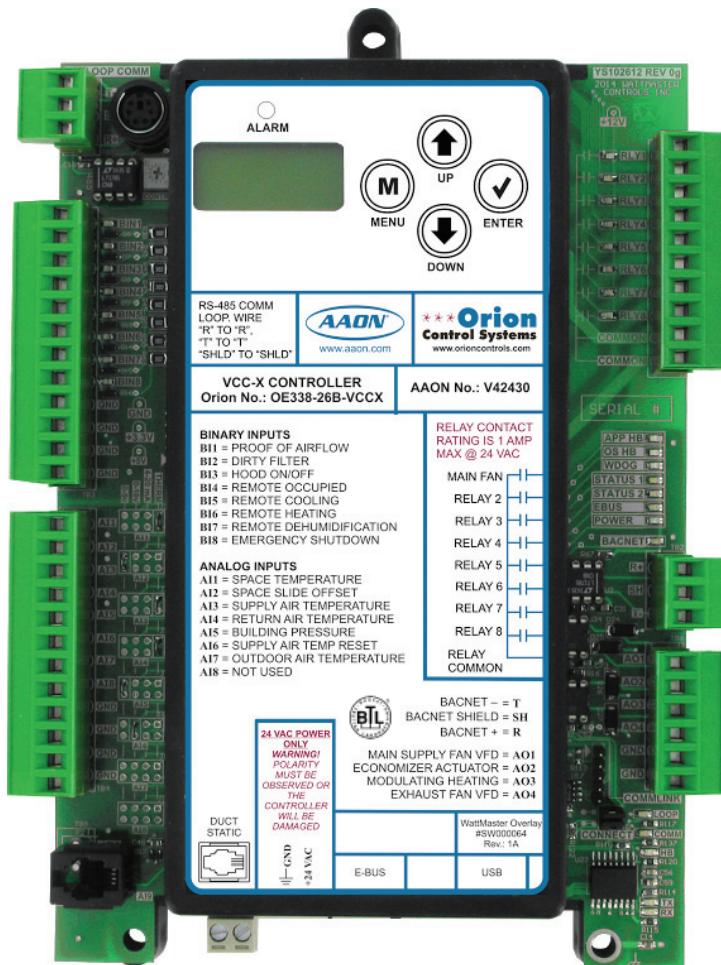




VCC-X Controller Technical Guide

VCC-X Controller Code: SS1079 Version 1.0 and up
Requires Service Tool SD Code: SS1063 Version 1.0 and up
Requires System Manager SD Code: SS1068 Version 1.11 and up
Requires System Manager Touch Screen (Limited Access): SS7013





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AAON Part Number: V57140

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System Features

Features

The VCC-X Controller (Orion Part No. OE338-26B-VCCX; AAON Part No. V42430) is designed with 8 analog inputs, 4 analog outputs, 8 binary inputs, and 8 relay outputs (7 configurable). It also has an on-board BACnet® port for connection to an MS/TP network. The Controller contains a 2 x 8 LCD character display and 4 buttons that allow for status and alarm display, force modes, and BACnet® configuration.

The VCC-X Controller can communicate with the Refrigerant System Module for VFD Compressors, Refrigerant System Module for VFD Compressors - Heat Pump, and Refrigerant System Module for Digital Compressors. In addition, the VCC-X EM1 Expansion Module and 12 Relay E-BUS Expansion Module provides additional specifically dedicated inputs and outputs.

There are also 2 E-BUS Expansion connectors on the VCC-X which allows for the connection of the expansion modules listed above, as well as communicating sensors, and future E-BUS Modules via modular E-BUS cables. There are presently 5 communicating sensors available. Two of these sensors have LCD displays: E-BUS Digital Space Temperature Only Sensor or E-BUS Digital Space Temperature and Humidity Sensor. There is a communicating E-BUS Space Temperature and Humidity Sensor with no LCD display as well as an E-BUS Space CO₂ Sensor, and E-BUS Duct CO₂ Sensor, each with no LCD display.

The VCC-X Controller provides for the following applications: Constant Volume, VAV, Single Zone VAV, Make-up Air, and Space Temperature Control of High Percentage Outdoor Air.

Other features of the VCC-X include:

- Controls up to 8 Digital Compressors
- Controls up to 4 sets of tandem 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)
- Full Integration with the AAON® Refrigerant System Modules
- Full Integration with the AAON® MODGAS-X Modulating Natural Gas Controller
- Full Integration with the AAON® MHGRV-X Modulating Hot Gas Reheat Valve Controller
- Full Integration with the AAON® PREHEAT-X Controller
- Advanced Dehumidification Capabilities
- Air to Air Heat Pump and Water Source Heat Pump applications
- Air Flow Monitoring of Outdoor Air, Supply Air, Return Air, and Exhaust Air Streams with approved EBTRON®, GreenTrol™, or Paragon Airflow Monitoring Stations
- Air Flow Control of Outdoor Air Damper
- Single Zone VAV Control w/Optional CAV Heating
- Primary/Secondary Heating Control
- Remote Forced Cooling, Heating, and Dehumidification Control
- Remote Supply Air Temperature Reset Signal
- Adaptive Supply Air Temperature Reset
- Selectable Mode Enable Sensor
- Fan Proving Interlock
- Dirty Filter Alarm
- Emergency Shutdown Input (Smoke Detector/ Firestat or other Shutdown Conditions)
- Drybulb/Wetbulb/Dewpoint Control of Economizer Operation
- Building Pressure Control (Direct or Reverse Acting)
- Remote Forced Occupied Capability
- Configurable for AAON® Return Air Bypass Applications
- IAQ Economizer Reset
- Title 24 Economizer Certified
- 7-Day, 2-Event-per-Day Scheduling
- 14 Holiday Event Scheduling
- Daylight Savings Time Adjustment
- Trend Logging Capability
- Static Pressure Control for Filter Loading Applications
- Heat Wheel - On/Off Control
- Head Pressure Control
- On-board BACnet® port for connection to an MS/TP network (See Appendix C)



Applications

Variable Air Volume Unit

The VCC-X can control VAV units that are typically designed for occupied Cooling Mode only, where VAV boxes equipped with reheat satisfy heating demands in individual spaces. In this application, unit heat is typically used for Morning Warm-Up. Morning Cool-Down is also available. The controller can be configured to control the supply fan VFD to maintain a duct static pressure setpoint.

The VCC-X can also control VAV units that may require occupied Heating operation to “temper” the outdoor air if it is too cold outside for the mixed air to maintain the Cooling Supply Air Setpoint.

Constant Air Volume Unit

The VCC-X can be configured for Constant Volume applications, that are typically Space Temperature or Return Air Temperature controlled.

The VCC-X can also be used for restaurant kitchen or lab applications that are 100% Outdoor Air part of the time and recirculating air part of the time. A Hood On binary contact closure input forces the VCC-X to switch to 100% Outdoor Air control based on an exhaust hood switch activation. The VCC-X requires Outdoor and Indoor Air Temperature (and Humidity) Sensors to accomplish this application.

Single Zone VAV

This is a hybrid CAV/VAV application for a unit serving a single space and using Space Temperature Setpoints to enable Heating and Cooling Modes. Heating and Cooling are controlled to their respective Supply Air Setpoints while the supply fan modulates to maintain the Space Temperature Setpoints. Single Zone VAV applications can be configured for VAV Cooling and either VAV or CAV Heating. Single Zone VAV operation requires the use of modulating Heating or Cooling sources.

Space Temperature Control of High Percentage Outdoor Air Units

This application allows the unit to be configured to use the space temperature to initiate Cooling and Heating Modes on units that are high percentage outdoor air or 100% outdoor air units. Before entering the space Vent Mode, the controller will first determine if the outdoor air temperature is above or below special outdoor air Cooling and Heating setpoints. If so, the unit will leave stages of Cooling or Heating on as necessary to achieve a neutral supply air temperature – thus avoiding dumping very hot or cold air into the space.

Make-Up Air Unit

The VCC-X can be configured for 100% Outdoor Air control for Make-Up Air units. All HVAC Modes are determined from the Outdoor Temperature and Humidity Sensors. The Outdoor Air Volume should be at least 50% or higher to be configured for Outdoor Air control.

AAON® Return Air Bypass Control

This control scheme can only be used on Constant Volume HVAC units that are equipped with a Return Air Bypass Damper and that use Space Temperature and Humidity Sensors as the Controlling Sensors.

AAON® Return Air Bypass Control provides improved moisture removal capabilities while utilizing internal space loads for reheat by redirecting Return Air from the upstream side of the DX Evaporator Coil to the downstream side of the coil during Dehumidification.

Zone Voting

The VCC-X can be configured to be the unit controller in a zone voting system where the individual zones vote to put the unit into occupied Cooling or Heating Mode. To be used in this application, Orion zone controllers must also be used in order to allow communication between the zones and the VCC-X Controller. Duct static pressure control can be accomplished with a supply fan VFD or a bypass damper.

OVERVIEW

Part Number Cross Reference

PART DESCRIPTION	ORION	AAON
VCC-X Controller	OE338-26B-VCCX	V42430
VCC-X EM1 Expansion Module	OE336-23-VCCXEM1	V53990
Refrigerant System Module for VFD Compressors	OE370-26-RSMV	V42440
Refrigerant System Module for Digital Compressors	OE370-26-RSMD	V61520
Refrigerant System Module VFD Compressors - Heat Pumps	OE370-26-RSMV-HP	V61540
12 Relay E-BUS Expansion Module	OE358-23E-12R	V13060
Building Static Pressure Sensor	OE258-01	R37030
CommLink 5 Communications Interface	OE361-13	V32950
Duct Static Pressure Sensor	OE271	P87100
Duct Static Pressure Pickup Tube	OE290	V10790
EBC E-BUS Cable Assembly E-BUS Power & Comm 1.5 Ft, 3 Ft, 10 Ft, 25 Ft, 50 Ft, 75 Ft, 100 Ft, 150 Ft, 250 Ft, and 1000 Foot Spool	EBC-1.5-F-A, EBC-3-F-A, EBC-10-F-A, EBC-25-F-A, EBC-50-F-A, EBC-75-F-A, EBC-100-F-A, EBC-150-F-A, EBC-250-F- A, EBC-SPOOL-A	V16720 (1.5 Ft), V16730 (3 Ft), V16740 (10 Ft), V16750 (25 Ft), V16760 (50 Ft), V16770 (75 Ft), V16780 (100 Ft), V36580 (150 Ft), V36590 (250 Ft)
E-BUS Adapter Hub	MS000248	N/A
E-BUS Adapter Hub with 1.5 Ft. EBC Cable	HZ-EBC-248	V17180
E-BUS Adapter Board	OE365-15-EBA-A	V15840
E-BUS CO ₂ Sensor Space Wall Mounted or Duct Mounted	OE256-05-A / OE256-07-A	V09310 / V09320
E-BUS Digital Room Sensor - LCD - Temp. or Temp & RH	OE217-02-A / OE217-03-A	V09290 / V09300
E-BUS Digital Room Sensor - No LCD Display - Temp & RH	OE217-04-A	V12920
E-BUS Horizontal Outside Air Temperature & RH Sensor	OE265-15-A / OE265-15-C	V13050 / 31444
E-BUS Vertical Outside Air Temperature & RH Sensor	OE265-16-A	N/A
E-BUS Return Air Temperature & RH Sensor	OE265-17-A	N/A
E-BUS CO ₂ Space Sensor Emulator Board	OE365-06-EBSE	N/A
E-BUS CO ₂ Return Air Sensor Emulator Board	OE365-07-EBSE	N/A
E-BUS Outdoor Air Temp/RH Sensor Emulator Board	OE365-05-EBSE	N/A
E-BUS Return Air Temp/RH Sensor Emulator Board	OE365-04-EBSE	N/A
E-BUS Space Temp/RH Sensor Emulator Board	OE365-03-EBSE	N/A
GPC-X Controller / GPC-XP Controller	OE332-23-GPCX / OE338-23-GPCXP	N/A / N/A
IP Module Kit	OE415-02	R66770
MHGRV-X Controller / Reheat Expansion Module	OE377-26-00059 / OE377-01-00059	V12100 / V42450
MiniLink Polling Device 5	OE364-23-OR	N/A
MODGAS-X Controller	OE377-26-00058	V12090
Modular Service Tool SD - Operator Interface	OE391-12	V28140
Modular System Manager SD - Operator Interface	OE392-12	V36570
Outdoor Air Temperature Sensor	OE250	P87150
PREHEAT-X Controller	OE377-26-00061	V48510
Return Air Temperature Sensor	OE231	P87140
Standard Room Sensor - Plain or W/ Override	OE210 / OE211	R31480 / P87040
Standard Room Sensor - W/ Slide Adjust	OE212	P94100
Standard Room Sensor - W/ Override & Slide Adjust	OE213	P94320
Strap-On Temperature Sensor Kit	OE233	N/A
Suction Pressure Sensor	OE275-01	N/A
Supply Air Temperature Sensor	OE231	P87140
System Manager TS-L (Touch Screen - Limited Access)	OE392-11	V90190
USB-Link 2 Kit	OE366	R71870

Parts and Descriptions

PART NO.	PART DESCRIPTION	ILLUSTRATION	PAGE NO.
OE338-26B-VCCX	<p>VCC-X Controller The VCC-X Controller provides 8 analog inputs, 4 analog outputs, 8 binary inputs, and 8 relay outputs. It also has an on-board BACnet port for connection to an MS/TP network. The Controller contains a 2 x 8 LCD character display and 4 buttons that allow for status and alarm display as well as BACnet configuration. It allows for the addition of the Refrigerant System Modules (RSMs), EM1 Expansion Module, and the 12 Relay E-BUS Expansion Module described below.</p> <p>NOTE: Set-up, configuring, and monitoring of the VCC-X Controller requires one of the following communication interfaces—Prism 2 Front-End Software used with a personal computer, Modular System Manager SD, or Modular Service Tool SD.</p>		Pages 16, 22-23
OE370-26-RSMV	<p>Refrigerant System Module for VFD Compressors The Refrigerant System Module for VFD Compressors (RSMV) monitors and controls one tandem compressor refrigeration circuit of the HVAC unit. The module is designed for R410-A refrigerant. Up to 4 RSMV's can be connected, depending on the size of the system. There are 2 E-BUS Expansion Ports which allow the use of communicating sensors and the E-BUS Modules. The RSMV provides 4 analog inputs, 3 binary inputs, 3 relays, and 4 analog outputs. It connects with an EBC E-BUS cable to the VCC-X Controller.</p>		Pages 17, 46-47
OE370-26-RSMD	<p>Refrigerant System Module for Digital Compressors The Refrigerant System Module for Digital Compressors (RSMD) monitors and controls one or two refrigeration circuits of the HVAC unit. The module is designed for R410-A refrigerant. Up to 4 RSMD's can be connected, depending on the size of the system. There are 2 E-BUS Expansion Ports which allow the use of communicating sensors and the E-BUS Modules. The RSMD provides 3 analog inputs, 4 binary inputs, 5 relays, and 2 analog outputs. It connects with an EBC E-BUS cable to the VCC-X Controller.</p>		Pages 17, 48-49
OE370-26-RSMV-HP	<p>Refrigerant System Module for VFD Heat Pumps The Refrigerant System Module for VFD Heat Pumps (RSMV-HP) monitors and controls one refrigeration circuit of the HVAC unit. The module is designed for R410-A refrigerant. The RSMV-HP is connected to the VCC-X Controller. Up to 4 RSMV-HP's can be connected, depending on the size of the system. There are 2 E-BUS Expansion Ports which allow the use of communicating sensors and the E-BUS Modules. The RSMV-HP provides 6 analog inputs, 4 binary inputs, 4 relays, and 2 analog outputs. It connects with an EBC E-BUS cable to the VCC-X Controller.</p>		Pages 17, 50-51
OE377-26-00058	<p>MODGAS-X Controller The MODGAS-X Controller modulates up to (2) gas valves to maintain a desired Discharge Air Temperature. It also controls the speed of the induced draft fan to maintain proper combustion in the heat exchanger. The MODGAS-X Controller connects to the VCC-X Controller via an EBC E-BUS cable. Available only from AAON.</p>		Page 53
OE377-26-00059	<p>MHGKV-X Controller The MHGKV-X Controller controls a Modulating Hot Gas Reheat Valve to maintain a desired Supply Air Temperature and Dehumidification setpoint. The MHGKV-X Controller connects to the VCC-X Controller via an EBC E-BUS cable. Available only from AAON.</p>		Page 52

OVERVIEW

Parts and Descriptions

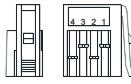
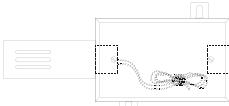
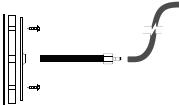
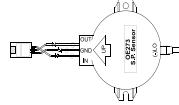
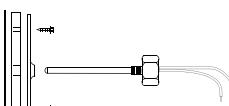
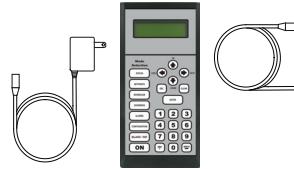
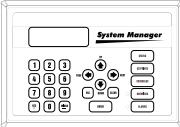
PART NO.	PART DESCRIPTION	ILLUSTRATION	PAGE NO.
OE377-01-00059	MHGRV REHEAT Expansion Module The OE377-01-00059 MHGRV Reheat Expansion Module is designed to control one set of reheat valves. The Reheat Expansion Module connects to the MHGRV-X Controller via an EBC E-BUS communication cable. Connected together, the Reheat Expansion Modules provide a system that allows the proper control of multiple sets of valves.		Page 52
OE377-26-00061	PREHEAT-X Controller The PREHEAT-X Controller is designed to control fixed stages of Preheat or optional modulating Preheat to maintain a desired Preheat Leaving Air Temperature Setpoint. The PREHEAT-X Controller directly connects to the VCC-X Controller or indirectly using an E-BUS Expansion Board via an EBC E-BUS cable.		Page 54
OE336-23-VCCXEM1	VCC-X EM1 Expansion Module The EM1 Expansion Module adds Title 24 Economizer Feedback and Chilled Water applications. It also provides 2 analog outputs for controlling a Return Air Bypass Damper and a Return Damper in Return Air Bypass applications. It also has 5 configurable relay outputs. It connects with an EBC E-BUS cable to the VCC-X Controller.		Pages 18, 40-43
OE358-23E-12R-A	12 Relay E-BUS Expansion Module The 12 Relay Expansion Module adds 12 configurable relays to the VCC-X Control System. It connects to the VCC-X Controller with an EBC E-BUS cable.		Pages 19, 44
OE210 OE211 OE212 OE213	Standard Room Sensor-Plain, w/Override, w/Override & Slide Adjust & w/Slide Adjust Only Includes: Standard Room Sensor - Plain, with Override, with Override and Slide Adjust & with Slide Adjust only. For wall mounting. Use with VCC-X Controller only. Connects to controller via field fabricated wiring.		Page 27
OE217-02 OE217-03 OE217-04	E-BUS Digital Room Sensor - Temp. Only & Temp & Humidity LCD Display and keypad allow for setpoint adjustment, override, and display of certain status and setpoints. The OE217-02 is used with the VCC-X Controller for room air temperature sensing applications. The OE217-03 & OE217-04 (no LCD display) is used with the VCC-X Controller for room air temperature and humidity sensing applications. All 3 Use EBC E-BUS cables.		Page 24
OE256-05	E-BUS CO₂ Wall-Mounted Sensor Used with the VCC-X for CO ₂ sensing applications where wall mounting in the space is desired. Connects to the VCC-X Controller with an EBC E-BUS cable of required length. Cable sold separately.		Page 25

Parts and Descriptions

PART NO.	PART DESCRIPTION	ILLUSTRATION	PAGE NO.
OE256-07	E-BUS CO₂ Duct Sensor with Remote Pickup Tube Used with the VCC-X Controller for duct mounted CO ₂ sensing applications. Connects to the VCC-X Controller with an EBC E-BUS cable of required length. Includes: Duct Mounted CO ₂ Sensor, Integral Aspiration Box, Airflow Pickup Tube and 10 ft. EBC Cable.		Page 26
OE265-15-A	E-BUS Horizontal Outdoor Air Temperature & Humidity Sensor Used for outdoor temperature and humidity sensing applications. Connects to VCC-X Controller or E-BUS Adapter Hub using EBC E-BUS cable. Includes: E-BUS Horizontal Outside Air Temperature & Humidity Sensor, mounted in a weatherproof handy box with attached 3 foot EBC E-BUS Cable with jack.		Page 33
OE265-16-A	E-BUS Vertical Outdoor Air Temperature & Humidity Sensor Used for outdoor temperature and humidity sensing applications. Connects to VCC-X Controller or E-BUS Adapter Hub using EBC E-BUS cable. Includes: E-BUS Vertical Outside Air Temperature & Humidity Sensor, mounted in a weatherproof handy box with attached 3 foot EBC E-BUS Cable with jack. A 10 foot EBC cable is included to connect to the VCC-X Controller. If a longer EBC cable is required, it must be ordered separately.		Page 33
OE265-17-A	E-BUS Return Air Temperature & Humidity Sensor Used for return air temperature and humidity sensing applications. Connects to VCC-X Controller or E-BUS Adapter Hub using EBC E-BUS cable. Includes: E-BUS Return Air Temperature & Humidity Sensor, mounted in a weatherproof handy box attached 3 foot EBC E-BUS Cable with jack. A 50 foot EBC cable is included to connect to the VCC-X Controller. If a longer EBC cable is required, it must be ordered separately.		Page 34
OE275-01	Suction Pressure Transducer Used for suction pressure sensing applications. Connects to the Refrigerant System Modules. Includes: OE275-01 Suction Pressure Transducer and modular cable with a modular connector on one end and bare stripped wires on the other end.		Pages 46, 48, 50
EBC-1.5-F EBC-3-F EBC-10-F EBC-25-F EBC-50-F EBC-75-F EBC-100-F EBC-150-F EBC-250-F EBC-SPOOL	EBC E-BUS Cables The EBC E-BUS Cables connect to the VCC-X Controller, VCC-X Expansion Modules, and E-BUS Sensors.. Different lengths can be joined together using an EBC Adapter Hub, if necessary. The EBC E-BUS Cables are available in 1.5, 3, 10, 25, 50, 75, 100, 150, & 250. Includes: EBC E-BUS Cable Assembly. The EBC-SPOOL is bulk EBC cable that can be used with CZ000303 bulk EBC Connectors.		Pages 24-54

OVERVIEW

Parts and Descriptions

PART NO.	PART DESCRIPTION	ILLUSTRATION	PAGE NO.
CZ000303	EBC Bulk Connectors Attaches to EBC Spool Cable. Must be crimped using the MS002026 EBC Crimp tool. Includes EBC Bulk Connector.		N/A
MS002026	EBC Crimp Tool Crimps the EBC Connectors for use with the EBC Spool Cable. Includes EBC Crimp Tool.		N/A
OE250	Outdoor Air Temperature Sensor Used for temperature sensing applications. Includes: 10k Ohm Outside Air Temperature Sensor, 2 wire, mounted in a weatherproof handy box only.		Page 32
OE290	Duct Static Pressure Pick-up Tube Used with OE271 Static Pressure Sensor for static pressure sensing applications. Includes: Static Pressure Pick-up Tube with 1 ft. length of FRP tubing, gasketed mounting bracket, and screws.		Page 35
OE271	Duct Static Pressure Sensor Used for duct static pressure sensing applications. Includes: 0-5" W.C., 0-5 VDC, Static Pressure Sensor only.		Page 35
OE258-01	Building Static Pressure Sensor Used for Building Pressure Sensing. Includes: -0.25 to +0.25" W.C., 0-5 VDC, 24 VAC/VDC supply power Building Pressure Sensor only.		Page 30
OE230 OE231	Duct Temperature Sensor - 6" Probe Duct Temperature Sensor - 12" Probe OE230 = 6" probe length. OE231 = 12" probe length. Used for return or supply air temperature sensing applications. Includes: 10k Ohm Duct Temperature Sensor, 2 wire only.		Pages 28 & 29
OE392-11	System Manager Touch Screen - Limited Access The System Manager Touch Screen - Limited Access (SMTS-L) provides a direct, graphic-enhanced, menu-driven link. The SMTS-L is an end-user interface only and allows the end user to view status points, change Space Setpoints, and view certain alarms of most controllers on the Orion Controls System. The SMTS-L is equipped with a 4.3" 480 x 272 WQVGA RGB TFT LCD Touch Screen Display. The System Manager TS-L is furnished with hardware for flush mounting into hollow drywall or surface mounting on concrete brick or plaster surfaces. Includes: SMTS-L with 12 ft. long pigtail cable assembly.		See the System Manager TS-L Technical Guide
OE391-12	Modular Service Tool SD Includes: Modular Service Tool, power supply, communication cables, 4 Gigabyte SD card, and (4) AA batteries. Used to program and monitor all Orion controllers.		See the VCC-X Controller Operator Interfaces SD Technical Guide
OE392-12	Modular System Manager SD Includes: Modular System Manager SD with 4 Gigabyte SD card and 12 ft. long pigtail cable assembly. Used to program and monitor all Orion controllers. Designed for hollow core wall mounting. When System Manager is to be mounted on a solid wall (concrete), you will also need to order the solid wall mounting bracket below.		See the VCC-X Controller Operator Interfaces SD Technical Guide

Parts and Descriptions

PART NO.	PART DESCRIPTION	ILLUSTRATION	PAGE NO.
EB101505	Solid Wall Mounting Bracket for Modular System Manager SD Includes: 22 gauge galvanized sheet metal mounting bracket with mounting holes and wire routing opening. Dimensions are 9.25"W x 8.00"H x 0.50"DP. The Wall Mounting Bracket provides wiring clearance between the System Manager and the wall mounting surface when the System Manager is to be mounted on a concrete or other solid wall surface. Not for use with System Manager TS-L.		N/A
OE361-13	CommLink 5 Communications Interface The CommLink 5 connects to your control system using a USB computer connection to provide direct on-site communications with the control system from a computer with the Prism 2 software installed. For remote communications, see OE415-02 IP Module Kit. Includes: CommLink 5, 6 ft. long USB cable, and 120/24 VAC power supply. Required on all networked systems or if direct computer or remote computer connection is required. Connects to your computer's USB 1.1 or 2.1 port. Prism 2 computer front-end software must be installed on the direct connected or remote connected computer in order to communicate with your system.		See the CommLink 5 Technical Guide
OE415-02	IP Module Kit - Internet/LAN Connection Used for Internet or Local Area Network communications with the control system. Field installs by plugging into the CommLink 5 circuit board and provides an addressable Ethernet connection to the controls system from any computer connected to your building's LAN. It can also be configured to allow access to the control system from the Internet through your LAN if your Ethernet firewall is configured for this option. Includes: IP Link module, 10 ft. long Ethernet cable, and installation instructions. Prism 2 computer front-end software must be installed on the remote computer in order to dial-up and communicate with the controls system.		See the IP Module Technical Guide
OE366	USB-Link 2 Kit The USB-Link 2 is a pocket-sized communications interface used to connect a laptop computer to your controls system for programming and monitoring purposes, utilizing a modular cable to allow connection to the service port connector on the controllers and a USB cable to connect to a laptop computer. Includes: USB-Link 2 for multiple or single loop systems, USB cable, modular connection cable, two mini-DIN to terminal adapters, and Prism 2 software.		See the USB-Link 2 Technical Guide
OE364-23-OR	MiniLink PD 5 Used with all Orion controllers to provide network communications, zone voting, alarming, and tenant logging capabilities. A MiniLink Polling Device is required on each loop of a Networked system. Includes: MiniLink Polling Device.		See the Orion MiniLink PD 5 Technical Guide
OE508	Prism 2 Front-End Computer Software Prism 2 provides standard, easy to understand status screens for each type of VCC-X equipment installed. Prism software has provisions for custom screens which allow floor plans, equipment photos, or user-defined summary screens to be implemented to meet their own individual needs. All controlling setpoints, trend logs, and alarm conditions are accessed in the Prism environment. Prism can be configured for direct on-site installation, remote modem connection, or TCP/IP Internet connection to several installations.		Pages 55 & 80

