0% as it attempts to maintain the Building Pressure Setpoint. The exhaust fan relay is energized whenever the modulating signal is above 0%.

Return Fan Tracking of Supply Fan Control

As the supply fan operates, the return fan will follow the supply fan speed signal and operate at 100% (adj.) of its signal. The return fan will operate and modulate down toward its minimum speed percentage 0% (adj.).

Return Fan Tracking of Supply Fan Control with Motorized Exhaust Damper

As the supply fan operates, the return fan will follow the supply fan speed signal and operate at 100% (adj.) of its signal. The return fan will operate and modulate down toward its minimum speed percentage 0% (adj.). The exhaust damper will modulate to control the return plenum pressure .01" WG (adj.) plus the return plenum pressure deadband of .01" while the return exhaust fan is enabled. As the plenum pressure rises above .01" WG., the control signal will modulate open to achieve setpoint. As the plenum pressure falls below .01" WG., the modulating exhaust damper will decrease to build pressure.

Reverse Acting Building Pressure Control

Outdoor Air Damper

If this option is configured, the VCCX-454 will use the user-adjustable economizer/outdoor air damper output signal (AO2 – Economizer Control Signal) to maintain the Building Pressure Setpoint.

Whenever the building pressure falls below the Building Pressure Setpoint by the deadband amount, the modulating economizer output signal will modulate the damper open to control to the Building Pressure Setpoint. If the building pressure rises above the Building Pressure Setpoint by the deadband amount, the damper will modulate towards closed as it attempts to maintain the Building Pressure Setpoint. When this option is selected, no economizer free cooling or CO_2 indoor air quality operation will be available.

Supply Fan VFD

Careful consideration should be made regarding the effects of potential reduced airflow when using this option. If this option is selected, the supply fan VFD output (AO1 - Main Supply Fan VFD) will be used to control the supply fan VFD to maintain the Building Pressure Setpoint in similar fashion to the outdoor air damper control described above.

NOTE: If reverse acting building pressure control using the outdoor air damper is configured, the hood on input is ignored and will not drive the outdoor air damper open.

Return Plenum Pressure Control

The VCCX-454 Controller can control the return plenum pressure using a motorized exhaust damper. This is used on certain RNZ units that have a return fan that will be used to control building static pressure. This sequence will require the use of the EM1 Expansion Module which has an input for a return plenum pressure transducer (the same transducer used for the building pressure control) and an analog output that is wired to the actuator used to control the motorized exhaust damper. When the return fan is active (based on building pressure) the motorized exhaust damper will modulate to control the Return Plenum Pressure Setpoint. If the pressure is above the setpoint the modulating signal will move towards 100%. If the pressure is below setpoint the modulating signal will move towards 0%.

If the return fan shuts off and the building pressure drops below the Building Pressure Setpoint by more than three times the Build Pressure Deadband, the economizer will modulate to meet the Building Pressure Setpoint. The Economizer will modulate between the Economizer Minimum Position setpoint and the Maximum Economizer in Heating Mode setpoint.

If for any reason the economizer is equal to or greater than 90% open and the building pressure rises above the Building Pressure Setpoint plus the Building Pressure Deadband, the return fans will be enabled. Before the fans are turned on, the motorized exhaust damper will open to 30% and wait 30 seconds to turn on the return fans. This is done to prevent any damage to either the return or exhaust damper assemblies.

Make-up Air Operation

Occupied Mode

The VCCX-454 will use the normal Cooling and Heating Mode Enable Setpoints (not the Hood On Setpoints) in conjunction with the Outdoor Air Temperature Sensor to determine the mode of operation. The Outdoor Air Dewpoint Setpoint will initiate the Dehumidification Mode. The outdoor air damper will be modulated to the economizer minimum damper position (normally set at 100% for a MUA unit).

Unoccupied Mode

Normally, an MUA unit is off during the Unoccupied Mode. However, if the unit has return air, it can be configured to operate as a recirculating night setback controlled unit during unoccupied hours. This is accomplished by simply configuring Night Setback Temperature Setpoints (anything other than the default 30ºF) on a unit that is also configured for outdoor temperature control (MUA). With this configuration, when the unit goes Unoccupied, it will close the outdoor air damper and begin to use a Space Temperature Sensor in conjunction with the existing Heating and Cooling Setpoints, offset by the night setbacks, to make night setback calls. If a Space Humidity Sensor is installed, and the unit is configured for night humidity control, the VCCX-454 Controller will use the Space Humidity Setpoint for Unoccupied Dehumidification calls.

DX-DOAS Operation

When the VCCX-454 is configured for DX-DOAS operation it requires the outdoor air damper to be 100% open and have an EBUS supply air temperature and humidity sensor installed. Modes of operation are determined the same way a unit configured as a Make-up Air would calculate its modes. The main difference is when the unit is in dehumidification mode it will try to control to a supply air dewpoint setpoint. To achieve the Supply Air Dewpoint setpoint, the VCCX-454 will monitor the supply air dewpoint and will rest the Coil Setpoint the RSM modules use to control the compressors.

Constant Air Volume/Make-up Air Dual Mode (Hood On/Off Operation)

The VCCX-454 can be configured as a CAV controller but switch to MUA operation when an exhaust hood is energized. This MUA Force Mode occurs when a 24 VAC wet contact closure is received on the hood on binary input on the VCCX-454. Under normal operation (CAV), the unit will operate as a recirculating space temperature (and space humidity) controlled unit. This sequence should not be used on a VAV unit.

When the hood on contact is made, the unit will open the outdoor air damper to its full open position. The Heating and Cooling Modes are determined by the Outdoor Air Temperature Sensor using the hood on Outdoor Air Heating and Cooling Setpoints which are used only in hood on operation.

Dehumidification is initiated by an Outdoor Dewpoint Setpoint. If using reverse building pressure control using the outdoor air damper, the hood on input will not affect the damper position.

When the Hood On Force Mode is removed, the unit will revert to CAV operation with the outdoor damper returning to its minimum position (unless economizer operation is enabled) and with mode control initiated by the Space Temperature and Humidity Sensors.

Commercial Kitchen MUA

When the VCCX-454 is configured to enable Commercial Kitchen MUA Control, the controller will control the amount of air being brought into the building to make up for the air being exhausted. The air being exhausted is controlled by a separate control system that sends the VCCX-454 a 0-10 VDC signal on analog input 6 based on its exhaust demand. The VCCX-454 uses the voltage signal being sent to it to calculate its OA damper position.

Three setpoints are used for determining where the OA damper should be positioned to bring in the correct amount of outdoor air. The MUA Min setpoint is the amount of CFM when 0 VDC is present on analog input 6. The MUA Max setpoint is the amount of CFM when 10 VDC is present. The Fan Speed Factor setpoint is used to calculate how far open the OA damper needs to be to get the required CFM based on the current fan speed.

When the MUA CFM Priority is checked the outdoor air damper will modulate solely based on the 0-10 VDC coming from the Exhaust system and the supply fan speed. When the MUA CFM Priority is unchecked it will use the higher value between the normal ECON desired output and the exhaust calculated desired output.

CAUTION: If the ECON dampers need more air, it will override the Exhaust and possibly over pressurize the kitchen.

Space Temperature Control of High Percentage Outdoor Air Units

This option allows for space temperature control of 100% outdoor air units or units with a high percentage of outdoor air (normally 50% or greater). Configure “Space Temperature w/High Percentage OA” for the controlling sensor option. The intent of this sequence is to allow space temperature and humidity control of the unit while preventing the dumping of hot or cold outside air into the space during the Space Vent Mode of operation. If a Return Air Humidity Sensor is available, it can be configured to initiate dehumidification.

As long as there is a space temperature call for Cooling or Heating or if there is a Space Dehumidification call, the unit will remain under space control.

During this space control operation, if the configured minimum outdoor air damper (economizer) position is less than 100%, the economizer can open farther for free cooling during Space Cooling Mode. Additionally, the economizer minimum position can be overridden by indoor air quality CO_2 conditions.

If both the space temperature and the space humidity are satisfied, before switching to the Space Vent Mode, the controller compares the outdoor air temperature to the Hood On HVAC Setpoints (Hood On Make-up Air Setpoints) to determine if a continued demand for heating or cooling is required to prevent dumping.

If there is no demand, the VCCX-454 switches to Vent Mode. If the outdoor air temperature is greater than the Hood On HVAC Cooling Setpoint or less than the Hood On HVAC Heating Setpoint, plus the Occupied deadband, the VCCX-454 will continue mechanical cooling or heating operation and stage or modulate it as necessary to maintain the Vent Mode Supply Air Setpoint (calculated to be halfway between the Space Heating and Cooling Mode Enable Setpoints). During this outdoor control, if the configured minimum outdoor air damper (economizer) position is less than 100%, the minimum position can be overridden by indoor air quality CO_2 conditions.

While the unit is under outdoor air temperature control, Dehumidification Mode is initiated by the Outdoor Air Dewpoint Setpoint with reheat controlling to the Vent Mode Supply Air Setpoint. Any call for space Cooling, Heating, or Dehumidification will cancel the outdoor operation and return the unit to space control.

NOTE: All minimum run times must be satisfied before mechanical cooling or heating is de-energized.

Single Zone Variable Air Volume

Single zone VAV is an application where the supply fan VFD modulates to maintain the Space Temperature Setpoint while heating or cooling is modulated to maintain the Supply Air Setpoint. This application can be configured to use VAV Cooling and either VAV Heating or CAV Heating. There is no Supply Air Temperature Setpoint reset function on a single zone VAV unit.

VAV Cooling and VAV Heating require modulating cooling and heating sources in order to maintain a constant supply air temperature no matter what the fan speed is. CAV Heating must be configured if using a staged form of heat.

The Space Temperature Sensor (cannot use return air temperature) determines the heating or cooling mode of operation.

In the Cooling Mode, the modulating cooling source will modulate to maintain the Cooling Supply Air Setpoint. The supply fan VFD will begin operation at a user-adjustable minimum VFD cooling speed (30% default) and modulate between this setpoint and 100% as needed to maintain the space temperature within the space cooling reset window created by configuring a Space Cooling High and a Space Cooling Low Reset Source Setpoint.

If the unit is configured for variable air volume heating, then in the Heating Mode the modulating heating source will modulate to maintain the Heating Supply Air Setpoint. The supply fan VFD will begin operation at a user-adjustable minimum VFD heating speed (50% default) and modulate between this setpoint and the maximum VFD heating speed (100% default) as needed to maintain the space temperature within the space heating reset window created by configuring a Space Heating High and a Space Heating Low Reset Source Setpoint.

If the unit needs to be configured for CAV heating, set the minimum VFD heating speed to be the same as the maximum VFD heating speed desired during heating. Once the unit enters the Heating Mode, the supply fan will run at the set maximum VFD heating speed (100% default).

In the Vent Mode of operation, the supply fan will operate at the VFD vent speed (user-adjustable).During Dehumidification, the fan will operate as described above, depending on if the space temperature is calling for Cooling Dehumidification or Heating Dehumidification.

When the controller is in the Vent-Dehumidification Mode, the supply fan VFD will still modulate based on the space temperature. It looks at a temperature half way between the Cooling and Heating Setpoints and modulates between the Cooling minimum and 100% as the space temperature goes from the midway value to 0.5°F above that value.

Night setback operation uses the same single zone VAV fan control logic. However, since the setbacks would normally be larger than the space reset range for the fan speed, the fan will typically always be at 100%.

If the hood on/off operation is used on a single zone VAV unit, then during hood on, the mode enable will switch to the Outdoor Air Temperature Sensor using Hood On Mode Enable Setpoints and the outdoor air damper will modulate to 100%. The supply fan VFD will modulate to 100%.

SZVAV Control of High Percentage Outdoor Air Units

This option allows for SZVAV control of units with a high percentage of outdoor air (normally 50% or greater). For this application configure “SZVAV w/High OA Content” for the controlling sensor option. The intent of this sequence is to allow space temperature and humidity control of the unit while preventing the dumping of hot or cold outside air into the space during the Space Vent Mode of operation.

This configuration uses the same sequence described in the Space Temperature Control of High Percentage Outdoor Air Units section for determining modes of operation. When in Space Vent Mode the supply fan will operate at the minimum VFD percentage for the mode of operation being calculated by the outdoor conditions.

Variable Air Volume Operation with Supply Air Tempering (Variable Air Volume Operation with Outdoor Air Temperature Control)

On a VAV unit that may need daytime heating in order to maintain the Cooling Supply Air Setpoint, previous controllers used a supply air tempering sequence with the Supply Air Temperature Sensor configured as the controlling sensor. The VCCX-454 Controller accomplishes the same result using the Hood-On Outdoor Air Setpoints to initiate Cooling and Heating.

To utilize this sequence, the HVAC Mode Enable Source is configured as supply air tempering. Then, configure the Hood On HVAC Setpoints for the outdoor air temperature values to enable Cooling and Heating. The Hood On Heating Setpoint should be set at or above the outdoor air temperature, that when mixed with the return air (with the economizer at its minimum position), requires Heating in order to achieve the Heating Supply Air Setpoint. The Hood On Cooling Setpoint is set above that, which allows a Vent Mode in between. Then, configure the Cooling and Heating Supply Air Setpoints. While not set at the same value, those would normally both be set at or near 55°F to allow the box heat to keep spaces comfortable.

With this configuration, as the outdoor air temperature rises above the Hood On Cooling Setpoint, the unit will be in Cooling Mode, controlling to the Cooling Supply Air Setpoint. The economizer can operate as normal for free cooling to maintain the Cooling Supply Air Setpoint. During the Vent Mode, when the outdoor air temperature is between the Hood On Cooling and Heating Setpoints, the economizer can modulate if necessary to maintain the Cooling Supply Air Setpoint.

Whenever the outdoor air temperature falls below the Hood On Heating Setpoint, the unit will be in Heating Mode controlling to the Heating Supply Air Setpoint. The economizer can still modulate during Heating Mode if the supply air temperature is too warm, and it will control to a setpoint calculated to be 2°F above the Heating Supply Air Setpoint. In this way, the economizer will have time to close to its minimum position before the supply air temperature falls below the Heating Supply Air Setpoint and Heating is initiated.

During Morning Warm-Up, heating will be controlled to the Morning Warm-Up Supply Air Setpoint.

In this operation, if night setback operation will be initiated by a Space Sensor connected to the VCCX-454 Controller, then the night setback Cooling and Heating offsets will be applied to the normal Occupied HVAC Mode Enable Setpoints (not the Hood On Setpoints). During night setback operation, Heating will be controlled to the Morning Warm-Up Supply Air Setpoint. Finally, configure the VCCX-454 for duct static pressure control.

Electronic Expansion Valve Operation

If using electronic expansion valves with VFD Compressors and the RM454-V Module, then a coil (suction line) temperature sensor will measure the coil (suction line) temperature after each evaporator coil line for each compressor, and this sensor will be connected to an RM454-V Module. This temperature will be used in conjunction with the calculated saturated refrigerant temperature to calculate the superheat of each evaporator coil. The electronic expansion valve for each coil will then be controlled to maintain the Superheat Setpoint.

Head Pressure Control

The RSM can monitor a Head Pressure Transducer and control a condenser fan to maintain a Head Pressure Setpoint.

In Cooling Mode, the condenser signal will modulate to maintain the Cooling Head Pressure Setpoint.

In Dehumidification Mode, the condenser output signal controls to the Reheat Head Pressure Setpoint. High head pressure conditions produce the same effects as in the Cooling Mode.

See the appropriate RSM Technical Guide for a more detailed sequence of operation.

Evaporative Condenser Operation

If the unit has been configured for evaporative condenser control and the outdoor air temperature is above the Evaporative/Modulating Condenser Low Ambient Setpoint, the evaporative condenser pump relay will energize to be used as the first stage of head pressure control when the compressors are active. Modulating condenser fan control will be the second stage.

If the outdoor air temperature is below the Evaporative/Modulating Condenser Low Ambient Setpoint, the modulating condenser fan will be used as the first stage of head pressure control, and the evaporative condenser pump relay will energize as the second stage.

If the head pressure is above the Cooling Head Pressure Setpoint by the Evaporative Head Pressure Deadband Setpoint, the second stage of head pressure control will be enabled. At this level below the Cooling Head Pressure Setpoint, the second stage of head pressure control will be disabled.

Sump Heater Operation

The sump heater relay activates if the sump temperature is below the Sump Heater Enable Temperature Setpoint. The sump heater relay deactivates once the sump temperature rises 10ºF above the Sump Heater Enable Temperature Setpoint or if the sump drain relay is active.

Sump Drain Enable Operation

If the sump temperature is below the Sump Drain Enable Setpoint for one minute, the sump pump drain relay will enable. The sump drain enable relay can be disabled in one of two ways:

1. Cycle power to the VCCX-454 when the sump temp is above the Sump Drain Enable Setpoint or
2. Use BACnet point AV:94 Sump Drain Override. The building management system (BMS) needs to set AV:94 to a value of 1 and back to 0 when the sump temp is above the Sump Drain Enable Setpoint.

Chemical Mixing Mode

If the VCCX-454 is configured to allow chemical mixing, a Chemical Mixing Mode can occur if the evaporative condenser pump hasn't ran for 23 hours. If 23 hours has elapsed the Chemical Mixing Mode will occur the next time the controller's clock time equals the Chemical Mixing Force Time setpoint. When this mode occurs the unit will shutdown and enable the condenser pump for the Chemical Mixing Run Time setpoint duration. Once the chemical mixing time is finished the unit will stay off for the Chemical Mixing Dry Time setpoint duration. When the dry time is finished the unit will turn back on.

Waterside Economizer Operation

If the unit is equipped with a waterside economizer, the following describes the operation of the waterside economizer valve, the waterside economizer bypass valve, and the condenser valve operation during the different modes.

Unit Off Mode and Unit Vent Mode

The waterside economizer, bypass, and condenser valves will be closed.

Unit Cooling Mode

If in Cooling Mode, the entering water temperature is below the entering air temperature (measured by the sensor connected to the outdoor temperature sensor input), by the entering water control deadband amount, the waterside economizer valve will modulate to maintain the Cooling Supply Air Setpoint. The bypass and condenser valves will remain closed.

If the waterside economizer valve opens to 100% and cannot maintain the Cooling Supply Air Setpoint, then the unit will enable and stage/modulate compressors to maintain the Cooling Supply Air Setpoint, while the waterside economizer valve is locked at 100%. The bypass valve will remain closed, while the condenser valve will modulate to maintain the Head Pressure Setpoint.

If the outdoor air temperature is cooler than the entering water temperature, the waterside economizer valve will remain closed, and compressor cooling will stage/modulate to maintain the Cooling Supply Air Setpoint. The bypass valve will modulate to maintain the Head Pressure Setpoint, and the condenser valve will be open.

Unit Heating Mode

The waterside economizer valve is closed, while the bypass valve and condenser valves are open.

NOTE: For waterside economizer bypass wiring, please see the *RM454-D Technical Guide*.

Waterside Economizer Flush Cycle

If the economizer has been closed for 72 hours, a flush cycle will be initiated the next time the compressor is activated or at the next 6:00 AM time slot, whichever happens first. During the flush cycle, the economizer valve will open for five minutes and then close again before the compressor activates. The 72-hour timer will restart once the flush cycle is completed or the economizer has been activated and has closed again.

Temperature Protection

Temperature protection is activated when the supply air temperature rises above the high cutoff temperature (immediate) or drops below the low cutoff temperature (default 10 minutes, adjustable starting in software version 1.08). Both cutoff setpoints are user-adjustable. This mode shuts off the unit.

This mode is canceled when the supply air temperature drops 5ºF below the High Cutoff Temperature Setpoint or rises 5ºF above the Low Temp Cutoff Temperature Setpoint or when the unit changes back into Occupied Mode.

Outdoor Air Lockouts

The compressors are disabled during Cooling Mode when the outdoor air temperature is below the Compressor Cooling Lockout Setpoint. Mechanical heating is disabled when the outdoor air temperature is above the Heating Lockout Setpoint.

For air to air heat pumps, the compressors are disabled during Heating Mode when the outdoor air temperature is below the Compressor Heating Lockout Setpoint.

NOTE: Compressors can also be forced to be locked out using BACnet point AV: 98 Emergency Compressor Lockout.

System Broadcasts

The VCCX-454 Controller can be configured to broadcast building pressure, outdoor air temperature, outdoor air humidity, space temperature, space humidity, and CO_2 to any VCCX-454 Controller that does not have one or more of these sensor(s). A CommLink 5, CommLink 6, or MiniLink PD 5 is required to broadcast these values.

Alarms

Alarm Detection and Reporting

The VCCX-454 Controller continuously performs self diagnostics during normal operation to determine if any operating failures have occurred. These failures (alarms) can be reported to a computer running Prism 2 software.

To view an alarm in Prism 2, click the Alarm icon and the ALARM screen will display all systems and active alarms.

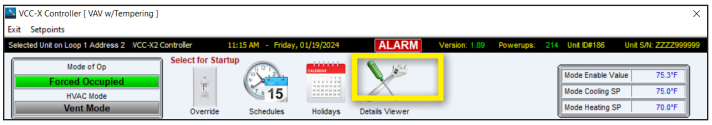


Figure 20: Prism 2 ALARM Button

Figure 21: Prism 2 ALARM Menu

A2L Alarms

A2L Leak Detect

This alarm is generated when there is a leak detected in either the airstream, cabinet, or both. Refer to the A2L sequences on **Page 9** for more information. The A2L Leak Detect alarm will stay active on the VCCX-454 even if the condition is cleared. It can only be manually cleared by power cycling the VCCX-454 or by using the keypad and display on the VCCX-454.

Sensor Failure

Supply Air Sensor

The Supply Air Temperature Sensor failure alarm is generated when the controller detects an open or short circuit on the Supply Air Temperature Sensor input. Once the alarm is generated, the unit will be completely shut down. If a sensor is properly detected after the unit has alarmed, the alarm will be cleared and the unit will restart operations.

Return Air Sensor

This alarm is generated if the controller is configured to have a Return Air sensor, but does not detect it.

Outdoor Air Sensor

The Outdoor Air Temperature Sensor failure alarm is generated when the controller detects an open or short circuit on the Outdoor Air Temperature Sensor input. When this occurs, the outdoor air reading will be artificially set to the half point between the Cooling and Heating Lockout Setpoints. This will allow cooling and heating to continue operating. For MUA systems, the Outdoor Air Temperature Sensor is the controlling sensor (Mode Enable Sensor). This alarm forces the MUA into Heating Mode.

Space Sensor

If the Space Sensor is configured as the controlling sensor (Mode Enable Sensor) or as the reset sensor, and if the controller detects an open or short circuit on the space sensor input, or if the controller detects a missing E-BUS Digital Space Sensor, then a Space Temperature Sensor failure alarm is generated. If the Space Sensor is configured as the controlling sensor and the failure alarm is generated, the unit will shut down. If the Space Sensor is only configured as a reset sensor and the failure alarm is generated, the space temperature will default to a value half way between the Heating and Cooling Mode Enable Setpoints, and the unit will continue to run.

Carbon Dioxide Sensor

This alarm is generated if the controller is configured to have a CO_2 Sensor, but does not detect it. Indoor Air Quality Mode is disabled when this occurs. If a sensor is properly detected after the unit has alarmed, the alarm will be cleared and the unit will return to CO_2 control.

Relief Pressure Sensor

The Relief Pressure Sensor alarm only occurs if the VCCX-454 is receiving the value from a Broadcast or BACnet and the value is out of an acceptable range.