OVERVIEW

Parts and Descriptions

PART NO.	PART DESCRIPTION	ILLUSTRATION	PAGE NO.
OE365-15-EBA-A	E-BUS Adapter Board The E-BUS Adapter Board is used for connecting the EBTRON®, GreenTrol™, or Paragon Airflow Measurement Digital Transmitter to the VCC-X Control System. The E-BUS Adapter Board connects to the VCC-X Controller with an EBC E-BUS cable. Cable supplied separately.		Page 45
MS000248	E-BUS Adapter Hub The E-BUS Adapter Hub is used for connecting E-BUS devices and Controllers together with EBC E-BUS cables of varying lengths. Includes: E-BUS Adapter Hub.		Pages 33 & 34
HZ-EBC-248	E-BUS Adapter Hub with 1.5 Foot EBC E-BUS Cable The E-BUS Adapter Hub is used for connecting E-BUS devices and Controllers together with EBC E-BUS cables of varying lengths. Includes: E-BUS Adapter Hub and 1.5 foot EBC E-BUS cable.		Pages 33 & 34
OE365-03-EBSE	E-BUS Space Temperature and Humidity Sensor Emulator Board with 1.5 Foot EBC E-BUS Cable The E-BUS Space Temperature and Humidity Sensor Emulator Board allows the use of 3rd party analog space temperature and humidity sensors to emulate the WattMaster E-BUS combination Space Temperature and Humidity Sensor. Includes: E-BUS Sensor Emulator Board and 1.5 foot EBC E-BUS cable.		N/A
OE365-04-EBSE	E-BUS Return Air Temperature and Humidity Sensor Emulator Board with 1.5 Foot EBC E-BUS Cable The E-BUS Return Air Temperature and Humidity Sensor Emulator Board allows the use of 3rd party analog return air temperature and humidity sensors to emulate the WattMaster E-BUS combination Return Air Temperature and Humidity Sensor. Includes: E-BUS Sensor Emulator Board and 1.5 foot EBC E-BUS cable.		N/A
OE365-05-EBSE	E-BUS Outdoor Air Temperature and Humidity Sensor Emulator Board with 1.5 Foot EBC E-BUS Cable The E-BUS Outdoor Air Temperature and Humidity Sensor Emulator Board allows the use of 3rd party analog outdoor air temperature and humidity sensors to emulate the WattMaster E-BUS combination Outdoor Air Temperature and Humidity Sensor. Includes: E-BUS Sensor Emulator Board and 1.5 foot EBC E-BUS cable.		N/A
OE365-06-EBSE	E-BUS Space CO₂ Sensor Emulator Board with 1.5 Foot EBC E-BUS Cable The E-BUS Space CO ₂ Sensor Emulator Board allows the use of a 3rd party analog CO ₂ sensor to emulate the WattMaster E-BUS Wall-Mounted Space CO ₂ Sensor. Includes: E-BUS Sensor Emulator Board and 1.5 foot EBC E-BUS cable.		N/A
OE365-07-EBSE	E-BUS Return Air CO₂ Sensor Emulator Board with 1.5 Foot EBC E-BUS Cable The E-BUS Return Air CO ₂ Sensor Emulator Board allows the use of a 3rd party analog CO ₂ sensor to emulate the WattMaster E-BUS Duct-Mounted CO ₂ Sensor. Includes: E-BUS Sensor Emulator Board and 1.5 foot EBC E-BUS cable.		N/A
OE437-03	Communication Surge Protector Kit Used to isolate power surges to the communications wiring caused by lightning strikes for communications wiring loops that are routed outdoors or between buildings. One kit is required at each point where the communications wiring leaves or enters a building. Includes: Communication Bus Surge Protector, Base Module, and Mounting/Wiring Instructions.		N/A

Parts and Descriptions

PART NO.	PART DESCRIPTION	ILLUSTRATION	PAGE NO.
OE332-23-GPCX	<p>GPC-X Controller</p> <p>The GPC-X Controller provides the flexibility to control, schedule, and/or monitor equipment such as unit heaters, exhaust fans, motorized louvers, etc. The GPC-X has (6) configurable inputs which will accept signals from thermistor temperature sensors, 4-20mA or 0-5 VDC transmitters, or dry contact closures. An additional modular input is provided for connection of an OE271 Static Pressure Sensor. The GPC-X has (5) relay outputs for on/off control and (2) analog outputs. The GPC-X also has (5) separate 2-events-per-day schedules, each with its own optimal start functions built in. In addition, the GPC-X provides Lead/Lag start capabilities. Use the GPC-X to provide additional schedules for your controllers. Includes: OE332-23-GPCX Controller.</p>		See the GPC-X Controller Technical Guide
OE338-23-GPCXP	<p>GPC-XP Controller</p> <p>The GPC-XP Controller is used for controlling equipment or processes that cannot be controlled using a standard HVAC controller. Prism 2 computer front end software is used to interface with the GPC-XP Controller functions. The GPC-XP Controller provides the flexibility to control, schedule, and/or monitor equipment such as unit heaters, exhaust fans, motorized louvers, and other mechanical equipment. In addition, the GPC-XP provides Lead/Lag start capabilities.</p> <p>The GPC-XP has 8 configurable analog inputs which will accept signals from thermistor temperature sensors, 4-20mA or 0-5VDC or 0-10VDC transmitters. Custom formulas created by available math functions and operators can be used in conjunction with the analog inputs to create a calculated value to be used and displayed for a specific analog input. The inputs are set for the desired scaling by means of a jumper bar. An additional input is available for communicating sensors available from WattMaster Controls. The GPC-XP also supports 8 wet contact binary inputs which can be configured for either normally open or normally closed operation. The GPC-XP has 8 relay outputs for on/off control and 4 analog outputs for proportional control signals. Highest/lowest/average of the analog input values can be used in the GPC-XP logic or broadcast to other controllers on the control system loop. The GPC-XP also has 8 separate 2 events per day schedules which can be assigned to any input or output for operational control or alarm recognition based on time of day. These schedules can also be configured to broadcast to other WattMaster HVAC equipment installed on the control system loop. Includes: OE338-23-GPCXP Controller.</p>		See the GPC-XP Controller Technical Guide

OVERVIEW

VCC-X Controller Dimensions

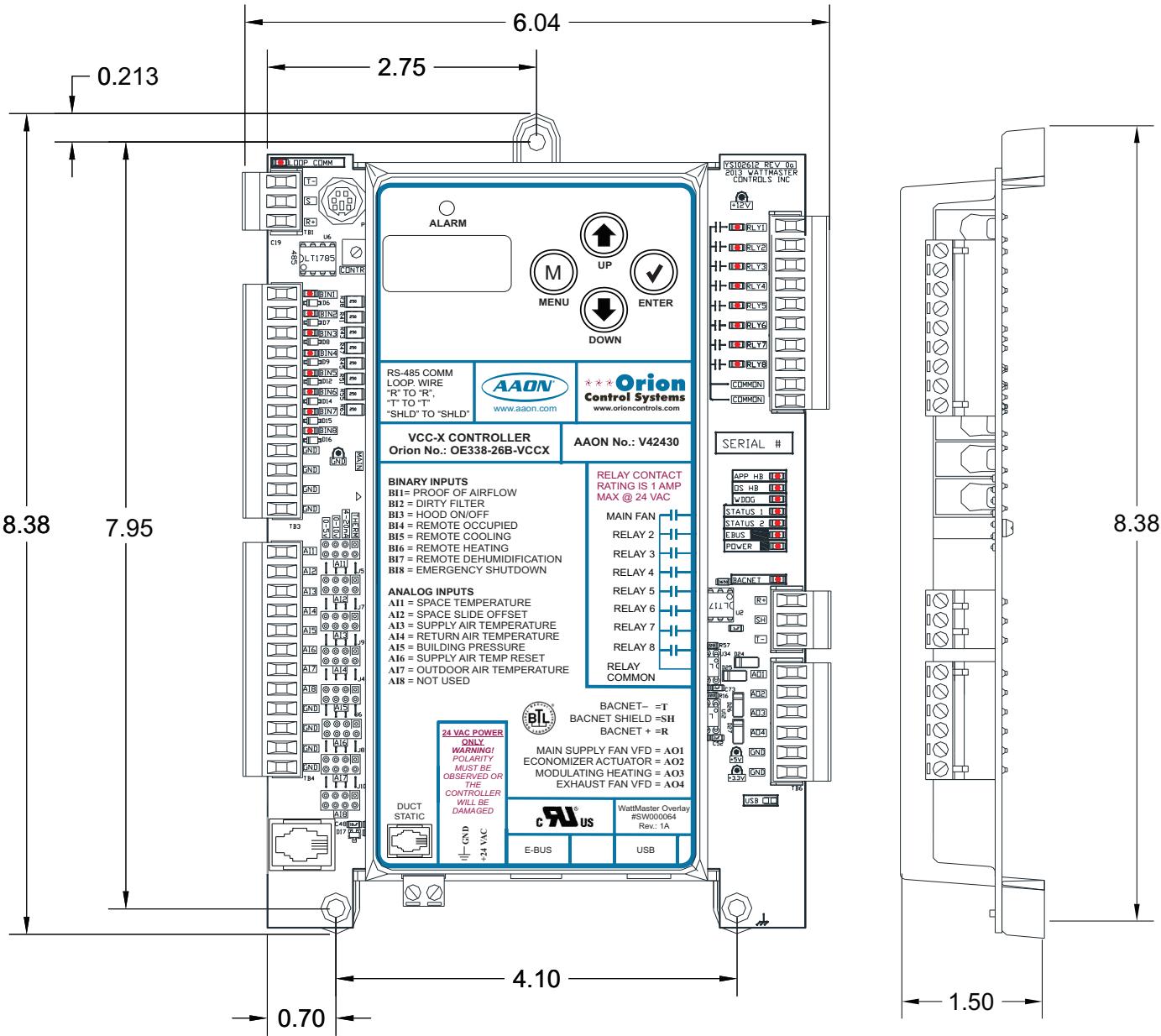


Figure 1: VCC-X Controller Dimensions

VCC-X CONTROLLER WIRING

Typical Refrigerant System Module Dimensions

NOTE: Typical Dimensions.
See Individual RSM Technical Guides For Each
RSM's Dimensions. RSMV Shown.

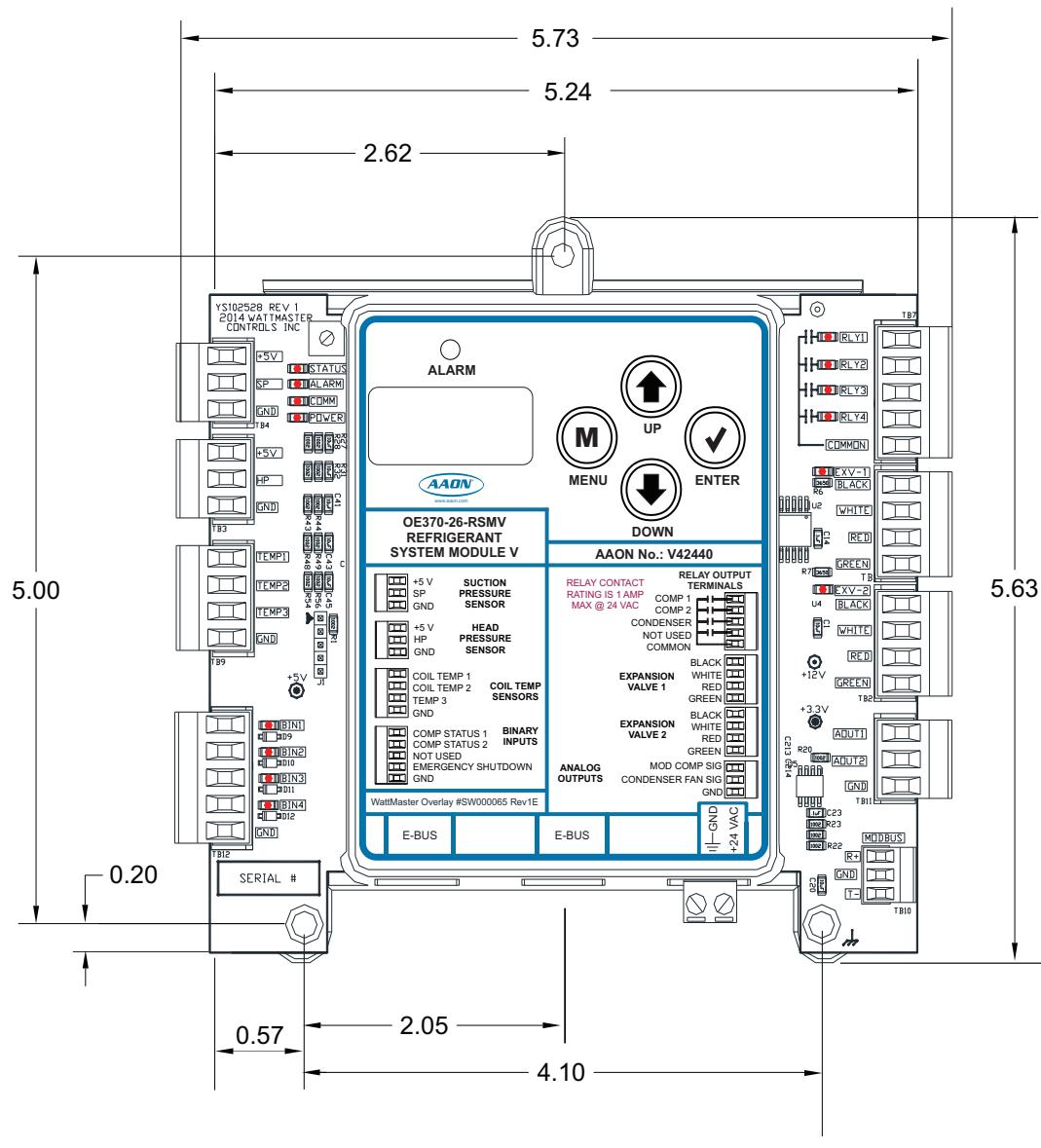


Figure 2: Typical Refrigerant System Module Dimensions (RSMV Shown)

VCC-X CONTROLLER WIRING

VCC-X EM1 Expansion Module Dimensions

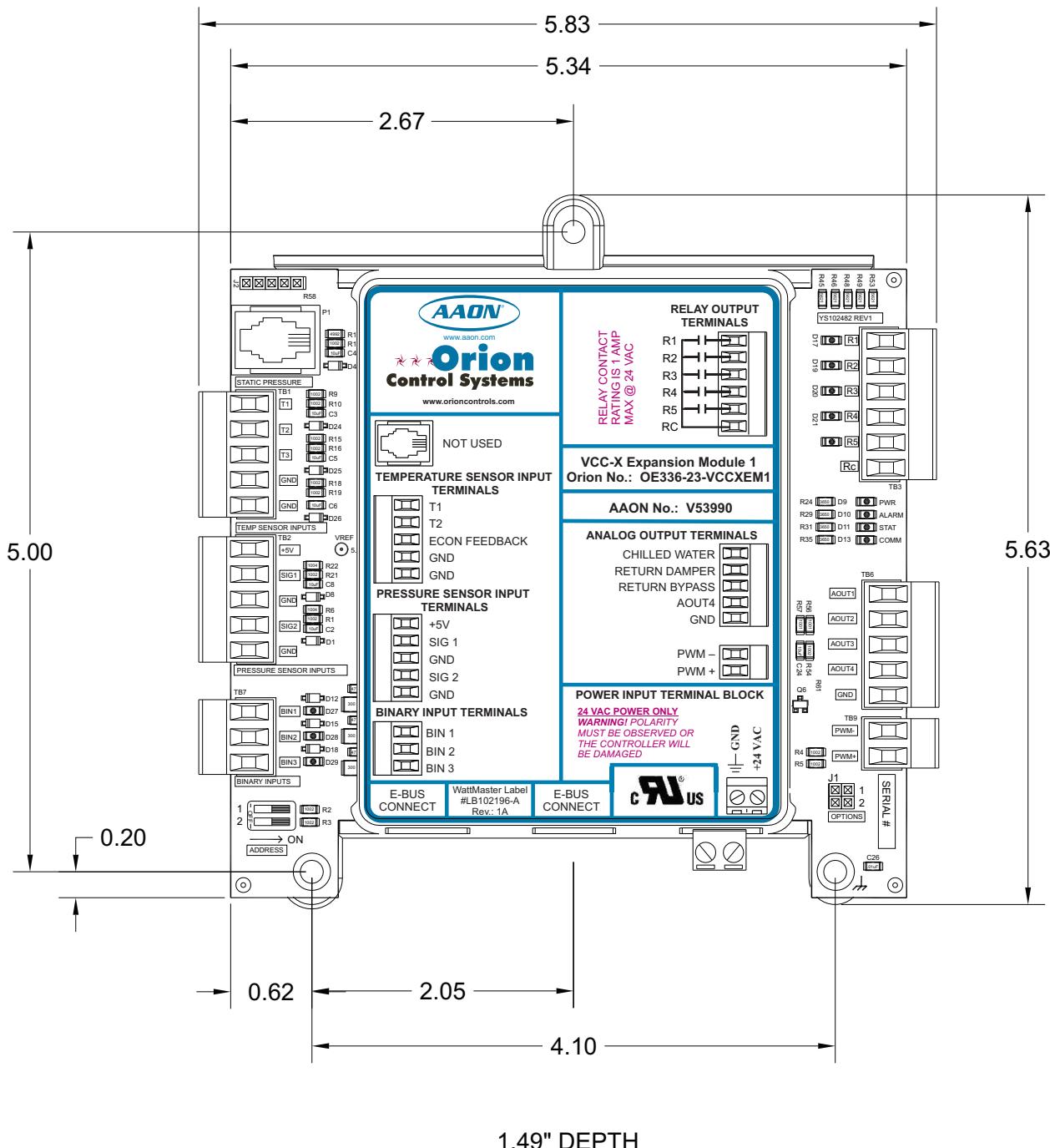


Figure 3: VCC-X EM1 Expansion Module Dimensions

12 Relay E-BUS Module Dimensions

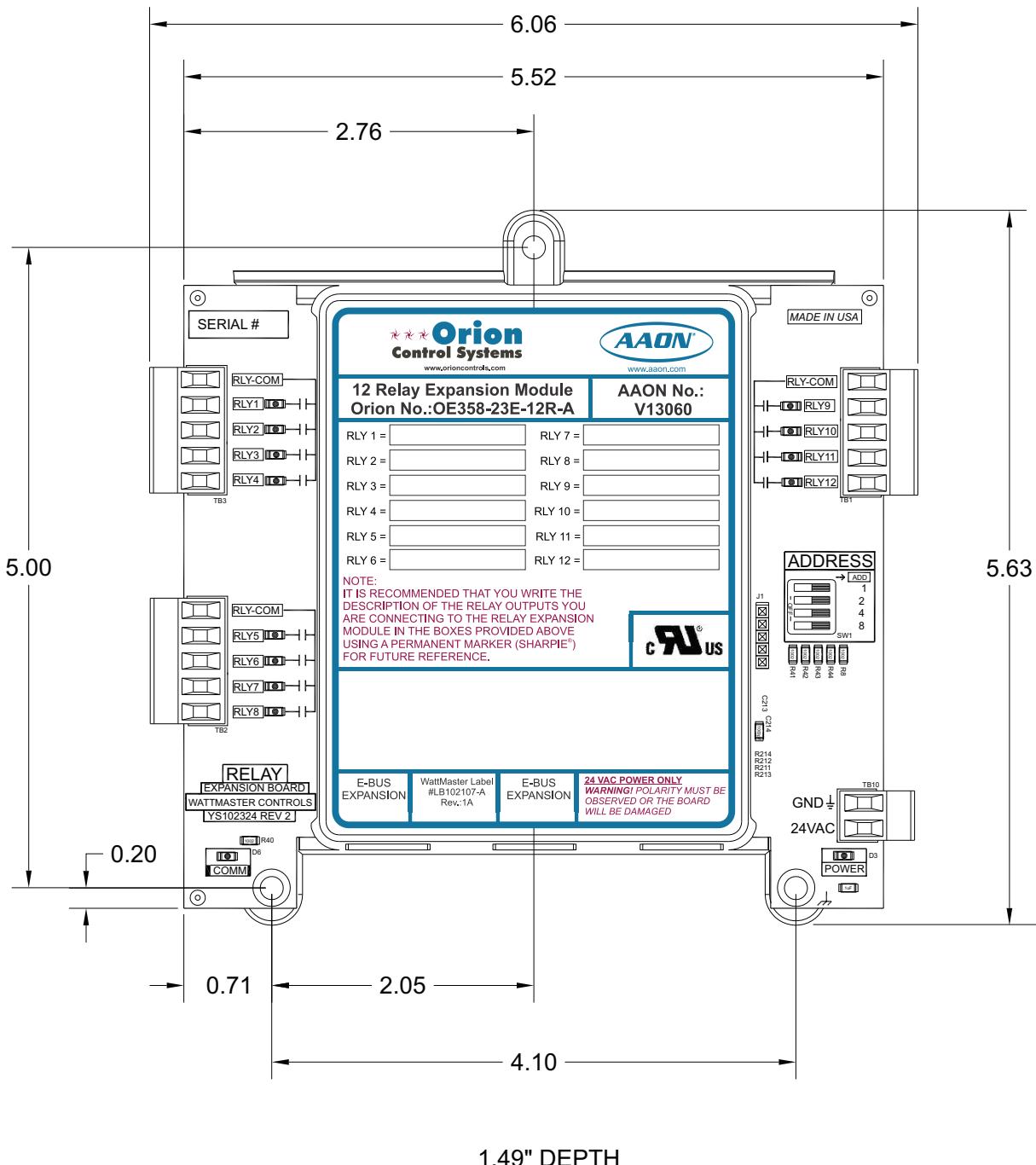


Figure 4: 12 Relay E-BUS Module Dimensions

VCC-X CONTROLLER WIRING

Controller with Enclosure Components

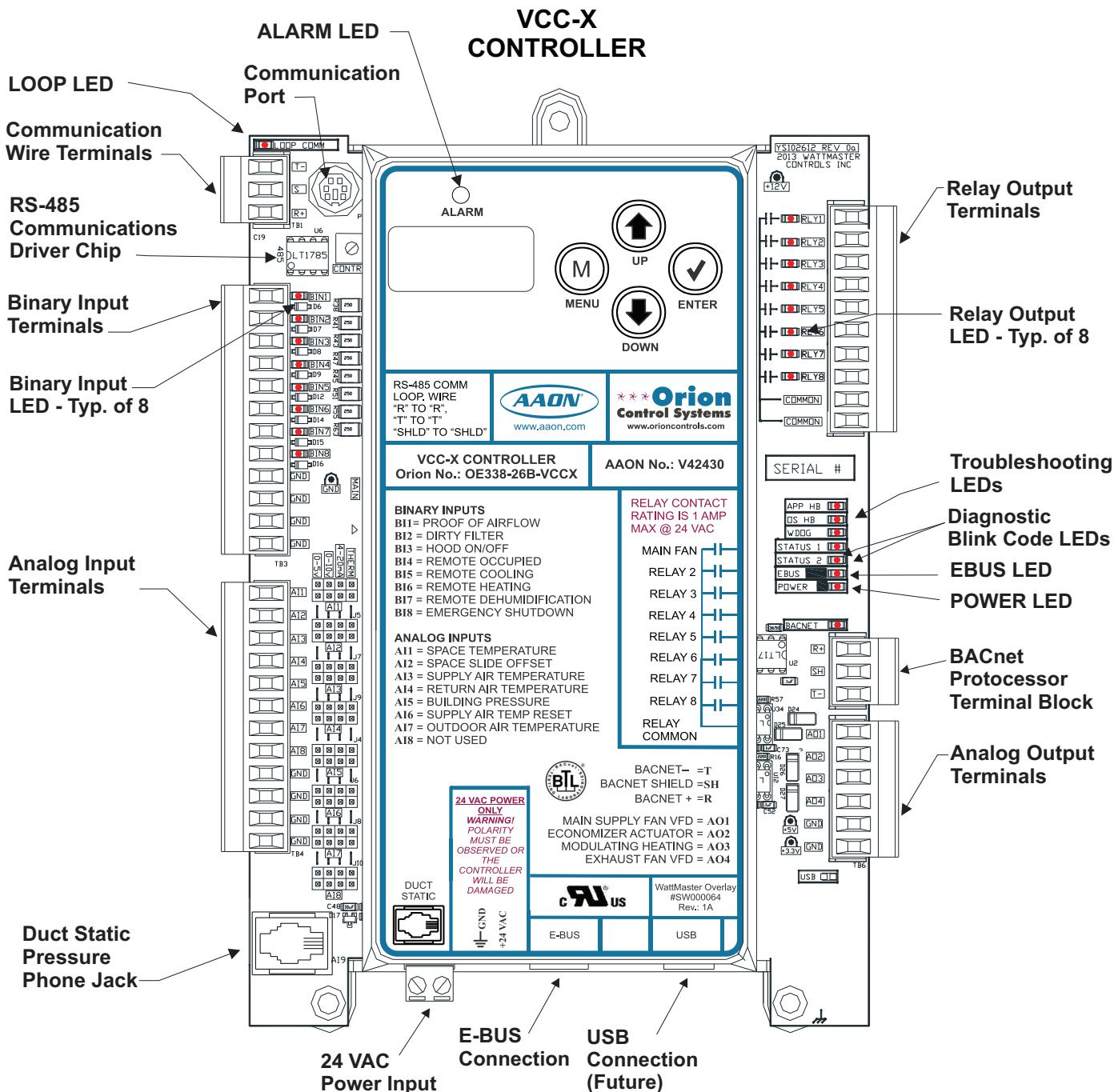


Figure 5: VCC-X Controller w/Enclosure Components

Important Wiring Considerations**General**

Correct wiring of the VCC-X Controller is the most important factor in the overall success of the controller installation process. In general, most VCC-X Controllers are factory installed and wired at the AAON® factory. It is also possible to purchase these controllers through your local AAON®/Orion representative for installation in the field. Some of the following information pertains to field wiring and may not apply to your 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** for a list of the required operating conditions for the VCC-X Controller and associated expansion modules.