Airflow Alarms

- Outdoor Airflow Sensor Alarm
- Exhaust Airflow Sensor Alarm
- Supply Airflow Sensor Alarm
- Return Airflow Sensor Alarm

If the controller is configured to have any of the above airflow sensors, but the controller does not detect that the sensor is connected, then the applicable alarm will occur. If the sensor is properly detected after the unit has alarmed, the alarm will be cleared.

Space Humidity Reading

Alarm will be active if controller is configured to detect Space Humidity but does not read it.

Mixed Air Temp

Alarm will be active if controller is configured to detect Mixed Air Temperature but does not read it.

Mechanical Failure Alarms

Mechanical Cooling Failure

Fixed Stage Cooling: The mechanical cooling failure alarm is generated if the supply air temperature is more than 5°F from the Supply Air Temperature Setpoint at the activation of stage 1 of cooling and subsequently fails to change by more than 5°F within the user-adjustable failure time period. If the supply air temperature subsequently changes by more than 5°F from that original supply air temperature, the alarm timer will be reset and the alarm will be cleared.

This alarm is not utilized for RSM based cooling systems or for modulating chilled water systems.

Variable Capacity Compressors (utilizing RSMs): This alarm is not generated; instead, the user has to monitor the compressor module alarms for mechanical cooling issues.

Mechanical Heating Failure

Fixed Stage Heating: The mechanical heating failure alarm is generated if the supply air temperature is more than 5°F from the Supply Air Temperature Setpoint at the activation of stage 1 of heating and subsequently fails to change by more than 5°F within the user-adjustable failure time period. If the supply air temperature subsequently changes by more than 5°F from that original supply air temperature, the alarm timer will be reset and the alarm will be cleared.

Any alarm on a MODGAS-X series module will cause this alarm to activate. This alarm is not utilized for modulating systems including modulating hot water systems or SCR electric heat.

Fan Proving Failure

A proof of flow switch provides a 24 VAC wet contact closure when the supply fan is operating. If this contact opens while the fan is being called to run, all heating and cooling is disabled, the outdoor air damper closes (if it is not configured for outdoor temperature control or space control with high percentage outdoor air), and a fan proving alarm is generated. Fan proving needs to be configured for this alarm to occur. There is a 30 second delay for this alarm.

Dirty Filter Alarm

A differential pressure switch is used to provide a 24 VAC wet contact closure to indicate a dirty filter status. A dirty filter alarm is then generated. Dirty filter needs to be configured for this alarm to occur.

Emergency Shutdown Alarm

A 24 VAC wet contact input is available to be used when a normally closed smoke Detector, Firestat, or other shutdown condition occurs. If this contact opens, it will initiate shutdown of the VCCX-454 and will generate an alarm condition. If an Occupied relay is configured, it will remain energized. BACnet override commands are canceled if the emergency shutdown alarm is activated.

Relay Runtime Exceeded

Alarm is generated if a Relay Run Time exceeds the user adjustable time.

Economizer Feedback Missing

This failure can only occur during calibration and won't clear until the feedback issue is corrected and it is recalibrated (cycle power to the unit). The Missing Feedback will cause B, C, D, E alarms.

Title 24 Alarm "A" (Economizer Air Temperature Sensor Failure)

Outside air or Supply Air Temperature Sensor is shorted or missing.

Title 24 Alarm "B" (Not Economizing When it Should)

Economizer is enabled but not following the desired economizer position commanded.

Title 24 Alarm "C" (Economizing When It Should Not)

Economizer is not enabled but the feedback signal indicates a position more open than the minimum.

Title 24 Alarm "D" (Economizer Damper Not Modulating)

Economizer is enabled but not within 10% of desired position within 150 seconds.

Title 24 Alarm "E" (Economizer Excess Outdoor Air Failure)

Economizer feedback is lost or economizer is not following commanded position.

Return/Exhaust Fan Proving Failure

There are configuration options for return fan proving and exhaust fan proving alarms. If the unit is configured for return fan proving, it is assumed that the return fan is wired in parallel with the supply fan relay. In this case, if the supply fan relay is energized, but the return/exhaust fan proving binary input on the EM1 Module does not see 24 VAC, a return/exhaust fan proving alarm will occur.

If the unit is configured for building pressure control of the exhaust fan, if the exhaust relay is energized, but the return/exhaust fan proving binary input on the EM1 Module does not see 24 VAC, a return/exhaust fan proving alarm will occur.

Alarms

Direct Fire Alarms

In the Prism 2 Alarm Menu, click OK on the Direct Fire Alarms to display the applicable alarms.

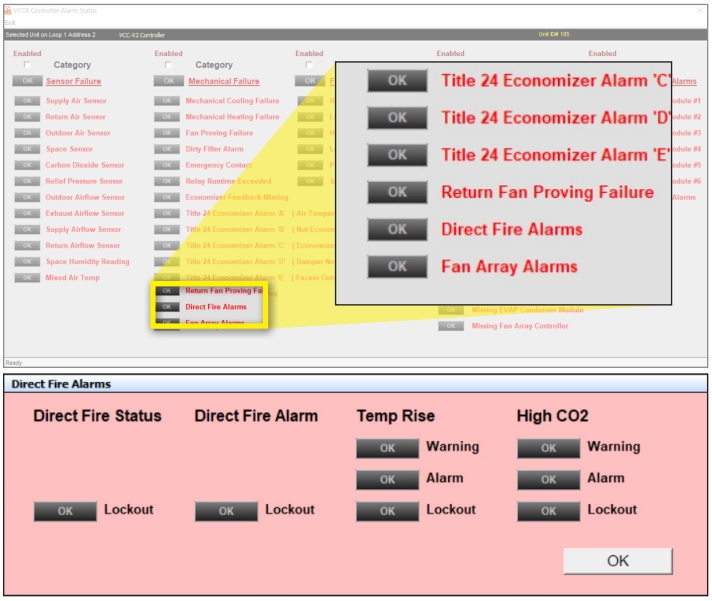


Figure 22: Prism 2 Direct Fire Alarms Screen

Failure Mode Alarms

High and Low Supply Air Temperature Alarm(s)

If the supply air temperature rises above the user-adjustable High Supply Air Temperature Cutoff Setpoint, heating will be immediately deactivated, and a high supply air temperature cutoff alarm will be generated. The fan will continue to run. This mode and alarm will be canceled if the supply air temperature falls below the High Supply Air Temperature Cutoff Setpoint by 5ºF.

If the supply air temperature falls below the user-adjustable Low Supply Air Temperature Cutoff Setpoint, all mechanical Cooling will be immediately deactivated. If, after 10 minutes, the supply air temperature is still below this setpoint, the fan and mechanical heating will be deactivated, the outdoor air damper will close, and a low supply air temperature cutoff alarm will be generated. This mode and alarm will be canceled if the supply air temperature rises above the Low Supply Air Temperature Cutoff Setpoint by 5ºF.

High and Low Control Temp Failure

When the space temperature rises above the Cooling Mode Enable Setpoint plus the Control Mode High Alarm Offset Setpoint for 30 seconds, the controller will generate a high control temp failure alarm. When the space temperature drops below the Heating Mode Enable Setpoint minus the control Mode Low Alarm Offset Setpoint for 30 seconds, the controller will generate a low control temp failure alarm. Both offset setpoints are user-adjustable.

Preheater Alarm

This alarm indicates a leaving air temperature cutoff alarm condition which is activated if the controlling leaving air temperature has dropped below 35ºF for more than two minutes. The alarm will be disabled if after a fixed delay period the leaving air temperature has risen above 35ºF

Sump Drain

When the Outside Air Temperature drops below the Sump Drain Enable Temperature, the Evaporative Condenser drain valve will open.

Expansion Boards

If the controller is configured to have any of the below expansion boards (Modules), but the VCCX-454 controller does not detect that board, then the applicable alarm will occur. If the board is properly detected after the unit has alarmed, the alarm will be cleared.

- Compressor Modules #1-6
- Pre-Heater Module
- MHGRV-X Module
- Modgas-X series module
- EM1 Expansion Module
- 12 Relay Expansion Module
- Sub Cool Module #1
- Sub Cool Module #2
- Missing Evap Condenser Module
- Missing Fan Array Controller

Alarms

Compressor Alarms

Compressor Module #1 - #6

In the Prism 2 Alarm Menu, Click OK on Compressor Alarms and the following detail screen will appear: Refer to the individual RSM Technical Guides for more details.

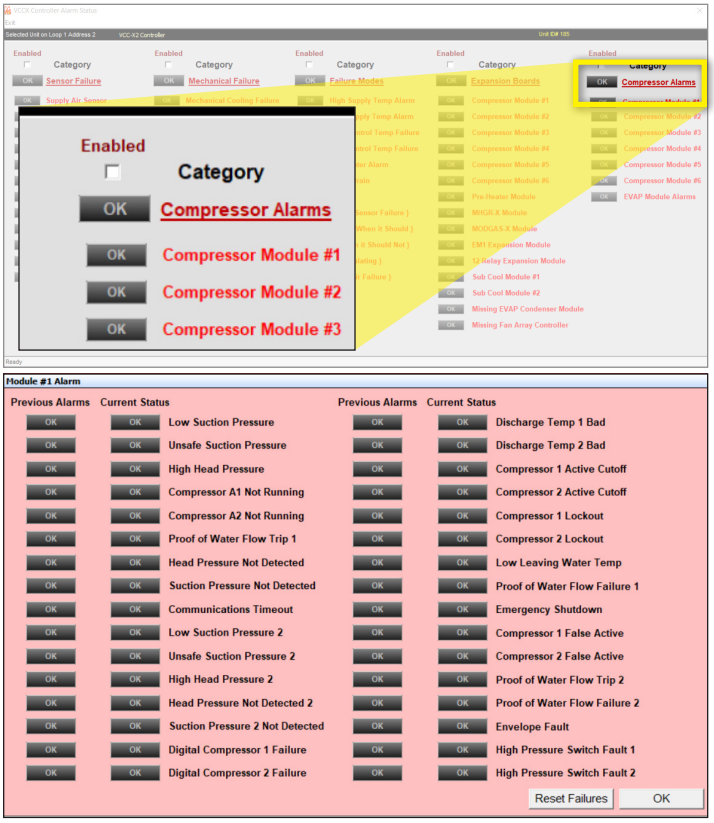


Figure 23: Prism 2 Compressor Alarms Screen

EVAP Module Alarms

In the Prism 2 Alarm Menu, Click OK on EVAP Module alarms and the following detail screen will appear:

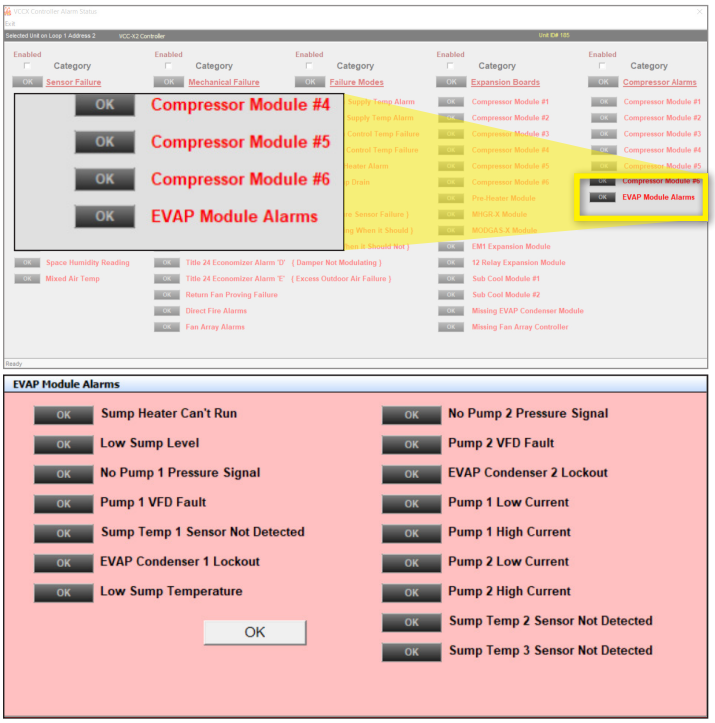


Figure 24: Prism 2 EVAP Module Alarms Screen

VCCX-454 Controller Trend Logs

VCCX-454 CONTROLLER TREND LOGS	
DESCRIPTION	ABBREVIATION (UNIT)
Date	**Date (Day Month)**
Time	**Time (24 Hr.)**
Mode of Operation	**Mode (Enumerated)***
HVAC Mode	**HVAC (Enumerated)***
Space Temperature	**Space (ºF)**
Indoor Humidity	**InRH (%)**
Mode Cooling Setpoint	**CSP (ºF)**
Mode Heating Setpoint	**HSP (ºF)**
Supply Air Temperature	**SAT (ºF)**
Supply Air Setpoint	**SATSP (ºF)**
Coil (Saturation) Temp Setpoint	**CoilSP (ºF)**
Return Air Temperature	**RAT (ºF)**
Return Air Humidity	**RA RH (%)**
Outdoor Air Temperature	**OAT (ºF)**
Outdoor Air Humidity	**OA RH (%)**
Outdoor Air Wetbulb	**OA WB (ºF)**
Outdoor Air Dewpoint	**OA DP (ºF)**
Carbon Dioxide	**CO2 (PPM)**
Outdoor Airflow CFM	**OACFM (kCFM)**
Supply Airflow CFM	**SACFM (kCFM)**
Return Airflow CFM	**RACFM (kCFM)**
Exhaust Airflow CFM	**EXCFM (kCFM)**
Building Pressure	**BldPr (WG")**
Duct Static Pressure	**Static (WG")**
MHGRV Valve Position	**ReHeat**
MODGAS Valve Position	**ModGas**
Main Fan Speed VFD Signal	**FanVFD (%)**
Economizer Position	**Econo (%)**
Modulating Heat Signal	**ModHeat (%)**
Building Pres. Relief VFD Signal	**Relief (%)**
Modulating Cooling Signal	**ModCool (%)**
Sensor Alarms	**AlrmGrp1 (Bit String)***
Mechanical Alarms	**AlrmGrp2 (Bit String)***
Temp Limit and Sump Drain Alarms	**AlrmGrp3 (Bit String)***
Missing Module Alarms	**AlrmGrp4 (Bit String)***
Refrigeration Module Alarms	**AlrmGrp5 (Bit String)***
Binary Inputs Status	**Bin IN (Bit String)***
Relays Status of VCCX-454 and EM1	**Main Rly (Bit String)***
Relays Status of 12 Relay Expansion Module	**Exp Rly (Bit String)***
*** Bit String and Enumeration Value information and interpretation is explained in the paragraphs and tables at the end of this section.**	

Table 16: VCCX-454 Controller Trend Logs

RM454-V/RM454-D/RM454-Z Trend Logs

RSM Trend Logs

There can be as many as four RM454-Vs, four RM454-Ds, or six RM454-Zs on a unit, with each RSM controlling up to two compressors and condensers. These can be referred to as modules 1, 2, 3, and 4 or as modules A, B, C, and D. Various items in the trend logs can refer to different modules and different compressor/condensers on each module. For instance:

- 1A1: Stat refers to the status of Module 1/Compressor 1
- 4D1 would be Module 4/Compressor 1.

Likewise, 1SuctTmp1 refers to the suction (saturation) temperature of Module 1/Compressor 1, while 3SucTmp2 refers to the suction (saturation) temperature of Module 3/Compressor 2. Several trend log items will use this pattern to identify the status of values related to certain modules and the compressors or condensers on those modules.

RM454-Z MODULE TREND LOGS (TYPICAL OF 4 RM MODULES)	
DESCRIPTION	ABBREVIATION (UNIT)
System Status	SYSState (Bit String)*
System Command	SYSCmd ((Bit String)*
A1 Compressor Modulating Position	1Comp1Perc (%)
A1 Condenser Fan Position	1CondFan (%)
A1 Discharge Pressure	1DisPrs (PSI)
A1 Discharge Line Temperature	1DisLnTmp (ºF)
A1 Suction Pressure	1SucPr (PSI)
A1 Suction Line Temperature	1SucLnTmp (ºF)
A1 Saturation Temperature	1SatTmp (ºF)
A1 Superheat	1Superheat (ºF)
A1 Expansion Valve Position	1EEV1Pos (%)
A1 Compressor Current	1CompCur (Amps)
A1 Compressor Status	1Comp1Stat (Bit String)*
A1 Compressor VFD Status	1VFDStat (Bit String)*
A1 RSM Alarms	1RSMAlrms (Bit String)*
A1 VFD Alarms 1	1VFDAlrm1 (Bit String)*
A1 VFD Alarms 2	1VFDAlrm2 (Bit String)*
A1 Subcooling Temperature	1Subcool (ºF)
* Bit String and Enumerated Value information and interpretation is explained in the paragraphs and tables at the end of this section.	

Table 17: RM454-Z Module Trend Log

Trend Logs

RM454-V / RM454-D MODULE TREND LOGS (TYPICAL OF 4 RSM MODULES)	
DESCRIPTION	**ABBREVIATION (UNIT)**
Compressor A1 Status	1A1Stat (Bit String)*
Compressor A2 Status	1A2Stat (Bit String)*
Compressor A1 Modulating Position	1Comp1 (%)
Compressor A2 Modulating Position	1Comp2 (%)
Condenser A1 Modulating Position	1Cond1 (%)
Condenser A2 Modulating Position	1Cond2 (%)
A1 Expansion Valve	1EXV1 (%)
A2 Expansion Valve	1EXV2 (%)
Condenser A1 Expansion Valve	1EXV3 (%)
Condenser A2 Expansion Valve	1EXV4 (%)
A1 Head Pressure	1HeadPr1 (PSI)
A2 Head Pressure	1HeadPr2 (PSI)
A1 Suction Pressure	1SuctPr1 (PSI)
A2 Suction Pressure	1SuctPr2 (PSI)
A1 Saturation Temperature	1SuctTmp1 (ºF)
A2 Saturation Temperature	1SuctTmp2 (ºF)
A1 Suction Line Temperature	1CoilTmp1 (ºF)
A2 Suction Line Temperature	1CoilTmp2 (ºF)
A1 Condenser Suction Temp	1CoilTmp3 (ºF)
A2 Condenser Suction Temp	1CoilTmp4 (ºF)
A1 Superheat	1SprHeat1 (ºF)
A2 Superheat	1SprHeat2 (ºF)
Condenser A1 Superheat	1SprHeat3 (ºF)
Condenser A2 Superheat	1SprHeat4 (ºF)
Superheat Setpoint	1SprHtSP (ºF)
Saturation (Suction) Setpoint	1CoilSP (ºF)
Leaving Water Temperature	1LvgWater (ºF)
A1 Discharge Temperature	1DisChg1 (ºF)
A2 Discharge Temperature	1DisChg2 (ºF)
Relay Status	1Relay1 (Bit String)*
* Bit String and Enumerated Value information and interpretation is explained in the paragraphs and tables at the end of this section.	

Table 18: RM454-V/RM454-D Module Trend Logs

RM454-Z TREND LOG ENUMERATED VALUES		
ITEM	**VALUE**	**DESCRIPTION**
Mode	0	Unoccupied
	1	Occupied
	2	Push Button Override Active
HVAC	0	Off
	1	Vent Mode
	2	Cooling Mode
	3	Heating Mode
	4	Vent Dehumidify Mode
	5	Cool Dehumidify Mode
	6	Heat Dehumidify Mode
	7	Warm-up Mode
	8	Fan Purge Mode
	9	Defrost Mode
	10	Cool Down Mode

Table 19: RM454-Z Trend Log Enumerated Values

RM454-Z TREND LOG BIT STRINGS - COMPSTAT			
ITEM	BIT	VALUE	DESCRIPTION
1Comp1Stat	0	1	Configured
2Comp1Stat	1	2	Enabled
3Comp1Stat	2	4	Running
3Comp2Stat	3	8	Failed
4Comp1Stat	4	16	Lockout
5Comp1Stat	5	32	MinRunFlag
6Comp1Stat	6	64	MinRunPending
6Comp2Stat	7	128	MinOffFlag
	8	256	MinOffPending
	9	512	StageUpConditionsMet
	10	1024	StageDwnConditionsMet
	11	2048	StageUpFlag
	12	4096	StageDwnFlag
	13	8192	CoilTempSatisfied

Table 20: RM454-Z Module Comp Status Trend Log

RM454-Z TREND LOG BIT STRINGS - RSM ALARMS			
ITEM	BIT	VALUE	DESCRIPTION
1RSMAlrms	0	1	LowSuction
2RSMAlrms	1	2	UnsafeSuction
3RSMAlrms	2	4	TripHighDiscPSI_Comp1
4RSMAlrms	3	8	Compressor1_NotRunning
5RSMAlrms	4	16	Compressor2_NotRunning
6RSMAlrms	5	32	LowSuperheat
	6	64	HighDischargeTemperature
	7	128	DMQ_NoDetect
	8	256	ModBusSlaveCommTO
	9	512	LowSuctionComp2Off
	10	1024	TripHighDiscPSI_Comp2
	11	2048	HighSuperheat
	12	4096	HighEvapTemp
	13	8192	EmergencyShutdown

Table 21: RM454-Z Module RSM Alarm Trend Log

RM454-Z TREND LOG BIT STRINGS - VFD STATUS				
ITEM	BIT	VALUE	VFD STATUS (BIT = 0)	VFD STATUS (BIT = 1)
1VFDStat 2VFDStat 3VFDStat 4VFDStat 5VFDStat 6VFDStat	0	1	0 = Control Not Ready	1 = Control Ready
	1	2	0 = Drive Not Ready	1= Drive Ready
	2	4	0 = Coasting	1 = Enable
	3	8	0 = No Error	1 = Trip
	4	16	0 = No Error	1 = Error (no trip)
	5	32	Reserved	
	6	64	0 = No Error	1 = TripLock (must cycle power)
	7	128	0 = No Warning	1 = Warning
	8	256	0 = Speed Not Equal Reference	1 = Speed Equal Reference
	9	512	0 = Local Operation	1 = Bus Control
	10	1024	0 = Out of Frequency Limit	1 = Frequency Limit Okay
	11	2048	0 = No Operation	1 = In Operation
	12	4096	0 = Drive Okay	1 = Stopped, Auto Start
	13	8192	0 = Voltage Okay	1 = Voltage Exceeded
	14	16384	0 = Torque Okay	1 = Torque Exceeded
	15	32768	0 = Timer Okay	1 = Timer Exceeded

Table 22: RM454-Z Module VFD Status Trend Log

Trend Log Bit String Decoding

Bit string values allow the manipulation of binary data in useful ways. For instance, a single trend log item may need to represent multiple simultaneous true conditions. An example would be a trend log item indicating what binary inputs are currently active, what relays are currently active, or what alarms are currently active. A single bit string value can be decoded to determine which multiple conditions might be simultaneously true. This section is not intended to be a full explanation of how bit strings work, but to explain how to decode the VCCX-454 trend log items that are indicated as being bit string values.

Determine Active Binary Inputs When a Trend Item Was Recorded

BINARY INPUTS	BIT STRING VALUES
0	No Binary Inputs Active
1	Fan Proving
2	Dirty Filter
4	Hood On/Off
8	Remote Occupied
16	Remote Cooling
32	Remote Heating
64	Remote Dehumidification
128	Emergency Shutdown

Example

If the trend log bit string value is 22 for Binary Inputs, first identify the highest value shown above that can be subtracted from 22. In this example, that would be 16 (Remote Cooling). The Remote Cooling binary input is currently active.

1. From the remainder of 6 (22 - 16 = 6), subtract the next highest possible number. That would be 4 (Hood On/Off). The Hood On/Off binary input is currently active.
2. From the remainder of 2 (6 – 4 = 2), subtract the next highest possible number which is 2 (Dirty Filter). The Dirty Filter binary input is also currently active.
3. There is no remainder (2 – 2 = 0), so there are no more inputs that are active.

With this example, from one value of 22 the formula above determined that three binary inputs were active when that trend item was recorded.

Example 2

With a value of 86, start with 64 (Remote Dehumidification). This would have left a remainder of 22 (86 – 64 = 22). Then continue as above to get the same three additional binary inputs.

With any trend log value that is designated to be a bit string value, simply identify from the trend log section in this technical guide what the bit string values are for each status condition and perform the same calculation.

The tables on the following pages provide the bits, values and descriptions for the various points on the VCCX-454 Controller and associated modules.

RM454-Z VFD Status Decoding

For the RM454-Z VFD status, instead of just one set of bit string values, there are two. The trend log bit string value represents the values in the BIT=1 column. All other values not represented in the trend log bit string are then active in the BIT=0 column.

Example

If the trend log bit string was 5, then the following status would be true:

0 = Timer Okay
0 = Torque Okay
0 = Voltage Okay
0 = Drive Okay
0 = No Operation
0 = Out of Frequency Limit
0 = Local Operation
0 = Speed Not Equal Reference
0 = No Warning
0 = No Error
0 = No Error
1 = Enable (Bit Value = 4)
0 = Drive Not Ready
1 = Control Ready (Bit Value = 1)

Trend Logs

VCCX-454 TREND LOG BIT STRINGS			
Item	**Bit**	**Value**	**Description**
Alarm Group 1	0	1	Bad Supply Sensor
	1	2	Bad Return Sensor
	2	4	Bad Outdoor Air Sensor
	3	8	Bad Space Sensor
	4	16	Bad CO2 Sensor
	5	32	Bad Building Pressure Sensor
	6	64	Bad Outdoor Airflow Sensor
	7	128	Bad Exhaust Airflow Sensor
	8	256	Bad Supply Airflow Sensor
	9	512	Bad Return Airflow Sensor
	10	1024	Missing Space Humidity Sensor Reading
	11	2048	Missing Mixed Air Temp Sensor
Alarm Group 2	0	1	Mechanical Cooling Alarm
	1	2	Mechanical Heating Alarm
	2	4	Fan Proving Alarm
	3	8	Dirty Filter Alarm
	4	16	Emergency Shutdown Alarm
	5	32	Relay Run Time Notification
	6	64	Bad Economizer Feedback
	7	128	Title 24 Failure Mode A
	8	256	Title 24 Failure Mode B
	9	512	Title 24 Failure Mode C
	10	1024	Title 24 Failure Mode D
	11	2048	Title 24 Failure Mode E
	12	4096	Direct Fire Alarms
Alarm Group 3	0	1	High Supply Air Temperature Cutoff
	1	2	Low Supply Air Temperature Cutoff
	2	4	High Control Temperature Alarm
	3	8	Low Control Temperature Alarm
	4	16	Preheater Alarm
	5	32	Sump Drain Alarm
	6	64	A2L Airstream Leak
	7	128	A2L Cabinet Leak

VCCX-454 TREND LOG BIT STRINGS			
Item	**Bit**	**Value**	**Description**
Alarm Group 4	0	1	Missing Refrigeration Module 1
	1	2	Missing Refrigeration Module 2
	2	4	Missing Refrigeration Module 3
	3	8	Missing Refrigeration Module 4
	4	16	Missing Preheater Module
	5	32	Missing MHGR-(V or X) Module
	6	64	Missing MODGAS Module
	7	128	Missing EM1 Expansion Module
	8	256	Missing 12 Relay Expansion Module
	9	512	Missing Sub Cool Module 1
	10	1024	Missing Sub Cool Module 2
	11	2048	Missing Evap Condenser Module
	12	4096	Missing Fan Array Controller
Alarm Group 5	0	1	Refrigeration Module #1 Alarm
	1	2	Refrigeration Module #2 Alarm
	2	4	Refrigeration Module #3 Alarm
	3	8	Refrigeration Module #4 Alarm
	4	16	Refrigeration Module #5 Alarm
	5	32	Refrigeration Module #6 Alarm
	6	64	Evap Condenser Module Alarm
Bin IN	0	1	Fan Proving
	1	2	Dirty Filter
	2	4	Hood On/Off
	3	8	Remote Occupied
	4	16	A2L Airstream Leak Detect
	5	32	A2L Cabinet Leak Detect
	6	64	Not Used
	7	128	Emergency Shutdown
MainRly	0	1	Supply Fan Relay #1
	1	2	VCCX-454 Relay #2 Configurable
	2	4	VCCX-454 Relay #3 Configurable
	3	8	VCCX-454 Relay #4 Configurable
	4	16	VCCX-454 Relay #5 Configurable
	5	32	VCCX-454 Relay #6 Configurable
	6	64	VCCX-454 Relay #7 Configurable
	7	128	VCCX-454 Relay #8 Configurable
	8	256	EM1 Relay #1 Configurable
	9	512	EM1 Relay #2 Configurable
	10	1024	EM1 Relay #3 Configurable
	11	2048	EM1 Relay #4 Configurable
	12	4096	EM1 Relay #5 Configurable

Table 23: VCCX-454 Trend Log Bit Strings

Trend Logs

VCCX-454 TREND LOG BIT STRINGS			
Item	**Bit**	**Value**	**Description**
ExpRly	0	1	12 Relay Exp Relay #1 Configurable
	1	2	12 Relay Exp Relay #2 Configurable
	2	4	12 Relay Exp Relay #3 Configurable
	3	8	12 Relay Exp Relay #4 Configurable
	4	16	12 Relay Exp Relay #5 Configurable
	5	32	12 Relay Exp Relay #6 Configurable
	6	64	12 Relay Exp Relay #7 Configurable
	7	128	12 Relay Exp Relay #8 Configurable
	8	256	12 Relay Exp Relay #9 Configurable
	9	512	12 Relay Exp Relay #10 Configurable
	10	1024	12 Relay Exp Relay #11 Configurable
	11	2048	12 Relay Exp Relay #12 Configurable
RM454-V/ RM454-D **1A1Stat** **1A2Stat** **2A1Stat** **2A2Stat** **3A1Stat** **3A2Stat** **4A1Stat** **4A2Stat**	0	1	System On
	1	2	Active Alarm
	2	4	Disabled
	3	8	Forced On
	4	16	Forced Off
	5	32	Outdoor Air Lockout
	6	64	System Not Used
	7	128	Min Run Pending
	8	256	Min Off Pending
	9	512	Defrost Mode
RM454-V/ RM454-D **1Relay1** **2Relay2** **3Relay3** **4Relay4**	0	1	Relay 1 Active
	1	2	Relay 2 Active
	2	4	Relay 3 Active
	3	8	Relay 4 Active
	4	16	Relay 5 Active
	5	32	Unloader 1 Active
	6	64	Unloader 2 Active

Table 23: VCCX-454 Trend Log Bit Strings (continued)

Updating via USB

The VCCX-454's USB port is only used for updating the VCCX-454's firmware using a USB flash drive.

NOTE: Only use a FAT32-formatted USB flash drive. USB Flash drives formatted as NTFS, exFAT, or any other file system will not work.

Multiple hex files can be on the USB drive – the VCCX-454 will only update if the software number is the same (SS1186) and the hex file is a higher version than what is currently on the VCCX-454.

1. Using a computer, create a folder called APP on the USB drive.
2. Copy the W44A2###.hex file (### represents the version number) into the APP folder on the USB.
3. Insert the USB drive in to the USB port on the VCCX-454.
4. Power cycle or power on the VCCX-454.
5. If the VCCX-454 was able to find an update file and it is newer than the version currently on the VCCX-454, the LCD will display "VALIDATE" as it is checking the update file.
6. If it is a valid update file, the LCD will then display "FLASHING".

WARNING: DO NOT power off the control or remove the USB drive while the VCCX-454 is flashing!

7. Once complete, the VCCX-454 should start the updated firmware.
8. Remove the USB drive.

VCCX-454 Controller LEDs

The VCCX-454 Controller is equipped with LEDs that can be used to verify operation and perform troubleshooting. There are LEDs for communication, operation modes, and diagnostic codes. The VCCX-454 Controller has 26 LEDs—10 used for operation and status, eight are used for relays, and eight are used for binary inputs. The LEDs associated with these inputs and outputs show what is active without using a voltmeter. The LEDs and their uses are as follows:

Operation LEDs - Factory Troubleshooting

POWER - This green LED lights up to indicate that 24 VAC power has been applied to the controller.

APP HB - This green LED lights up and blinks continuously to indicate the application software is working properly.

OS HB - This green LED lights up and blinks continuously to indicate the operating system is working properly.

WDOG - This green LED lights up and stays lit to indicate the operating system is working properly.

Diagnostic LEDs

ALARM - This red LED is a diagnostic blink code LED. It lights up and stays lit when there is an alarm present. The type of alarm displays on the LCD display.

STATUS 1 - This red LED is a diagnostic blink code LED. Under normal operation, it should not be blinking. If the LED is blinking non-stop along with Status 2 LED, the controller is resetting to factory defaults.

STATUS 2 - This red LED is a diagnostic blink code LED. If the software is running, this LED should blink at a rate of one blink every 10 seconds. If there is an override, the LED blinks two times every 10 seconds. And finally, if one of the outputs is in Force Mode, the LED blinks three times every 10 seconds.

Communication LEDs

EBUS - This yellow LED blinks to signal E-BUS communications.

LOOP COMM - This yellow LED lights up and blinks continuously to indicate the VCCX-454 Controller is communicating.

BACnet- This yellow LED lights up and blinks continuously to indicate BACnet communications.

Relay LEDs

RLY1 - This green LED lights up when the supply fan is enabled and stays lit as long as the supply fan is active.

RLY2 - RLY8 - These green LEDs light up when the relays are enabled and stay lit as long as they are active.

Binary Input LEDs

BI1 - This green LED lights up when the proof of flow contact is closed.

BI2 - This green LED lights up when the dirty filter switch is closed.

BI3 - This green LED lights up when the hood on/off switch is closed.

BI4 - This green LED lights up when the remote occupied switch is closed.

BI5 - This green LED lights up when the A2L Airstream Leak Detect switch is closed.

BI6 - This green LED lights up when the A2L Cabinet Leak Detect switch is closed.

BI7 - This green LED is not used.

BI8 - This green LED lights up when the emergency shutdown contact is closed.

EM1 Expansion Module LEDs

The EM1 Expansion Module is equipped with four LEDs that can be used as troubleshooting tools. The LEDs and their uses are as follows:

PWR - This LED lights up to indicate that 24 VAC power has been applied to the controller.

ALARM - If the module does not receive communications for more than one minute, this LED lights up, the relays turn off, and the Analog Outputs go to 0 VDC.

STAT - If the software is running, this LED blinks at a rate of one blink per second.

COMM - Every time the module receives a valid E-BUS request from the VCCX-454 Controller, this LED blinks on and then off, indicating it received a valid request and responded.

Binary Input LEDs

BI1 - This green LED lights up when the return/exhaust proof of flow contact is closed.

LED Diagnostics

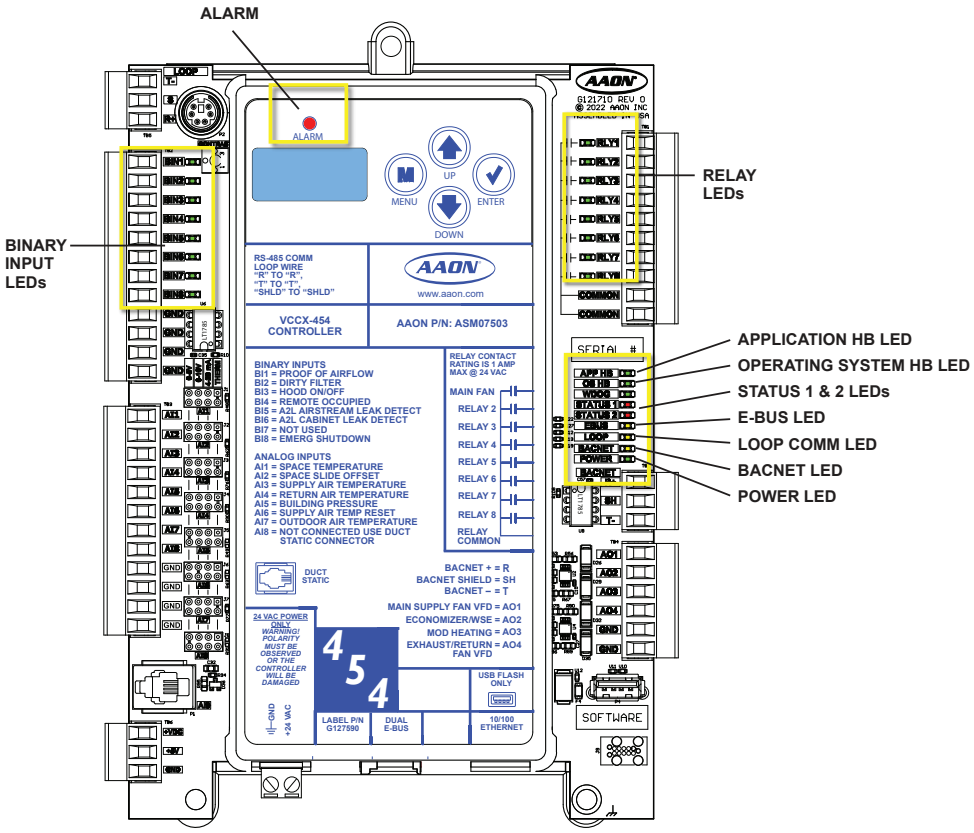


Figure 25: VCCX-454 Controller LED Locations

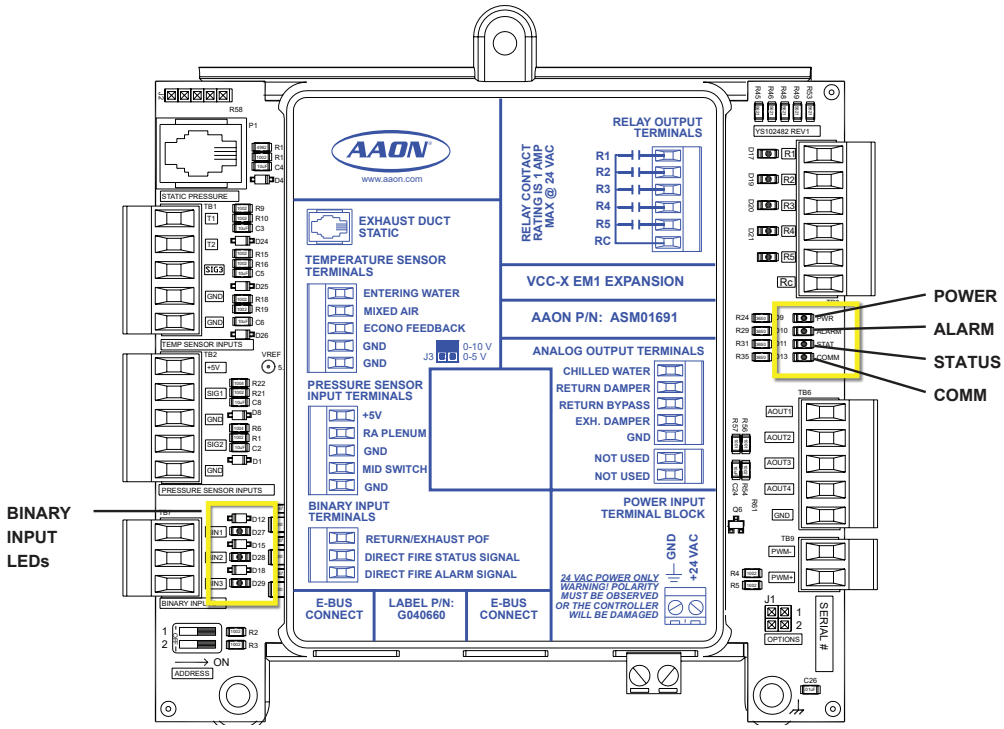


Figure 26: EM1 Expansion Module LED Locations

LED Diagnostics

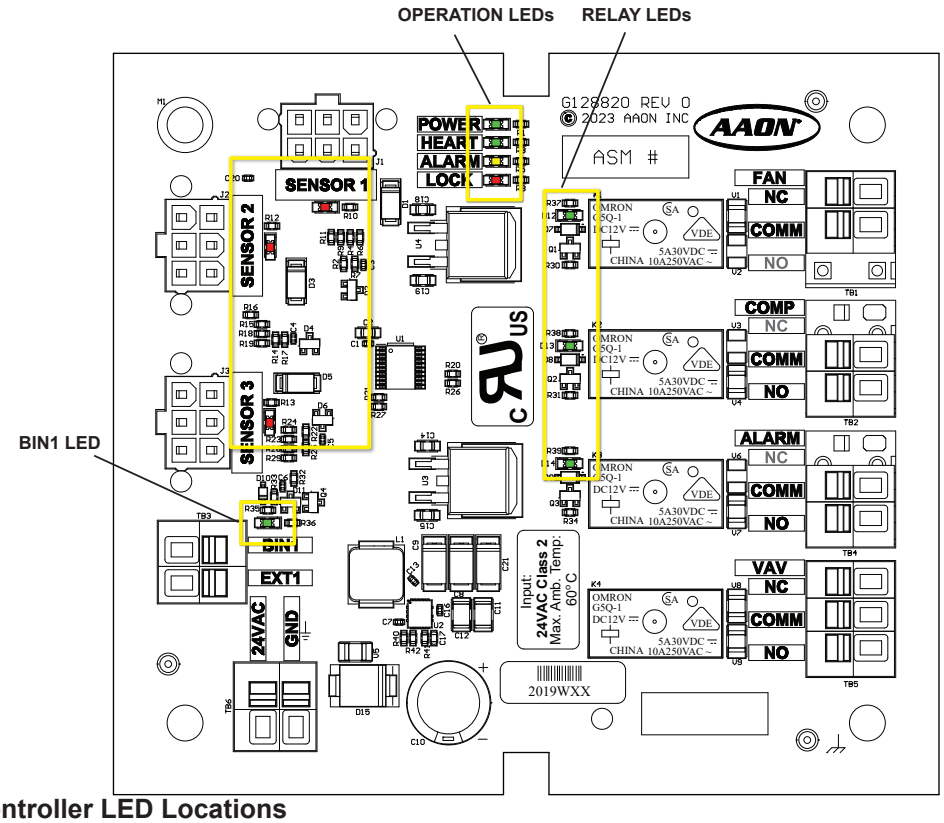


Figure 27: A2L Controller LED Locations

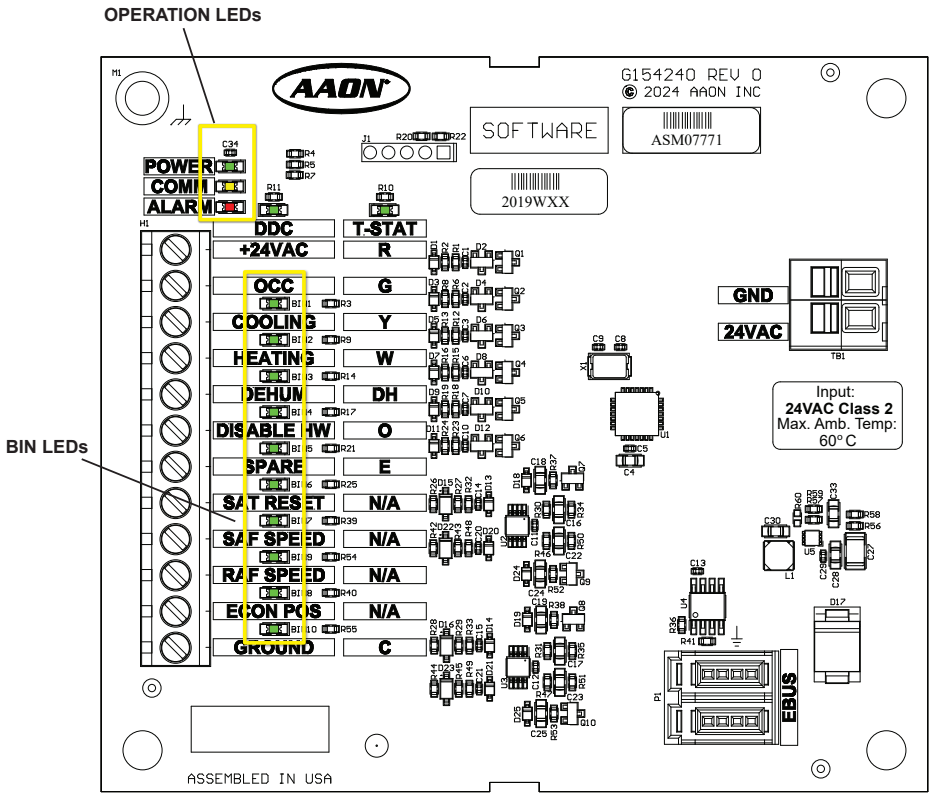


Figure 28: BD-3PI LED Locations

Temperature Sensor Testing

Space, Supply Air, Outdoor Air or Return Air Temperature Sensor Testing

The following sensor voltage and resistance table is provided to aid in checking sensors that appear to be operating incorrectly. Many system operating problems can be traced to incorrect sensor wiring. Be sure all sensors are wired per the wiring diagrams in this manual.

If the sensors still do not appear to be operating or reading correctly, check voltage and/or resistance to confirm the sensor is operating correctly per the tables. Please follow the notes and instructions that appear after the chart when checking sensors.

Thermistor Sensor Testing Instructions

Use the resistance column to check the Thermistor Sensor while disconnected from the controllers (not powered).

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.

If the voltage is above 4.88 VDC, then the sensor or wiring is "open." If the voltage is less than 0.05 VDC, then the sensor or wiring is shorted.

TEMPERATURE – RESISTANCE – VOLTAGE FOR TYPE III 10 K OHM THERMISTOR SENSORS

Temp (ºF)	Temp (ºC)	Resistance (Ohms)	Voltage @ Input (VDC)	Temp (ºF)	Temp (ºC)	Resistance (Ohms)	Voltage @ Input (VDC)
-10	-23.3	93333	4.51	**72**	22.2	11136	2.635
-5	-20.6	80531	4.45	**73**	22.8	10878	2.605
0	-17.8	69822	4.37	**74**	23.3	10625	2.576
5	-15	60552	4.29	**75**	23.9	10398	2.549
10	-12.2	52500	4.2	**76**	24.4	10158	2.52
15	-9.4	45902	4.1	**77**	25	10000	2.5
20	-6.6	40147	4.002	**78**	25.6	9711	2.464
25	-3.9	35165	3.891	**80**	26.7	9302	2.41
30	-1.1	30805	3.773	**82**	27.8	8893	2.354
35	1.7	27140	3.651	**84**	28.9	8514	2.3
40	4 4.4	23874	3.522	**86**	30	8153	2.246
45	7.2	21094	3.39	**88**	31.1	7805	2.192
50	10	18655	3.252	**90**	32.2	7472	2.139
52	11.1	17799	3.199	**95**	35	6716	2.009
54	12.2	16956	3.143	**100**	37.8	6047	1.884
56	13.3	16164	3.087	**105**	40.6	5453	1.765
58	14.4	15385	3.029	**110**	43.3	4923	1.65
60	15.6	14681	2.972	**115**	46.1	4449	1.54
62	16.7	14014	2.916	**120**	48.9	4030	1.436
64	17.8	13382	2.861	**125**	51.7	3656	1.339
66	18.9	12758	2.802	**130**	54.4	3317	1.246
68	20	12191	2.746	**135**	57.2	3015	1.159
69	20.6	11906	2.717	**140**	60	2743	1.077
70	21.1	11652	2.691	**145**	62.7	2502	1.001
71	21.7	11379	2.661	**150**	65.6	2288	0.931

Table 24: 0-5V Temperature Sensor - Voltage and Resistance for Type III Sensors

Pressure Sensor Testing

Duct Static Pressure Sensor Testing Instructions

Use the voltage column, **Table 26, this page**, to check the Duct Static Pressure Sensor while connected to powered controllers. Read voltage with meter set on DC volts. Place the "-" (minus) lead on the GND terminal and the "+" (plus) lead on the right side of the resistor labeled R85. Be sure to replace the jumper after checking.