The VCC-X Controller is housed in a plastic enclosure. It is designed to be mounted by using the 3 mounting holes in the enclosure base. The VCC-X Controller needs to be installed in an environment which can maintain a temperature range between -30°F and 150°F not to exceed 90% RH levels (non-condensing). Be careful not to damage the electronic components when mounting the controller.

Wiring

The VCC-X 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**.

Control Device	Voltage	VA Load	Temperature	Humidity (Non-Condensing)
OE338-26B-VCCX-VCC-X Controller	24VAC	15	-30°F to 150°F	90% RH
OE370-26-RSMV, OE370-26-RSMD & OE370-26-RSMV-HP Refrigerant System Modules	24VAC	18	-30°F to 150°F	90% RH
OE336-23-VCCXEM1	24VAC	5	-30°F to 150°F	90% RH
OE358-23E-12R-A	24VAC	15	-30°F to 150°F	90% RH

Table 1: Voltage and Environment Requirements**WARNING:**

When using a single transformer to power more than one controller or expansion module, the correct polarity must always be maintained between the boards. Failure to observe correct polarity will result in damage to the VCC-X Controller and expansion modules.

Please carefully read and apply the following information when wiring the VCC-X Controller, RSMs, and the Expansion Module.

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

Powering Up

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

VCC-X CONTROLLER WIRING

VCC-X Controller Input Wiring

VCC-X Controller Inputs

The VCC-X Controller is designed with 8 analog inputs, 4 analog outputs, 8 binary inputs and 8 relay outputs.

There are also 2 E-BUS Expansion Ports which allow the use of communicating sensors and the E-BUS Modules.

See **Figures 6, below & Figure 7, page 23** for wiring details. Detailed wiring for all inputs and outputs are found on the pages that follow.

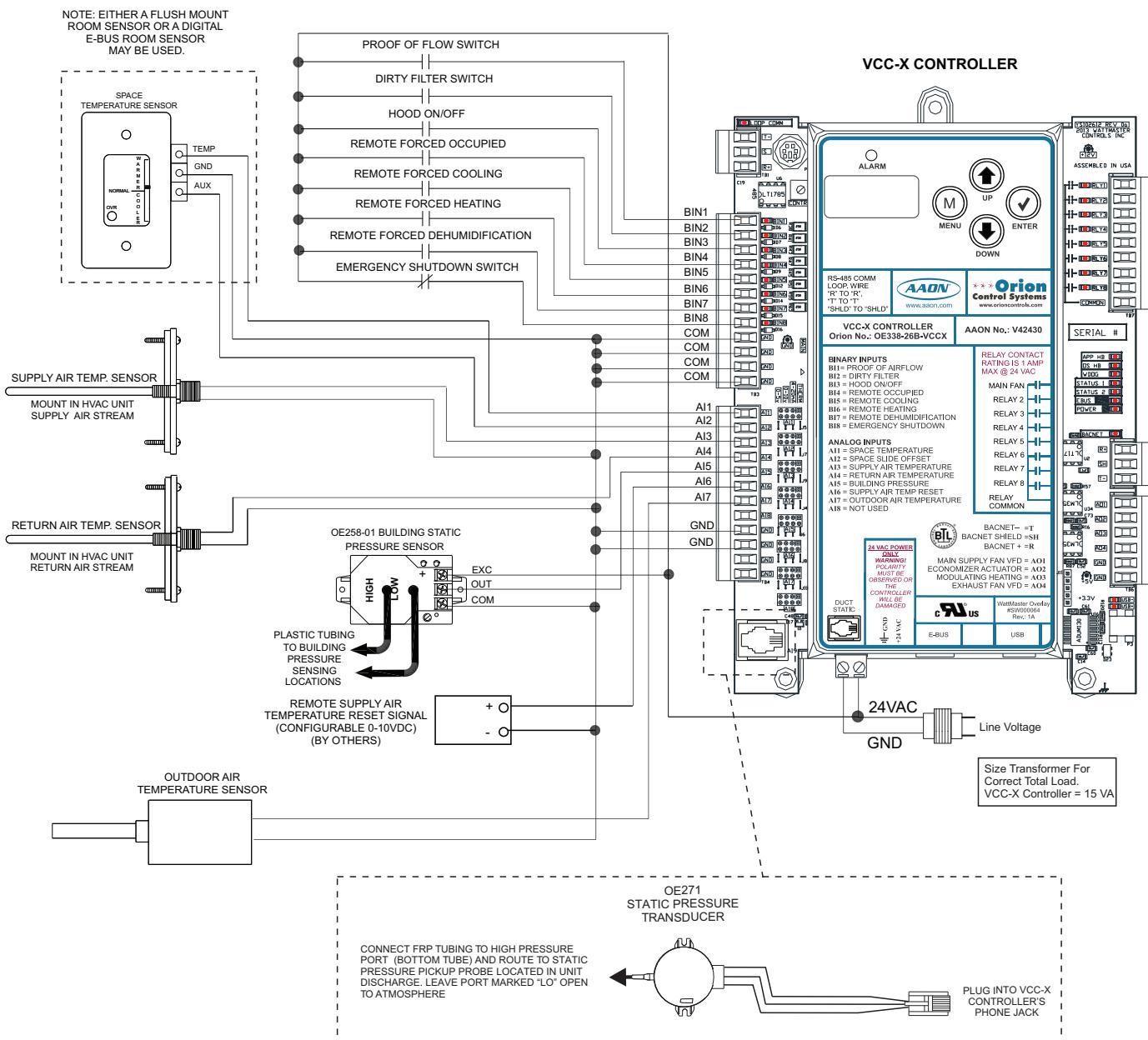


Figure 6: VCC-X Controller Input Wiring

VCC-X CONTROLLER WIRING

VCC-X Controller Output Wiring

VCC-X Controller Outputs

The VCC-X Controller must be connected to 24 VAC as shown in the wiring diagram below. Please see **Table 1, page 21** for correct VA requirements to use when sizing the transformer(s) used for powering the Controller.

Also please note that when wiring the VCC-X Controller, its contacts must be wired as wet contacts (connected to 24 VAC).

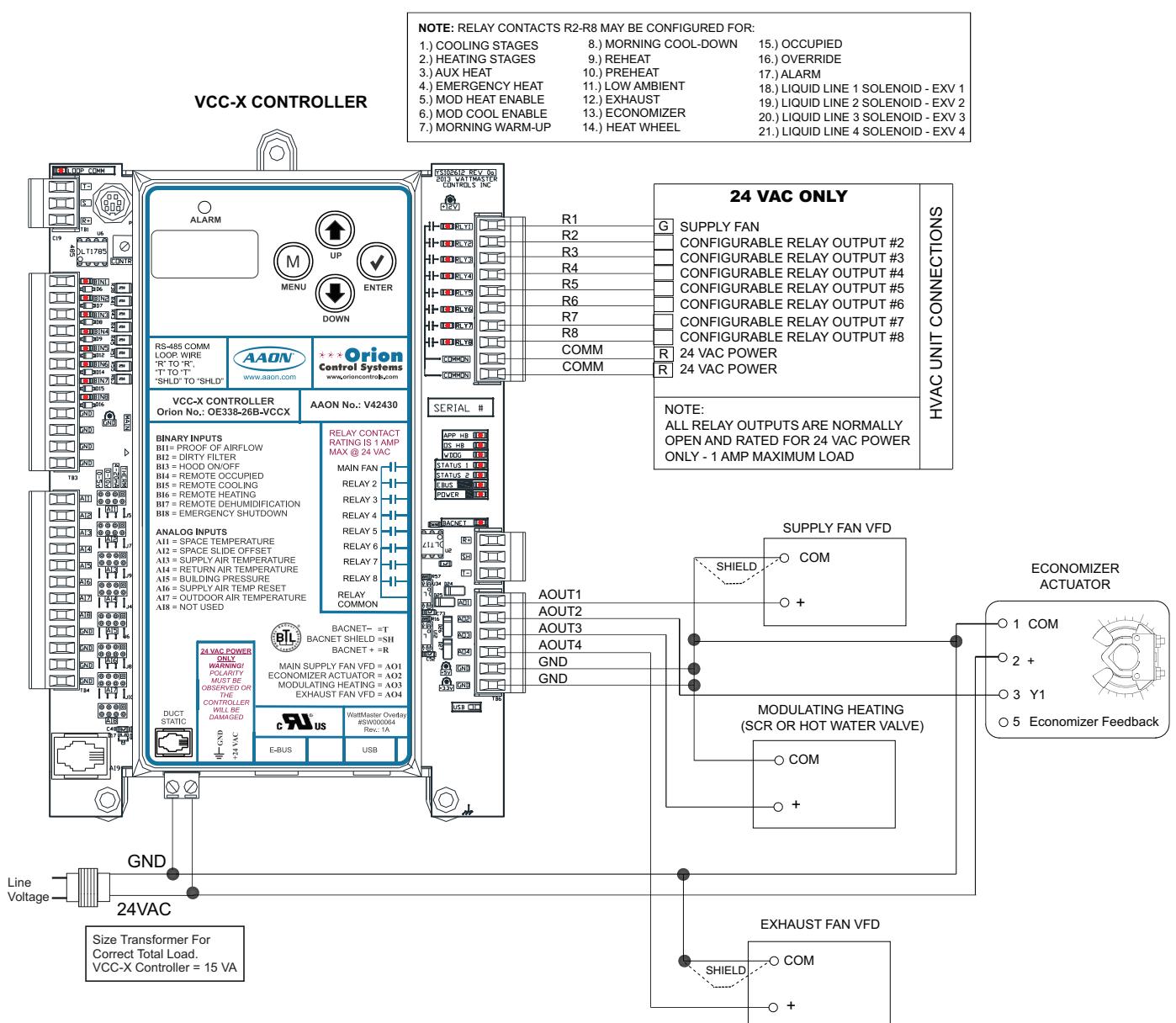


Figure 7: VCC-X Controller Output Wiring

VCC-X CONTROLLER WIRING

E-BUS Digital Room Sensor Wiring

E-BUS Digital Room Sensor

The OE217-02 E-BUS Digital Room Temperature Sensor can be used to sense Space Temperature. The OE217-03 or OE217-04 E-BUS Digital Room Temperature Sensor can be used to sense Space Temperature and Humidity. The OE217-04 has no LCD display or keypad. The Sensor connects to the VCC-X Controller with the EBC E-BUS expansion cable. It can also be daisy-chained with a CO₂ Sensor for applications requiring both a wall mounted CO₂ sensor and space temperature sensor.

The E-BUS Digital Room Sensor should be mounted at approximately 5 Ft. above the floor on the wall in an area that does not have drafts or is exposed to direct sunlight. See **Figure 8, below** for wiring details.

NOTE: If using multiple E-BUS Sensors or Modules, the E-BUS Hub or Adapter Board may be required.

NOTE: Only one indoor combination Temperature/Humidity Sensor should be used - either Space or Return Air. If both a Space and Return Air Sensor are used, the unit will only use the Return Air Humidity value and will display that value for both the Space and Return Air Humidity Status.

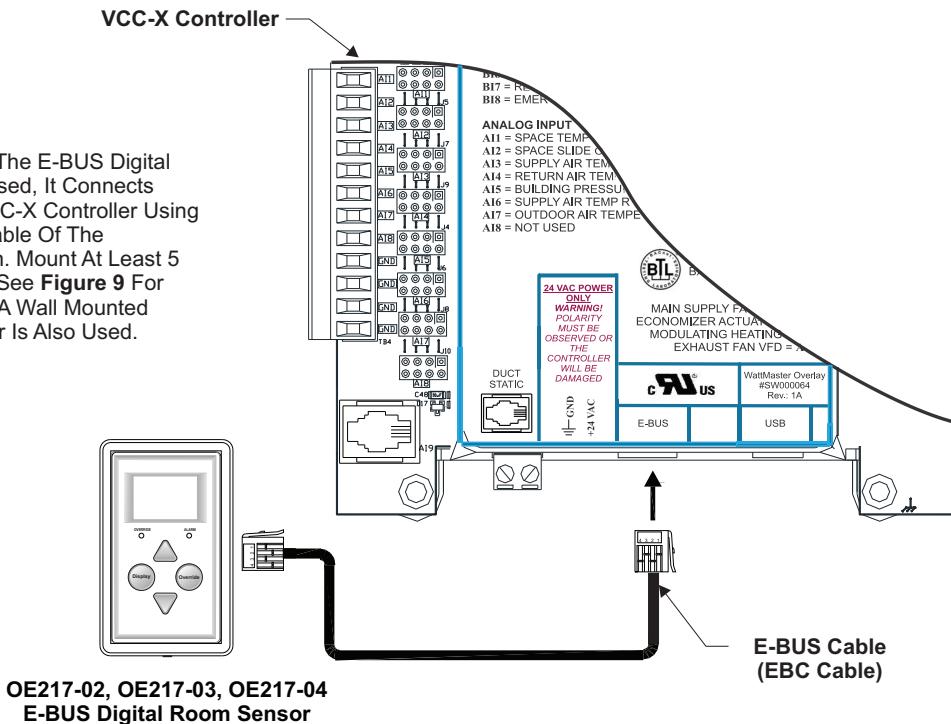


Figure 8: OE217-02, OE217-03, OE217-04 – E-BUS Digital Room Sensor Wiring

Wall-Mounted E-BUS CO₂ Sensor Wiring**E-BUS CO₂ Wall-Mounted Sensor**

The OE256-05 Wall Mounted E-BUS CO₂ Sensor is used to monitor CO₂ levels in the space served by the HVAC unit. The E-BUS CO₂ Sensor connects to the VCC-X Controller with an EBC E-BUS cable. It can be daisy-chained with the E-BUS Digital Room Sensor (OE217-02, OE217-03, OE217-04) for applications requiring both a room CO₂ sensor and room temperature sensor.

It should be mounted at approximately 5 Ft. above the floor on the wall in an area that does not have drafts or is exposed to direct sunlight. See **Figure 9, below** for wiring details and installation notes. A Duct Mounted E-BUS CO₂ Sensor can be used if desired instead of the Wall Mounted E-BUS CO₂ Sensor. See **Figure 10, page 26** for Duct Mounted E-BUS CO₂ Sensor wiring details.

NOTE: If using multiple E-BUS Sensors or Modules, the E-BUS Hub or Adapter Board may be required.

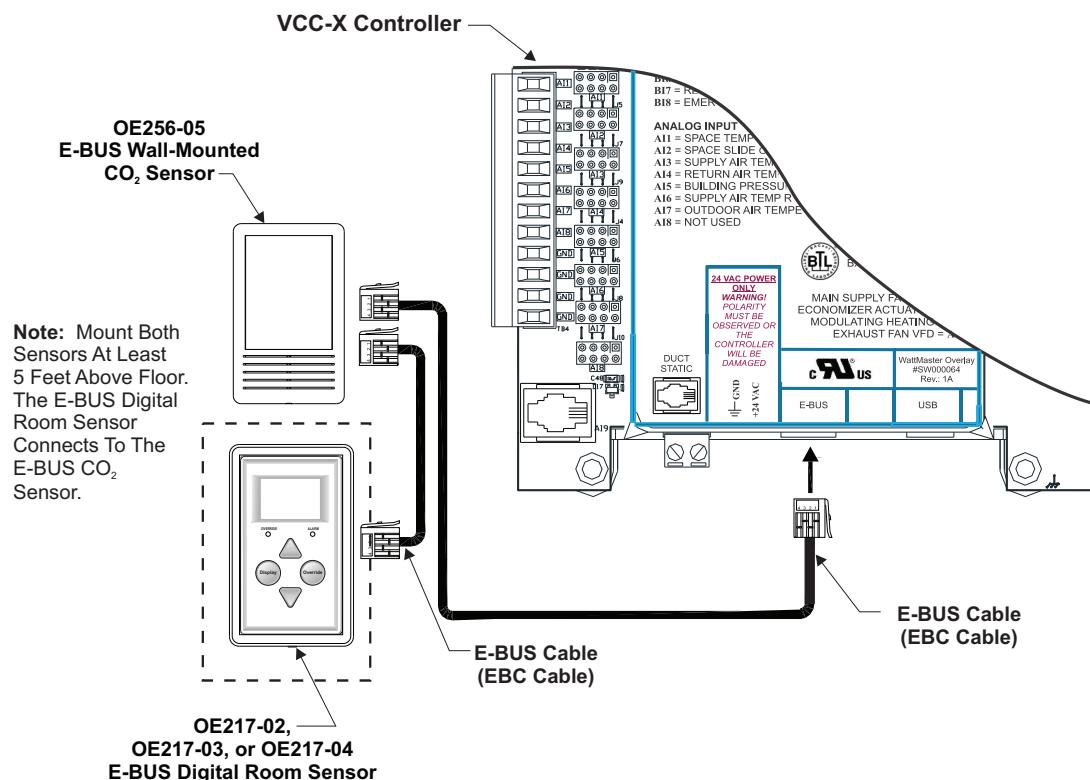


Figure 9: OE256-05 – Wall Mounted E-BUS CO₂ Sensor Wiring

VCC-X CONTROLLER WIRING

Duct Mounted E-BUS CO₂ Sensor

The OE256-07 Duct Mounted E-BUS CO₂ Sensor with Remote Pickup Tube is used for sensing the current CO₂ level in the HVAC unit's return air stream. This is useful when you want an average CO₂ reading in the area served by the HVAC unit or when you don't want a wall mounted E-BUS CO₂ Sensor due to sensor tampering concerns in the space.

The OE256-07 Duct Mounted Return Air CO₂ Sensor is comprised of the CO₂ Sensor, the WattMaster Aspiration Box Assembly, and a Remote Pickup Tube.

Note:

- 1.) The Duct Mounted E-BUS CO₂ Sensor Connects To The VCC-X Controller Using An EBC E-BUS Cable Of The Required Length Or The Provided 10 Foot EBC Cable.

OE256-07 Duct Mounted E-BUS CO₂ Sensor

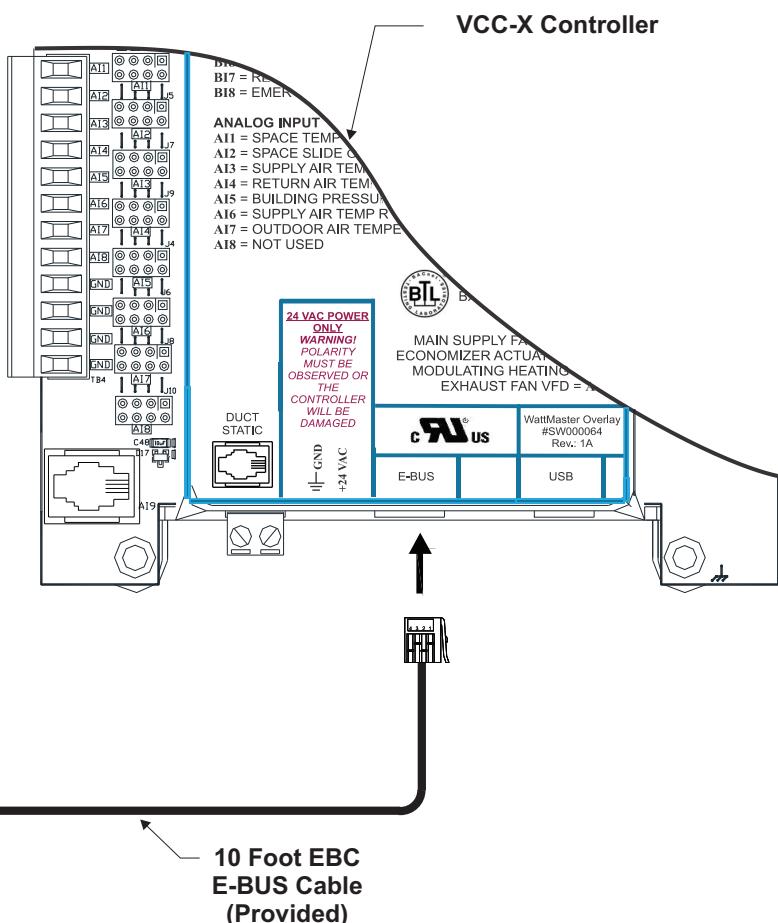
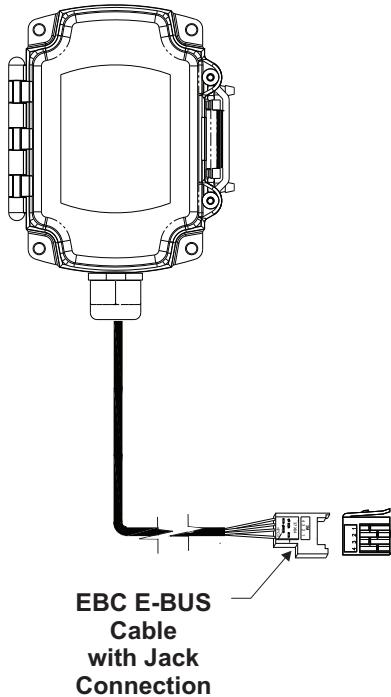


Figure 10: OE256-07 - Duct Mounted E-BUS CO₂ Sensor Wiring

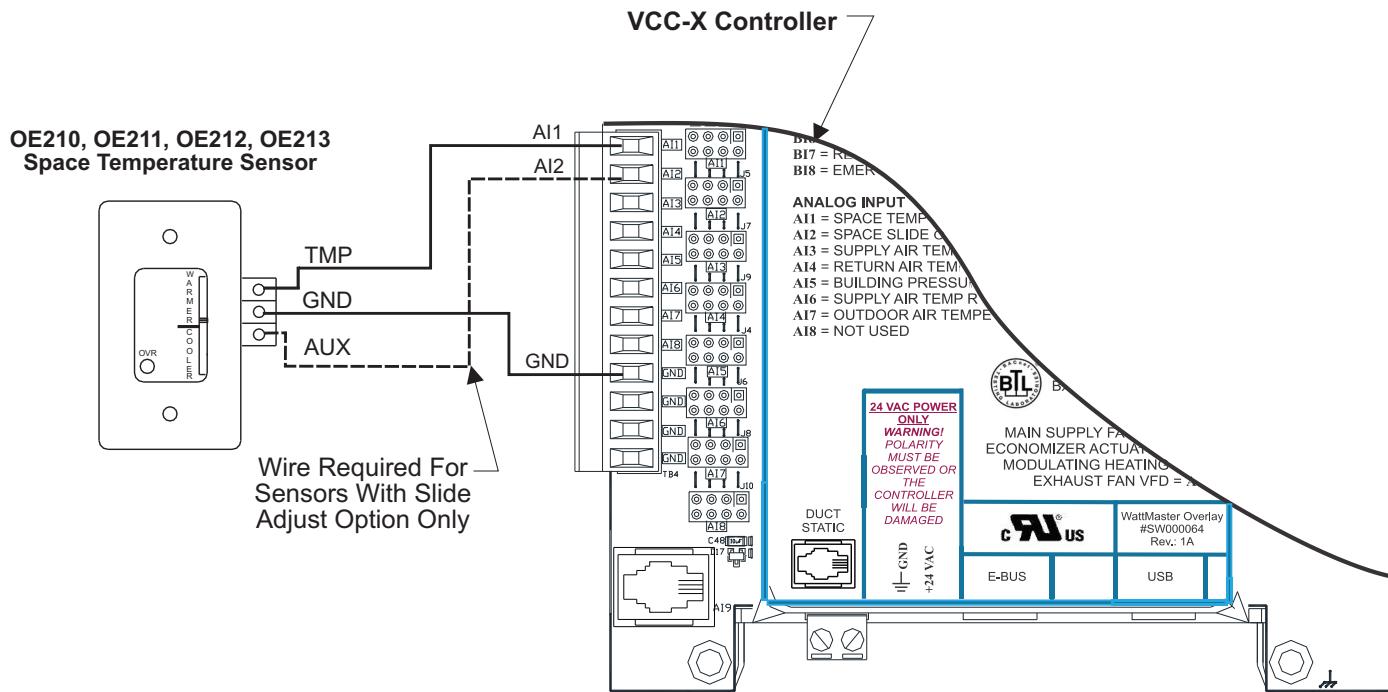
Space Temperature Sensor Wiring

Space Temperature Sensor

The OE210, OE211, OE212, OE213 Space Temperature Sensor is typically used for constant volume HVAC unit applications controlling one zone. The Space Temperature Sensor is a 10K Type III thermistor sensor and should be mounted approximately 5 feet above the floor in the space that is to be controlled.

The Space Temperature Sensor is available as a sensor only, sensor with override button, sensor with slide adjust, and sensor with slide adjust and override configurations.

See **Figure 11, below** for complete Space Temperature Sensor wiring details.



VCC-X CONTROLLER WIRING

Supply Air Temperature Sensor Wiring

Supply Air Temperature Sensor

The OE231 Supply Air Temperature Sensor must be wired as shown for proper operation. The Supply Air Temperature Sensor is a 10K Type III thermistor sensor. The Supply Air Temperature Sensor should be mounted in the unit discharge plenum or in the supply air duct. See **Figure 12**, below for details.

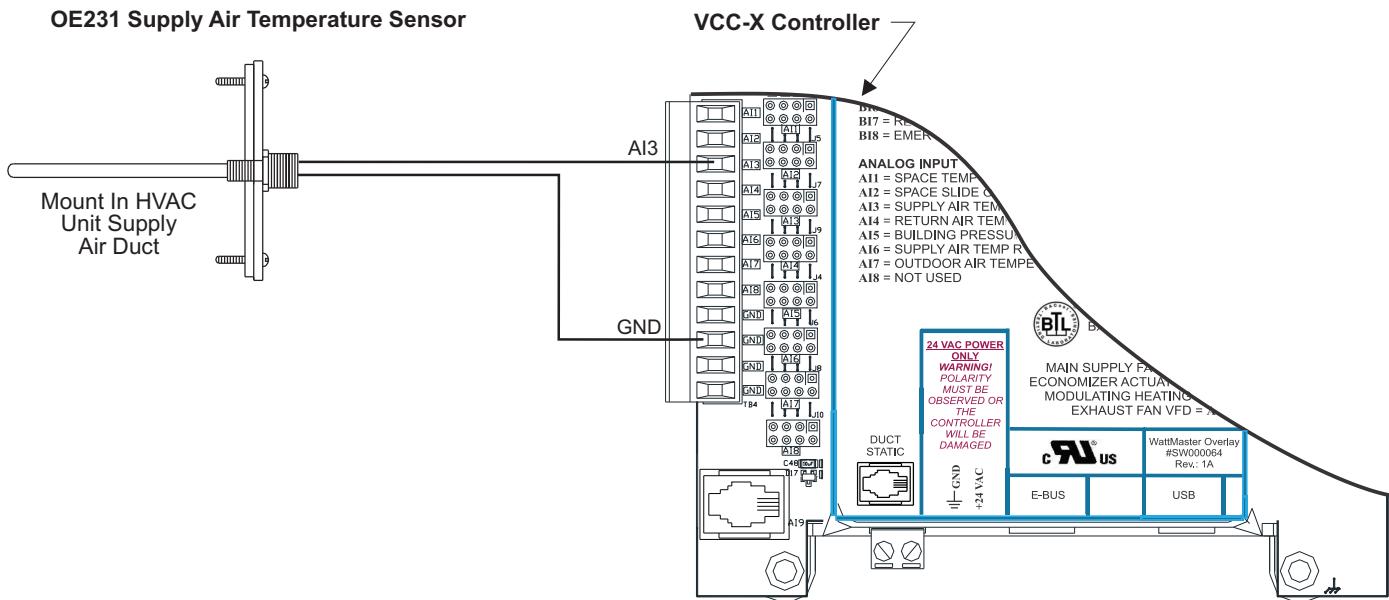


Figure 12: OE231 – Supply Air Temperature Sensor Wiring

Return Air Temperature Sensor Wiring

Return Air Temperature Sensor

The OE231 Return Air Temperature Sensor must be wired as shown for proper operation. The Return Air Temperature Sensor is a 10K Type III thermistor sensor. The Return Air Temperature Sensor should be mounted in the return air duct. If the system has a Zoning Bypass Damper installed, be sure the return air sensor is located upstream of the bypass duct connection. See **Figure 13, below** for details.