Building Pressure Sensor Testing Instructions

Use the voltage column, **Table 27, this page**, to check the Building Static Pressure Sensor while connected to a powered expansion module. Read voltage with meter set on DC volts. Place the "-" (minus) lead on terminal labeled GND and the "+" lead on terminal AI5 on the VCCX-454 Controller.

DUCT STATIC PRESSURE SENSOR			
Pressure @ Sensor (" W.C.)	Voltage @ Input (VDC)	Pressure @ Sensor (" W.C.)	Voltage @ Input (VDC)
0.00	0.25	2.60	2.33
0.10	0.33	2.70	2.41
0.20	0.41	2.80	2.49
0.30	0.49	2.90	2.57
0.40	0.57	3.00	2.65
0.50	0.65	3.10	2.73
0.60	0.73	3.20	2.81
0.70	0.81	3.30	2.89
0.80	0.89	3.40	2.97
0.90	0.97	3.50	3.05
1.00	1.05	3.60	3.13
1.10	1.13	3.70	3.21
1.20	1.21	3.80	3.29
1.30	1.29	3.90	3.37
1.40	1.37	4.00	3.45
1.50	1.45	4.10	3.53
1.60	1.53	4.20	3.61
1.70	1.61	4.30	3.69
1.80	1.69	4.40	3.77
1.90	1.77	4.50	3.85
2.00	1.85	4.60	3.93
2.10	1.93	4.70	4.01
2.20	2.01	4.80	4.09
2.30	2.09	4.90	4.17
2.40	2.17	5.00	4.25
2.50	2.25		

Table 25: Duct Static Pressure/Voltage for Duct Static Pressure Sensors

BUILDING PRESSURE SENSOR			
Pressure @ Sensor (" W.C.)	Voltage @ Input (VDC)	Pressure @ Sensor (" W.C.)	Voltage @ Input (VDC)
-0.25	0.00	0.01	2.60
-0.24	0.10	0.02	2.70
-0.23	0.20	0.03	2.80
-0.22	0.30	0.04	2.90
-0.21	0.40	0.05	3.00
-0.20	0.50	0.06	3.10
-0.19	0.60	0.07	3.20
-0.18	0.70	0.08	3.30
-0.17	0.80	0.09	3.40
-0.16	0.90	0.10	3.50
-0.15	1.00	0.11	3.60
-0.14	1.10	0.12	3.70
-0.13	1.20	0.13	3.80
-0.12	1.30	0.14	3.90
-0.11	1.40	0.15	4.00
-0.10	1.50	0.16	4.10
-0.09	1.60	0.17	4.20
-0.08	1.70	0.18	4.30
-0.07	1.80	0.19	4.40
-0.06	1.90	0.20	4.50
-0.05	2.00	0.21	4.60
-0.04	2.10	0.22	4.70
-0.03	2.20	0.23	4.80
-0.02	2.30	0.24	4.90
-0.01	2.40	0.25	5.00
0.00	2.50		

Table 26: Building Static Pressure/Voltage for Building Pressure Sensors

APPENDIX A: SYSTEM CONFIGURATION

Options

The VCCX-454 Controller can be used as a stand-alone system (one VCCX-454 Controller only), connected together on an interconnected system (multiple VCCX-454 Controllers only), or connected together on a network system (multiple VCCX-454 Controllers, VAV/Zone Controllers, or add-on controllers) to form a complete controls system that can be programmed and monitored through Prism II.

Operator Interfaces

Operator interfaces are designed to provide for programming and monitoring of VCCX-454 Controller(s) and/or any VAV/Zone or add-on controller(s) connected to the system.

Stand-Alone System

The stand-alone system is used with a single VCCX-454 Controller. Programming and status monitoring are accomplished through Prism II.

Interconnected System

The interconnected system is used when there are multiple VCCX-454 Controllers. With this system, connect the controllers together using AAON communications wire or 18-gauge, two-conductor, twisted pair with shield wire (Belden #82760 or equivalent). This allows for all controllers that are connected on the communications loop to be programmed and monitored through Prism II connected on the communications loop.

Networked System

For a networked single loop system, a range of one to 59 VCCX-454 Controllers sharing information, connect the controllers together using AAON communications wire or 18-gauge, two-conductor, twisted pair with shield wire (Belden #82760 or equivalent). The networked single loop system requires either a MiniLink PD communication interface and/or CommLink communication interface be purchased and wired into the communications loop to the VCCX-454 Controllers.

The networked multiple loop system is used for a system with more than 59 VCCX-454 Controllers and/or are using multiple VCCX-454 Controllers that are connected to VAV/Zone controllers. These groups of controllers are broken into multiple “local loops” that connect to each other via the “network loop.” Each MiniLink PD handles its specific local loop’s communications requirements. The CommLink communications interface handles all the communications between the individual MiniLink PDs to form the network loop. Up to 60 local loops can be connected with this configuration. This provides the capability for over 3,500 controllers to be networked.

Networked System Single Loop Layout

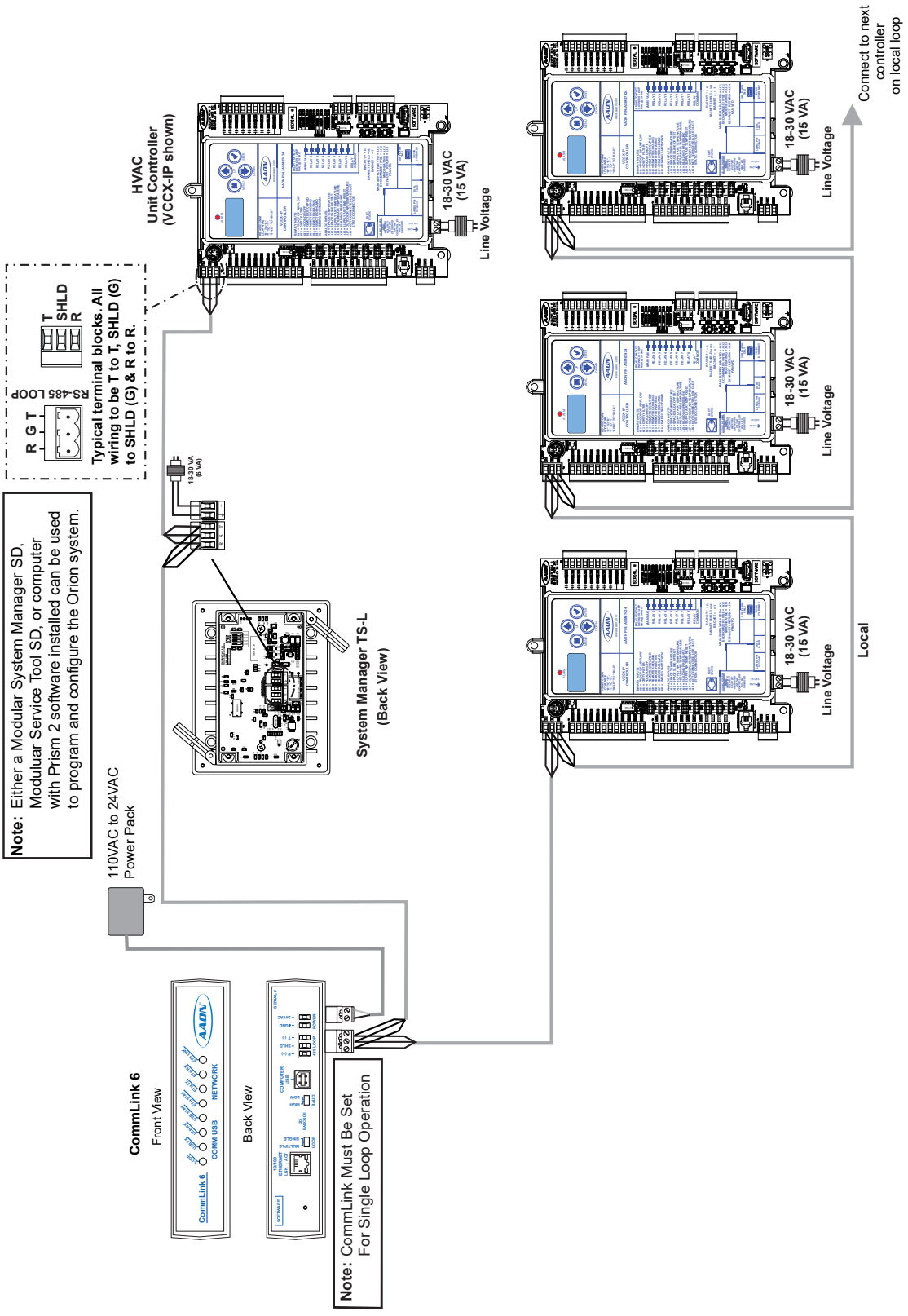


Figure 29: Typical Networked Single Loop System Layout

Networked System Multiple Loop Layouts

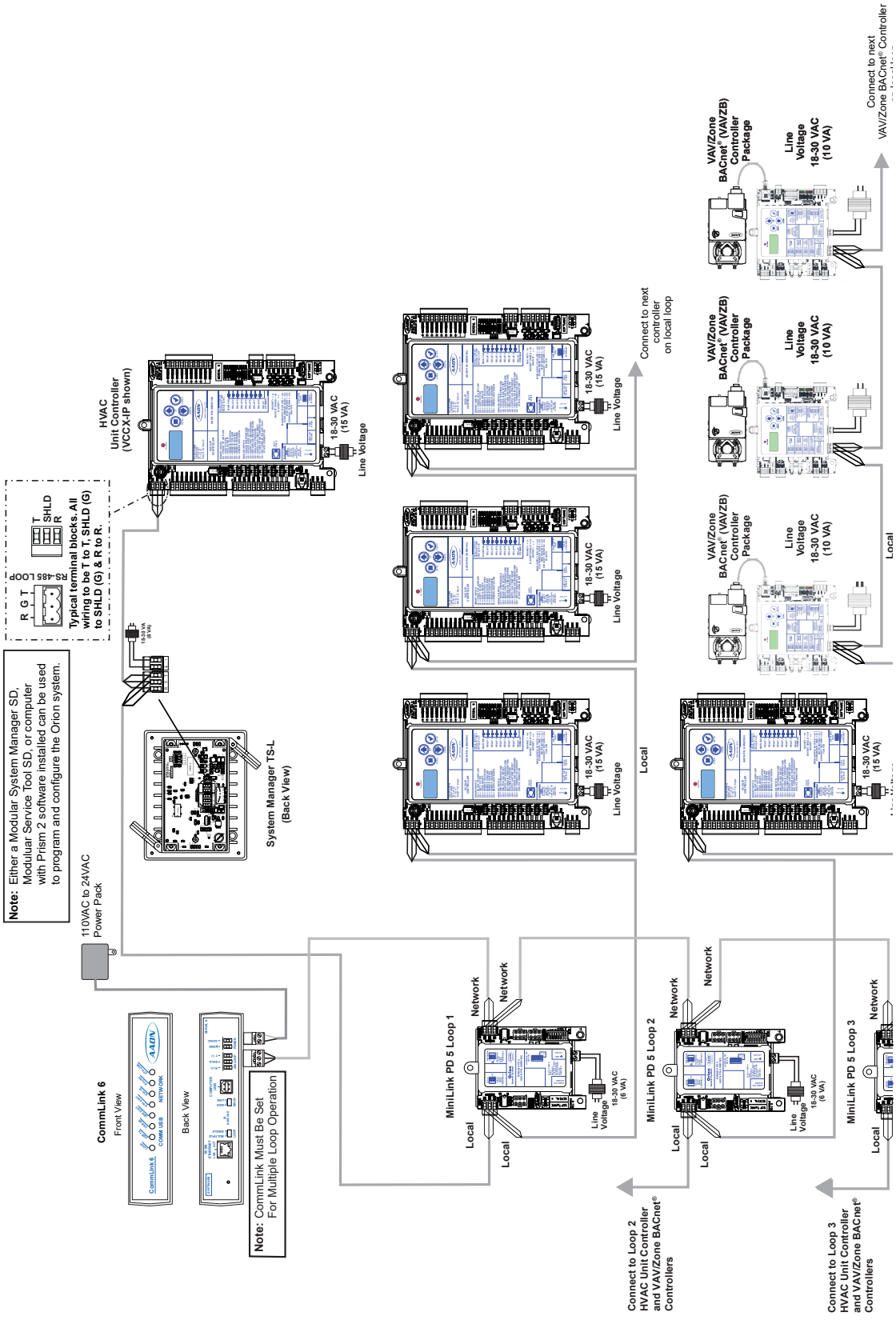


Figure 30: Typical Networked Multiple Loop System Layout

LCD Display Screen and Navigation Keys

The LCD display screens and buttons allow you to view status and alarms, and enable force modes. See **Figure 31, this page,** and refer to **Table 28 and Table 29, this page,** for key functions.

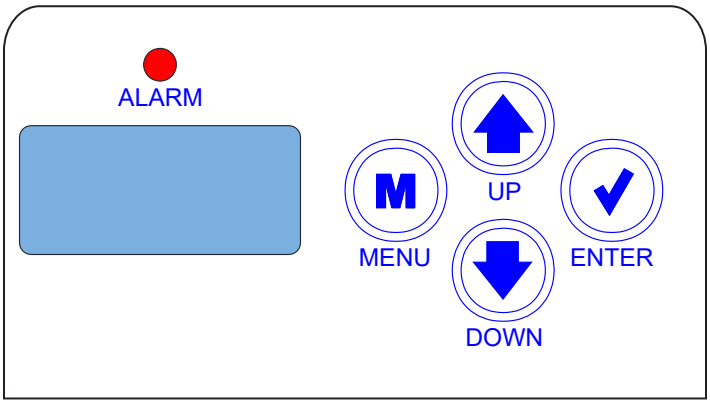


Figure 31: LCD Display and Navigation Keys

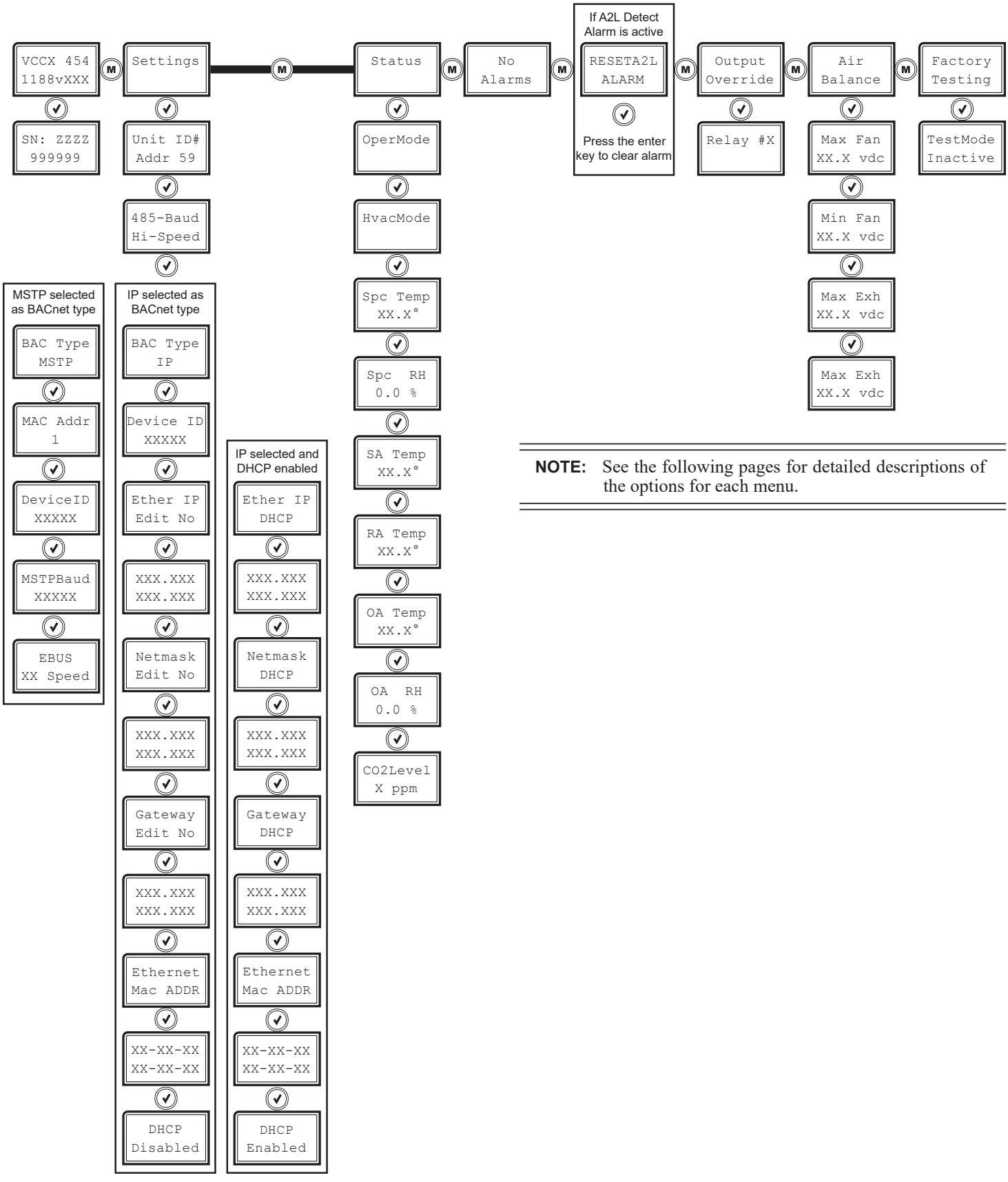
NAVIGATION KEY FUNCTIONS	
KEY	**FUNCTION**
MENU M	Use the **<MENU>** key to move through screens within Main Menu categories and return to the Main Menu while at other screens.
UP	Use this key to adjust setpoints and change configurations.
DOWN	Use this key to adjust setpoints and change configurations.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

Table 27: 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 28: Editing Key Functions

Main Screens Map



NOTE: See the following pages for detailed descriptions of the options for each menu.

APPENDIX B: LCD SCREENS

Screen Descriptions

Main Screens

Refer to the following table when navigating through the LCD Main Screens.

Press the **<MENU>** button to navigate between the top level screens. Press the **<ENTER>** button to scroll through the next level screens,

MAIN SCREENS	
Screen Text	**Description**
VCCX 454 1188vXXX	Controller screens. The second line shows the software number and its version.
Settings	System settings screens.
Status	System status screens
NO ALARMS	Alarm status screens. Screen shows NO ALARMS if no alarms are active.
Output Override	Used to override relay and analog outputs.
Air Balance	Air Balance screens that can be used by air balance to set min and max fan speeds.
Factory Testing	This screen is for AAON factory use only.

Table 29: Main Screens

Controller Screens

Refer to the following table when navigating through the controller screens. From the VCCX AHU screen, press **<ENTER>** to scroll through the screens.

CONTROLLER SCREENS	
Screen Text	**Description**
VCCX 454 1188vXXX	Controller screens. The second line shows the software number and its version.
SN: ZZZ 999999	Unit Serial Number.

Table 30: Controller Screens

Screen Descriptions

Settings Screens

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

SETTINGS SCREENS - BAC TYPE MSTP	
Screen Text	**Description**
Settings	Settings screens.
Unit ID# Addr 59	Unit address ID. Valid range is 1-59. **Default is 59.** Once the cursor is under a field, use the **<UP>** and **<DOWN>** arrow keys to select a number between 0 and 9.
485-Baud Hi-Speed	485 baud rate speed. Valid options are Lo-Speed or Hi-Speed. **Default is Hi-Speed.** Use the **<UP>** and **<DOWN>** arrow keys to select the options.
BAC Type MSTP	Select **<DOWN>** for MSTP or **<UP>** for IP. Either configuration changes the following screens.
MAC Addr 1	BACnet. Current MAC address. Valid range is 0-127. **Default is 1.** Once the cursor is under a field, use the **<UP>** and **<DOWN>** arrow keys to select a number between 0 and 9.
DeviceID XXXXX	BACnet. Current device ID. A device ID with up to seven digits can be entered. Once the cursor is under a field, use the **<UP>** and **<DOWN>** arrow keys to select a number between 0 and 9.
MSTPBaud XXXXX	BACnet. Current baud rate. Valid options are 9600, 19200, 38400, 57600, 76800. **Default is 38400.**
EBUS XX Speed	EBUS communication speed. Valid options are Hi Speed and Lo Speed. **Default is Hi Speed.**

Table 31: Settings Screens - BACnet Type MSTP

SETTINGS SCREENS - BAC TYPE IP	
Screen Text	**Description**
Settings	Settings screens.
Unit ID# Addr 59	Unit address ID. Valid range is 1-59. **Default is 59.** Once the cursor is under a field, use the **<UP>** and **<DOWN>** arrow keys to select a number between 0 and 9.
485-Baud Hi-Speed	485 baud rate speed. Valid options are Lo-Speed or Hi-Speed. **Default is Hi-Speed.** Use the **<UP>** and **<DOWN>** arrow keys to select the options.
BAC Type IP	This is either MSTP or IP. Either configuration changes the following screens.
DeviceID XXXXX	BACnet. Current device ID. A device ID with up to seven digits can be entered. Once the cursor is under a field, use the **<UP>** and **<DOWN>** arrow keys to select a number between 0 and 9.
Ether IP	This screen informs the following screen will display the current IP address. If DHCP is disabled, allows modification of the Netmask address. **<UP> to edit** and **<DOWN>** to leave as is. If DHCP is enabled, will display DHCP.
XXX.XXX XXX.XXX	If edit was selected, use the arrow keys to modify the entry. Otherwise, displays current Ethernet IP address.
Netmask Edit No	This screen informs the following screen will display the current Netmask address. If DHCP is disabled, allows modification of the Netmask address. **<UP> to edit** and **<DOWN>** to leave as is. If DHCP is enabled, will display DHCP.
XXX.XXX XXX.XXX	If edit was selected, use the arrow keys to modify the entry. Otherwise, displays current Netmask address.
Gateway Edit No	This screen informs the following screen will display the current Gateway address. If DHCP is disabled, allows modification of the Gateway address. **<UP> to edit** and **<DOWN>** to leave as is. If DHCP is enabled, will display DHCP.
XXX.XXX XXX.XXX	If edit was selected, use the arrow keys to modify the entry. Otherwise, displays current Gateway address.
Ethernet Mac ADDR	The following screen will display the Ethernet MAC Address. This address cannot be modified.
XX-XX-XX XX-XX-XX	The Ethernet Mac Address
DHCP Disabled	With DHCP disabled, most entries can be manually configured. Enabling DHCP disables the manual configuration of IP settings.

Table 32: Settings Screens - BACnet Type IP

APPENDIX B: LCD SCREENS

Screen Descriptions

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	
Screen Text	**Description**
Status	Status screens.
OperMode	Operation mode. Options are: • UNOCCUPY (Unoccupied) • OCCUPIED • OVERRIDE • HOL UNOC (Holiday unoccupied) • FRC OCC (Force occupied) • FRC UNOC (Force unoccupied) • REM OCC (Remote occupied) • ZONEHEAT (Zone heat) • ZONECOOL (Zone cool) • ZONE OVR (Zone override) • A2LPRTCT
HvacMode	HVAC mode. Options are: • OFF • VENT • COOL • HEAT • VENT RH • COOL RH • HEAT RH • WARMUP • PURGE • DEFROST • COOLDOWN
Spc Temp XX.X°	Space temperature.
Spc RH X.X %	Space humidity. 0.00% - 100%.
SA Temp XX.X°	Supply air temperature.
RA Temp XX.X°	Return air temperature.
OA Temp XX.X°	Outdoor air temperature.
OA RH X.X %	Outdoor air humidity. 0.00% - 100%.
CO2Level X ppm	Carbon dioxide level. 0.00 ppm to 5000 ppm.

Table 33: Status Screens

APPENDIX B: LCD SCREENS

Screen Descriptions

Alarms Screens

If no alarms are present, the Alarms screen displays No Alarms. If an alarm is present, the ALARM LED above the LCD display lights up red and blinks. The alarms display and scroll automatically from the ALARMS screen when alarms are present. Press **<ENTER>** to scroll through the screens.

ALARMS SCREENS			
Screen Text	**Description**	**Screen Text**	**Description**
ALARMS	Alarms Status screens	**HI SAT ALARM**	High supply temperature cutoff alarm
NO ALARMS	This is shown if there are no current alarms.	**LO SAT ALARM**	Low supply temperature cutoff alarm
SAT SENSOR	Supply Air Temperature Sensor failure alarm	**CONTROL TEMP HI**	High control temperature failure
RAT SENSOR	Return Air Temperature Sensor failure alarm	**CONTROL TEMP LO**	Low control temperature failure
OAT SENSOR	Outdoor Air Temperature Sensor failure alarm	**PRE_HEAT ALARM**	Preheat-X module alarm
SPC SENSOR	Space Temperature Sensor failure alarm	**SUMP ALARM**	Sump drain alarm
CO2 SENSOR	CO_2 Sensor failure alarm	**A2L AIR DETECT**	There is a refrigerant leak detected in the airstream.
BLDG PR. ALARM	Building Pressure Sensor failure alarm	**A2L CAB DETECT**	There is a refrigerant leak detected in the cabinet
OA CFM SENSOR	Outdoor air airflow alarm	**REFRIG # MISSING**	The indicated refrigeration module is missing where # can indicate 1-6.
EX CFM SENSOR	Exhaust air airflow alarm	**PRE-HEAT MISSING**	PREHEAT board missing alarm
SA CFM SENSOR	Supply air airflow alarm	**REHEAT MISSING**	Reheat board missing alarm
RA CFM SENSOR	Return air airflow alarm	**MODGAS MISSING**	MODGAS board missing alarm
MAT SENSOR	Mixed Air Temperature Sensor failure alarm	**EM1 MISSING**	Missing Expansion Module alarm
COOLING FAILURE	Mechanical cooling failure alarm	**12 RELAY MISSING**	Missing E-BUS 12 Relay Module alarm
HEATING FAILURE	Mechanical heating failure alarm	**SUBCOOL1 MISSING**	Missing Subcool module #1 alarm
FAN POF FAILURE	Proof of flow interlock alarm	**SUBCOOL2 MISSING**	Missing Subcool module #2 alarm
DIRTY FILTER	Dirty filter alarm	**FAC1 MISSING**	Missing Fan Array Controller #1 alarm
EMERG SHUTDOWN	Emergency shutdown alarm	**FAC2 MISSING**	Missing Fan Array Controller #2 alarm
RELAY RUNTIME	Relay run time exceeded alarm	**MODULE # ALARM**	Refrigerant Module # operating alarm where # can indicate 1-6
ECONO FAILURE	Title 24 Economizer alarms	**UNKNOWN ALARM**	This screen should never display. But if it does, it means the controller doesn't know what the alarm is.
RET FAN FAILURE	Return/Exhaust fan proving alarm		
DIR FIRE ALARM	Direct fire heat alarm		
FAC ALARM	Fan Array Controller alarm		

Table 34: Alarms Screens

Screen Descriptions

Output Override Screens

Refer to the following map when navigating through the Output Override screens. From the Output Override screen, press **<ENTER>**.

OUTPUT OVERRIDE SCREENS	
Screen Text	**Description**
OUTPUT OVERRIDE	Used to override relay and analog outputs.
RELAY #1 AUTO	VCCX-454 controller relays 1-8. Press the **<UP>** button to change the value. **Default is AUTO.**
FAN VFD -1.0 VDC	Supply fan VFD. 0.0 to 10.0 = Active Force Mode. Press the **<UP>** and **<DOWN>** buttons to change the value. **Default is -1.0 = AUTO.**
OA DAMPR -1.0 VDC	Outdoor air damper. 0.0 to 10.0 = Active Force Mode. Press the **<UP>** and **<DOWN>** buttons to change the value. **Default is -1.0 = AUTO.**
MOD HEAT -1.0 VDC	Modulating heating. 0.0 to 10.0 = Active Force Mode. Press the **<UP>** and **<DOWN>** buttons to change the value. **Default is -1.0 = AUTO.**
EXHAUST -1.0 VDC	Exhaust fan. 0.0 to 10.0 = Active Force Mode. Press the **<UP>** and **<DOWN>** buttons to change the value. **Default is -1.0 = AUTO.**
MOD COOL -1.0 VDC	Modulating cooling. 0.0 to 10.0 = Active Force Mode. Press the **<UP>** and **<DOWN>** buttons to change the value. **Default is -1.0 = AUTO.**
RA DAMPR -1.0 VDC	Return air damper. 0.0 to 10.0 = Active Force Mode. Press the **<UP>** and **<DOWN>** buttons to change the value. **Default is -1.0 = AUTO.**
RA BYPAS -1.0 VDC	Return air bypass. 0.0 to 10.0 = Active Force Mode. Press the **<UP>** and **<DOWN>** buttons to change the value. **Default is -1.0 = AUTO.**

Table 35: Output Override Screens

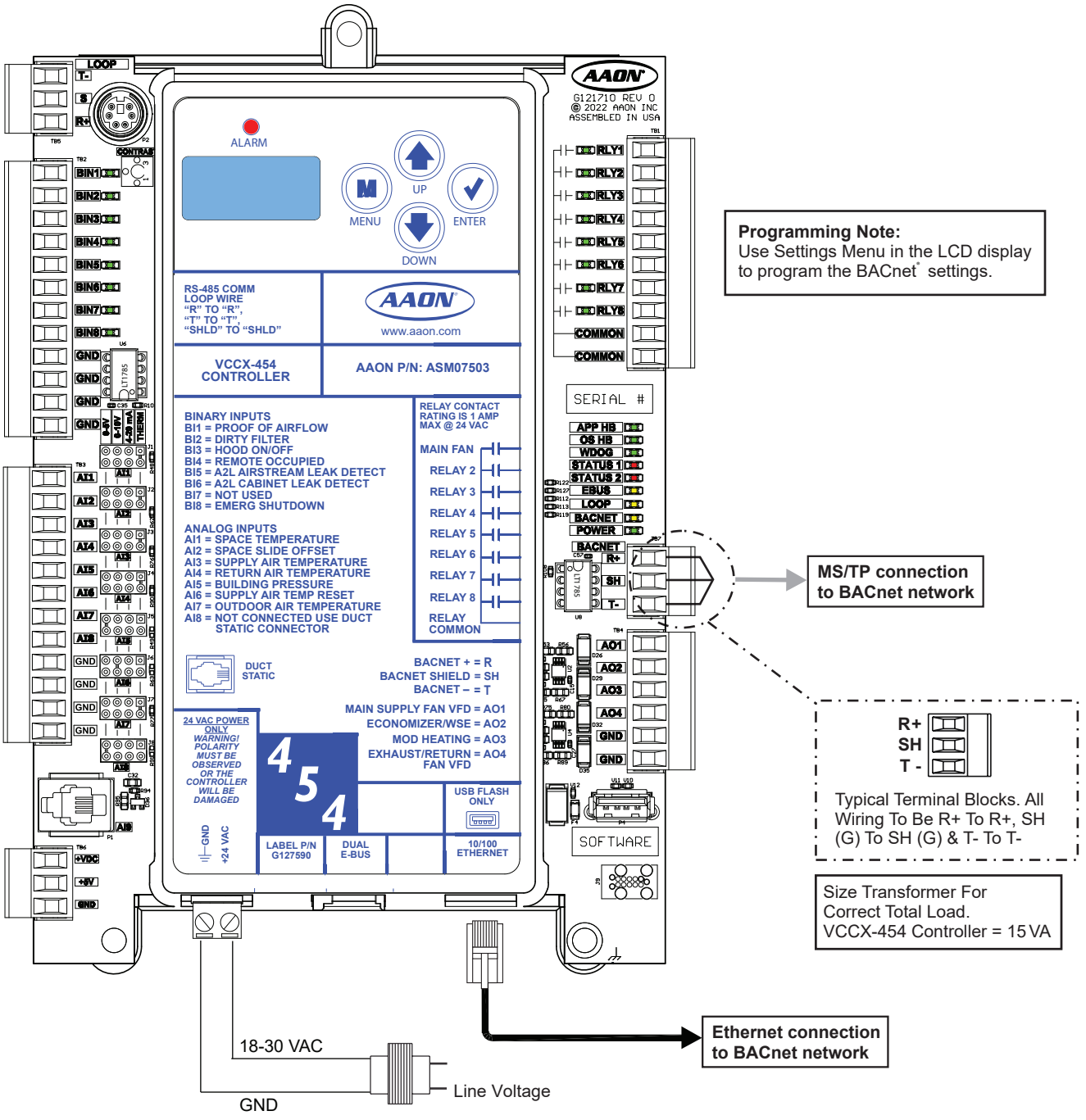
Air Balance Screens

Refer to the following map when navigating through the Air Balance screens. From the Air Balance screen, press **<ENTER>**.

OUTPUT OVERRIDE SCREENS	
Screen Text	**Description**
AIR BALANCE	Air balance screens that can be used by air balance to set min and max fan speeds
MAX FAN 10.0 VDC	Maximum fan voltage. 0.0 to 10.0 VDC. Press the **<UP>** and **<DOWN>** buttons to change the value. **Default is 10.0.**
MIN FAN 0.0 VDC	Minimum fan voltage. 0.0 to 10.0 VDC. Press the **<UP>** and **<DOWN>** buttons to change the value. **Default is 0.0.**
MAX EXH 10.0 VDC	Maximum exhaust voltage. 0.0 to 10.0 VDC. Press the **<UP>** and **<DOWN>** buttons to change the value. **Default is 10.0.**
MIN EXH 10.0 VDC	Minimum exhaust voltage. 0.0 to 10.0 VDC. Press the **<UP>** and **<DOWN>** buttons to change the value. **Default is 10.0.**

Table 36: Air Balance Screens

BACnet Connection to MS/TP or IP Network

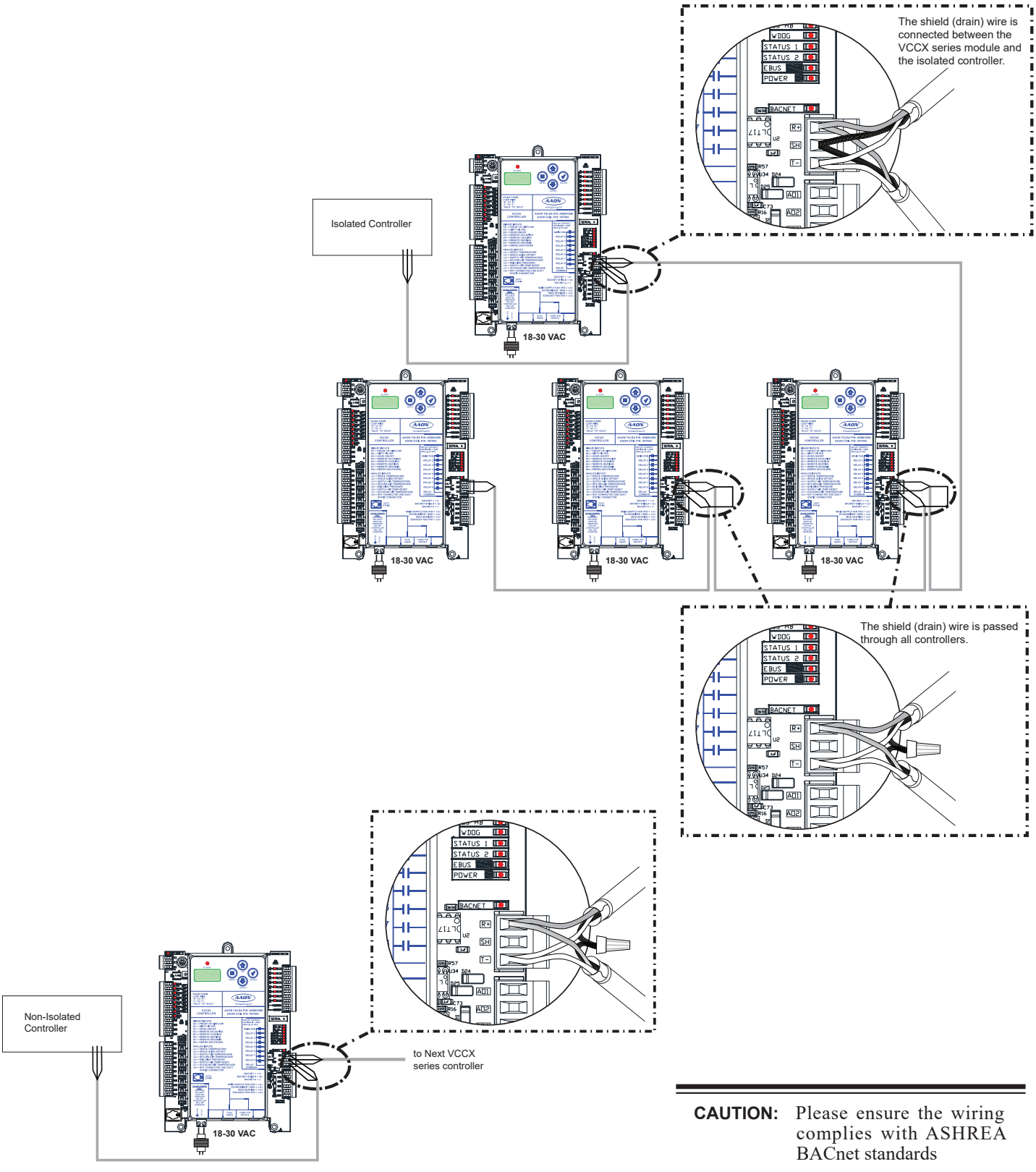


Wiring Notes:

1. All wiring to be in accordance with local and national electrical codes and specifications.
2. All communication wiring to be 18-gauge minimum, two-conductor, twisted pair with shield. Use Belden #82760 or equivalent.

Figure 32: VCCX-454 BACnet Connection to MS/TP or IP Network

BACnet Connection to MS/TP or IP Network



CAUTION: Please ensure the wiring complies with ASHREA BACnet standards

Figure 33: VCCX-454 BACnet Connection Drain Wire Example

Analog Inputs

VCCX-454 ANALOG INPUTS			
Parameter	**Object**	**Description**	**Limits**
Application Software Version	AI: 1	Current version of the software in the unit	
Control Mode	AI: 2	Configured unit application	See Control Mode on page 102
Control Status	AI: 3	Current Occupied/Unoccupied Status	See Control Status on page 102
HVAC Mode	AI: 4	Current operational status	See HVAC Mode on page 102
Control Temperature	AI: 5	Current value of the Control Temperature Sensor	
Mode Cooling Setpoint	AI: 6	Cooling Mode Enable Setpoint Mirror (adjusted by the Space Sensor Slide adjustment and/or Night Setback offsets)	
Mode Heating Setpoint	AI: 7	Heating Mode Enable Setpoint Mirror (adjusted by the Space Sensor Slide adjustment and/or Night Setback offsets)	
Sensor Slide Adjust Effect	AI: 8	Amount of Current Sensor Slide Adjust	
Supply Air Temperature	AI: 9	Current value of the Supply Air Temperature sensor	
Supply Air Setpoint	AI: 10	Current SAT Cooling or Heating Setpoint if there is no reset source; Current calculated SAT setpoint with Reset Source	
Controlling Coil Temp Setpoint	AI: 11	This is the current calculated Coil Suction Temperature target during Dehumidification Mode	
Space Temperature	AI: 12	Current value of the Space Temperature Sensor	
Space Humidity	AI: 13	Current value of the Space Humidity	
Return Air Temperature	AI: 14	Current value of the Return Temperature Sensor	
Return Air Humidity	AI: 15	Current value of the Return Air Humidity	
Outdoor Air Temperature	AI: 16	Current value of the Outdoor Air Temperature Sensor	
Outdoor Air Humidity	AI: 17	Current value of the Outdoor Humidity Sensor	
Outdoor Air Wetbulb	AI: 18	Current calculated Outdoor Wetbulb Temperature	
Outdoor Air Dewpoint	AI: 19	Current Calculated Outdoor Air Dewpoint Temperature	
Supply Air Setpoint Reset Voltage	AI: 20	Supply Air Temp Setpoint Reset Input Signal	
Duct Static Pressure	AI: 21	Current Duct Static Pressure	
Duct Static Control Signal	AI: 22	Current Duct Static Control Signal (Fan VFD)	
Building Pressure	AI: 23	Current value of the Building Pressure Sensor	
Building Pressure Control Signal	AI: 24	Current Building Pressure Control Signal	
Outdoor Airflow	AI: 25	Current Outdoor Airflow Measurement	
Supply Airflow	AI: 26	Current Supply Airflow Measurement	
Return Airflow	AI: 27	Current Return Airflow Measurement	
Exhaust Airflow	AI: 28	Current Exhaust Airflow Measurement	
Carbon Dioxide	AI: 29	Current Indoor CO2 Level	
Desired Economizer Position	AI: 30	Current Modulating Signal to the Economizer Damper	
Economizer Feedback Position	AI: 31	Title 24 current position of feedback from Economizer actuator	
Return Damper Position	AI: 32	Current Signal to the Return Air Damper if using Return Air Bypass	
Return Bypass Position	AI: 33	Current Signal to the Return Air Bypass Damper if using Return Air Bypass	
Modulating Cooling Position	AI: 34	Current percentage of the Modulating Chilled Water Signal	
Objects labeled AI are read-only.			

Analog Inputs

VCCX-454 ANALOG INPUTS			
Parameter	**Object**	**Description**	**Limits**
Modulating Heat Position	AI: 35	Current percentage of the Modulating Heating signal (Hot Water or SCR heat)	
Preheater Leaving Air Temp #1	AI: 36	Current Preheater Leaving Air Temperature #1	
Preheater Leaving Air Temp #2	AI: 37	Current Preheater Leaving Air Temperature #2	
Preheater Entering Air Temp	AI: 38	Current Entering Air Temp for Preheater	
Preheater Setpoint Reset Voltage	AI: 39	Current Voltage Reset Input Value for Preheater	
Preheater SCR Output Signal	AI: 40	Current Modulating Heat Signal for Preheater	
Preheater PWM Output Signal	AI: 41	Current PWM Output Signal for Preheater	
Mod Hot Gas Reheat Valve Position	AI: 42	Current position of MHGRV Modulating Hot Gas Reheat Valve	
Mod Gas Heat Valve Position	AI: 43	Current position of MODGAS Modulating Gas Valve Control	
A1 Compressor Signal	AI: 44	Current Compressor A1 Modulating Cooling Signal	
A2 Compressor Signal	AI: 45	Current Compressor A2 Modulating Cooling Signal	
A1 Condenser Signal	AI: 46	Current A1 Condenser Signal	
A2 Condenser Signal	AI: 47	Current A2 Condenser Signal or WSE Bypass Valve Signal	
A1 Suction Pressure	AI: 48	Current Compressor A1 Suction Pressure	
A2 Suction Pressure	AI: 49	Current Compressor A2 Suction Pressure	
A1 Head Pressure	AI: 50	Current Compressor A1 Head Pressure	
A2 Head Pressure	AI: 51	Current Compressor A2 Head Pressure	
A1 Saturation Temperature	AI: 52	Current Compressor A1 Coil Saturation Temperature	
A2 Saturation Temperature	AI: 53	Current Compressor A2 Coil Saturation Temperature	
A1 Suction Line Temperature	AI: 54	Current Compressor A1 Suction Line Temperature	
A2 Suction Line Temperature	AI: 55	Current Compressor A2Suction Line Temperature	
A1 Condenser Suction Temp (Heat Pump)	AI: 56	Current Compressor A1 Suction Line Temperature (Heat Pump)	
A2 Condenser Suction Temp (Heat Pump)	AI: 57	Current Compressor A2 Suction Line Temperature (Heat Pump)	
A1 Superheat Temperature	AI: 58	Current Compressor A1 Superheat Temperature	
A2 Superheat Temperature	AI: 59	Current Compressor A2 Superheat Temperature	
Condenser A1 Superheat (Heat Pump)	AI: 60	Current Compressor A1 Superheat Temperature (Heat Pump)	
Condenser A2 Superheat (Heat Pump)	AI: 61	Current Compressor A2 Superheat Temperature (Heat Pump)	
A1 Expansion Valve Position	AI: 62	Current position of Compressor A1 Expansion Valve	
A2 Expansion Valve Position	AI: 63	Current position of Compressor A2 Expansion Valve	
Condenser A1 Expansion Valve Position	AI: 64	Current position of Condenser A1 Expansion Valve	
Condenser A2 Expansion Valve Position	AI: 65	Current position of Condenser A2 Expansion Valve	
A1 Discharge Temperature	AI: 66	Current Compressor A1 Discharge Temperature	
A2 Discharge Temperature	AI: 67	Current Compressor A2 Discharge Temperature	
A1 Leaving Water Temp	AI: 68	Current A1 Leaving Water Temperature for WSHP	
B1 Compressor Signal	AI: 69	Current Compressor B1 Modulating Cooling Signal	
Objects labeled AI are read-only.			