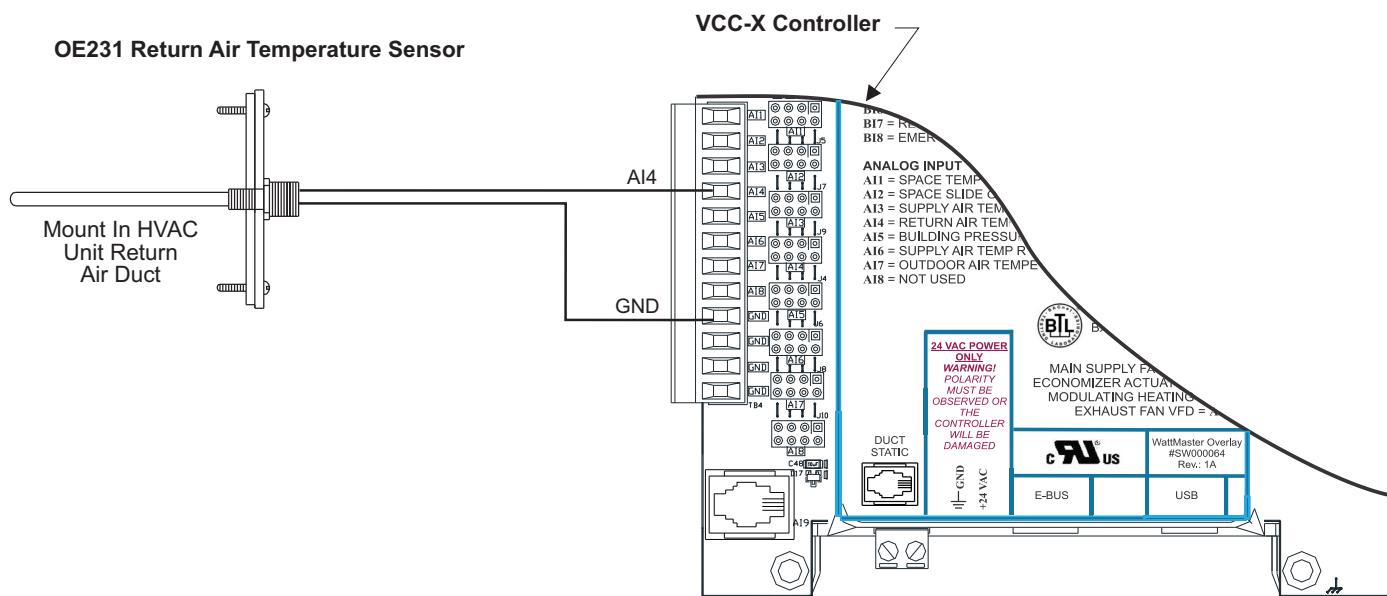


Figure 13: OE231 – Return Air Temperature Sensor Wiring

VCC-X CONTROLLER WIRING

Building Pressure Sensor Wiring

Building Pressure Sensor

The OE258-01 Building Static Pressure Sensor must be wired as shown in **Figure 14, below**. There are 3 terminal connections on the Building Pressure Sensor. Connect the power side of the 24 VAC power source to the terminal labeled “+ EXC.” Connect the GND side of the 24 VAC power source to the terminal labeled “- COM.” Connect the remaining terminal labeled “OUT” to AIN5 on the VCC-X Controller.

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 HVAC Unit Controller, Building Pressure Sensor, and the VCC-X Controller.

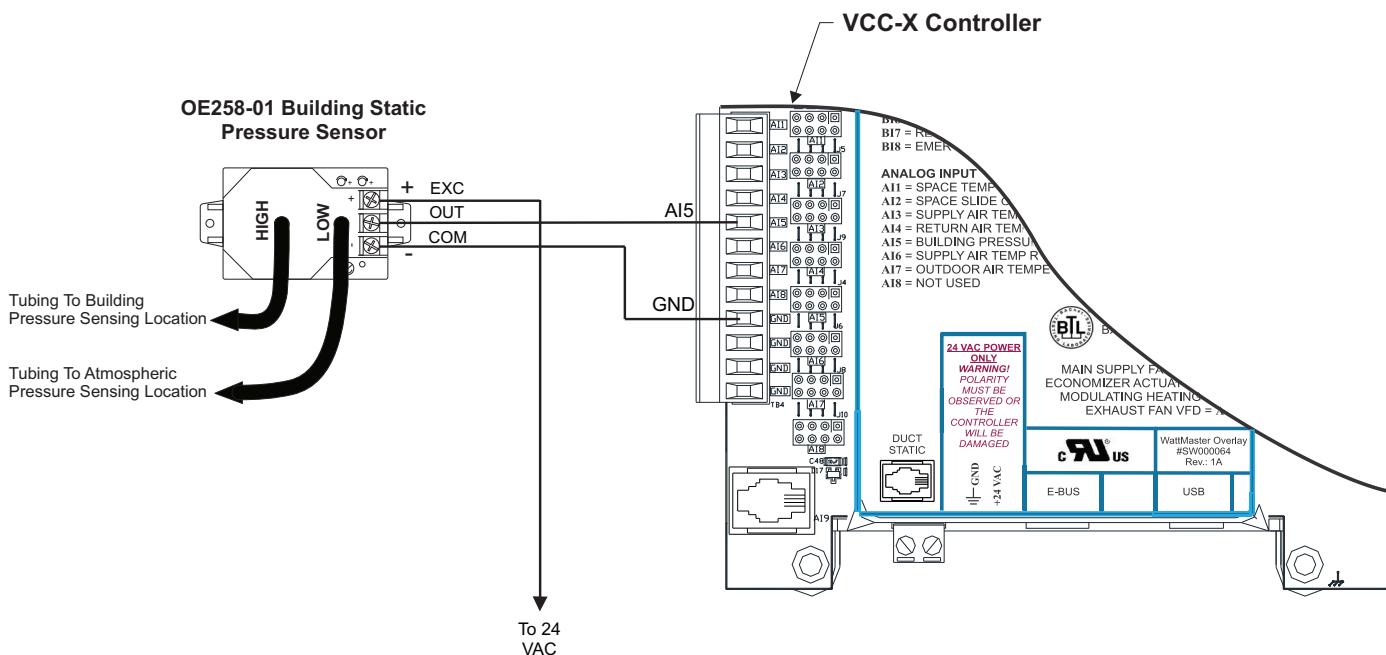


Figure 14: OE258-01 Building Pressure Sensor Wiring Diagram

Remote SAT Reset Signal

A Remote Supply Air Temperature Reset Signal can be connected to AI6 for applications requiring Remote Reset of the Supply Air Temperature Setpoint. See **Figure 15**, below.

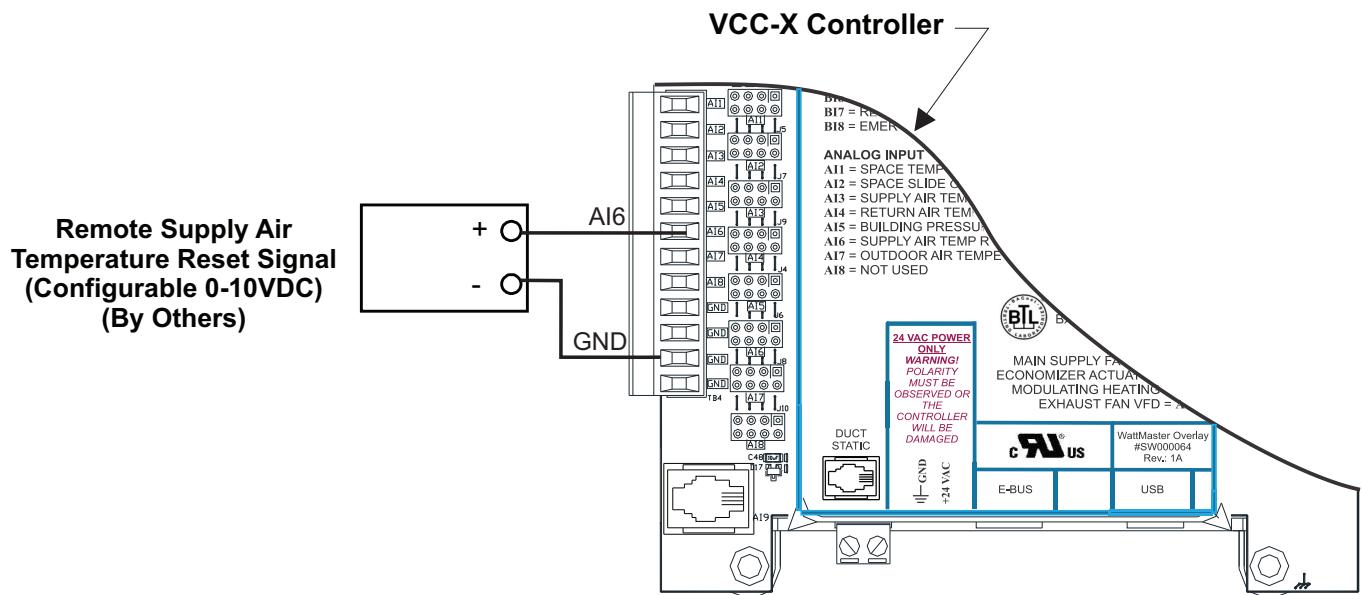


Figure 15: Remote SAT Reset Signal Wiring Diagram

VCC-X CONTROLLER WIRING

Outdoor Air Temperature Sensor Wiring

Outdoor Air Temperature Sensor

The OE250 Outdoor Air Temperature Sensor must be wired as shown for proper operation of the VCC-X Controller. The Outdoor Air Temperature Sensor is a 10K Type III thermistor sensor. The sensor should be mounted in the upright position as shown in an area that is protected from the elements and direct sunlight. Be sure to make the wiring splices inside of the Outdoor Air Temperature Sensor weather-tight enclosure. See **Figure 16, below** for details.

For applications involving Outdoor Air Humidity, the OE265-15-A or OE265-16-A E-BUS Outside Air & Humidity Sensor must be used instead. See **Figures 17, page 33 & Figure 18, page 34** for details.

CAUTION:

Be sure to mount the Outdoor Air Temperature Sensor in an area that is not exposed to direct sunlight. The shaded area under the HVAC unit rain hood is normally a good location. Unused conduit opening(s) must have closure plugs installed and must be coated with sealing compound to provide a rain-tight seal. Water can damage the sensor.

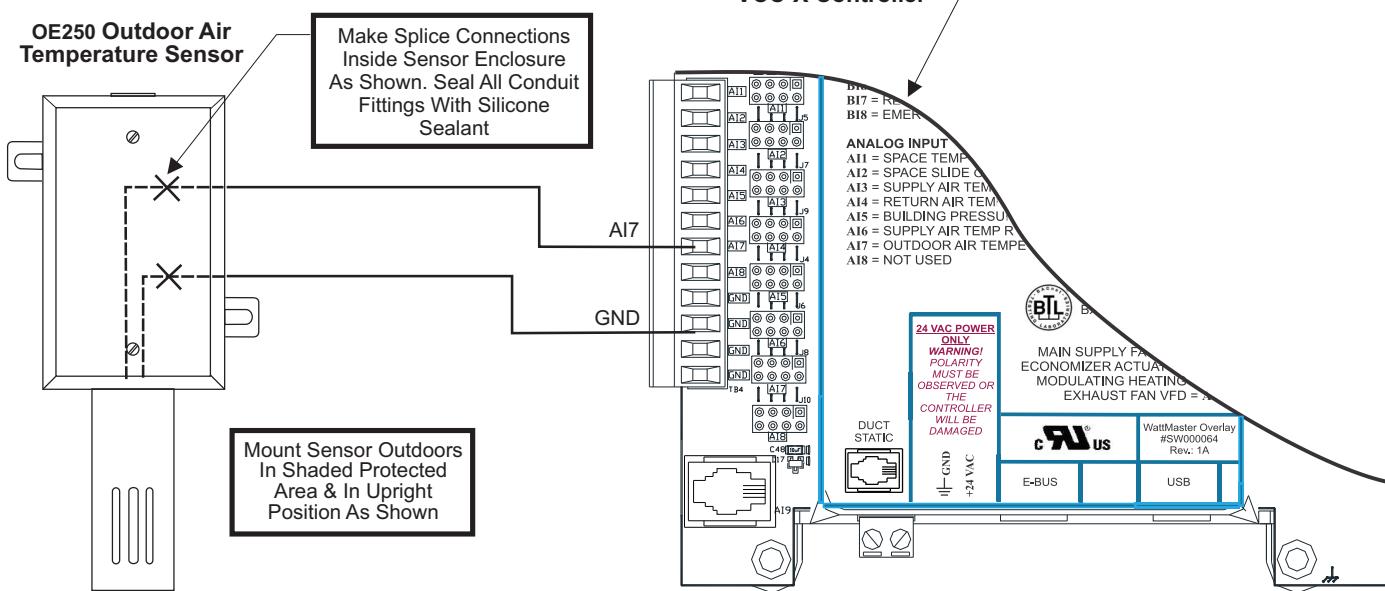


Figure 16: OE250 – Outdoor Air Temperature Sensor Wiring

E-BUS Outdoor Air Temperature & Humidity Sensor Wiring**E-BUS Horizontal or Vertical Outdoor Air Temperature & Humidity Sensor**

The OE265-15-A (Horizontal) or OE265-16-A (Vertical) E-BUS Outdoor Air Temperature & Humidity Sensor connects to the VCC-X Controller. An EBC E-BUS cable plugs into the Sensor's attached 3 foot cable and then plugs into the E-BUS port of the VCC-X Controller or other E-BUS Expansion Board. The sensor should be mounted in the upright position as shown in an area that is protected from the elements and direct sunlight. See **Figure 17**, below for details.

CAUTION:

Be sure to mount the Outdoor Air Temperature & Humidity Sensor in an area that is not exposed to direct sunlight. The shaded area under the HVAC unit rain hood is normally a good location. Unused conduit opening(s) must have closure plugs installed and must be coated with sealing compound to provide a rain-tight seal. Water can damage the sensor.

NOTE: If using multiple E-BUS Sensors or Modules, the E-BUS Hub (HZ-EBC-248 or MS000248) or E-BUS Adapter Board (OE365-15-EBA) may be required.

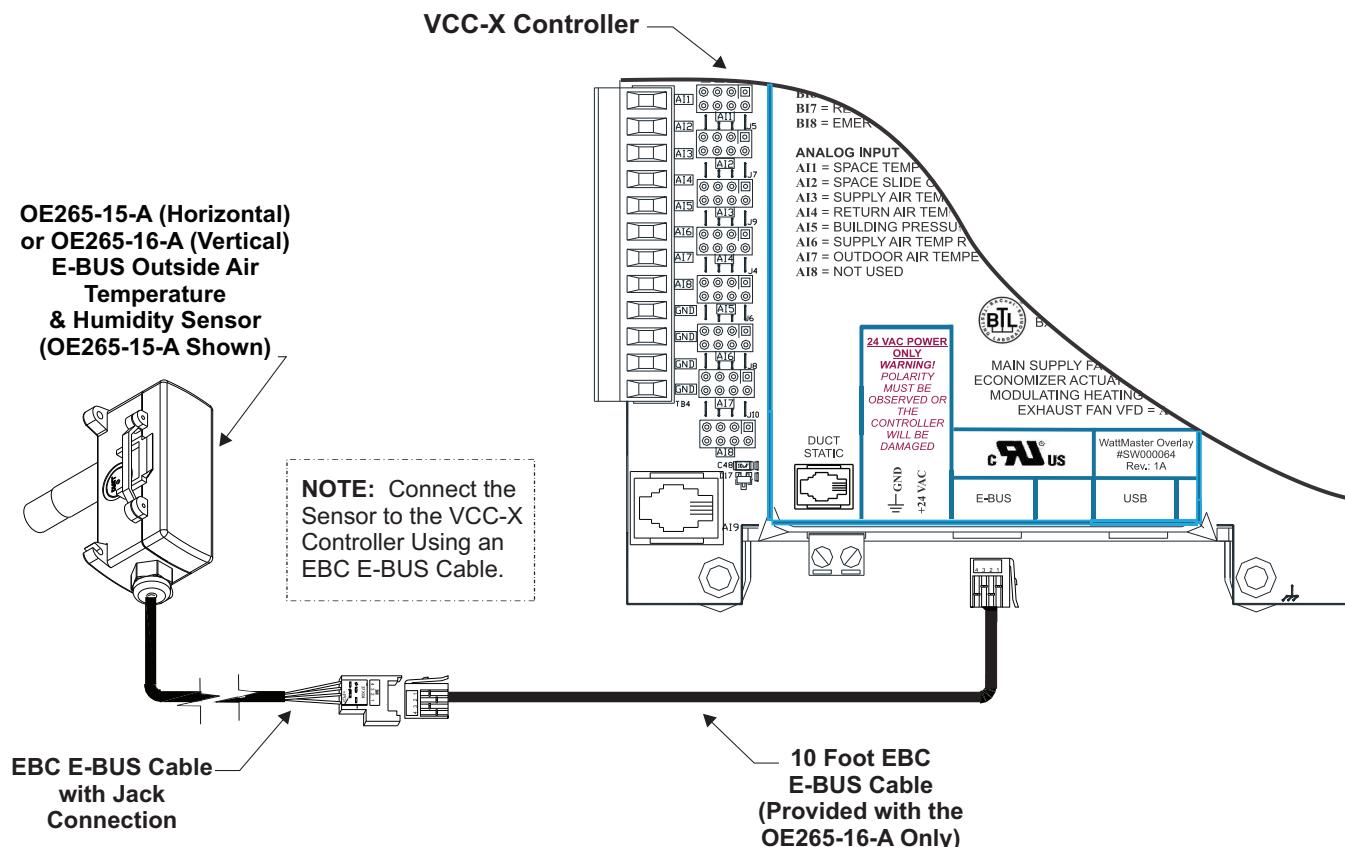


Figure 17: OE265-15-A or OE265-16-A – E-BUS Outdoor Air Temperature & Humidity Sensor Wiring

VCC-X CONTROLLER WIRING

E-BUS Return Air Temperature & Humidity Sensor Wiring

E-BUS Return Air Temperature & Humidity Sensor

The OE265-17-A E-BUS Return Air Temperature & Humidity Sensor connects to the VCC-X Controller. A 50 foot EBC E-BUS cable (provided) plugs into the Sensor's attached 3 foot cable and then plugs into the E-BUS port of the VCC-X Controller or other E-BUS Expansion Board. The sensor should be mounted in the upright position as shown in an area that is protected from the elements and direct sunlight. See **Figure 18, below** for details.

NOTE: Only one indoor combination Temperature/Humidity Sensor should be used - either Space or Return Air. If both a Space and Return Air Sensor are used, the unit will only use the Return Air Humidity value and will display that value for both the Space and Return Air Humidity Status.

NOTE: If using multiple E-BUS Sensors or Modules, the E-BUS Hub (HZ-EBC-248 or MS000248) or E-BUS Adapter Board (OE365-15-EBA) may be required.

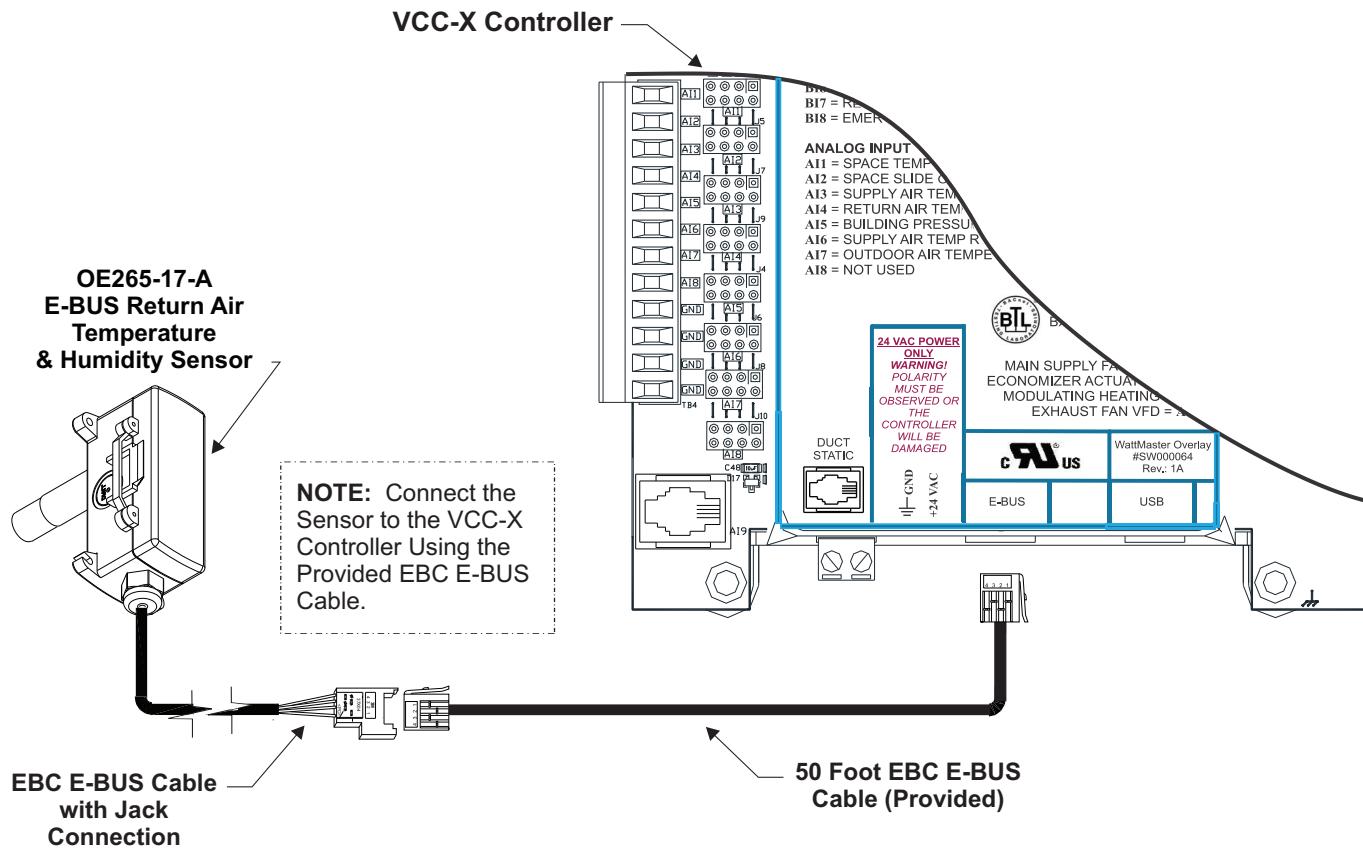


Figure 18: OE265-17-A – E-BUS Return Air Temperature & Humidity Sensor Wiring

Static Pressure Transducer Wiring

Static Pressure Transducer

The OE271 Static Pressure Transducer plugs directly into the VCC-X Controller's Static Pressure port. 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 you have configured the HVAC unit for Constant Volume operation, this Sensor is optional. If it is installed on a Constant Volume unit, it will not affect operation, but rather will be used as a status-only reading. See Figure 19, below for detailed wiring.

CAUTION: It is strongly recommended that you use pneumatic tubing instead of relocating the sensor. Extending the wires could cause voltage drop problems.

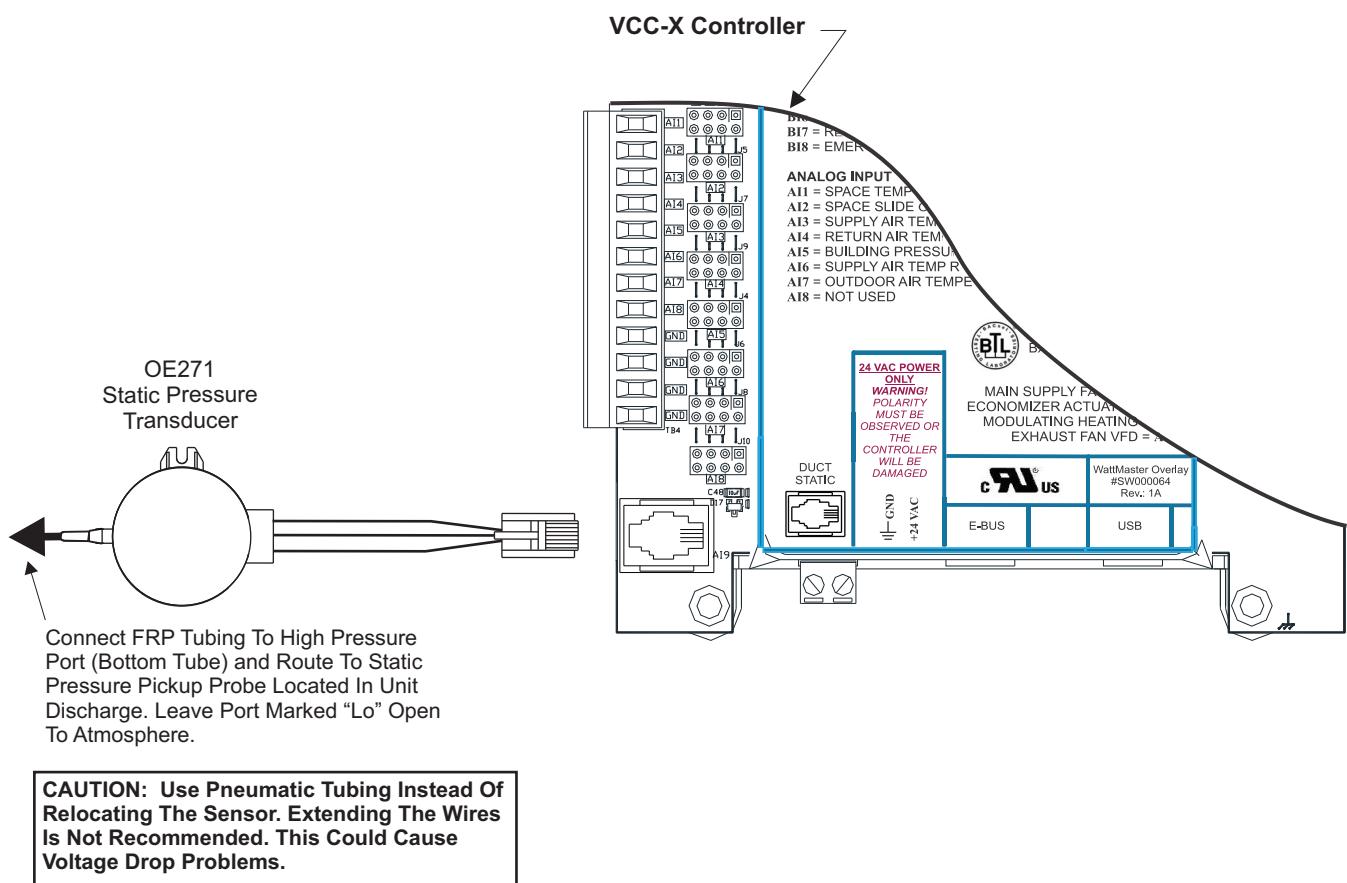


Figure 19: OE271 Static Pressure Transducer Wiring Diagram

VCC-X CONTROLLER WIRING

Supply Fan VFD Wiring

Supply Fan VFD Signal

The Supply Fan VFD Signal is a user-adjustable signal with a range of 0-10 VDC from AOUT1 on the VCC-X Controller. This signal output can be connected to the Supply Fan Variable Frequency Drive to modulate the Supply Fan speed.

See **Figure 20**, below for detailed wiring.

CAUTION: Variable Frequency Drive units can cause large transient noise spikes which can cause interference to be propagated on other electronic equipment. Use shielded wire wherever possible and route all sensor and controller wiring away from the Variable Frequency Drive and the HVAC Unit electrical wiring.

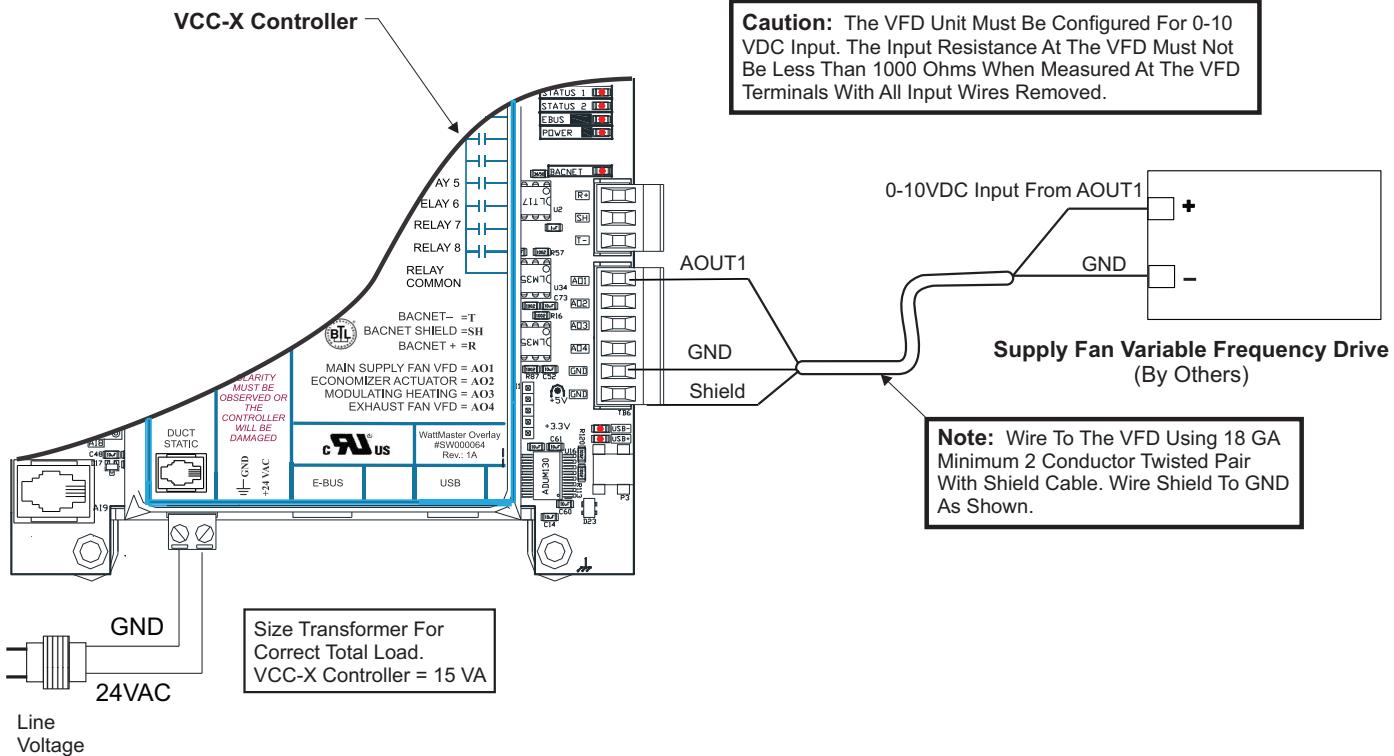


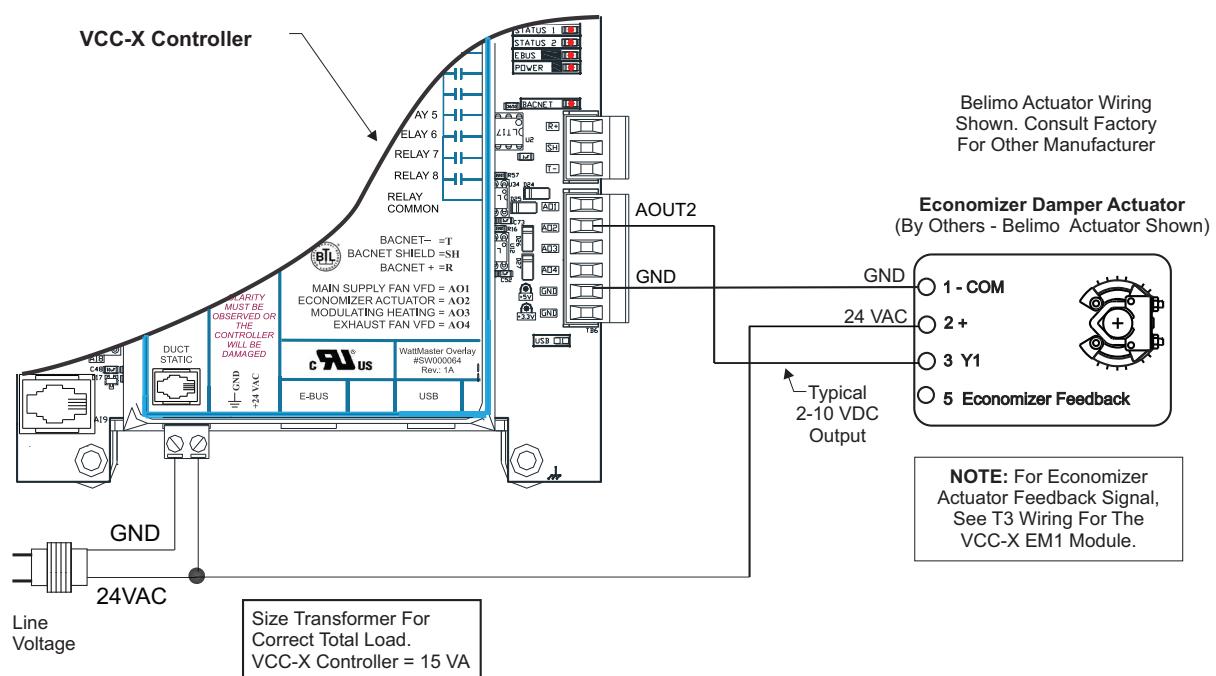
Figure 20: Supply Fan VFD Wiring

Economizer Actuator Wiring**Economizer Damper Actuator**

The Economizer Damper Actuator signal voltage output (using AOUT2) is user-adjustable, but must be set to 2-10 VDC for this application. This signal output is used by the VCC-X Controller to modulate the Economizer Damper Actuator in order to control the amount of Outdoor Air delivered to the HVAC unit for Free Cooling and/or Indoor Air Quality requirements. See **Figure 21**, below for detailed wiring.

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 actuator or VCC-X Controller.

**Figure 21: Economizer Damper Actuator Wiring**

VCC-X CONTROLLER WIRING

Modulating Heating Device Wiring

Modulating Heating Device

The Modulating Heating Device signal voltage output is a user-adjustable signal with a range of 0-10 VDC from AOUT3 when programming the controller. The output signal can be configured for either Direct Acting or Reverse Acting operation as required.

The Output signal is normally used to control a Modulating Hot Water Valve or Modulating Steam Valve or is used for SCR Control of an Electric Heating Coil.

See **Figure 22**, below for detailed wiring of the Modulating Heating Device.

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 could result in damage to the Modulating Heating Device or the VCC-X Controller.

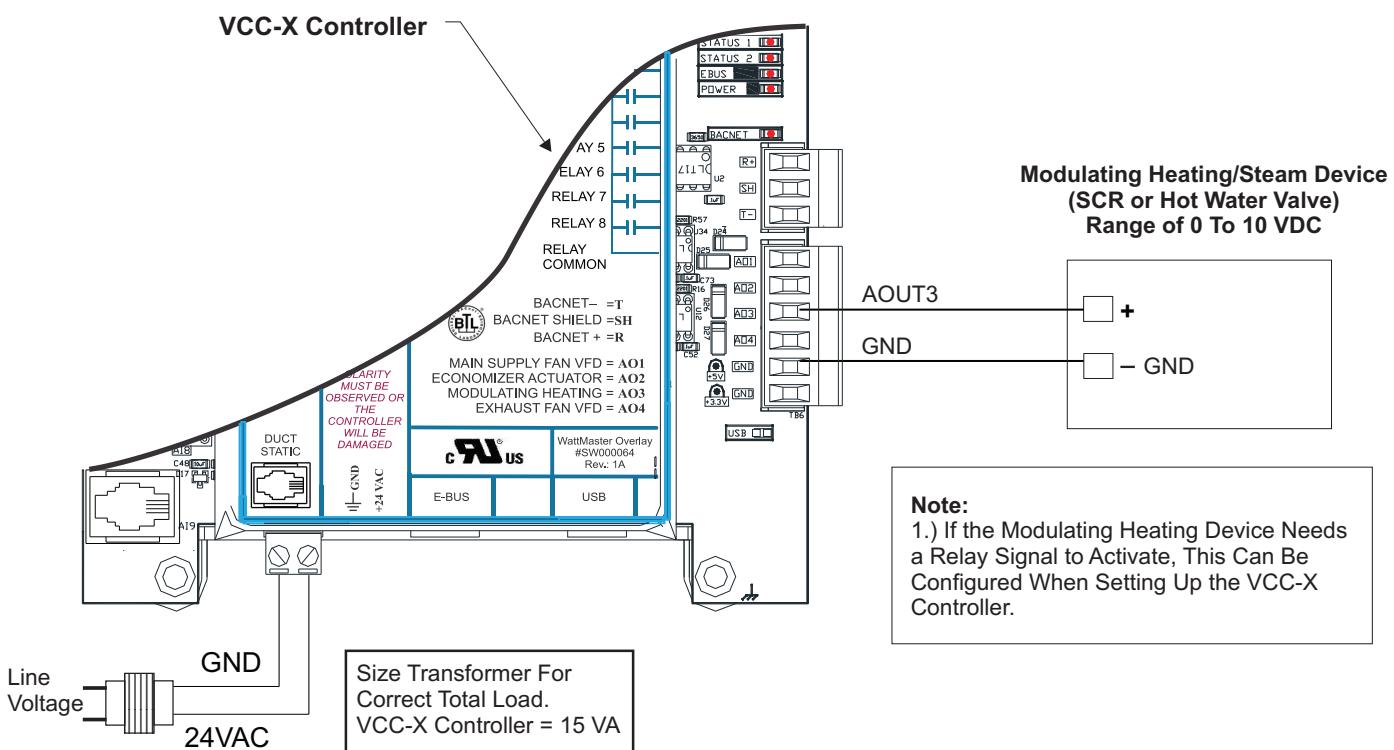


Figure 22: Modulating Heating Device Wiring

Building Pressure Control Output Wiring

Building Pressure Control Output

The Building Pressure Control Output is a 0-10 VDC or 2-10 VDC signal sent from the VCC-X Controller. When using the output for Direct Building Pressure Control (output signal rises on a rise in building pressure), the output signal can be connected to either a Variable Frequency Drive controlling an exhaust fan or to a damper actuator controlling an exhaust damper (both by others). When used in this manner, the output signal must be configured for Direct Acting operation. See **Figure 23, below** for detailed wiring of the Building Pressure Control Output Signal.

When using this output for Reverse Building Pressure Control (output signal rises on a fall in building pressure), a damper actuator controlling an OA Damper or Supply Fan VFD would be

used. When using the OA damper for Reverse Building Pressure Control, the output signal must be configured for Reverse Acting operation. A Building Pressure Sensor connected to AI5 on the VCC-X Controller is used to sense and control the signal to the Building Pressure Output. The OE258-01 Building Static Pressure Sensor must be connected in order for the Building Pressure Output to operate correctly.

CAUTION: Variable Frequency Drive units can cause large transient noise spikes that can cause interference to be propagated on other electronic equipment. Use shielded wire wherever possible and route all sensor and controller wiring away from the Variable Frequency Drive and the HVAC unit electrical wiring.

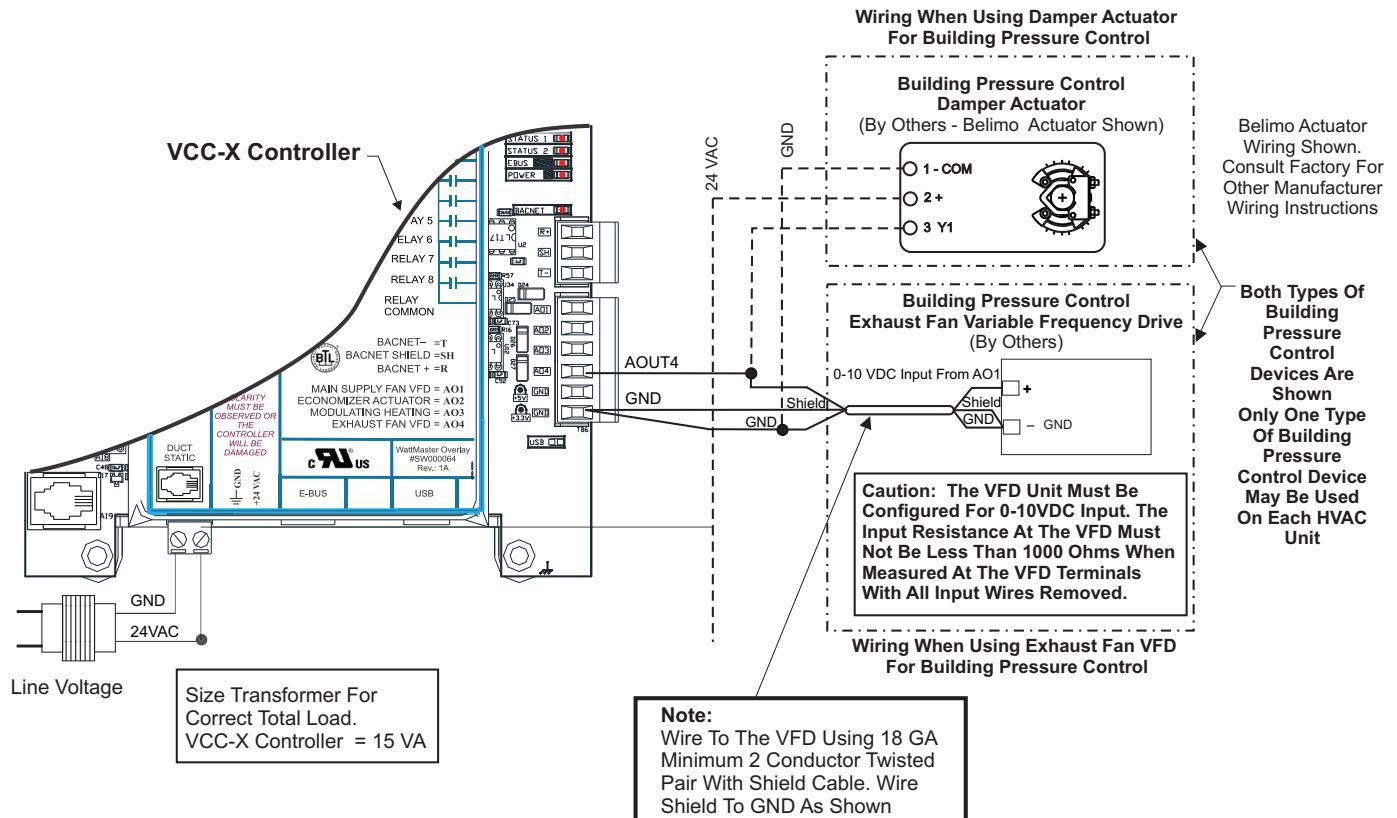


Figure 23: Building Pressure Control Output Wiring Diagram

VCC-X EM1 EXPANSION MODULE WIRING

VCC-X EM1 Economizer Actuator Feedback Wiring

VCC-X EM1 Economizer Actuator Feedback

The VCC-X EM1 Expansion Module (OE336-23-VCCXEM1) connects to the VCC-X Controller with an EBC E-BUS cable and adds an additional 5 Analog Inputs, 5 Analog Outputs, 3 Binary Inputs, and 5 Configurable Relay Outputs.

The VCC-X 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 your specific applications.

Title 24 Economizer Feedback

If the controller has been configured for Title 24 Economizer operation, the Economizer Actuator Feedback signal will be wired to the VCC-X EM1's SIG3 input. The jumper should be set to 0-10V.

See **Figure 24**, below for wiring.

WARNING!!
Observe Polarity! All boards must be wired with GND-to-GND and 24VAC-to-24VAC. 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.

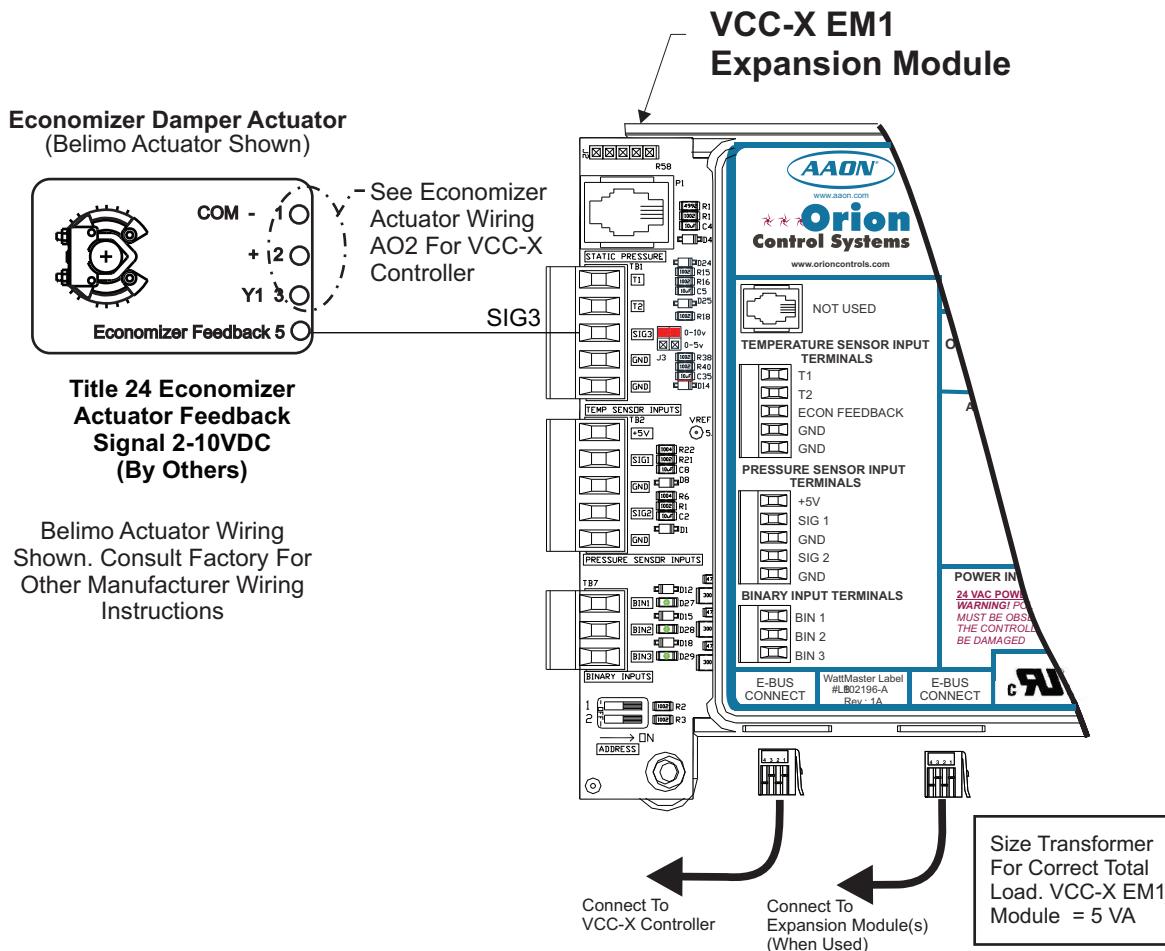


Figure 24: VCC-X EM1 Economizer Actuator Feedback Wiring

VCC-X EM1 EXPANSION MODULE WIRING

VCC-X EM1 Expansion Module Output Wiring

VCC-X EM1 Expansion Module Outputs

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

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

See **Figure 25, below** for input wiring.

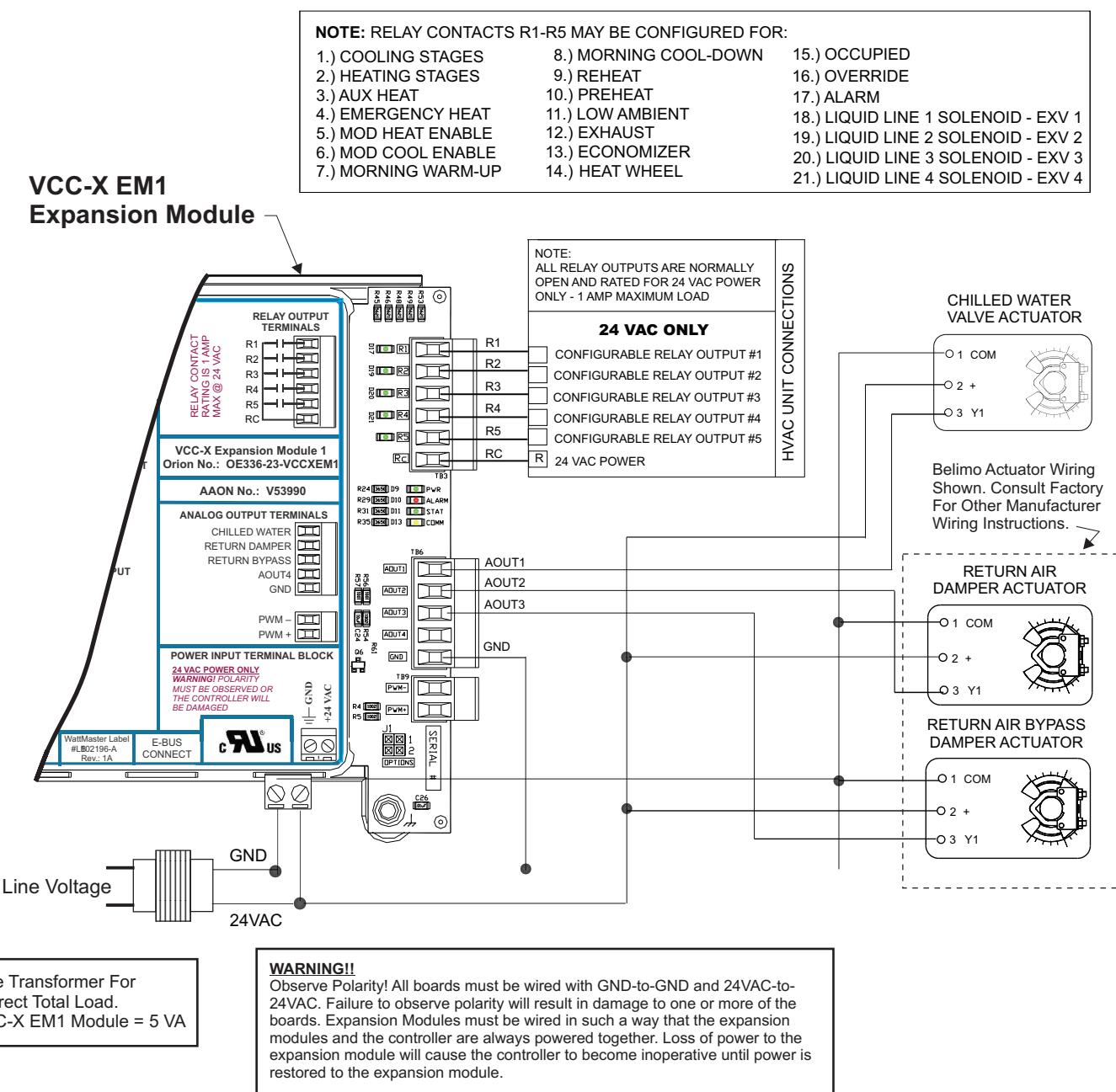


Figure 25: VCC-X EM1 Expansion Module Output Wiring Diagram

VCC-X EM1 EXPANSION MODULE WIRING

Chilled Water Valve Actuator Wiring

Modulating Cooling Output

This output is used to control a Modulating Chilled Water Valve to maintain the Cooling Supply Air Temperature Setpoint. The output is configured for 0-10 VDC direct acting operation.. See **Figure 26, below** for wiring details.