Analog Inputs

VCCX-454 ANALOG INPUTS			
Parameter	**Object**	**Description**	**Limits**
B2 Compressor Signal	AI: 70	Current Compressor B2 Modulating Cooling Signal	
B1 Condenser Signal	AI: 71	Current B1 Condenser Signal	
B2 Condenser Signal	AI: 72	Current B2 Condenser Signal or WSE Bypass Valve Signal	
B1 Suction Pressure	AI: 73	Current Compressor B1 Suction Pressure	
B2 Suction Pressure	AI: 74	Current Compressor B2 Suction Pressure	
B1 Head Pressure	AI: 75	Current Compressor B1 Head Pressure	
B2 Head Pressure	AI: 76	Current Compressor B2 Head Pressure	
B1 Saturation Temperature	AI: 77	Current Compressor B1 Coil Saturation Temperature	
B2 Saturation Temperature	AI: 78	Current Compressor B2 Coil Saturation Temperature	
B1 Suction Line Temperature	AI: 79	Current Compressor B1 Suction Line Temperature	
B2 Suction Line Temperature	AI: 80	Current Compressor B2 Suction Line Temperature	
B1 Condenser Suction Temp (Heat Pump)	AI: 81	Current Compressor B1 Suction Line Temperature (Heat Pump)	
B2 Condenser Suction Temp (Heat Pump)	AI: 82	Current Compressor B2 Suction Line Temperature (Heat Pump)	
B1 Superheat Temperature	AI: 83	Current Compressor B1 Superheat Temperature	
B2 Superheat Temperature	AI: 84	Current Compressor B2 Superheat Temperature	
Condenser B1 Superheat (Heat Pump)	AI: 85	Current Compressor B1 Superheat Temperature (Heat Pump)	
Condenser B2 Superheat (Heat Pump)	AI: 86	Current Compressor B2 Superheat Temperature (Heat Pump)	
B1 Expansion Valve Position	AI: 87	Current position of Compressor B1 Expansion Valve	
B2 Expansion Valve Position	AI: 88	Current position of Compressor B2 Expansion Valve	
Condenser B1 Expansion Valve Position	AI: 89	Current position of Condenser B1 Expansion Valve	
Condenser B2 Expansion Valve Position	AI: 90	Current position of Condenser B2 Expansion Valve	
B1 Discharge Temperature	AI: 91	Current Compressor B1 Discharge Temperature	
B2 Discharge Temperature	AI: 92	Current Compressor B2 Discharge Temperature	
B1 Leaving Water Temp	AI: 93	Current B1 Leaving Water Temperature for WSHP	
C1 Compressor Signal	AI: 94	Current Compressor C1 Modulating Cooling Signal	
C2 Compressor Signal	AI: 95	Current Compressor C2 Modulating Cooling Signal	
C1 Condenser Signal	AI: 96	Current C1 Condenser Signal	
C2 Condenser Signal	AI: 97	Current C2 Condenser Signal or WSE Bypass Valve Signal	
C1 Suction Pressure	AI: 98	Current Compressor C1 Suction Pressure	
C2 Suction Pressure	AI: 99	Current Compressor C2 Suction Pressure	
C1 Head Pressure	AI: 100	Current Compressor C1 Head Pressure	
C2 Head Pressure	AI: 101	Current Compressor C2 Head Pressure	
C1 Saturation Temperature	AI: 102	Current Compressor C1 Coil Saturation Temperature	
C2 Saturation Temperature	AI: 103	Current Compressor C2 Coil Saturation Temperature	
C1 Suction Line Temperature	AI: 104	Current Compressor C1 Suction Line Temperature	
C2 Suction Line Temperature	AI: 105	Current Compressor C2 Suction Line Temperature	
C1 Condenser Suction Temp (Heat Pump)	AI: 106	Current Compressor C1 Suction Line Temperature (Heat Pump)	
Objects labeled AI are read-only.			

Analog Inputs

VCCX-454 ANALOG INPUTS			
Parameter	**Object**	**Description**	**Limits**
C2 Condenser Suction Temp (Heat Pump)	AI: 107	Current Compressor C2 Suction Line Temperature (Heat Pump)	
C1 Superheat Temperature	AI: 108	Current Compressor C1 Superheat Temperature	
C2 Superheat Temperature	AI: 109	Current Compressor C2 Superheat Temperature	
Condenser C1 Superheat (Heat Pump)	AI: 110	Current Compressor C1 Superheat Temperature (Heat Pump)	
Condenser C2 Superheat (Heat Pump)	AI: 111	Current Compressor C2 Superheat Temperature (Heat Pump)	
C1 Expansion Valve Position	AI: 112	Current position of Compressor C1 Expansion Valve	
C2 Expansion Valve Position	AI: 113	Current position of Compressor C2 Expansion Valve	
Condenser C1 Expansion Valve Position	AI: 114	Current position of Condenser C1 Expansion Valve	
Condenser C2 Expansion Valve Position	AI: 115	Current position of Condenser C2 Expansion Valve	
C1 Discharge Temperature	AI: 116	Current Compressor C1 Discharge Temperature	
C2 Discharge Temperature	AI: 117	Current Compressor C2 Discharge Temperature	
C1 Leaving Water Temp	AI: 118	Current C1 Leaving Water Temperature for WSHP	
D1 Compressor Signal	AI: 119	Current Compressor D1 Modulating Cooling Signal	
D2 Compressor Signal	AI: 120	Current Compressor D2 Modulating Cooling Signal	
D1 Condenser Signal	AI: 121	Current D1 Condenser Signal	
D2 Condenser Signal	AI: 122	Current D2 Condenser Signal or WSE Bypass Valve Signal	
D1 Suction Pressure	AI: 123	Current Compressor D1 Suction Pressure	
D2 Suction Pressure	AI: 124	Current Compressor D2 Suction Pressure	
D1 Head Pressure	AI: 125	Current Compressor D1 Head Pressure	
D2 Head Pressure	AI: 126	Current Compressor D2 Head Pressure	
D1 Saturation Temperature	AI: 127	Current Compressor D1 Coil Saturation Temperature	
D2 Saturation Temperature	AI: 128	Current Compressor D2 Coil Saturation Temperature	
D1 Suction Line Temperature	AI: 129	Current Compressor D1 Suction Line Temperature	
D2 Suction Line Temperature	AI: 130	Current Compressor D2 Suction Line Temperature	
D1 Condenser Suction Temp (Heat Pump)	AI: 131	Current Compressor D1 Suction Line Temperature (Heat Pump)	
D2 Condenser Suction Temp (Heat Pump)	AI: 132	Current Compressor D2 Suction Line Temperature (Heat Pump)	
D1 Superheat Temperature	AI: 133	Current Compressor D1 Superheat Temperature	
D2 Superheat Temperature	AI: 134	Current Compressor D2 Superheat Temperature	
Condenser D1 Superheat (Heat Pump)	AI: 135	Current Compressor D1 Superheat Temperature (Heat Pump)	
Condenser D2 Superheat (Heat Pump)	AI: 136	Current Compressor D2 Superheat Temperature (Heat Pump)	
D1 Expansion Valve Position	AI: 137	Current position of Compressor D1 Expansion Valve	
D2 Expansion Valve Position	AI: 138	Current position of Compressor D2 Expansion Valve	
Condenser D1 Expansion Valve Position	AI: 139	Current position of Condenser D1 Expansion Valve	
Condenser D2 Expansion Valve Position	AI: 140	Current position of Condenser D2 Expansion Valve	
D1 Discharge Temperature	AI: 141	Current Compressor D1 Discharge Temperature	
Objects labeled AI are read-only.			

Analog Inputs

VCCX-454 ANALOG INPUTS			
Parameter	**Object**	**Description**	**Limits**
D2 Discharge Temperature	AI: 142	Current Compressor D2 Discharge Temperature	
D1 Leaving Water Temp	AI: 143	Current D1 Leaving Water Temperature for WSHP	
Alarm Status	AI: 144	Indicates an alarm condition	0 = No Alarms, 1 = Alarm(s) Present
Outdoor Enthalpy	AI: 145	Current Outdoor Enthalpy	
Plenum Pressure	AI: 146	Reserved	
Return Fan Speed	AI: 147	Reserved	
Plenum Calculated Setpoint	AI: 148	Reserved	
Return Air Enthalpy Status	AI: 149	Current value of Return Air Enthalpy	
Current Duct Static Setpoint	AI: 150	Status of the duct static setpoint	
RM454-Z 1 Condenser Fan	AI: 151	Current RM454-Z 1 condenser fan signal	
RM454-Z 1 VFD Comp Perc	AI: 152	Current RM454-Z 1 VFD Compressor Percentage	
RM454-Z 1 Discharge Pressure	AI: 153	Current RM454-Z 1 discharge pressure	
RM454-Z 1 Suction Pressure	AI: 154	Current RM454-Z 1 Suction Pressure	
RM454-Z 1 Suction Line Temp	AI: 155	Current RM454-Z 1 Suction Line Temperature	
RM454-Z 1 Saturation Temp	AI: 156	Current RM454-Z 1 Saturation Temperature	
RM454-Z 1 Superheat	AI: 157	Current RM454-Z 1 Superheat Temperature	
RM454-Z 1 EEV Position	AI: 158	Current RM454-Z 1 EEV Valve Position	
RM454-Z 1 Warnings	AI: 159	Current RM454-Z 1 Warnings	See RM454-Z Warnings Bits on page 102.
RM454-Z 1 Comp VFD Alarms 1	AI: 160	Current RM454-Z 1 Comp VFD Alarms 1	See RM454-Z Alarms 1 Bits on page 103
RM454-Z 1 Comp VFD Alarms 2	AI: 161	Current RM454-Z 1 Comp VFD Alarms 2	See RM454-Z Alarms 2 Bits on page 103
RM454-Z 1 Comp VFD Drive Status	AI: 162	Current RM454-Z 1 Comp VFD drive status	See RM454-Z Drive Status Bits page 102
RM454-Z 1 Compressor Current	AI: 163	Current reading in Amps that the RM454-Z 1 compressor is using	
RM454-Z 1 Discharge Line Temp	AI: 164	Current RM454-Z 1 discharge line temperature	
RM454-Z 1 Faults	AI: 165	Current RM454-Z 1 Faults	See RM454-Z Faults Bits on page 102
RM454-Z 1 Lockouts	AI: 166	Current RM454-Z 1 Lockouts	See RM454-Z Lockouts Bits on page 102
RM454-Z 2 Condenser Fan	AI: 167	Current RM454-Z 2 condenser fan signal	
RM454-Z 2 VFD Comp Perc	AI: 168	Current RM454-Z 2 VFD Compressor Percentage	
RM454-Z 2 Discharge Pressure	AI: 169	Current RM454-Z 2 discharge pressure	
RM454-Z 2 Suction Pressure	AI: 170	Current RM454-Z 2 Suction Pressure	
RM454-Z 2 Suction Line Temp	AI: 171	Current RM454-Z 2 Suction Line Temperature	
RM454-Z 2 Saturation Temp	AI: 172	Current RM454-Z 2 Saturation Temperature	
RM454-Z 2 Superheat	AI: 173	Current RM454-Z 2 Superheat temperature	
RM454-Z 2 EEV Position	AI: 174	Current RM454-Z 2 EEV valve position	
RM454-Z 2 Warnings	AI: 175	Current RM454-Z 2 Warnings	See RM454-Z Warnings Bits on page 102.
RM454-Z 2 Comp VFD Alarms 1	AI: 176	Current RM454-Z 2 Comp VFD Alarms 1	See RM454-Z Alarms 1 Bits on page 103
RM454-Z 2 Comp VFD Alarms 2	AI: 177	Current RM454-Z 2 Comp VFD Alarms 2	See RM454-Z Alarms 2 Bits on page 103
Objects labeled AI are read-only.			

Analog Inputs

VCCX-454 ANALOG INPUTS			
Parameter	**Object**	**Description**	**Limits**
RM454-Z 2 Comp VFD Drive Status	AI: 178	Current RM454-Z 2 Comp VFD drive status	See RM454-Z Drive Status Bits on page 102
RM454-Z 2 Compressor Current	AI: 179	Current reading in Amps that the RM454-Z 2 compressor is using	
RM454-Z 2 Discharge Line Temp	AI: 180	Current RM454-Z 2 discharge line temperature	
RM454-Z 2 Faults	AI: 181	Current RM454-Z 2 Faults	See RM454-Z Faults Bits on page 102
RM454-Z 2 Lockouts	AI: 182	Current RM454-Z 2 Lockouts	See RM454-Z Lockouts Bits on page 102
RM454-Z 3 Condenser Fan	AI: 183	Current RM454-Z 3 condenser fan signal	
RM454-Z 3 Reheat Valve 1	AI: 184	Current RM454-Z 3 Reheat Valve 1 position	
RM454-Z 3 Discharge Pressure	AI: 185	Current RM454-Z 3 discharge pressure	
RM454-Z 3 Suction Pressure	AI: 186	Current RM454-Z 3 Suction Pressure	
RM454-Z 3 Suction Line Temp	AI: 187	Current RM454-Z 3 Suction Line Temperature	
RM454-Z 3 Saturation Temp	AI: 188	Current RM454-Z 3 Saturation Temperature	
RM454-Z 3 Superheat	AI: 189	Current RM454-Z 3 Superheat temperature	
RM454-Z 3 EEV Position	AI: 190	Current RM454-Z 3 EEV valve position	
RM454-Z 3 Suction Pressure 2	AI: 191	Current RM454-Z 3 Suction pressure 2	
RM454-Z 3 Suction Line Temp 2	AI: 192	Current RM454-Z 3 Suction Line Temperature 2	
RM454-Z 3 Saturation Temp 2	AI: 193	Current RM454-Z 3 Saturation Temperature 2	
RM454-Z 3 Superheat 2	AI: 194	Current RM454-Z 3 Superheat Temperature 2	
RM454-Z 3 EEV Position 2	AI: 195	Current RM454-Z 3 EEV valve position 2	
RM454-Z 3 Warnings	AI: 196	Current RM454-Z 3 Warnings	See RM454-Z Warnings Bits on page 102
RM454-Z 3 Discharge Line Temp	AI: 197	Current RM454-Z 3 discharge line temperature	
RM454-Z 3 Faults	AI: 198	Current RM454-Z 3 Faults	See RM454-Z Faults Bits on page 102
RM454-Z 3 Lockouts	AI: 199	Current RM454-Z 3 Lockouts	See RM454-Z Lockouts Bits on page 102
RM454-Z 4 Condenser Fan	AI: 200	Current RM454-Z 4 Condenser Fan Signal	
RM454-Z 4 VFD Comp Perc	AI: 201	Current RM454-Z 4 VFD Compressor Percentage	
RM454-Z 4 Discharge Pressure	AI: 202	Current RM454-Z 4 Discharge Pressure	
RM454-Z 4 Suction Pressure	AI: 203	Current RM454-Z 4 Suction Pressure	
RM454-Z 4 Suction Line Temp	AI: 204	Current RM454-Z 4 Suction Line Temperature	
RM454-Z 4 Saturation Temp	AI: 205	Current RM454-Z 4 Saturation Temperature	
RM454-Z 4 Superheat	AI: 206	Current RM454-Z 4 Superheat Temperature	
RM454-Z 4 EEV Position	AI: 207	Current RM454-Z 4 EEV valve position	
RM454-Z 4 Warnings	AI: 208	Current RM454-Z 4 Warnings	See RM454-Z Warnings Bits on page 102
RM454-Z 4 Comp VFD Alarms 1	AI: 209	Current RM454-Z 4 Comp VFD Alarms 1	See RM454-Z Alarms 1 Bits on page 103
RM454-Z 4 Comp VFD Alarms 2	AI: 210	Current RM454-Z 4 Comp VFD Alarms 2	See RM454-Z Alarms 2 Bits on page 103
RM454-Z 4 Comp VFD Drive Status	AI: 211	Current RM454-Z 4 Comp VFD drive status	See RM454-Z Drive Status Bits on page 102
RM454-Z 4 Comp VFD Compressor Current	AI: 212	Current reading in Amps that the RM454-Z 4 compressor is using	
Objects labeled AI are read-only.			

Analog Inputs

VCCX-454 ANALOG INPUTS			
Parameter	**Object**	**Description**	**Limits**
RM454-Z 4 Discharge Line Temp	AI: 213	Current RM454-Z 4 discharge line temperature	
RM454-Z 4 Faults	AI: 214	Current RM454-Z 4 Faults	See RM454-Z Faults Bits on page 102
RM454-Z 4 Lockouts	AI: 215	Current RM454-Z 4 Lockouts	See RM454-Z Lockouts Bits on page 102
RM454-Z 5 Condenser Fan	AI: 216	Current RM454-Z 5 Condenser Fan Signal	
RM454-Z 5 VFD Comp Perc	AI: 217	Current RM454-Z 5 VFD Compressor Percentage	
RM454-Z 5 Discharge Pressure	AI: 218	Current RM454-Z 5 discharge pressure	
RM454-Z 5 Suction Pressure	AI: 219	Current RM454-Z 5 Suction pressure	
RM454-Z 5 Suction Line Temp	AI: 220	Current RM454-Z 5 Suction Line Temperature	
RM454-Z 5 Saturation Temp	AI: 221	Current RM454-Z 5 Saturation Temperature	
RM454-Z 5 Superheat	AI: 222	Current RM454-Z5 Superheat temperature	
RM454-Z 5 EEV Position	AI: 223	Current RM454-Z 5 EEV valve position	
RM454-Z 5 Warnings	AI: 224	Current RM454-Z 5 Warnings	See RM454-Z Warnings Bits on page 102
RM454-Z 5 Comp VFD Alarms 1	AI: 225	Current RM454-Z 5 Comp VFD Alarms 1	See RM454-Z Alarms 1 Bits on page 103
RM454-Z 5 Comp Alarms 2	AI: 226	Current RM454-Z 5 Comp VFD Alarms 2	See RM454-Z Alarms 2 Bits on page 103
RM454-Z 5 Comp VFD Drive Status	AI: 227	Current RM454-Z 5 Comp VFD drive status	See RM454-Z Drive Status Bits on page 102
RM454-Z 5 Compressor Current	AI: 228	Current reading in Amps that the RM454-Z 5 compressor is using	
RM454-Z 5 Discharge Line Temp	AI: 229	Current RM454-Z 5 discharge line temperature	
RM454-Z 5 Faults	AI: 230	Current RM454-Z 5 Faults	See RM454-Z Faults Bits on page 102
RM454-Z 5 Lockouts	AI: 231	Current RM454-Z 5Lockouts	See RM454-Z Lockouts Bits on page 102
RM454-Z 6 Condenser Fan	AI: 232	Current RM454-Z 6 condenser fan signal	
RM454-Z 6 Reheat Valve 1	AI: 233	Current RM454-Z 6 Reheat Valve 1 position	
RM454-Z 6 Discharge Pressure	AI: 234	Current RM454-Z 6 discharge pressure	
RM454-Z 6 Suction Pressure	AI: 235	Current RM454-Z 6 Suction Pressure	
RM454-Z 6 Suction Line Temp	AI: 236	Current RM454-Z 6 Suction Line Temperature	
RM454-Z 6 Saturation Temp	AI: 237	Current RM454-Z 6 Saturation Temperature	
RM454-Z 6 Superheat	AI: 238	Current RM454-Z 6 Superheat Temperature	
RM454-Z 6 EEV Position	AI: 239	Current RM454-Z 6 EEV valve position	
RM454-Z 6 Suction Pressure 2	AI: 240	Current RM454-Z 6 Suction pressure 2	
RM454-Z 6 Suction Line Temp 2	AI: 241	Current RM454-Z 6 Suction Line Temperature 2	
RM454-Z 6 Saturation Temp 2	AI: 242	Current RM454-Z 6 Saturation Temperature 2	
RM454-Z 6 Superheat 2	AI: 243	Current RM454-Z 6 Superheat Temperature 2	
RM454-Z 6 EEV Position 2	AI: 244	Current RM454-Z 6 EEV valve position 2	
RM454-Z 6 Warnings	AI: 245	Current RM454-Z 6 Warnings	See RM454-Z Warnings Bits on page 102
RM454-Z 6 Discharge Line Temp	AI: 246	Current RM454-Z 6 discharge line temperature	
RM454-Z 6 Faults	AI: 247	Current RM454-Z 6 Faults	See RM454-Z Faults Bits on page 102
RM454-Z 6 Lockouts	AI: 248	Current RM454-Z 6 Lockouts	See RM454-Z Lockouts Bits on page 102
Objects labeled AI are read-only.			

Analog Inputs

VCCX-454 ANALOG INPUTS			
Parameter	**Object**	**Description**	**Limits**
Not used	AI: 249	Not used	
Not used	AI: 250	Not used	
Not used	AI: 251	Not used	
Not used	AI: 252	Not used	
SUB 1 Sub Cool 1	AI: 253	Current Subcooling Module 1 Sub Cool 1 reading	
SUB 1 Sub Cool 2	AI: 254	Current Subcooling Module 1 Sub Cool 2 reading	
SUB 1 Sub Cool 3	AI: 255	Current Subcooling Module 1 Sub Cool 3 reading	
SUB 1 Pressure 1	AI: 256	Current Subcooling Module 1 liquid line pressure 1 reading	
SUB 1 Pressure 2	AI: 257	Current Subcooling Module 1 liquid line pressure 2 reading	
SUB 1 Pressure 3	AI: 258	Current Subcooling Module 1 liquid line pressure 3 reading	
SUB 1 Saturation 1	AI: 259	Subcooling Module 1 saturation temperature 1 reading	
SUB 1 Saturation 2	AI: 260	Subcooling Module 1 saturation temperature 2 reading	
SUB 1 Saturation 3	AI: 261	Subcooling Module 1 saturation temperature 3 reading	
SUB 1 Line Temp 1	AI: 262	Subcooling Module 1 liquid line temperature 1 reading	
SUB 1 Line Temp 2	AI: 263	Subcooling Module 1 liquid line temperature 2 reading	
SUB 1 Line Temp 3	AI: 264	Subcooling Module 1 liquid line temperature 3 reading	
SUB 2 Sub Cool 1	AI: 265	Current Subcooling Module 2 Sub Cool 1 reading	
SUB 2 Sub Cool 2	AI: 266	Current Subcooling Module 2 Sub Cool 2 reading	
SUB 2 Sub Cool 3	AI: 267	Current Subcooling Module 2 Sub Cool 3 reading	
SUB 2 Pressure 1	AI: 268	Current Subcooling Module 2 liquid line pressure 1 reading	
SUB 2 Pressure 2	AI: 269	Subcooling Module 2 liquid line pressure 2 reading	
SUB 2 Pressure 3	AI: 270	Subcooling Module 2 liquid line pressure 3 reading	
SUB 2 Saturation 1	AI: 271	Subcooling Module 2 saturation temperature 1 reading	
SUB 2 Saturation 2	AI: 272	Subcooling Module 2 saturation temperature 2 reading	
SUB 2 Saturation 3	AI: 273	Subcooling Module 2 saturation temperature 3 reading	
SUB 2 Line Temp 1	AI: 274	Subcooling Module 2 liquid line temperature 1 reading	
SUB 2 Line Temp 2	AI: 275	Subcooling Module 2 liquid line temperature 2 reading	
SUB 2 Line Temp 3	AI: 276	Subcooling Module 2 liquid line temperature 3 reading	
Enter Water Pump	AI: 277	Status of Entering Water Temperature	
Return Plenum Press. Status	AI: 278	Current value of the Return Plenum Pressure Sensor	
Return Plenum Control Signal	AI: 279	Current Return Plenum Control Signal (Motorized Exhaust Damper)	
Mixed Air Temp	AI: 280	Mixed air temperature sensor status. Used on units with Direct Fire Heat.	
Actual Heat Rise	AI: 281	Difference between supply air temperature and mixed air temperature on units with Direct Fire Heat.	
Calculated Heat Rise	AI: 282	The heat rise limit determined by how open the Outside Damper is.	
Supply Air Relative Humidity	AI: 283	If an EBUS Supply Air Sensor is being used this shows the current supply air relative humidity reading.	
Supply Air Dew Point	AI: 284	If an EBUS Supply Air Sensor is being used this shows the current calculated supply air dew point.	
Space Dew Point	AI: 285	Current value of the calculated Space Dew Point.	
Return Dew Point	AI: 286	Current value of the calculated Return Dew Point.	
Objects labeled AI are read-only.			