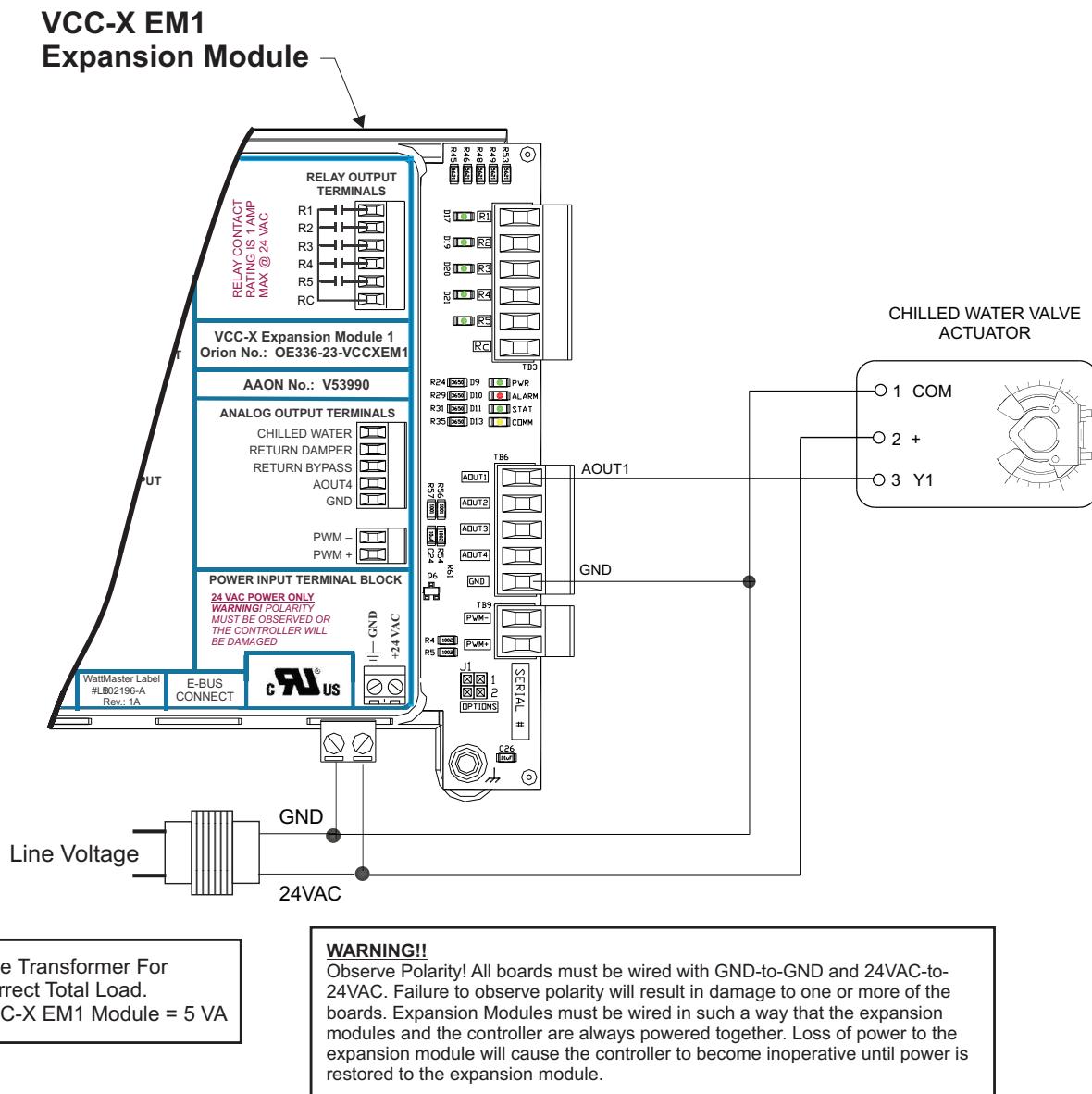


Figure 26: Chilled Water Valve Actuator Wiring Diagram

Return Air Bypass Wiring

Return Air Bypass

The VCC-X Controller can be configured for AAON® Return Air Bypass applications. These provide improved moisture removal capabilities while utilizing internal space loads for reheat by redirecting Return Air around the Evaporator Coil instead of through the coil. See the AAON® Return Air Bypass application section of this manual on page 7 for complete operation details.

The AAON® Return Air Bypass applications utilize a Return Air Bypass Damper Actuator and a Return Air Damper Actuator to modulate the Return Air and Return Air Bypass Dampers to control the amount of air that is redirected around the Evaporator Coil.

See Figure 27, below for detailed wiring of the Return Air Bypass and Return Air Damper Actuators.

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 could result in damage to the Damper Actuator or the VCC-X Expansion Module.

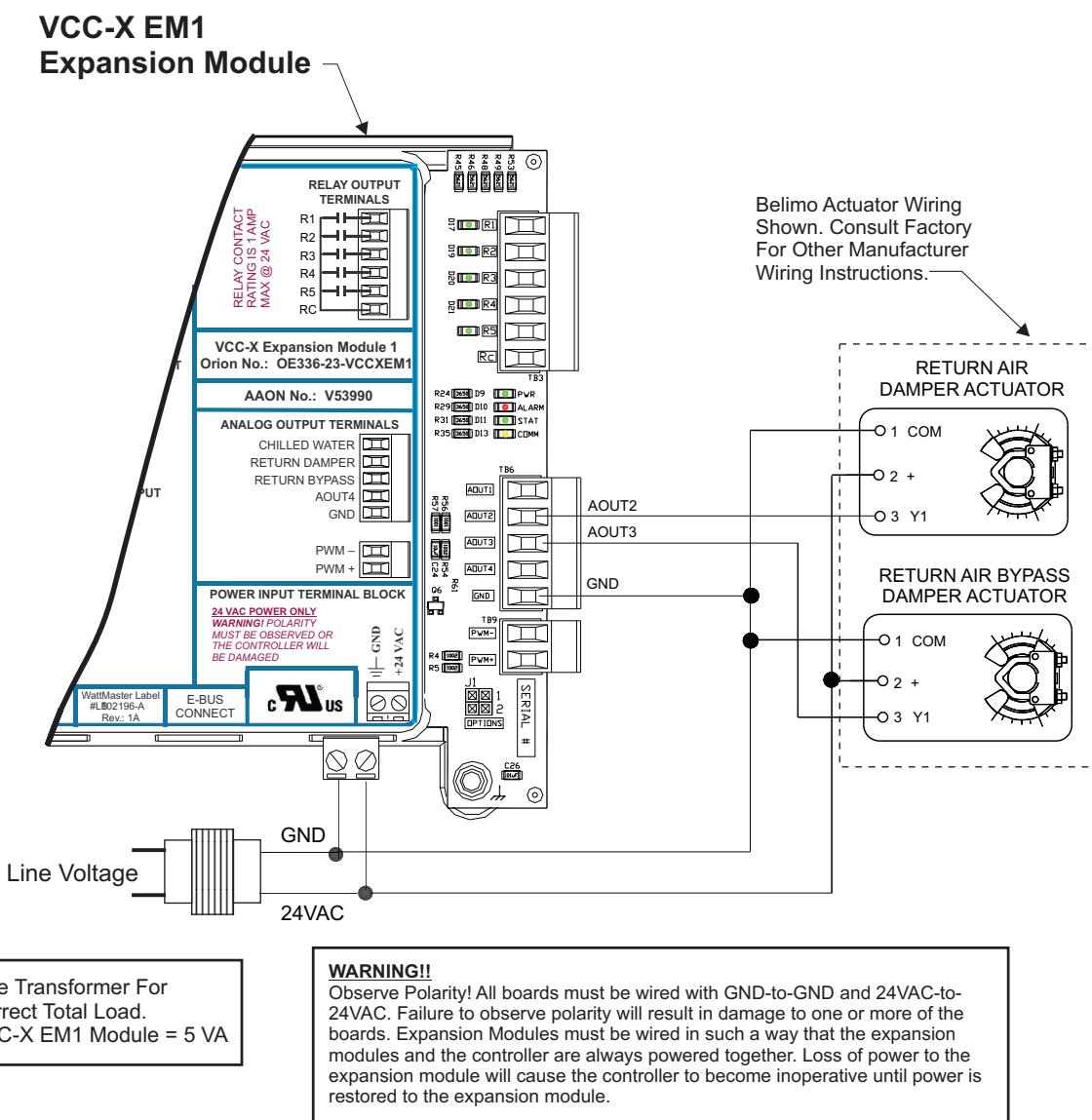


Figure 27: Return Air Bypass Wiring

AIRFLOW MONITORING WIRING

12-Relay E-BUS Expansion Module Wiring

E-BUS 12-Relay Expansion Module

The E-BUS 12-Relay Expansion Module (OE358-23E-12R-A) provides for 12 Dry Contact Configurable Relay Outputs. See **Figure 28, below** for complete wiring details.

The E-BUS 12-Relay Expansion Module can be used in conjunction with the VCC-X EM1 Expansion Module (OE336-23-VCCXEM1). The expansion modules can be used individually or together to provide the required inputs and outputs for your specific applications.

The expansion modules can be used individually or together to provide the required inputs and outputs for your specific applications.

NOTE: A total of 17 relays are available by adding the Relay Expansion Modules. All Expansion Module relay outputs are user-configurable.

WARNING!!

Observe Polarity! All boards must be wired with GND-to-GND and 24VAC-to-24VAC. 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.

NOTE:
All Relay Outputs Are
Normally Open And Rated
For 24 VAC Power Only.
1 Amp Maximum Load.

NOTE: RELAY CONTACTS R1-R12 MAY BE CONFIGURED FOR:

1.) COOLING STAGES	8.) MORNING COOL-DOWN	15.) OCCUPIED
2.) HEATING STAGES	9.) REHEAT	16.) OVERRIDE
3.) AUX HEAT	10.) PREHEAT	17.) ALARM
4.) EMERGENCY HEAT	11.) LOW AMBIENT	18.) LIQUID LINE 1 SOLENOID - EXV 1
5.) MOD HEAT ENABLE	12.) EXHAUST	19.) LIQUID LINE 2 SOLENOID - EXV 2
6.) MOD COOL ENABLE	13.) ECONOMIZER	20.) LIQUID LINE 3 SOLENOID - EXV 3
7.) MORNING WARM-UP	14.) HEAT WHEEL	21.) LIQUID LINE 4 SOLENOID - EXV 4

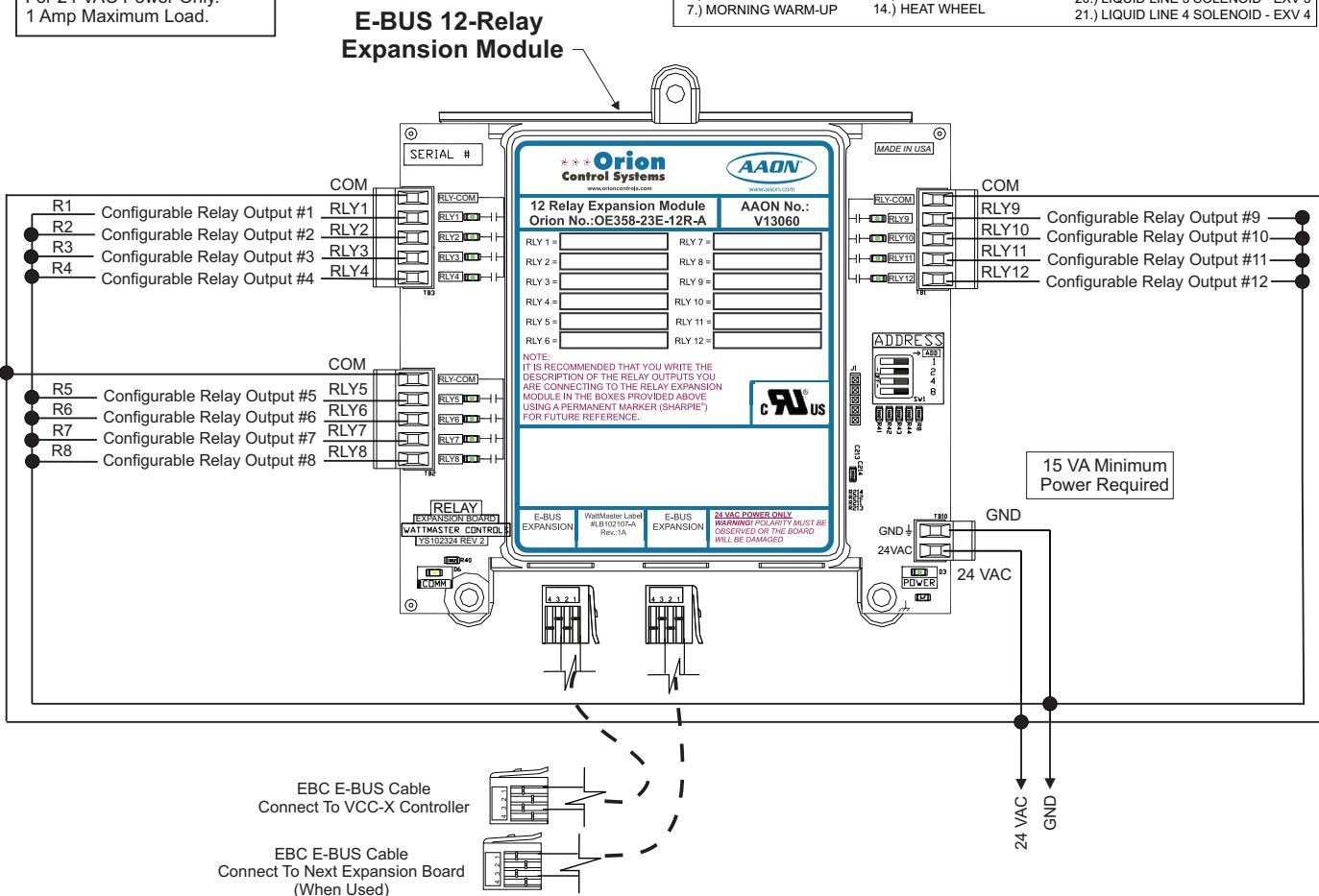


Figure 28: OE358-23E-12R-A – E-BUS 12-Relay Expansion Module Wiring

12-RELAY E-BUS EXPANSION MODULE WIRING

EBTRON®, GreenTrol™, and Paragon Wiring

EBTRON®, GreenTrol™, and Paragon Air Flow Measurement Digital Transmitters

NOTE: Only the EBTRON® GTC116 or HTN104 series, GreenTrol™ GA-200-N Module (with GF series Airflow Station), or Paragon MicroTrans^{EQ} series of MODBUS RTU transmitters are compatible with the VCC-X Controller. No other series of transmitters will work for this application. Contact WattMaster Controls for information on other airflow station options.

The OE365-15-EBA E-BUS Adapter Board attaches to the VCC-X Controller with an EBC E-BUS cable. The Adapter Board is used for connecting the EBTRON®, GreenTrol™, or Paragon Airflow Measurement Digital Transmitter to the VCC-X Control System. You must wire the Airflow Measurement Digital Transmitter to the Adapter Board as shown in **Figure 29** below.

NOTE: The Airflow Station's baud rate needs to be set to 19,200 in order to communicate with the VCC-X Controller.

NOTE: Up to 4 EBTRON®, GreenTrol™, or Paragon Airflow Measurement Digital Transmitters can be attached to each Adapter Board.

NOTE: If using multiple E-BUS Sensors or Modules, the E-BUS Hub (HZ-EBC-248 or MS000248) may be required.

***NOTE:** When configuring the GTC116 or HTN104 Series, be sure to set the Parity to "NO PARITY, 1 STOP BIT."

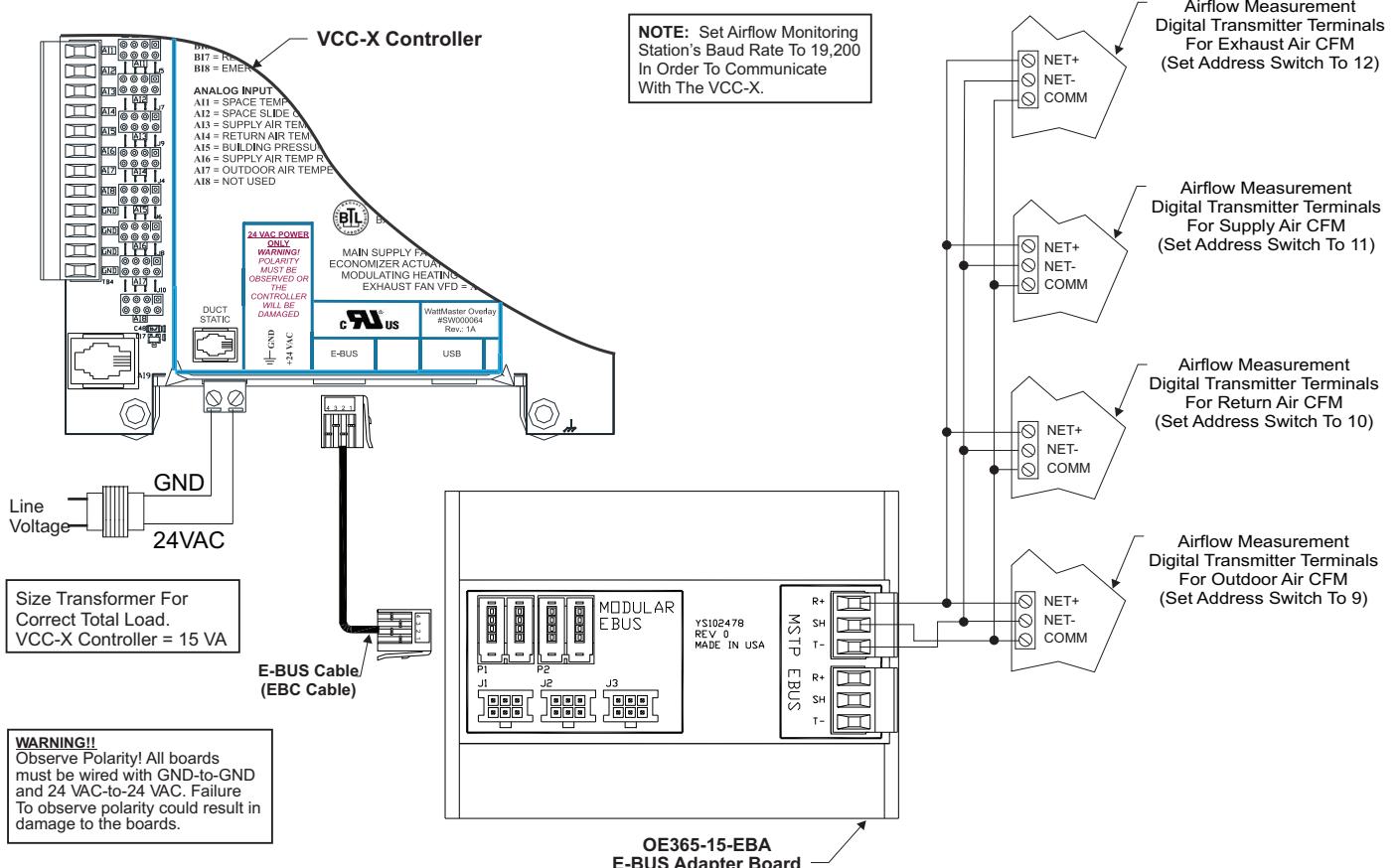


Figure 29: EBTRON® GTC116 or HTN104 Series, GreenTrol™ GA-200-N Series, and Paragon MicroTrans^{EQ} Series Air Flow Measurement Digital Transmitter Wiring

REFRIGERANT SYSTEM MODULE WIRING

RSMV Inputs & Outputs Wiring

Refrigerant System Module for VFD Compressors Wiring

The OE370-26-RSMV Refrigerant System Module for VFD Compressors (RSMV) monitors and controls one tandem refrigeration circuit of the HVAC unit. The module is designed for R410-A refrigerant.

The RSMV is connected to the VCC-X Controller. Up to 4 RSMV's can be connected, depending on the size of the system. There are 2 E-BUS Expansion Ports which allow the use of communicating sensors and the E-BUS Modules.

The RSMV provides 4 analog inputs, 3 binary inputs, 3 relays, and 4 analog outputs. See **Figure 30, below** for inputs wiring and **Figure 31, page 47** for outputs wiring.

The RSMV Module provides the following:

- Modulates the Compressors to satisfy the Suction Coil (Saturated) Temperature. The Suction Coil (Saturated) Temperature Setpoint is reset by the VCC-X Controller to maintain the Supply Air Temperature during Cooling Mode. During Dehumidification Mode, it controls the Compressors to the Suction (Saturation) Temperature Setpoint.
- Modulates the Condenser Fan to maintain the Head Pressure Setpoint.
- Modulates the Expansion Valves to maintain the Superheat Setpoint.
- Provides alarms and safeties for the compressor and condenser operation.
- Contains a 2 x 8 LCD character display and 4 buttons that allow for status display, setpoint changes, and configuration changes.

REFRIGERANT SYSTEM MODULE
FOR VFD COMPRESSORS
(RSMV)

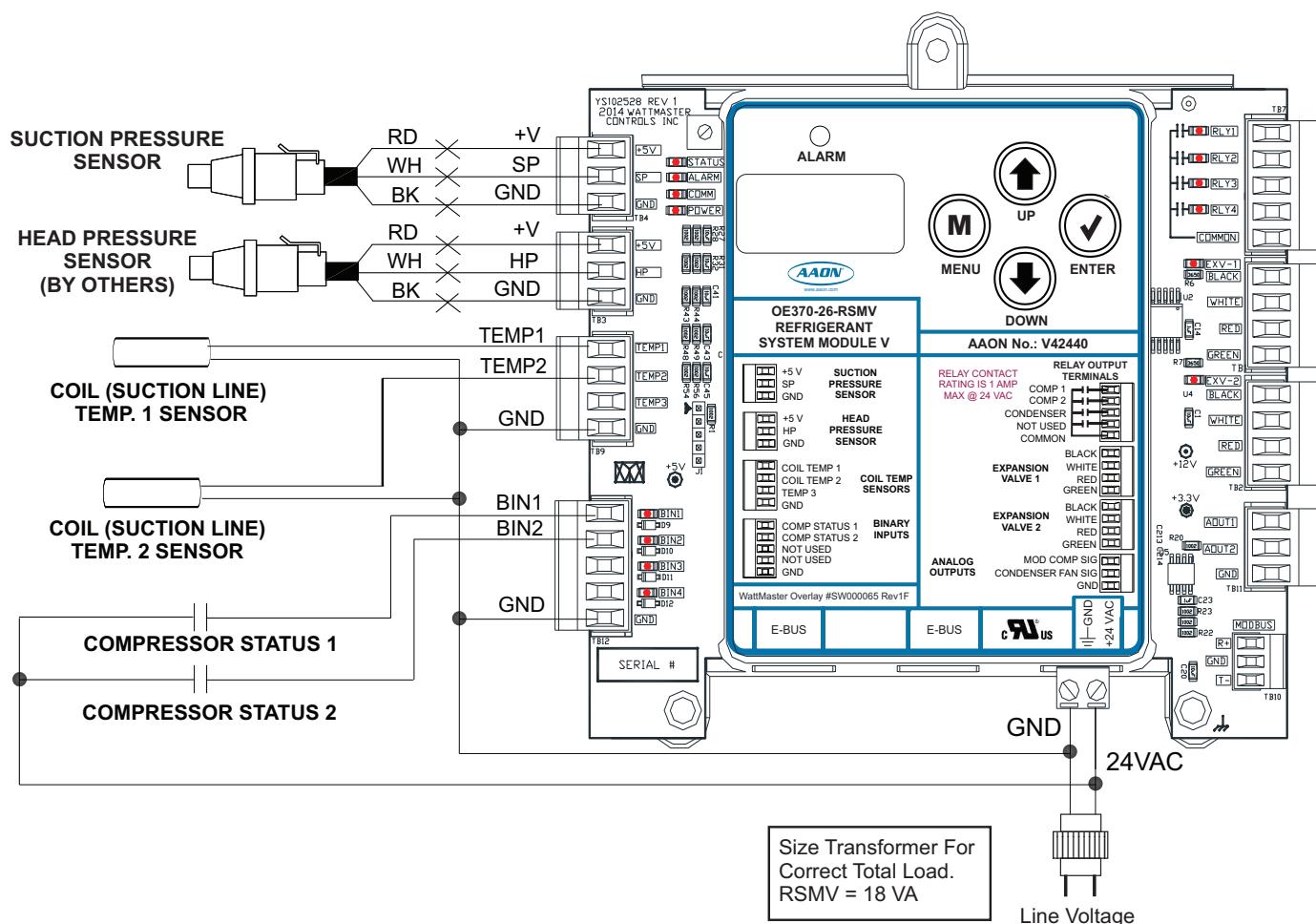


Figure 30: RSMV Inputs Wiring

REFRIGERANT SYSTEM MODULE WIRING

RSMV Inputs & Outputs Wiring

Suction Pressure Sensor Wiring

The OE275-01 Suction Pressure Transducer must be wired as shown in **Figure 31, below**. It is required for all compressorized VCC-X applications.

The Suction Pressure Sensor is used to measure suction pressure at the HVAC unit's DX evaporator coil suction line. This suction line pressure is converted to saturated refrigerant temperature by the RSMV Controller. This temperature is used by the RSMV to accurately control the Expansion Valves to maintain Superheat to provide optimum performance of the system. The saturated refrigerant temperature is used to properly control the compressors to maintain a given Suction Coil (Saturated) Temperature Setpoint. In Cooling and Heat Pump mode, the VCC-X resets the Suction Coil (Saturated) Temperature Setpoint to maintain a given supply air temperature setpoint. In Dehumidification mode, the Suction Coil (Saturated) Temperature Setpoint is a user configurable setpoint that does not reset.

CAUTION: The Shraeder port used for installation of the suction pressure transducer should be located in a vertical position of the suction line to prevent refrigerant oil from accumulating in the sensor.

Head Pressure Control

The RSMV can monitor a Head Pressure Transducer and control Condenser Fans to maintain a Head Pressure Setpoint. The Condenser Fan will be controlled with a 0-10 VDC output signal.

Coil Temperature Sensors

The Coil Temperature Sensors are used to measure Coil Temperature after each evaporator coil line. This temperature combined with the calculated saturated refrigerant temperature is used to calculate the Superheat of each individual evaporator coil. The Superheat is used to drive the Expansion Valves to maintain a given Superheat Setpoint.

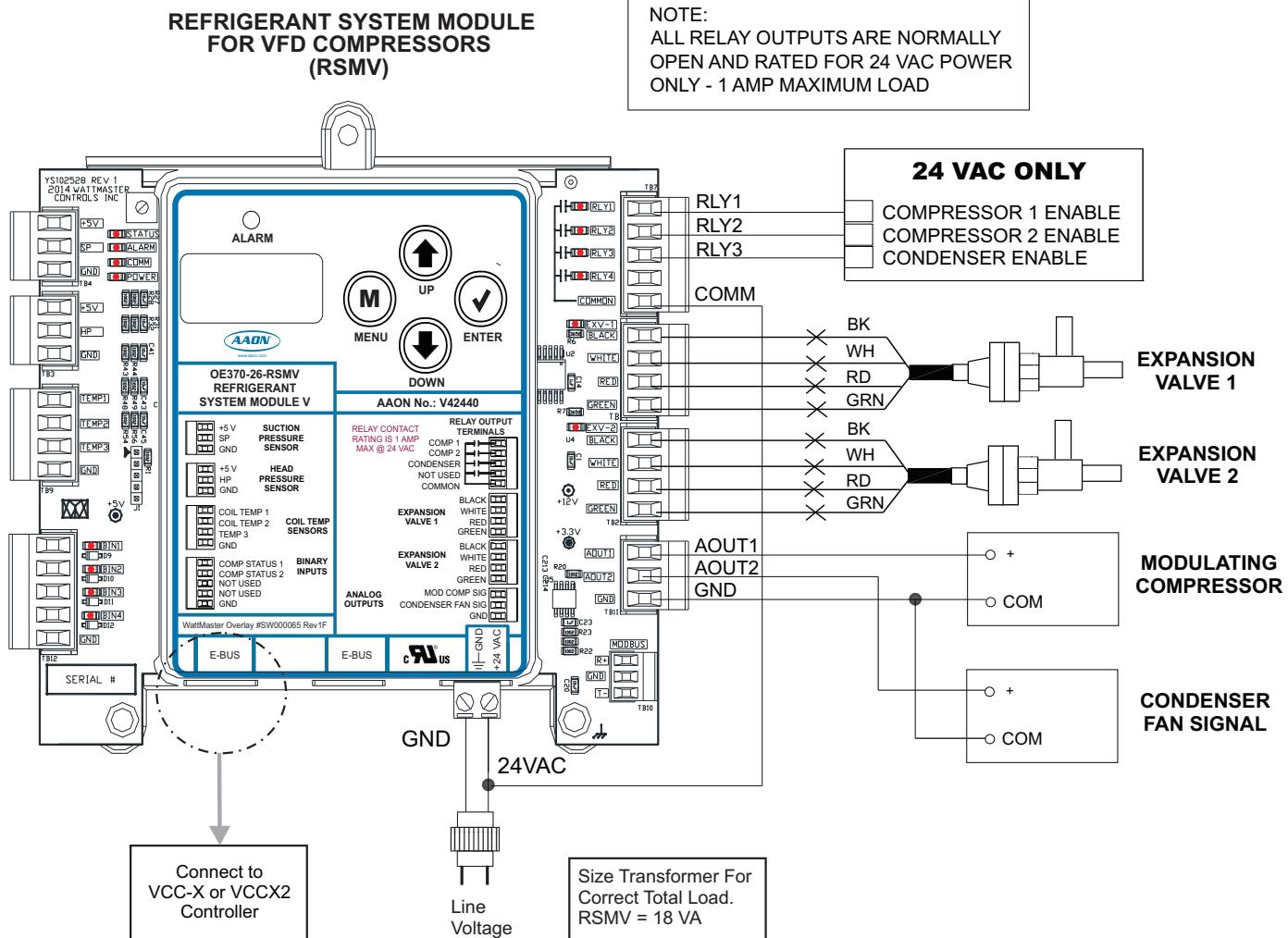


Figure 31: RSMV Outputs Wiring

REFRIGERANT SYSTEM MODULE WIRING

RSMD Inputs Wiring

Refrigerant System Module for Digital Compressors Wiring

The OE370-26-RSMD Refrigerant System Module for Digital Compressors (RSMD) can monitor and control up to two compressors and condensers. The compressors can be in either a tandem or non-tandem configuration. The module is designed for R410-A refrigerant.