test

Analog Values

VCCX-454 ANALOG VALUES				
Parameter	**Object**	**Description**	**Limits Minimum**	**Limits Maximum**
Occupied Cooling Setpoint	AV: 1	If the control temperature rises one deadband above this setpoint, the control activates the cooling demand. This setpoint does not determine the mode in Occupied operation if the unit is configured for Supply Air Cooling or Supply Air Tempering.	1°F (-17.2°C)	110°F (43.3°C)
Occupied Heating Setpoint	AV: 2	If the control temperature drops one deadband below this setpoint, the control activates the heating demand. This setpoint does not determine the mode in Occupied operation if the unit is configured for Supply Air Cooling or Supply Air Tempering.	1°F (-17.2°C)	110°F (43.3°C)
Hood On Cooling Setpoint	AV: 3	This is the Cooling Mode Enable Setpoint used only in Hood On Mode or Space Temperature Control of High Percentage Outdoor Air Units or VAV Tempering	1°F (-17.2°C)	110°F (43.3°C)
Hood On Heating Setpoint	AV: 4	This is the Heating Mode Enable Setpoint used only in Hood On Mode or Space Temperature Control of High Percentage Outdoor Air Units or VAV Tempering	1°F (-17.2°C)	110°F (43.3°C)
Unoccupied Cooling Offset	AV: 5	During the Unoccupied Mode of Operation, this Setpoint offsets the Occupied Cooling Setpoint up by this user-adjustable amount. Use the default setting of 30°F for this setpoint to prevent Cooling during the Unoccupied Mode.	0°F (0°C)	30°F (16.6°C)
Unoccupied Heating Offset	AV: 6	During the Unoccupied Mode of Operation, this Setpoint offsets the Occupied Heating Setpoint down by this user-adjustable amount. Use the default setting of 30°F for this setpoint to prevent Heating during Unoccupied Mode.	0°F (0°C)	30°F (16.6°C)
Mode Select Deadband	AV: 7	This value is added to and subtracted from the HVAC Mode Setpoints to create a control deadband range	0°F (0°C)	10°F (5.5°C)
Max Coil Setpoint Reset Limit	AV: 8	This is the highest that the Coil Temperature resets to during Space Humidity Reset of the Coil Suction Temperature Setpoint. If no coil temperature reset is required, this value should be set the same as the Min Coil Reset Limit.	35°F (1.7°C)	70°F (21.1°C)
Min Coil Setpoint Reset Limit	AV: 9	This is the lowest the Coil Temperature resets to during Space Humidity Reset of the Coil Suction Temperature Setpoint. If no coil temperature reset is required, this value should be set the same as the Max Coil Reset Limit.	35°F (1.7°C)	70°F (21.1°C)
Supply Air Cooling Setpoint	AV: 10	Supply Air Cooling Setpoint. If Supply Air Reset is configured this is the Low SAT Cooling Reset Value	30°F (-1.1°C)	80°F (26.6°C)
Supply Air Heating Setpoint	AV: 11	Supply Air Heating Setpoint. If Supply Air Reset is configured this is the Low SAT Heating Reset Value	40°F (4.5°C)	240°F (115.5°C)
Max SAT Cooling Setpoint Reset Limit	AV: 12	If Supply Air Reset is configured this is the High SAT Cooling Reset Value	0°F (-17.7°C)	100°F (37.7°C)
Max SAT Heating Setpoint Reset Limit	AV: 13	If Supply Air Reset is configured this is the High SAT Heating Reset Value	0°F (-17.7°C)	250°F (121.1°C)
Supply Air Cooling Staging Window	AV: 14	In Cooling Mode, if the Supply Air Temperature drops below the Active Supply Air Cooling Setpoint minus this Staging Window, the Cooling Stage deactivates after its Minimum Run Time	1°F (0.6°C)	30°F (16.6°C)
Supply Air Heating Staging Window	AV: 15	In Heating Mode, if the Supply Air Temperature rises above the Active Supply Air Heating Setpoint plus this Staging Window, the Heating Stage deactivates after its Minimum Run Time	1°F (0.6°C)	50°F (27.7°C)
Warm-Up Target Temperature (See AV: 89 for Cool-Down Target Temperature)	AV: 16	If Morning Warm-Up is configured, then upon entering occupied mode, the Warm-Up Mode activates if the Return Air is below this temperature by one degree	50°F (10°C)	90°F (32.2°C)
Objects labeled AV are read/write. The only sensor values that can be written to are AV points 72, 73, and 76 through 79.				

Analog Values

VCCX-454 ANALOG VALUES				
Parameter	**Object**	**Description**	**Limits Minimum**	**Limits Maximum**
Warm-Up Mode Supply Air Setpoint	AV: 17	During Morning Warm-Up, the Supply Air Temperature is controlled to this Setpoint	40°F (4.5°C)	240°F (115.5°C)
Cool-Down Mode Supply Air Setpoint	AV: 18	During Morning Cool-Down, the Supply Air Temperature is controlled to this Setpoint	30°F (-1.1°C)	80°F (26.6°C)
Mechanical Cooling Outdoor Air Lockout	AV: 19	Mechanical Cooling is locked out when the Outdoor Air Temperature is below this Setpoint	-30°F (-34.4°C)	100°F (37.7°C)
Mechanical Heating Outdoor Air Lockout	AV: 20	Mechanical Heating is locked out when the Outdoor Air Temperature is above this Setpoint	-30°F (-34.4°C)	150°F (65.5°C)
Low Supply Temp Cutoff Alarm	AV: 21	Cooling is disabled if the Supply Air Temperature falls below this value. See sequence for more details	0°F (-17.7°C)	100°F (37.7°C)
High Supply Temp Cutoff Alarm	AV: 22	Heating is disabled if the Supply Air Temperature rises above this value. See sequence for more details	0°F (-17.7°C)	250°F (121.1°C)
Preheater Cooling Mode Setpoint	AV: 23	If the Preheater is enabled, and the unit is in the Cooling Mode, this is sent to the Preheat-X Controller to control Leaving Air Temperature	35°F (1.7°C)	90°F (32.2°C)
Preheater Venting Mode Setpoint	AV: 24	If the Preheater is enabled, and the unit is in the Vent Mode, this setpoint is sent to the Preheat-X Controller to control Leaving Air Temperature	35°F (1.7°C)	90°F (32.2°C)
Preheater Heating Mode Setpoint	AV: 25	If the Preheater is enabled, and the unit is in the Heating Mode, this setpoint is sent to the Preheat-X Controller to control Leaving Air Temperature	35°F (1.7°C)	140°F (60.0°C)
Outdoor Air Dewpoint Setpoint	AV: 26	On an MUA unit, if the OA dewpoint rises above this setpoint, Dehumidification is initiated	30°F (-1.1°C)	80°F (26.6°C)
Economizer Enable Setpoint	AV: 27	The economizer is enabled if the outdoor drybulb, dewpoint, or wetbulb temperature falls below this setpoint	-30°F (-34.4°C)	80°F (26.6°C)
Heat Wheel Defrost Enable Setpoint	AV: 28	The unit goes into Heat Wheel Defrost if the Outdoor Air is below this setpoint	0°F (-17.7°C)	50°F (10°C)
PreHeat Enable Setpoint	AV: 29	If the Supply Fan is energized, this is the temperature at which the Preheat Relay activates, or the Preheat-X activates. Operates only in the Occupied Mode.	-30°F (-34.4°C)	105°F (40.6°C)
Sensor Slide Offset Max Effect	AV: 30	If the space sensor has the optional slide adjustment feature, this is the maximum amount the slide can adjust the current heating and cooling setpoints up or down with full deflection of the slide	0°F (0°C)	10°F (5.5°C)
Space Sensor Calibration Offset	AV: 31	If the Space Temperature Sensor is reading incorrectly, use this option to enter an offset temperature to adjust the Sensor's Temperature	-100°F (-55.5°C)	100°F (55.5°C)
Supply Air Sensor Calibration Offset	AV: 32	If the Supply Air Temperature Sensor is reading incorrectly, use this option to enter an offset temperature to adjust the Sensor's Temperature	-100°F (-55.5°C)	100°F (55.5°C)
Return Air Sensor Calibration Offset	AV: 33	If the Return Temperature Sensor is reading incorrectly, use this option to enter an offset temperature to adjust the Sensor's Temperature	-100°F (-55.5°C)	100°F (55.5°C)
Outdoor Air Sensor Calibration Offset	AV: 34	If the Outdoor Temperature Sensor is reading incorrectly, use this option to enter an offset temperature to adjust the Sensor's Temperature	-100°F (-55.5°C)	100°F (55.5°C)
Carbon Dioxide Sensor Calibration Offset	AV: 35	If the CO2 Sensor is reading incorrectly, use this option to enter an offset value to adjust the Sensor's CO2 reading	-500 ppm	500 ppm
Low Ambient Protection Setpoint	AV: 36	Temperature at which the Low Ambient Relay activates in the Occupied or Unoccupied Mode	-30°F (-34.4°C)	70°F (21.1°C)
Objects labeled AV are read/write. The only sensor values that can be written to are AV points 72, 73, and 76 through 79.				

Analog Values

VCCX-454 ANALOG VALUES				
Parameter	**Object**	**Description**	**Limits Minimum**	**Limits Maximum**
SAT Cool Setpoint Reset Source Low Limit	AV: 37	If doing Supply Air Setpoint Reset, this is the Low Reset Source value in Cooling that corresponds to the Supply Air Cool High Reset Setpoint	-30°F (-34.4°C)	150°F (65.5°C)
SAT Cool Setpoint Reset Source High Limit	AV: 38	If doing Supply Air Setpoint Reset, this is the High Reset Source value in Cooling that corresponds to the Supply Air Cooling Setpoint (Low Reset)	0°F (-17.7°C)	150°F (65.5°C)
SAT Heat Setpoint Reset Source Low Limit	AV: 39	If doing Supply Air Setpoint Reset, this is the Low Reset Source value in Heating that corresponds to the Supply Air Heating High Reset Setpoint	-30°F (-34.4°C)	150°F (65.5°C)
SAT Heat Setpoint Reset Source High Limit	AV: 40	If doing Supply Air Setpoint Reset, this is the High Reset Source value in Heating that corresponds to the Supply Air Heating Setpoint (Low Reset)	0°F (-17.7°C)	150°F (65.5°C)
Control Temperature High Alarm Offset	AV: 41	If the temperature of the controlling sensor rises above the Occupied Cooling Setpoint by this value, a High Control Temp Alarm occurs. Only applies if configured for Space or Return Air Temp Control, or as Single Zone VAV.	0°F (0°C)	50°F (27.7°C)
Control Temperature Low Alarm Offset	AV: 42	If the temperature of the controlling sensor falls below the Occupied Heating Setpoint by this value, a Low Control Temp Alarm occurs. Only applies if configured for Space or Return Air Temp Control, or as Single Zone VAV.	0°F (0°C)	50°F (27.7°C)
Heat Pump Compressor Heat Lockout	AV: 43	Compressor Heat is locked out below this setpoint	-30°F (-34.4°C)	100°F (37.7°C)
Maximum Main Fan VFD in SZ VAV Heating Mode	AV: 44	In Single Zone VAV configuration, this is the max fan speed the VFD can modulate up to in Heat Mode	0	100
Minimum Main Fan VFD in Cooling Mode	AV: 45	In Single Zone VAV configuration, this is the fan speed at which the VFD starts when Cooling is initiated. In a VAV configuration this is the lowest fan speed allowed in the Cooling Mode. In CAV and MUA configurations this should be set to 100%.	0	100
Minimum Main Fan VFD in Heating Mode	AV: 46	In Single Zone VAV configuration, this is the fan speed at which the VFD starts when Heating is initiated. In a VAV configuration this is the lowest fan speed allowed in the Heating Mode. In CAV and MUA configurations this should be set to 100%.	0	100
Minimum Main Fan VFD in Vent Mode	AV: 47	Speed at which the VFD operates in the Vent Mode in Single Zone VAV	0	100
Maximum Economizer in Heating Mode	AV: 48	Max position the Economizer Damper opens to in Supply Air Tempering during Heating Mode. Takes priority over Max Position in High CO2.	0	100
Minimum Economizer Position	AV: 49	The minimum position of the Outdoor Air damper in the Occupied Mode. This can be reset upwards based on indoor CO2 levels. NOTE: See Economizer Override via BACnet section in the Economizer area of the Sequence of Operations for additional information.	0	100
Maximum Economizer CO2 Reset Limit	AV: 50	The maximum value the Economizer Minimum Position can be reset up to during CO2 override	0	100
Minimum Carbon Dioxide Setpoint	AV: 51	This is the threshold CO2 level at which the Economizer Min Damper Position Setpoint begins to be reset higher	0 ppm	2000 ppm
Maximum Carbon Dioxide Setpoint	AV: 52	This is the CO2 level at which the Economizer Min Damper Position resets to the Economizer Max Position in High CO2. In between the Min and Max CO2 levels the Economizer Min Damper Position is proportionally reset between the configured Min Damper Position and the Max Position in High CO2.	0 ppm	2000 ppm
Objects labeled AV are read/write. The only sensor values that can be written to are AV points 72, 73, and 76 through 79.				

Analog Values

VCCX-454 ANALOG VALUES				
Parameter	**Object**	**Description**	**Limits Minimum**	**Limits Maximum**
Indoor Humidity Setpoint Low Reset Limit	AV: 53	On indoor controlled (non-MUA) units, this is the Humidity setpoint at which the unit leaves Dehumidification. During Coil Temp Reset, this is the lowest Space RH value that corresponds to the High Coil Temp Setpoint. If the VCCX-454 is configured for indoor dewpoint control, this point displays Dew Point instead of Humidity.	0	100
Indoor Humidity Setpoint High Reset Limit	AV: 54	On indoor controlled (non-MUA) units, this is the Humidity setpoint at which the unit initiates Dehumidification. During Coil Temp Reset, this is the highest Space RH value that corresponds to the Low Coil Temp Setpoint. If the VCCX-454 is configured for indoor dewpoint control, this point displays Dew Point instead of Humidity.	0	100
Duct Static Pressure Setpoint	AV: 55	Current Static Pressure Setpoint	0.1	3
Duct Static Pressure Control Deadband	AV: 56	Value above and below the Duct Static Pressure Setpoint where no control change occurs	0.01	0.5
Building Pressure Control Setpoint	AV: 57	Building Pressure Setpoint or Exhaust Duct Static Pressure Setpoint	-0.2	3
Building Pressure Control Deadband	AV: 58	Value above and below the Building Pressure Setpoint or the Exhaust Duct Static Pressure Setpoint where no control change occurs	0.01	0.5
Minimum Outdoor CFM Requirement	AV: 59	Minimum Outdoor Airflow CFM Setpoint	0.10K	200K
Outdoor CFM Control Deadband	AV: 60	Controls rate of change for damper signal. As OA CFM moves further from setpoint within this window, the damper makes a larger change.	10	1000
Single Zone VAV Fan Speed Integral	AV: 61	The Integral Constant for Single Zone VAV Fan Control	0	10
Relay Run-time Hours Warning Limit	AV: 62	If any configured relay's run time exceeds this number of hours of operation, a warning alarm is generated so that periodic maintenance can be performed	0	30000
Cooling Mode Head Pressure Setpoint	AV: 63	Head Pressure Setpoint in the Cooling Mode	250	450
Dehum Mode Head Pressure Setpoint	AV: 64	Head Pressure Setpoint in the Dehumidification Mode	250	450
Superheat Setpoint	AV: 65	Superheat Setpoint	1°F (1°C)	30°F (17°C)
Maximum Outdoor CFM Requirement	AV: 66	Maximum Outdoor Airflow CFM Setpoint in High CO2	0.10K	200K
Schedule Force	AV: 67	0 = Auto (uses controller's schedule) 1 = Forced Occupied 2 = Forced Unoccupied	0	2
HVAC Mode Override	AV: 68	Overrides normal controller operation to force the unit into this desired mode. Configuring for "Auto" restores normal unit control of the mode of operation. 0=Auto 1=Vent 2=Cool 3=Heat 4=Vent Dehum 5=Cool Dehum 6=Heat Dehum.	0	6
Fan VFD Override	AV: 69	Override to force the VFD to this percentage speed. Configuring "Auto" restores normal unit control of the VFD speed.	0% Auto=65535	100% Auto=65535
Objects labeled AV are read/write. The only sensor values that can be written to are AV points 72, 73, and 76 through 79.				

Analog Values

VCCX-454 ANALOG VALUES				
Parameter	**Object**	**Description**	**Limits Minimum**	**Limits Maximum**
Outdoor Air Damper Override	AV: 70	Overrides all other Outdoor Air Damper position commands to maintain this fixed position. Configuring for “Auto” restores normal unit control of the Outdoor Air Damper/ Economizer operation. NOTE: When a value of 0 or 100% is written the compressors are allowed to operate. Any value between 0-100% the compressors will be locked out. See the *Economizer Override via BACnet* section on **page 46** for additional information.	0% Auto=65535	100% Auto=65535
Supply Setpoint Override	AV: 71	This overrides whatever setpoint the Supply Air Temperature is currently being controlled to. 0=No Override.	0°F (-17.7°C)	200°F (93.3°C)
Space Temperature Value	AV: 72	If the controller is configured for this operation, the user can write a Space Sensor value	0°F (-17.7°C)	120°F (48.8°C)
Space Humidity Value	AV: 73	If the controller is configured for this operation, the user can write a Space Humidity Sensor value	0	100
Indoor RH Calibration Offset	AV: 74	If the Space Humidity Sensor is reading incorrectly, use this option to enter an offset humidity to adjust the Sensor’s Humidity	-1	1
Relief Fan VFD	AV: 75	Override to force the VFD to this percentage speed. Configuring “Auto” restores normal unit control of the VFD speed	0% Auto=65535	100% Auto=65535
Relief Pressure Value	AV: 76	If the controller is configured for this operation, the user can write Building Pressure Sensor value	-0.5	0.5
Carbon Dioxide Value	AV: 77	If the controller is configured for this operation, the user can write a CO2 Sensor value.	0	3000
Outdoor Air Temperature Value	AV: 78	If the controller is configured for this operation, the user can write an Outdoor Sensor value	-40°F (-40°C)	150°F (65.5°C)
Outdoor Air Humidity Value	AV: 79	If the controller is configured for this operation, the user can write an Outdoor Humidity Sensor value	0	100
High Level Enthalpy (Reserved)	AV: 80	Reserved	10	50
Low Level Enthalpy (Reserved)	AV: 81	Reserved	10	50
Max Plenum Pressure Setpoint Reset Limit	AV: 82	Reserved	0.1	1.4
Min Plenum Pressure Setpoint Reset Limit	AV: 83	Reserved	0.1	1.4
Enthalpy Enable Setpoint	AV: 84	If configured for Comparative Enthalpy Economizer Control, the OA Enthalpy must be below this setpoint by the Enthalpy Enable Deadband before the OA/RA Enthalpy comparison is utilized to enable the Economizer	25 BTU/lb.	35 BTU/lb.
EnthalpyEnable Deadband	AV: 85	The OA Enthalpy must be below the Enthalpy Enable Setpoint by this amount, and the OA Enthalpy must be below the RA Enthalpy by this amount to utilize the Economizer	0.3 BTU/lb.	1.5 BTU/lb.
Maximum Static Setpoint Reset Limit	AV: 86	As the most open VAV damper rises above 80%, the static setpoint resets up to this maximum limit	0.01 “WG	3.00 “WG
Minimum Static Setpoint Reset Limit	AV: 87	As the most open VAV damper drops below 80%, the static setpoint resets down to this minimum reset limit	0.01 “WG	3.00 “WG
Static Setpoint Reset Interval	AV: 88	The Reset Interval is how often the setpoint reset calculation occurs. This must be an infrequent event, so the default is 15 minutes.	10 min	60 min
Objects labeled AV are read/write. The only sensor values that can be written to are AV points 72, 73, and 76 through 79.				

Analog Values

VCCX-454 ANALOG VALUES				
Parameter	**Object**	**Description**	**Limits Minimum**	**Limits Maximum**
Cool-Down Target Temperature (See AV: 16 for Warm-Up Target Temperature)	AV: 89	If Morning Cool-Down is configured then upon entering occupied mode, the Cool-Down Mode activates if the return air is above this temperature by one degree	50°F (10°C)	90°F (32.2°C)
Warm-Up Override	AV: 90	Commands the unit into Morning Warm-Up Mode. 1=Command Warm-Up Mode	0	1
Cool Down Override	AV: 91	Commands the unit into Morning Cool-Down Mode 1=Command Cool-Down Mode	0	1
Return Air High Limit Protection (for Voting Units or CV Units Only)	AV: 92	If the Return Air Temperature goes above this limit, the unit reverts to Return Air Control. NOTE: This point only applies when the BMS is writing a space temperature value to the VCCX-454 and that value is lost.	60	100
Return Air Low Limit Protection (for Voting Units or CV Units Only)	AV: 93	If the Return Air Temperature goes below this limit, the unit reverts to Return Air Control. NOTE: This point only applies when the BMS is writing a space temperature value to the VCCX-454 and that value is lost.	45	70
Sump Drain Override	AV: 94	Setting this value to 1 turns the Sump Drain relay on. Setting this value to 0 sets the relay operation to Auto. 0=Auto 1=On	0	1
Return Plenum Pressure Setpoint	AV: 95	Current Return Plenum Pressure Setpoint	-0.2"WG	0.2"WG
Return Plenum Pressure Deadband	AV: 96	Value above and below the Return Plenum Pressure Setpoint where no control change occurs	0.01"WG	0.2"WG
Dehum Lockout Setpoint	AV: 97	If Outdoor Air temperature is below this setpoint, Dehumidification Mode is locked out	-30°F (-34.4°C)	60°F (15.6°C)
Emergency Compressor Lockout	AV: 98	This point can be used to lockout the compressors if the BMS wants them disabled.	0	1
Supply Air Dew Point Setpoint	AV: 99	When the VCCX-454 is configured for DX-DOAS control it modulates the compressors to try to maintain the Supply Air Dew Point Setpoint during dehumidification mode.	35	80
Objects labeled AV are read/write. The only sensor values that can be written to are AV points 72, 73, and 76 through 79.				