The RSMD is connected to the VCC-X Controller. Up to 4 RSMD's can be connected, depending on the size of the system. There are 2 E-BUS Expansion Ports which allow the use of communicating sensors and the E-BUS Modules.

The RSMD provides 3 analog inputs, 4 binary inputs, 5 relays, and 2 analog outputs. See **Figure 32, below** for inputs wiring and **Figure 33, page 49** for outputs wiring.

Suction Pressure Sensor Wiring

The OE275-01 Suction Pressure Transducers must be wired as shown in **Figure 32, below**. It is typically required for all VCC-X applications.

The Suction Pressure Sensors are used to measure suction pressure at the HVAC unit's DX evaporator coil suction line. This suction line pressure is converted to saturated refrigerant temperature. The saturated refrigerant temperature is used to properly control the compressors to maintain a given Suction Coil (Saturated) Temperature Setpoint. In Cooling and Heat Pump mode, the VCC-X resets the Suction Coil (Saturated) Temperature Setpoint to maintain a given supply air temperature setpoint. In Dehumidification mode, the Suction Coil (Saturated) Temperature Setpoint is a user configurable setpoint that does not reset.

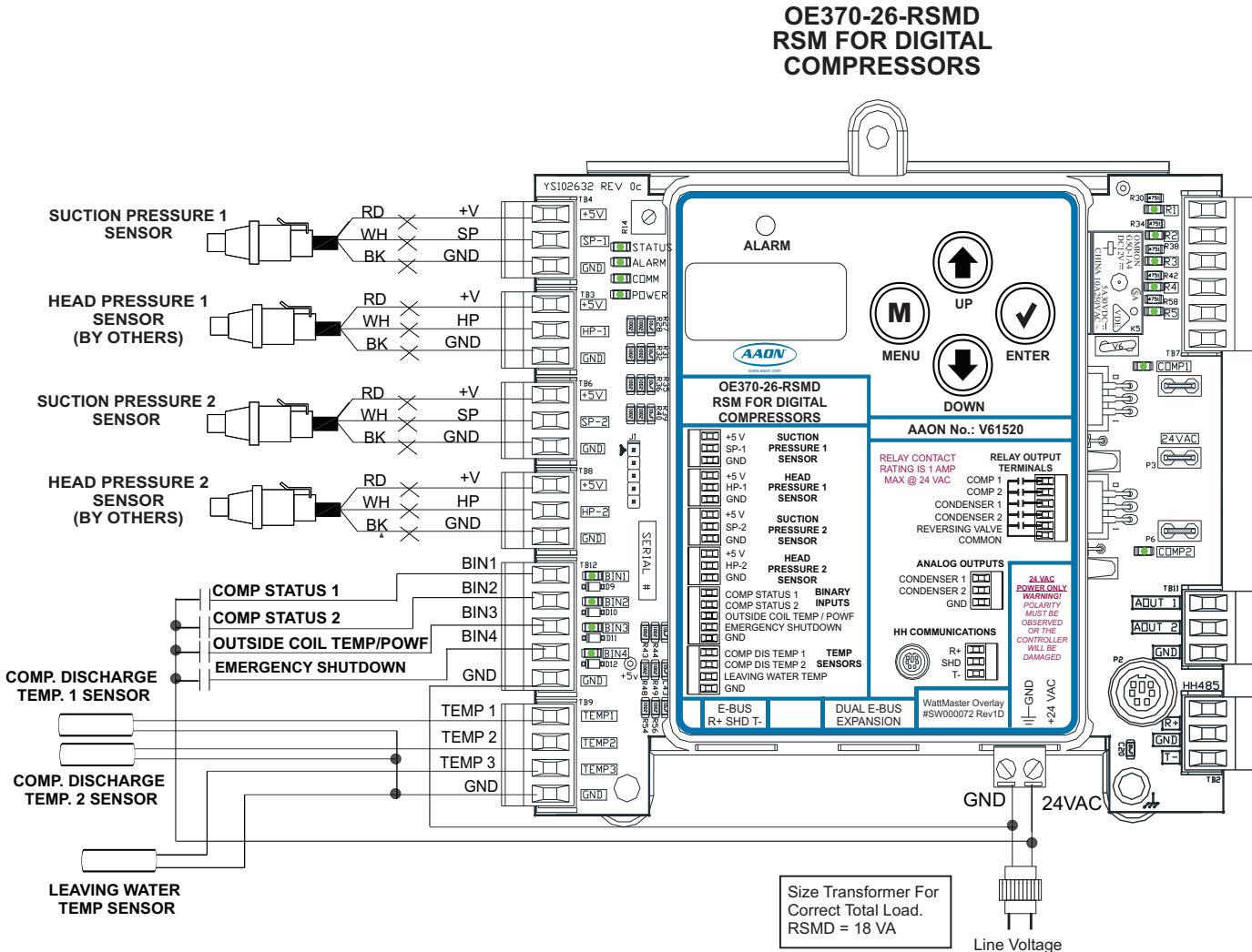


Figure 32: RSMD Inputs Wiring

REFRIGERANT SYSTEM MODULE WIRING

RSMD Outputs Wiring

CAUTION: The Shraeder port used for installation of the suction pressure transducer should be located in a vertical position of the suction line to prevent refrigerant oil from accumulating in the sensor.

Head Pressure Control

The Head Pressure Transducers are used to measure Head Pressure at the discharge line. This Head Pressure is used to drive the Condenser Fans with a 0-10 VDC output signal to maintain a given Head Pressure Setpoint.

Compressor Discharge Sensors

The Digital Compressor Discharge Temperature Sensor monitors the discharge temperature from the Digital Compressor to protect against overheating.

Leaving Water Temperature Sensor

The Leaving Water Temperature Sensor is used to measure the Leaving Water Temperature when used on a WSHP unit.

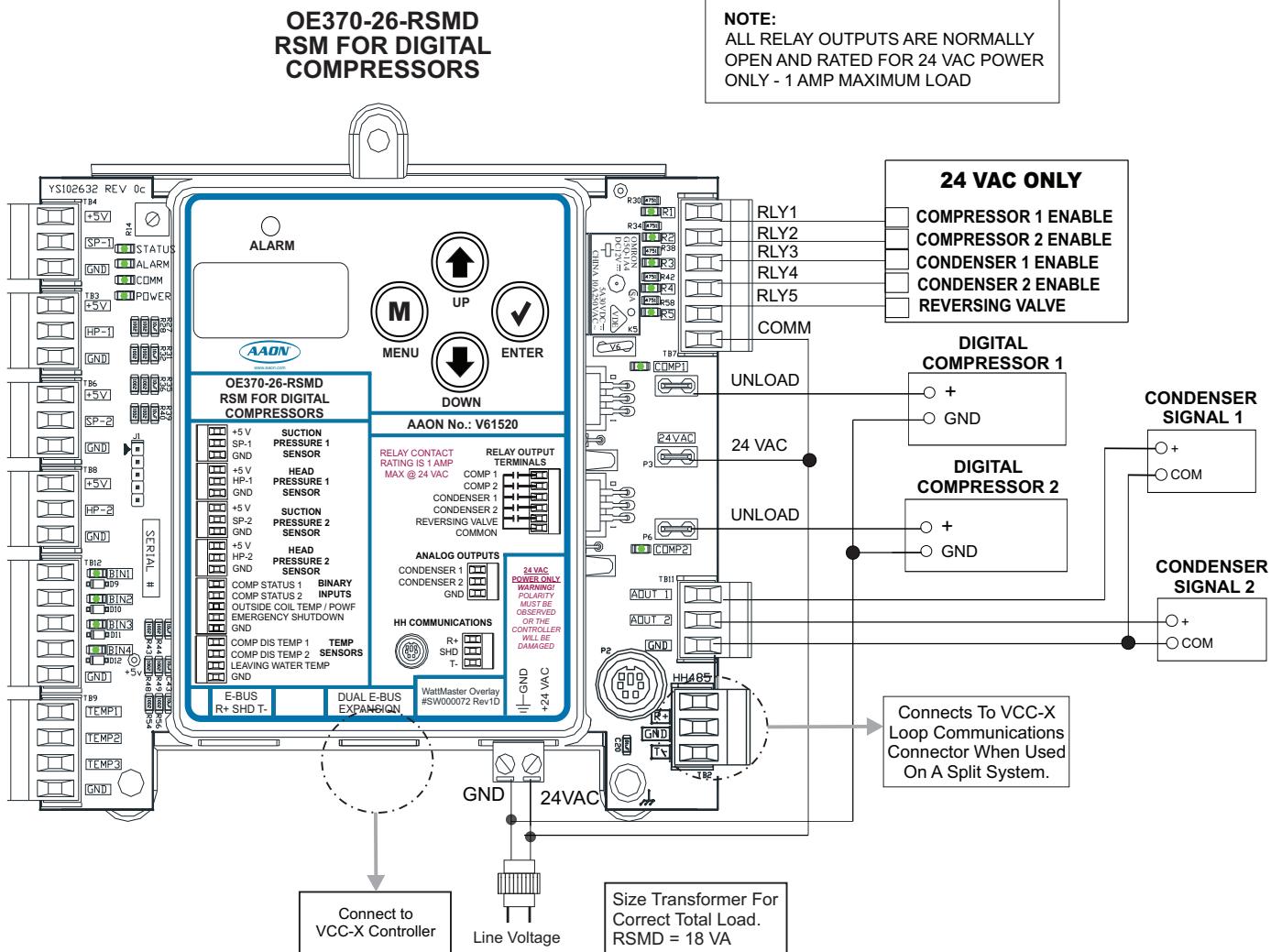


Figure 33: RSMD Outputs Wiring

REFRIGERANT SYSTEM MODULE WIRING

RSMV-HP Inputs Wiring

Refrigerant System Module for VFD Compressors - Heat Pump Wiring

The OE370-26-RSMV-HP Refrigerant System Module for VFD Compressors - Heat Pump (RSMV-HP) monitors and controls one refrigeration circuit of the HVAC unit. The module is designed for R410-A refrigerant.

The RSMV-HP is connected to the VCC-X Controller. Up to 4 RSMV-HP's can be connected, depending on the size of the system. There are 2 E-BUS Expansion Ports which allow the use of communicating sensors and the E-BUS Modules.

The RSMV-HP provides 6 analog inputs, 4 binary inputs, 4 relays, and 2 analog outputs. See **Figure 34, below** for inputs wiring and **Figure 35, page 51** for outputs wiring.

Suction Pressure Sensor Wiring

The OE275-01 Suction Pressure Transducer must be wired as shown in **Figure 34, below**. It is required for all compressorized VCC-X applications.

The Suction Pressure Sensors are used to measure suction pressure at the HVAC unit's DX evaporator coil suction line. This suction line pressure is converted to saturated refrigerant temperature. The saturated refrigerant temperature is used to properly control the compressors to maintain a given Suction Coil (Saturated) Temperature Setpoint. In Cooling and Heat Pump mode, the VCC-X resets the Suction Coil (Saturated) Temperature Setpoint to maintain a given supply air temperature setpoint. In Dehumidification mode, the Suction Coil (Saturated) Temperature Setpoint is a user configurable setpoint that does not reset.

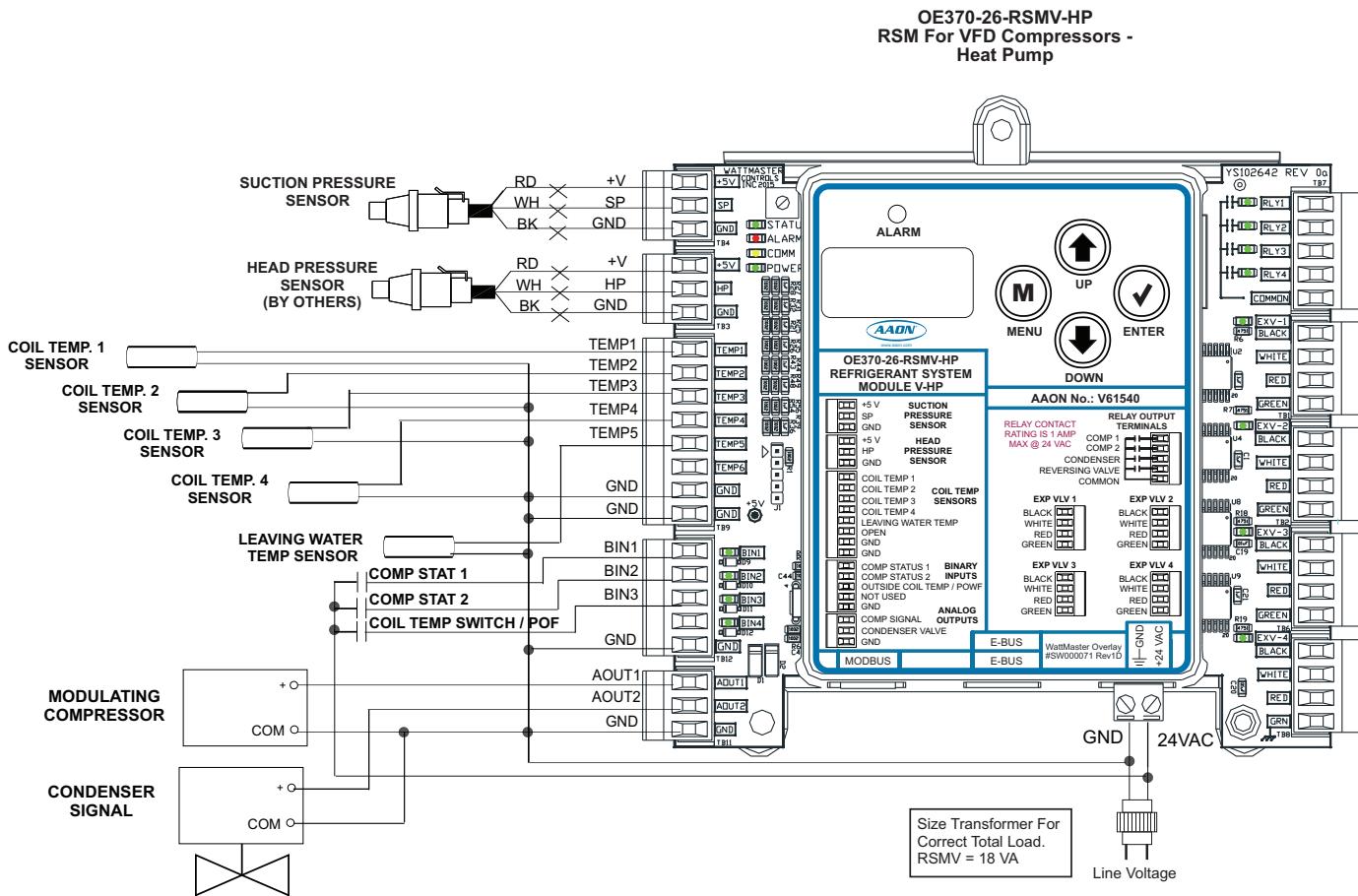


Figure 34: RSMV-HP Input Wiring

REFRIGERANT SYSTEM MODULE WIRING

RSMV-HP Outputs Wiring

CAUTION: The Shraeder port used for installation of the suction pressure transducer should be located in a vertical position of the suction line to prevent refrigerant oil from accumulating in the sensor.

Head Pressure Control

The RSMV-HP can monitor a Head Pressure Transducer and control Condenser Fans to maintain a Head Pressure Setpoint. The Condenser Fan will be controlled with a 0-10 VDC output signal. Head pressure control can also be used to modulate the water valve when configured as a water source heat pump. The water valve signal is 2-10 volts.

Coil Temperature Sensors

The Coil Temperature Sensors are used to measure Coil Temperature after each evaporator coil line. This temperature combined with the calculated saturated refrigerant temperature is used to calculate the Superheat of each individual evaporator coil. The Superheat is used to drive the Expansion Valves to maintain a given Superheat Setpoint.

Leaving Water Temperature Sensor

The Leaving Water Temperature Sensor is used to measure the Leaving Water Temperature when used on a WSHP unit.

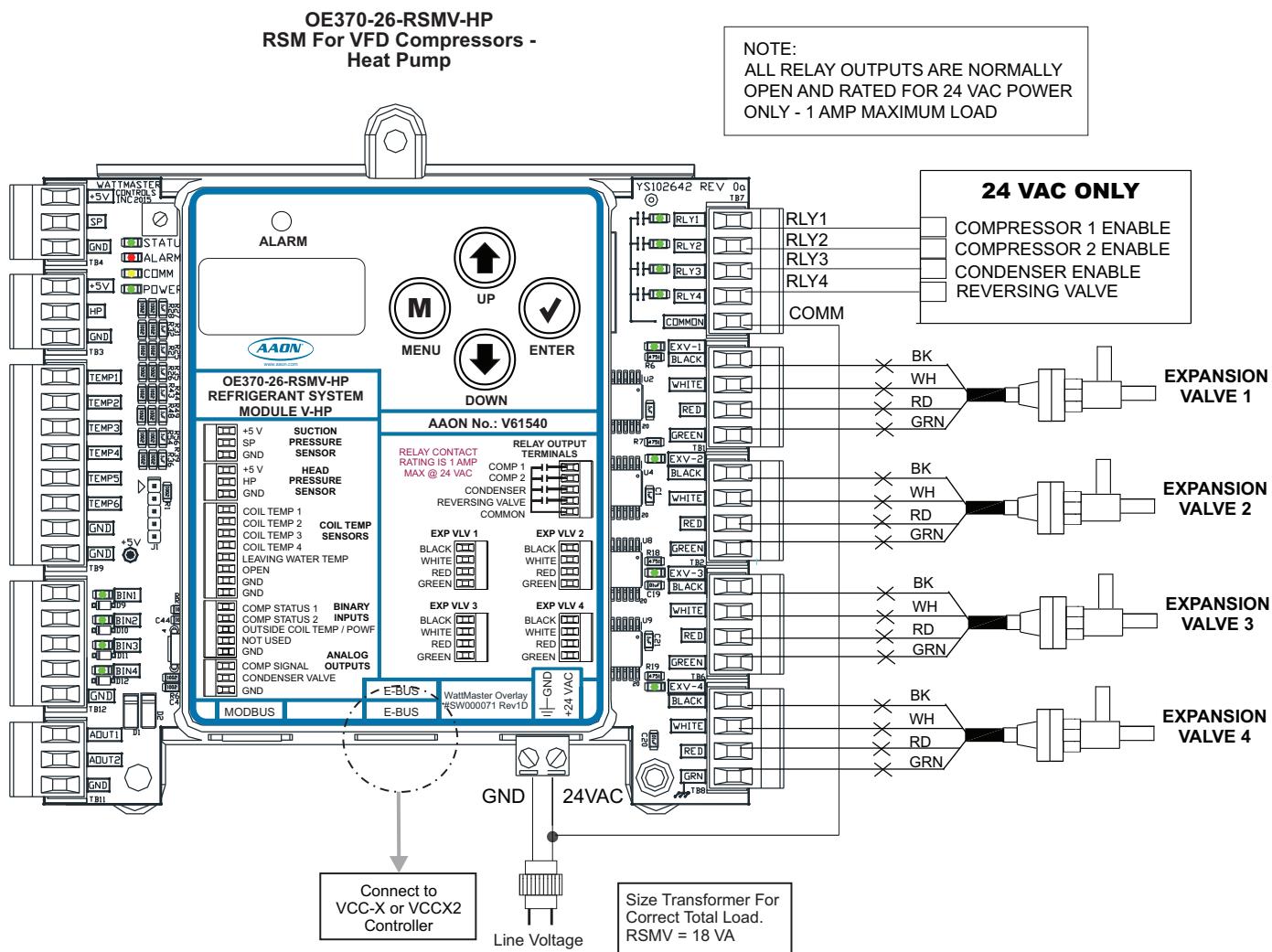


Figure 35: RSMV-HP Outputs Wiring

MHGRV-X CONTROLLER WIRING

MHGRV-X Controller Wiring

MHGRV-X Controller Wiring

The OE377-26-00059 MHGRV-X Controller (AAON part number V12100) is designed to control a Modulating Hot Gas Reheat Valve to maintain a desired Supply Air Temperature and Dehumidification setpoint. The MHGRV-X Controller directly connects to the VCC-X Controller or indirectly using an E-BUS Expansion Board via an EBC E-BUS cable. See **Figure 36**, below.

The following information will be passed between the MHGRV-X controller and the VCC-X Controller:

- Reheat Enable command
- Supply Air Temperature Setpoint
- The Reset Supply Air Temperature Setpoint

- The Supply Air Temperature Reset Signal
- If the communication is interrupted between the MHGRV-X Controller and the VCC-X Controller, the MHGRV-X controller will revert to stand-alone operation.

For more information, refer to the *MHGRV-X Controller Technical Guide*.

NOTE: Up to (7) Reheat Expansion Modules (OE377-01-00059) can be connected to the MHGRV-X Controller and to each other for additional Reheat Valve Control.

NOTE: If using multiple E-BUS Sensors or Modules, the E-BUS Hub or Adapter Board may be required.

MHGRV-X CONTROLLER (OE377-26-00059)

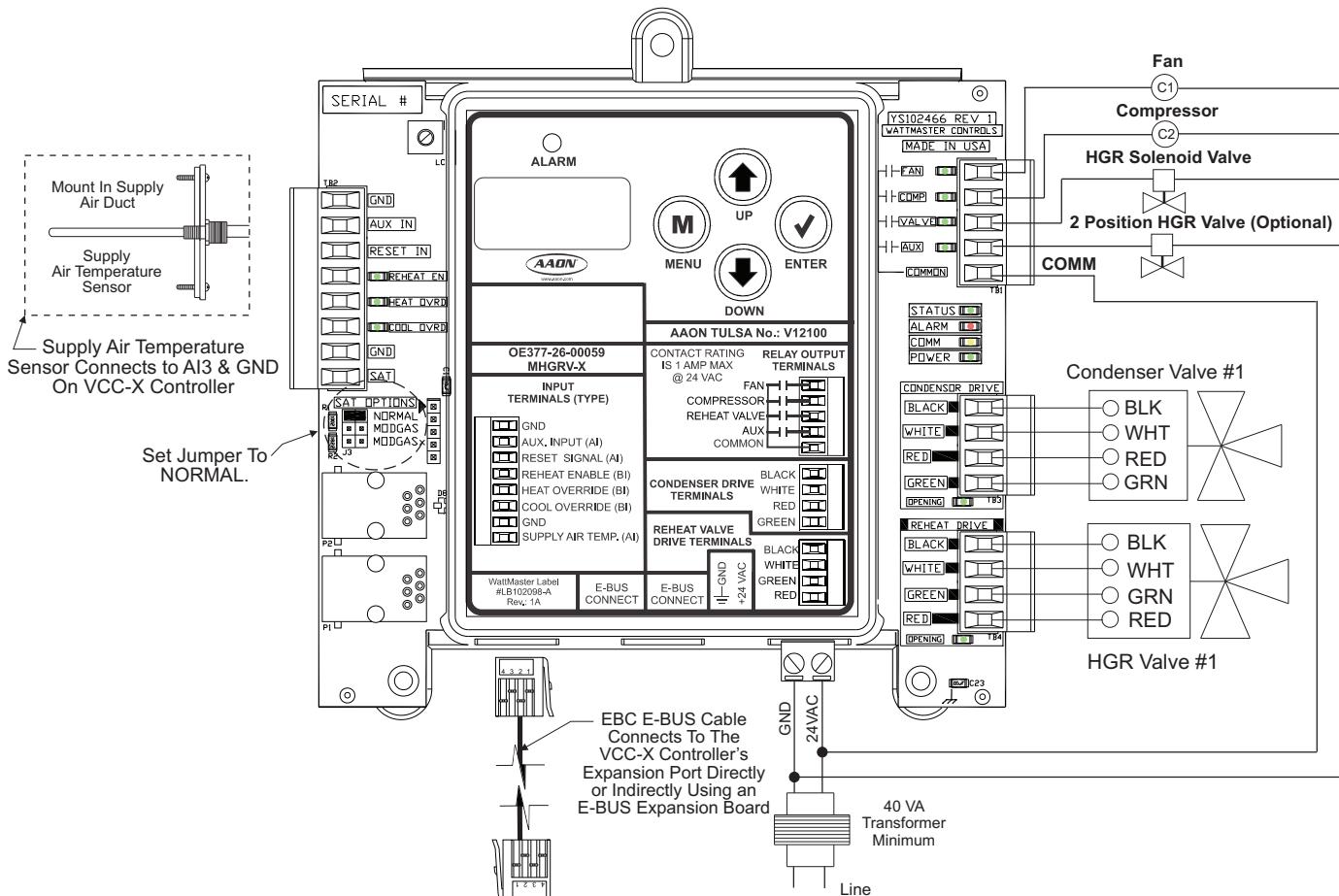


Figure 36: MHGRV-X Controller to VCC-X Controller Wiring

MODGAS-X Controller Wiring

The OE377-26-00058 MODGAS-X Controller (AAON Part No. V12090) is designed to modulate up to (2) gas valves to maintain a desired Discharge Air Temperature. It also controls the speed of the induced draft fan to maintain proper combustion in the heat exchanger. The MODGAS-X Controller directly connects to the VCC-X Controller or indirectly using an E-BUS Expansion Board via an EBC E-BUS cable. See **Figure 37**, below.

The following information will be passed between the MODGAS-X controller and the VCC-X Controller:

- Heat activation command
- Heating Discharge Setpoint

- The offset for the Supply Air Temperature Sensor
- High Limit Temperature Setpoint
- If the communication is interrupted between the MODGAS-X Controller and the VCC-X Controller, the MODGAS-X controller will revert to stand-alone operation.