Binary Inputs

VCCX-454 BINARY INPUTS		
Parameter	**Object**	**Description**
Cooling Enabled Status	BI: 1	Status that indicates Mechanical Cooling is enabled based on the Cooling Lockout
Heating Enabled Status	BI: 2	Status that indicates that Mechanical Heating is enabled based on the Heating Lockout
Economizer Enabled Status	BI: 3	Status that indicates the Economizer is enabled based on the Economizer Enable Setpoint
Aux Heat Enabled Status	BI: 4	Heat Pump Auxiliary Heat enabled
Emergency Heat Enabled Status	BI: 5	Shows the Emergency Heat is enabled based on the Compressor Heating Lockout
Fan Proof of Airflow Status	BI: 6	Proof of Airflow Binary Input Status
Exhaust Hood On/Off Status	BI: 7	Exhaust Hood On/Off Binary Input Status
Remote Forced Occupied Status	BI: 8	Remote Forced Occupied Mode Binary Input Status
A2L Airstream Leak Detect Status	BI: 9	Alarm active. Only BI 5 is deactivated (0VAC on input)
A2L Cabinet Leak Detect Status	BI: 10	Alarm active. Only BI 6 is deactivated (0VAC on input)
Reserved for future use	BI: 11	
Bad Supply Air Sensor	BI: 12	Alarm that indicates a failure of the Supply Air Sensor
Bad Return Air Sensor	BI: 13	Alarm that indicates a failure of the Return Air Sensor
Bad Outdoor Air Sensor	BI: 14	Failure of the Outdoor Air Temperature Sensor
Bad Space Temp Sensor	BI: 15	Failure of the Space Temperature Sensor. If Space is the controlling sensor, the unit shuts down.
Bad Carbon Dioxide Sensor	BI: 16	Failure of the CO2 Sensor
Bad Building Pressure Sensor	BI: 17	Alarm indicating missing or failed Building Pressure Sensor
Bad Outdoor Airflow Sensor	BI: 18	An Outdoor Airflow Sensor is configured, but not detected
Bad Exhaust Airflow Sensor	BI: 19	An Exhaust Airflow Sensor is configured, but not detected
Bad Supply Airflow Sensor	BI: 20	A Supply Airflow Sensor is configured, but not detected
Bad Return Airflow Sensor	BI: 21	A Return Airflow Sensor is configured, but not detected
Mechanical Cooling Alarm	BI: 22	Compressor Relays are enabled but the Supply Air Temperature has not fallen 5°F w/in a user-adjustable time period. This does not apply to Modulating Cooling.
Mechanical Heating Alarm	BI: 23	Heating Mode has been initiated but the Supply Air Temperature has not risen 5°F w/in a user-adjustable time period. Alarms on the MODGAS series and Preheat-X Controller generate this alarm. This alarm does not apply to SCR Heat, Modulating Hot Water or Steam Heating.
Fan Proving Alarm	BI: 24	Alarm that indicates an Airflow failure from the Main Fan. Heating and Cooling are disabled.
Dirty Filter Alarm	BI: 25	Alarm that indicates the filters are dirty
Emergency Shutdown Alarm	BI: 26	Alarm that indicates that Emergency Shutdown has been activated. Shuts the unit down.
Relay Runtime Warning	BI: 27	Indicates when any of the configured relays exceeds a configured number of hours of runtime. Can be used to schedule service, etc.
Economizer Missing Alarm	BI: 28	Title 24 operation indicates missing economizer feedback
Economizer Title 24 Failure A	BI: 29	Title 24 Air Temperature Sensor Failure
Economizer Title 24 Failure B	BI: 30	Title 24 Not Economizing when it should
Economizer Title 24 Failure C	BI: 31	Title 24 Economizing when it should not
Economizer Title 24 Failure D	BI: 32	Title 24 Damper Not Modulating
Economizer Title 24 Failure E	BI: 33	Title 24 Excess Outdoor Air
High Supply Temp Cutoff	BI: 34	The Supply Air has risen above the Hi SAT Cutoff Setpoint. Heating stages deactivate and the fan continues to run. This alarm is generated.
Low Supply Temp Cutoff	BI: 35	The Supply Air has fallen below the Low SAT Cutoff Setpoint. Cooling stages deactivate. After 10 minutes, the fan deactivates and this alarm is generated.
High Control Mode Alarm	BI: 36	Occurs when the Controlling Sensor Temperature rises above the Cooling Mode Enable Setpoint plus the Control Mode High Alarm Offset. Applies only to Space or Return Air Temperature controlled units.
Objects labeled BI are read-only.		

Binary Inputs

VCCX-454 BINARY INPUTS		
Parameter	**Object**	**Description**
Low Control Mode Alarm	BI: 37	Occurs when the Controlling Sensor Temperature falls below the Heating Mode Enable Setpoint minus the Control Mode Low Alarm Offset. Applies only to Space or Return Air Temperature controlled units.
Missing Refrigerant Module #1	BI: 38	Refrigerant Module #1 is bad or missing
Missing Refrigerant Module #2	BI: 39	Refrigerant Module #2 is bad or missing
Missing Refrigerant Module #3	BI: 40	Refrigerant Module #3 is bad or missing
Missing Refrigerant Module #4	BI: 41	Refrigerant Module #4 is bad or missing
Missing Preheater Board	BI: 42	Preheater Module is bad or missing
Missing Reheat Board	BI: 43	The MHGR board is configured but not detected
Missing Mod Gas Board	BI: 44	The MODGAS board is configured but not detected
Missing EM1 Board	BI: 45	EM1 Expansion Board is bad or missing
Missing 12 Relay Expansion Board	BI: 46	The 12 Relay Expansion Board is configured but not detected
On Board Relay 1 Main Fan	BI: 47	Current Status of Main Fan Relay #1 on Main Board
On Board Relay 2	BI: 48	Current Status of Configurable Relay #2 on Main Board
On Board Relay 3	BI: 49	Current Status of Configurable Relay #3 on Main Board
On Board Relay 4	BI: 50	Current Status of Configurable Relay #4 on Main Board
On Board Relay 5	BI: 51	Current Status of Configurable Relay #5 on Main Board
On Board Relay 6	BI: 52	Current Status of Configurable Relay #6 on Main Board
On Board Relay 7	BI: 53	Current Status of Configurable Relay #7 on Main Board
On Board Relay 8	BI: 54	Current Status of Configurable Relay #8 on Main Board
Expansion Board EM1 Relay 1	BI: 55	Current Status of Configurable Relay #1 on EM1 Board
Expansion Board EM1 Relay 2	BI: 56	Current Status of Configurable Relay #2 on EM1 Board
Expansion Board EM1 Relay 3	BI: 57	Current Status of Configurable Relay #3 on EM1 Board
Expansion Board EM1 Relay 4	BI: 58	Current Status of Configurable Relay #4 on EM1 Board
Expansion Board EM1 Relay 5	BI: 59	Current Status of Configurable Relay #5 on EM1 Board
12 Relay Expansion Board Relay 1	BI: 60	Current Status of Configurable Relay #1 on 12 Relay Board
12 Relay Expansion Board Relay 2	BI: 61	Current Status of Configurable Relay #2 on 12 Relay Board
12 Relay Expansion Board Relay 3	BI: 62	Current Status of Configurable Relay #3 on 12 Relay Board
12 Relay Expansion Board Relay 4	BI: 63	Current Status of Configurable Relay #4 on 12 Relay Board
12 Relay Expansion Board Relay 5	BI: 64	Current Status of Configurable Relay #5 on 12 Relay Board
12 Relay Expansion Board Relay 6	BI: 65	Current Status of Configurable Relay #6 on 12 Relay Board
12 Relay Expansion Board Relay 7	BI: 66	Current Status of Configurable Relay #7 on 12 Relay Board
12 Relay Expansion Board Relay 8	BI: 67	Current Status of Configurable Relay #8 on 12 Relay Board
12 Relay Expansion Board Relay 9	BI: 68	Current Status of Configurable Relay #9 on 12 Relay Board
12 Relay Expansion Board Relay 10	BI: 69	Current Status of Configurable Relay #10 on 12 Relay Board
12 Relay Expansion Board Relay 11	BI: 70	Current Status of Configurable Relay #11 on 12 Relay Board
12 Relay Expansion Board Relay 12	BI: 71	Current Status of Configurable Relay #12 on 12 Relay Board
Preheater Enable Status	BI: 72	Status of Preheater Enable Input
Preheater Emergency Shutdown	BI: 73	Status of Preheater Emergency Shutdown Input
Preheater Spare Binary Input #3	BI: 74	Status of Preheater Binary Input #3
MODGAS Enable Status	BI: 75	Status of MODGAS Controller
MHGR Enable Status	BI: 76	Status of MHGRV Controller
A1 Compressor Enable	BI: 77	Current Status of Enable Signal to Compressor A1
A2 Compressor Enable	BI: 78	Current Status of Enable Signal to Compressor A2
Objects labeled BI are read-only.		

Binary Inputs

VCCX-454 BINARY INPUTS		
Parameter	**Object**	**Description**
A1 Compressor Alarms	BI: 79	Indicates an RSM alarm is present on the A1 circuit
A2 Compressor Alarms	BI: 80	Indicates an RSM alarm is present on the A2 circuit
A1-2 Defrost Switch	BI: 81	Outside Coil A1/A2 Temp Switch for Defrost Mode
A1-2 Water Proof of Flow	BI: 82	A1/A2 Water Proof of Flow Switch
A1-4 Emergency Shutdown (RM454-D)	BI: 83	Emergency Shutdown Input on Module A
Refrigerant Module 1 Relay 1	BI: 84	Current Status of Compressor A1 Enable Relay
Refrigerant Module 1 Relay 2	BI: 85	Current Status of Compressor A2 Enable Relay
Refrigerant Module 1 Relay 3	BI: 86	Current Status of Condenser 1 Enable Relay
Refrigerant Module 1 Relay 4	BI: 87	Current Status of Relay #4
Refrigerant Module 1 Relay 5	BI: 88	Current Status of Relay #5
B1 Compressor Enable	BI: 89	Current Status of Enable Signal to Compressor B1
B2 Compressor Enable	BI: 90	Current Status of Enable Signal to Compressor B2
B1 Compressor Alarms	BI: 91	Indicates an RSM alarm is present on the B1 circuit
B2 Compressor Alarms	BI: 92	Indicates an RSM alarm is present on the B2 circuit
B1-2 Defrost Switch	BI: 93	Outside Coil B1/B2 Temp Switch for Defrost Mode
B1-2 Water Proof of Flow	BI: 94	B1/B2 Switch for Water Proof of Flow
B1-4 Emergency Shutdown (RM454-D)	BI: 95	Emergency Shutdown Input on Module B
Refrigerant Module 2 Relay 1	BI: 96	Current Status of Compressor 1 Enable Relay
Refrigerant Module 2 Relay 2	BI: 97	Current Status of Compressor 2 Enable Relay
Refrigerant Module 2 Relay 3	BI: 98	Current Status of Condenser 1 Enable Relay
Refrigerant Module 2 Relay 4	BI: 99	Current Status of Relay #4
Refrigerant Module 2 Relay 5	BI: 100	Current Status of Relay #5
C1 Compressor Enable	BI: 101	Current Status of Enable Signal to Compressor C1
C2 Compressor Enable	BI: 102	Current Status of Enable Signal to Compressor C2
C1 Compressor Alarms	BI: 103	Indicates an RSM alarm is present on the C1 circuit
C2 Compressor Alarms	BI: 104	Indicates an RSM alarm is present on the C2 circuit
C1-2 Defrost Switch	BI: 105	Outside Coil C1/C2Temp Switch for Defrost Mode
C1-2 Water Proof of Flow	BI: 106	C1/C2 Switch for Water Proof of Flow
C1-4 Emergency Shutdown (RM454-D)	BI: 107	Emergency Shutdown Input on Module C
Refrigerant Module 3 Relay 1	BI: 108	Current Status of Compressor 1 Enable Relay
Refrigerant Module 3 Relay 2	BI: 109	Current Status of Compressor 2 Enable Relay
Refrigerant Module 3 Relay 3	BI: 110	Current Status Condenser 1 Enable Relay
Refrigerant Module 3 Relay 4	BI: 111	Current Status of Relay #4
Refrigerant Module 3 Relay 5	BI: 112	Current Status of Relay #5
D1 Compressor Enable	BI: 113	Current Status of Enable Signal to Compressor D1
D2 Compressor Enable	BI: 114	Current Status of Enable Signal to Compressor D2
D1 Compressor Alarms	BI: 115	Indicates an RSM alarm is present on the D1 circuit
D2 Compressor Alarms	BI: 116	Indicates an RSM alarm is present on the D2 circuit
D1-2 Defrost Switch	BI: 117	Outside Coil D1/D2 Temp Switch for Defrost Mode
D1-2 Water Proof of Flow	BI: 118	D1/D2 Switch for Water Proof of Flow
D1-4 Emergency Shutdown (RM454-D)	BI: 119	Emergency Shutdown Input on Module D
Refrigerant Module 4 Relay 1	BI: 120	Current Status of Compressor 1 Enable Relay
Refrigerant Module 4 Relay 2	BI: 121	Current Status of Compressor 2 Enable Relay
Objects labeled BI are read-only.		

Binary Inputs

VCCX-454 BINARY INPUTS		
Parameter	**Object**	**Description**
Refrigerant Module 4 Relay 3	BI: 122	Current Status of Condenser 1 Enable Relay
Refrigerant Module 4 Relay 4	BI: 123	Current Status of Relay #4
Refrigerant Module 4 Relay 5	BI: 124	Current Status of Relay #5
Preheater Alarm	BI: 125	Preheater Alarm Indicator
Return Fan Proving Alarm	BI: 126	Exhaust Fan / Return Fan Proof of Flow Alarm
Compressor Running A	BI: 127	Current Run Status of Compressor A
Compressor Running B	BI: 128	Current Run Status of Compressor B
Compressor Running C	BI: 129	Current Run Status of Compressor C
Compressor Running C2	BI: 130	Current Run Status of Compressor C2
Compressor Running D	BI: 131	Current Run Status of Compressor D
Compressor Running E	BI: 132	Current Run Status of Compressor E
Compressor Running E2	BI: 133	Current Run Status of Compressor E2
Compressor Running F	BI: 134	Current Run Status of Compressor F
Compressor Running F2	BI: 135	Current Run Status of Compressor F2
Return Fan Proving Status	BI: 136	Proof of Return Fan Airflow Binary Input Status
IAQ Mode Active	BI: 137	Indicates that IAQ Mode is active
Heat Wheel Defrost Active	BI: 138	Indicates Heat Wheel Defrost is active
Direct Fire Status	BI: 139	Signal on EM1 binary input 2 from Direct Fire Module that indicates that the direct fire heater is active.
Direct Fire Alarm Status	BI: 140	Signal on EM1 binary input 3 that indicates there is an active alarm on the Direct Fire Module.
Temp Rise Warning	BI: 141	Indicates the heat rise when direct fire heat is active has exceeded the max heat rise by more than 1°F.
Temp Rise Alarm	BI: 142	Indicates the heat rise when direct fire heat is active has exceeded the max heat rise by more than 2°F.
Temp Rise Lockout	BI: 143	Indicates three High Temp Rise alarms occurred within a 1-hour span and the unit heat is disabled until the unit is serviced.
High CO2 Rise Warning	BI: 144	Indicates that high return CO2 was detected when running direct fire heat.
High CO2 Rise Alarm	BI: 145	Indicates high return CO2 was detected and direct fire heat has been temporarily shut down for recovery.
High CO2 Rise Lockout	BI: 146	Indicates three CO2 warning alarms occurred within a 1-hour span and direct fire heat is now disabled until the unit is serviced.
Ignition Lockout	BI: 147	Indicates an active alarm on the Direct Fire Module.
Direct Fire Status Lockout	BI: 148	Indicates that Direct Fire Status Signal is not active within 10 minutes of a call to activate the heat. Heat Enable signal is removed and direct fire heating is locked out.
Direct Fire Setpoint Override	BI: 149	Indicates the max calculated heat rise is limiting the Supply Air Setpoint to a lower value.
Fan Array Failure	BI: 150	Indicates a Fan Array Failure
A2L Leak Detect	BI: 151	Indicates an A2L Leak Detected in the Airstream
A2L Cabinet Leak Detect	BI: 152	Indicates an A2L Leak Detected in the Cabinet
Objects labeled BI are read-only.		

Enumerated Fields

VCCX CONTROL MODE = ENUMERATED	
ITEM	ENUM
Supply Air Cooling Only	0
Supply Air Tempering	1
Outdoor Temperature Control	2
Return Air Constant Volume Mode	3
Space Temp Constant Volume Mode	4
Space Temp w/ High OA Content	5
Single Zone VAV	6

Table 37: VCCX Control Mode = Enumerated

VCCX CONTROL STATUS = ENUMERATED	
ITEM	ENUM
Unoccupied	0
Occupied	1
Override Mode	2
Holiday Unoccupied	3
Holiday Occupied	4
Forced Occupied	5
Forced Unoccupied	6
Remote Contact Occupied	7
Reserved	8
Reserved	9
Reserved	10
OA Damper Calibration	11
A2L Protection Mode	12

Table 38: VCCX Control Status = Enumerated

VCCX HVAC MODE STATUS = ENUMERATED	
ITEM	ENUM
Off	0
Vent Mode	1
Cooling Mode	2
Heating Mode	3
Vent RH Mode	4
Cooling RH Mode	5
Heating RH Mode	6
Warm Up Mode	7
Purge Mode	8
Defrost Mode	9
Cool Down Mode	10

Table 39: VCCX Mode Status = Enumerated

Bitfields

RM454-Z WARNINGS STATUS BIT STRINGS			
ITEM	BIT	VALUE	DESCRIPTION
AI:159 AI:175 AI:196 AI:208 AI:224 AI:245	0	1	Low Suction Pressure
	1	2	Low Suction No Start
	2	4	High Discharge Pressure Level 1
	3	8	High Discharge Pressure Level 2
	4	16	Discharge Pressure Sensor Not Detected
	5	32	VFD Compressor Alarm
	6	64	High Superheat
	7	128	High Discharge Temperature
	8	256	Comp 1 False Active
	9	1024	Comp 2 False Active
	10	2048	Reserved
	11	4096	Discharge Line Temp Sensor Not Detected

Table 40: RM454-Z Warnings Status Bit Strings

RM454-Z FAULTS STATUS BIT STRINGS			
ITEM	BIT	VALUE	DESCRIPTION
AI:165 AI:181 AI:198 AI:214 AI:230 AI:247	0	1	Low Suction Pressure
	1	2	Unsafe Suction Pressure
	2	4	Trip High Discharge Pressure Comp 1
	3	8	Compressor 1 Not Running
	4	16	Compressor 2 Not Running
	5	32	Low Superheat
	6	64	High Discharge Temperature
	7	128	EEV Not Detected
	8	256	MODBUS Slave Comm Timeout
	9	1024	Low Suction Pressure Comp 2
	10	2048	Trip High Discharge Pressure Comp 2
	11	4096	High Superheat
	12	8192	High Evap Temperature
	13	16384	Emergency Shutdown

Table 41: RM454-Z Faults Status Bit Strings

RM454-Z LOCKOUT STATUS BIT STRINGS			
ITEM	BIT	VALUE	DESCRIPTION
AI:166 AI:182 AI:199 AI:215 AI:231 AI:248	0	1	Suction Pressure System Lockout
	1	2	Oil Boost Lockout
	2	4	High Discharge Pressure System Lockout
	3	8	Low Superheat System Lockout
	4	16	High Superheat System Lockout
	5	32	High Evap Temperature System Lockout
	6	64	High Discharge Temp System Lockout

Table 42: RM454-Z Lockout Status Bit Strings

RM454-Z DRIVE STATUS BIT STRINGS				
BACnet Bitfields	ITEM	BIT	VALUE	DESCRIPTION
AI: 162 AI: 178 AI: 211 AI: 227	Control Ready	0	1	0=Control Not Ready; 1=Control Ready
	Drive Ready	1	2	0=Drive Not Ready; 1=Drive Ready
	Enable	2	4	0=Coasting; 1=Enable
	Trip Error	3	8	0=No Error; 1=Trip
	Error No Trip	4	16	0=No Error; 1=Error (no trip
	Reserved	5	32	Reserved
	Triplock Error	6	64	0=No Error; 1=TripLock (must power cycle)
	Warning	7	128	0=No Warning; 1=Warning
	Speed Equals Reference	8	256	0=Speed Not=Reference; 1=Speed=Reference
	Bus Control	9	512	0=Local Operation; 1=Bus Control
	Frequency Limit Okay	10	1024	0=Out of Frequency Limit; 1=Frequency Limit Okay
	In Operation	11	2048	0=No Operation; 1=In Operation
	Stopped AutoStart	12	4096	0=Drive OK; 1=Stopped, Auto Start
	Voltage Exceeded	13	8192	0=Voltage Okay; 1=Voltage Exceeded
	Torque Exceeded	14	16384	0=Torque Okay; 1=Torque Exceeded
	Timer Exceeded	15	32768	0=Timer Okay; 1=Timer Exceeded

Table 43: RM454-Z Drive Status Bit Strings

Bitfields

RM454-Z TREND LOG BIT STRINGS - VFD1 ALARMS			
BACnet Bitfields	BIT	VALUE	VFD STATUS (BIT = 0)
AI: 160	0	1	Brake Check
AI: 176	1	2	Pwr. Card Temp
AI: 209	2	4	Earth Fault
AI: 225	3	8	Ctrl. Card Temp
	4	16	Ctrl. Word TO
	5	32	Over Current
	6	64	Torque Limit
	7	128	Motor Th Over
	8	256	Motor ETR Over
	9	512	Inverter Overld.
	10	1024	DC under Volt
	11	2048	DC over Volt
	12	4096	Short Circuit
	13	8192	Inrush Fault
	14	16384	Mains ph. Loss
	15	32768	AMA Not OK

Table 44: RM454-Z Module VFD1 Alarm Trend Log

RM454-Z TREND LOG BIT STRINGS - VFD2 ALARMS			
BACnet Bitfields	BIT	VALUE	VFD STATUS (BIT = 0)
AI: 161	0	1	Live Zero Error
AI: 177	1	2	Internal Fault
AI: 210	2	4	Brake Overload
AI: 226	3	8	U phase Loss
	4	16	V phase Loss
	5	32	W phaseLoss
	6	64	Fieldbus Fault
	7	128	24 V Supply Low
	8	256	Mains Failure
	9	512	1.8V Supply Low
	10	1024	Brake Resistor
	11	2048	Brake IGBT
	12	4096	Option Change
	13	8192	Drive Initialized
	14	16384	Safe Stop
	15	32768	Mech brake low

Table 45: RM454-Z Module VFD2 Alarm Trend Log

BACnet® Protocol Implementation Conformance Statement

Date:	March 2024
Vendor:	AAON
Product:	VCCX-454
Product Model Number:	ASM07503
Product Version:	FW 1.09
Product Description:	HVAC Unit Controller
BACnet Protocol Revision:	Revision 15 (ANSI/ASHRAE Standard 135-2019)

BACnet® Protocol Implementation Conformance Statement

K.1.2 BIBB – Data Sharing-ReadProperty-B (DS-RP-B)
K.1.4 BIBB – Data Sharing-ReadPropertyMultiple-B (DS-RPM-B)
K.1.8 BIBB – Data Sharing-WriteProperty-B (DS-WP-B)
K.5.2 BIBB – Device Management-DynamicDeviceBinding-B (DM-DDB-B)
K.5.4 BIBB – Device Management-DynamicObjectBinding-B (DM-DOB-B)
K.5.6 BIBB – Device Management-DeviceCommunicationControl-B (DM-DCC-B)

BACnet Standardized Device Profile

L.4 BACnet Application Specific Controller (B-ASC)

Standard Object Types Supported

Analog Input:	Optional properties supported: Description
Analog Value:	Optional properties supported: Description
Binary Input:	Optional properties supported: Description, Inactive_Text, Active_Text
Binary Value:	Optional properties supported: Description, Inactive_Text, Active_Text
Device Object:	Optional properties supported: Description, Location, Serial_Number
Multi-state Input:	Optional properties supported: Description, State_Text
Multi-state Value:	Optional properties supported: Description, State_Text

For all supported objects, device does not support CreateObject or DeleteObject.
There are no proprietary objects.

Data Link Layer Options

MS/TP Master: Supported Baud rates: 9.6K, 19.2K, 38.4K, 57.6K, 76.8K
BACnet/IP, 'DIX' Ethernet

Segmentation Support

Neither segmented requests nor segmented responses are supported.

VCCX-454 Controller Technical Guide

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

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

AAON Factory Technical Support:
918-382-6450 | techsupport@aaon.com

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.

2425 So. Yukon Ave • Tulsa, OK • 74107-2728
Ph: (918) 583-2266 • Fax: (918) 583-6094
Rev. E