For more information, refer to the *MODGAS-X Controller Technical Guide*.

NOTE: If using multiple E-BUS Sensors or Modules, the E-BUS Hub or Adapter Board may be required.

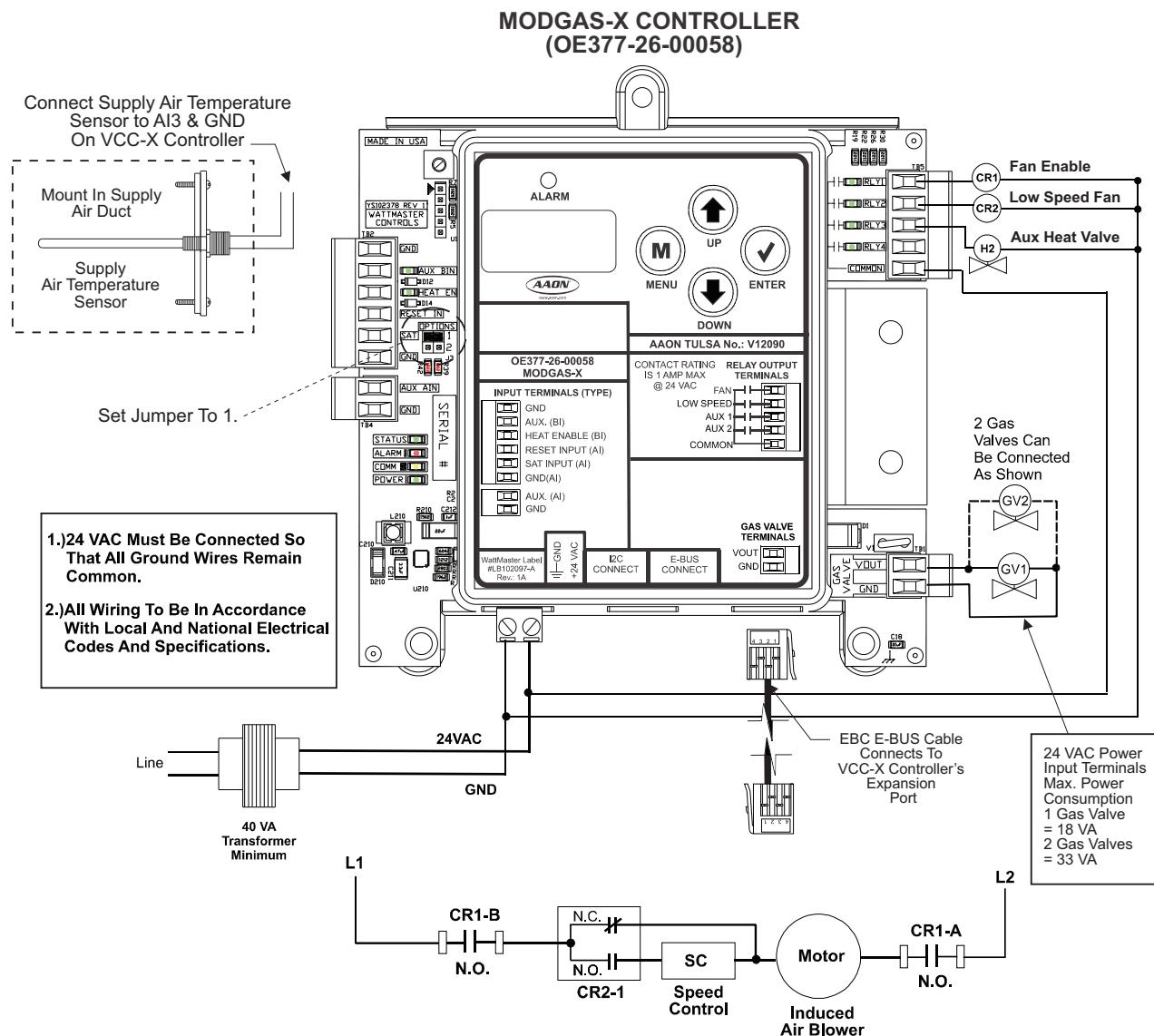


Figure 37: MODGAS-X Controller to VCC-X Controller Wiring Diagram

PREHEAT-X CONTROLLER WIRING

PREHEAT-X Controller Wiring

PREHEAT-X Controller Wiring

The OE377-26-00061 PREHEAT-X Controller (AAON Part No. V48510) is designed to control fixed stages of Preheat and optional modulating Preheat to maintain a desired Preheat Leaving Air Temperature Setpoint. The PREHEAT-X Controller directly connects to the VCC-X Controller or indirectly using an E-BUS Expansion Board via an EBC E-BUS cable. See **Figure 38, below** for wiring.

The following information will be passed between the PREHEAT-X Controller and the VCC-X Controller:

- Leaving Air Temperature Setpoint
- Entering Air Temperature Setpoint
- Preheat Enable Signal

- Leaving Air Temperature Status
- Entering Air Temperature Status
- Alarm Status
- If the communication is interrupted between the PREHEAT-X Controller and the VCC-X Controller, the PREHEAT-X controller will be disabled.

For more information, refer to the *PREHEAT-X Controller Technical Guide*.

NOTE: If using multiple E-BUS Sensors or Modules, the E-BUS Hub or Adapter Board may be required.

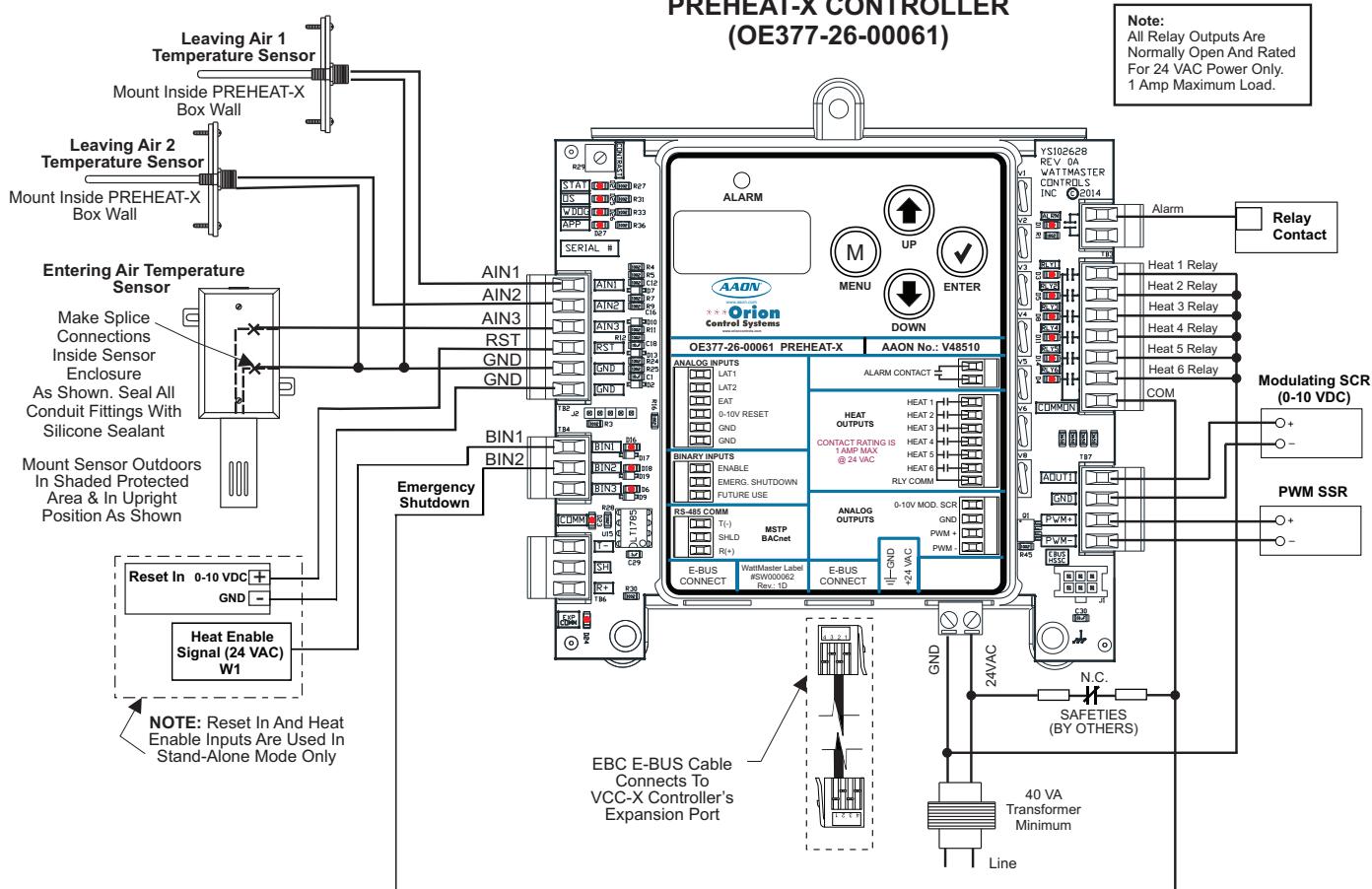


Figure 38: PREHEAT-X Controller to VCC-X Controller Wiring

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 correctly address the controller and 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 VCC-X Controller requires 8 VA of power delivered to it at 24 VAC. You may use separate transformers for each device (preferred) or power several devices from a common transformer. If several devices are to be powered from a single transformer, correct polarity must be followed.

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 that all sensors required for your system are mounted in the appropriate location and wired into the correct terminals on the VCC-X Controller.

After all the above wiring checks are complete, apply power to the VCC-X Controller.

Configuring the Controller

The next step is configuring the controller for your specific requirements. In order to configure the VCC-X Controller, you must use an operator interface. Four different operator interfaces are available for programming and monitoring of the VCC-X Controller. See **Figure 39**. They are as follows:

- Modular Service Tool SD
- Modular System Manager SD
- Computer with Prism 2 Software & CommLink 5 Installed
- System Manager TS-L (Touch Screen - Limited Access)

Any of these devices or a combination of them can be used to access the status, configuration, and setpoints of any controller on your communications loop.

If using the Modular Service Tool SD or the Modular System Manager SD for programming, refer to the *VCC-X Operator Interface SD Technical Guide*. If using a computer and the Prism 2 software for programming, refer to the *Prism 2 Technical Guide*. If using the System Manager TS-L for monitoring, please see the *System Manager TS-L Technical Guide*.

No matter which operator interface you use, we recommend that you proceed with the programming and setup of the VCC-X Controller in the order that follows:

1. Configure the Controller for your application.
2. Program the Controller setpoints.
3. Program the Controller operation schedules.
4. Set the Controller current time and date.
5. Review Controller status screens to verify system operation and correct Controller configuration.

NOTE: For BACnet® Configuration, see **Appendix C, page 91**.



Figure 39: Modular Service Tool SD, Modular System Manager SD, and Prism 2 Graphical Software Operator Interfaces

INPUTS & OUTPUTS

VCC-X Controller & EM1 Module Input/Output Maps

Input/Output Map

See **Table 2** for VCC-X Controller Input/Outputs and **Table 3** for VCC-X EM1 Inputs/Outputs. For the RSM Module Input/Output tables, please see each individual *RSM Module Technical Guide*.

VCC-X CONTROLLER	
Analog Inputs	
1	Space Temperature (AI1)
2	Space Slide Offset (AI2)
3	Supply Air Temperature (AI3)
4	Return Air Temperature (AI4)
5	Building Pressure (AI5)
6	Supply Air Temperature Reset (AI6)
7	Outside Air Temperature (AI7)
8	Static Pressure (Phone Jack)
Binary Inputs	
1	Proof of Flow (BIN1)
2	Dirty Filter (BIN2)
3	Hood On/Off (BIN3)
4	Remote Forced Occupied (BIN4)
5	Remote Forced Cooling (BIN5)
6	Remote Forced Heating (BIN6)
7	Remote Forced Dehumidification (BIN7)
8	Emergency Shutdown (BIN8)
Analog Outputs (0-10 VDC)	
1	Main Supply Fan VFD (AOUT1)
2	Economizer (Outdoor Air Damper) (AOUT2)
3	Modulating Heating (Hot Water, Steam, or SCR) (AOUT3)
4	Exhaust Fan VFD / Building Pressure Control Signal (AOUT4)
Binary Outputs (24 VAC)	
1	Fan Relay (RLY1)
2	Configurable Relay (RLY2)
3	Configurable Relay (RLY3)
4	Configurable Relay (RLY4)
5	Configurable Relay (RLY5)
6	Configurable Relay (RLY6)
7	Configurable Relay (RLY7)
8	Configurable Relay (RLY8)

Table 2: VCC-X Controller Inputs & Outputs

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

1. E-BUS Digital Room Sensor - LCD Display - Temp Only or Temp & Humidity
2. E-BUS Digital Room Sensor - No LCD Display - Temp & Humidity
3. E-BUS Space and Return Air CO₂ Sensors
4. E-BUS connection to EBTRON, GreenTrol and Paragon Air Flow Stations
5. E-BUS Outside Air Temperature & Humidity Sensor

Table 2, cont.: VCC-X Controller Inputs & Outputs

VCC-X EM1 EXPANSION MODULE	
Analog Input (Configurable 2-10 VDC)	
1	Economizer Actuator Feedback (SIG3)
Analog Outputs (0-10 VDC)	
1	Chilled Water (AOUT1)
2	Return Air Damper (AOUT2)
3	Return Air Bypass (AOUT3)
Binary Outputs (24 VAC)	
1	Configurable Relay (R1)
2	Configurable Relay (R2)
3	Configurable Relay (R3)
4	Configurable Relay (R4)
5	Configurable Relay (R5)

Table 3: VCC-X EM1 Inputs & Outputs

VCC-X Controller Inputs

AI1 - Space Temperature Sensor Input

The Space Temperature Sensor will initiate 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 will detect user overrides and switch 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 SAT Reset Source, the Slide Adjustment adjusts both the HVAC Mode Enable Heating and Cooling Setpoints and the SAT Reset Source Heating and Cooling Setpoints simultaneously by a user-configurable maximum amount.

AI3 - Supply Air Temperature (SAT) Sensor Input

Once the unit is in the Heating or Cooling Mode (based on the temperature at the mode enable sensor), the unit will control the staging or modulation of the heating or cooling sources to maintain a Heating or Cooling SAT Setpoint. The HVAC unit must always have a SAT Sensor installed.

AI4 - Return Air Temperature Sensor Input

If you want 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 you wish to configure the VCC-X 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 will activate the Exhaust Fan any time the Building Pressure is above the Building Pressure Setpoint.

AI6 - Remote Supply Air Temperature Reset Signal

If a Remote SAT 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 SAT Setpoint. See the SAT Reset section in the Sequence of Operations for more details.

AI7 - Outdoor Air Temperature Sensor Input

The Outdoor Air Temperature is used to lock out Heating or Cooling to conserve energy at whatever temperature you deem appropriate 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 Pre-Heater operation and for Low Ambient Protection operation.

NOTE: For AI1, AI3, AI4 & AI7, all Temperature Sensors must be Thermistor Type III which provide 77.0°F @ 10K Ohms Resistance.

AI8 - Duct Static Pressure Sensor Input

This phone 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 you have configured the HVAC unit for Constant Volume operation, this sensor is optional. If it is installed on a Constant Volume unit, it can be used for filter loading VFD control or used for a status-only reading.

BIN1 - 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.

BIN2 - 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.

BIN3 - Hood On/Off Input

When this wet contact input closes (Hood On), the VCC-X 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.

BIN4 - Remote Forced Occupied Mode Input

When this wet contact input closes, it will force the VCC-X Controller into the Occupied Mode. When the Remote Forced Occupied Signal is removed, the controller will revert to the Unoccupied Mode of operation if no internal or external schedule has been configured or is in effect when this occurs.

INPUTS & OUTPUTS

VCC-X Controller Inputs & Outputs

NOTE: If Remote Forced operation is used, it must apply to Cooling, Heating, and Dehumidification. The unit must be configured for Mode Set By Remote Contact.

BIN5 - Remote Forced Cooling Mode Input

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

BIN6 - Remote Forced Heating Mode Input

A wet contact closure on this input is used to provide a means for another BAS or control device (by others) to force the unit into Heating Mode.

BIN7 - Remote Forced Dehumidification Input

A wet contact closure on this input is used to provide a means for another BAS or control device (by others) to force the VCC-X Controller into Dehumidification Mode.

BIN8 - Emergency Shutdown Input

This wet contact input is used to initiate shutdown of the HVAC unit when a N.C. 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 you provide dry contacts, the contact closure will not be recognized. All Binary Inputs are optional. This means that you must configure the VCC-X Controller to recognize these input signals.

Finally, this output can be used to control the Outdoor Air Damper during Reverse Acting Building Pressure Control to maintain a Building Pressure Setpoint.

AOUT3 - 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.

AOUT4 - 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 VCC-X Controller will use the outputs specific to those devices. On the main VCC-X Controller, AOUT2 would control the Outdoor Air Damper and AOUT4 would control the Supply Fan VFD to maintain the Building Pressure Setpoint.

Alternatively, this AOUT4 output will mirror those outputs and can be used as well.

R1 - Supply Fan (Enable)

This is a non-configurable output.

R2-R8 - User-Configurable Relays

These relays are configurable by the user. For all the available configuration options, see **Table 4**.

VCC-X Controller Outputs

AOUT1 - Main Supply Fan VFD 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.

AOUT2 - Economizer (Outdoor Air Damper) 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 the Occupied Mode when the Outdoor Air Temperature is not suitable for Economizer Cooling purposes. This minimum position can be reset based on CO₂ override conditions.

This output is also used to control the Outdoor Air Damper based on an Outdoor Air Flow Setpoint if using an Outdoor Airflow Monitoring station. This position can be overridden during Economizer Control.

VCC-X EM1 Expansion Module**SIG3 - Economizer Feedback**

If Title 24 Economizer operation has been configured, this input will be used for the 2-10 VDC Feedback Signal from the Economizer actuator.

AOUT1 - 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 can be configured with a user-adjustable voltage range of operation which can be set up to provide either direct or reverse acting operation.

AOUT2 - Return Air Damper Actuator Signal

This output signal is a Direct Acting 0-10 VDC output signal that is used to modulate a Return Air Damper Actuator in conjunction with a Return Air Bypass Damper Actuator for AAON® PAC or DPAC control applications.

AOUT3 - Return Air Bypass Damper Actuator Signal

This output signal is a Direct Acting 0-10 VDC output signal that is used to modulate a Return Air Bypass Damper Actuator in conjunction with a Return Air Damper Actuator for AAON® PAC or DPAC control applications.

R1-R5 - User-Configurable Relays

These relays are configurable by the user. For all the available configuration options, see **Table 4**, below.

E-BUS 12-Relay Expansion Module

Please refer to the user-configurable relays in **Table 4**, below for relay definitions.

No.	Relay Description	Details
1	Cooling Stage	Configured for each fixed stage of cooling (except heat pump compressor). Do not configure if using Refrigerant System Modules.
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	Pre-Heat	Configure for Pre-Heat operation. Only operates in the Occupied Mode.
10	Low Ambient	Configure for Low Ambient operation. Operates in both Occupied and Unoccupied Modes.
11	Exhaust Fan	Configure (1) Relay for enabling exhaust 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.
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 VCC-X alarm is active.
17	Liquid Line 1 Solenoid - EXV 1	If configured, this relay energizes when Compressor A1 activates.
18	Liquid Line 2 Solenoid - EXV 2	If configured, this relay energizes when Compressor A2 activates.
19	Liquid Line 3 Solenoid - EXV 3	If configured, this relay energizes when Compressor B1 activates.
20	Liquid Line 4 Solenoid - EXV 4	If configured, this relay energizes when Compressor B2 activates.

Table 4: User-Configurable Relay Outputs

SEQUENCE OF OPERATIONS

Supply Fan & Occupied/Unoccupied Operation

Supply Fan Operation

Anytime the Supply Fan is requested to start, a 1 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.

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

The Supply Fan will cycle on a call for Heating, Cooling, or Dehumidification.

HVAC Source Configuration Options

The VCC-X 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.

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.

HVAC Mode Set by Remote Contact Input—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.

Occupied/Unoccupied Mode of Operation

The VCC-X 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

Forced Schedule

The VCC-X Controller can be forced into the Occupied Mode by inputting a Forced Schedule from any operator interface.

Remote Forced Occupied Signal

This Forced Occupied input can be used in place of, or in conjunction with, the internal VCC-X Schedule. When this wet contact input closes, it will force the VCC-X Controller into the Occupied Mode. When the Remote Forced Occupied Signal is removed, the controller will revert to the Unoccupied Mode of operation, or if an internal VCC-X schedule is also being used, it will revert back 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 savings configuration.

Broadcast Schedule

Eight external broadcast schedules are available with 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 will occur 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.

HVAC Modes of Operation

There are 8 possible HVAC Modes of Operation. They are as follows:

- Cooling Mode
- Heating Mode
- Vent Mode
- Dehumidification Mode
- Purge 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 (OAT) falls 1° below the Cooling Lockout Setpoint and will remain disabled until the OAT rises 1° above the Cooling Lockout Setpoint. If the OAT 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 (see Economizer section).

Cooling with the Refrigerant System Modules (RSMs)

On units with digital or VFD compressors, the VCC-X Controller will utilize one or more Refrigerant System Modules (RSMs). Units with only fixed staged compressors that are doing dehumidification or that require head pressure control would also utilize an RSM. Each RSM will control the compressors, condensers, and EXVs (on Bitzer VFD compressor units) for one or two refrigeration circuits. Up to four RSMs may be used in controlling up to eight circuits.

The RSMD is used for digital compressor units, including heat pumps. The RSMV is used for Bitzer VFD compressor units (non heat pumps). The RSMV-HP is used for Bitzer VFD compressor units that are heat pumps. The RSMVC is used for Copeland VFD compressor units.

In the Cooling Mode, as the Supply Air Temperature (SAT) rises above the Active Cooling SAT Setpoint (see the Supply Air Temperature Reset section for explanation), 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 (adj.) before it is allowed to energize, and successive stages are subject to a Cooling Stage Up Delay (adj.).

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 (adj.) before it is allowed to stage off and successive stages are subject to a Cooling Stage Down Delay (adj.).

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

Staged Cooling without the Refrigerant System Modules (RSMs)

On units with fixed stage compressor that are not doing dehumidification and that do not require head pressure control, or on units with On/Off Chilled Water, an RSM will not be used.

In the Cooling Mode, as the Supply Air Temperature (SAT) rises above the Active Supply Air Cooling Setpoint (see Supply Air Temperature Setpoint Reset section for explanation), cooling will begin to stage on. Each stage must meet its Minimum Off Time (adj.) before it is allowed to energize, and successive stages are subject to a Cooling Stage Up Delay (adj.).

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 (adj.) before it is allowed to stage off and successive stages are subject to a Cooling Stage Down Delay (adj.).

Modulating Chilled Water Cooling Control

In the Cooling Mode, as the Supply Air Temperature (SAT) rises above the Active Supply Air Cooling Setpoint (see Supply Air Temperature Setpoint Reset section for explanation). 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 °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.

SEQUENCE OF OPERATIONS

Economizer Operation & Dehumidification

Economizer Operation

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

The Economizer acts as the 1st 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% 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 (VAV Tempering)”. See that section for more details. During Unoccupied Mode, the Economizer can be used for night setback free cooling; otherwise it will remain closed.

IAQ (CO₂) Override of the Economizer simply resets the Economizer Minimum Position higher. See IAQ (CO₂) Control Operation section for more details.

If utilizing the Title 24 Economizer option, an Economizer feedback signal (0-10 VDC) can be wired into the VCCX-EM1 Expansion Module for status monitoring. Several Title 24 alarm conditions can also be annunciated and are listed in the Alarms section of this manual.

Dehumidification Mode

On VAV, CAV, Single Zone VAV, and High Percentage Outdoor Units with Space Temperature Control, the Dehumidification Mode is initiated when the Indoor Humidity rises above the Indoor Humidity High Reset Source Setpoint. The unit will leave the Dehumidification Mode when the humidity falls below the Indoor Humidity 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%. The unit will leave the Dehumidification Mode when the humidity falls 2% below this setpoint. The Outdoor Air Dewpoint is calculated using the Outdoor Air Temperature and the Outdoor Air Humidity

There is no Dehumidification allowed during Heat Mode on a Water Source Heat Pump unit.

NOTE: Configuring the controller with Outdoor Air (OA) Temperature as the Mode Enable Sensor, but with Space or Return Humidity as the source to initiate Dehumidification will result in the controller comparing the Indoor Humidity to the OA Dewpoint Setpoint

instead of the Space Humidity Setpoint for Dehumidification. So, that combination typically should not be selected. In most cases, instead of this mix of indoor and outdoor operation, the MUA unit could be configured for Space Temperature Control of a High Percentage Outdoor Air Unit. See that section of the Sequence of Operations for more details.

There are four configuration options for Dehumidification operation.

In 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.

In 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.

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 OA damper remains closed in the Unoccupied Mode.

In 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.

In 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 since you never want humidity to get out of control.

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 OA damper remains closed in the Unoccupied Mode.

NOTE: Compressor operation is subject to the Outdoor Air Temperature Cooling Lockout during Dehumidification.

Dehumidification Operation on DX Compressor Units

Any DX unit doing dehumidification will utilize one or more Refrigerant System Modules (RSMs). Each RSM will control the compressors, condensers, and EXVs (on Bitzer VFD compressor units) for one or two refrigeration circuits. Up to four RSMs may be used in controlling up to eight circuits.

Reheat and Return Air Bypass Damper Control

The RSMD is used for digital compressor units, including heat pumps. The RSMV is used for Bitzer VFD compressor units (non heat pumps). The RSMV-HP is used for Bitzer VFD compressor units that are heat pumps. The RSMVC is used for Copeland 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.

SAFETY: 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.

Dehumidification Operation on Chilled Water Units

For Chilled Water units, the VCC-X controller will open the Chilled Water valve to a fixed 100% position to provide full moisture removal capability.

Reheat

During the Dehumidification Mode, the VCC-X 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 (see the Supply Air Temperature Setpoint Reset section for further explanation) 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 Modulating Hot Gas Reheat Controller (MHGRV-X), then 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 SAT is less than the SAT 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 or a Heat Source located in the Supply Air Duct can be used for Reheat if the unit is not equipped with Hot Gas Reheat or to supplement Hot Gas Reheat. Please read the warning that follows regarding applications that operate Heating and Cooling simultaneously.

WARNING: Simultaneous Heating and Cooling cannot be approved unless the HVAC unit has been specifically designed for this purpose. A Special Price Authorization (SPA) must be obtained from the AAON® factory for these applications to avoid warranty and/or rating problems. WattMaster Controls Inc. assumes no liability for any Simultaneous Heating and Cooling application if a SPA is not obtained from the AAON® Factory at the time the HVAC unit is ordered.

When Heating is used for Reheat instead of Hot Gas Reheat, the VCC-X can activate the Heat Source(s) discussed in the Heating Mode section. When Heating is used to supplement Hot Gas Reheat, the VCC-X restricts the Heating to one form of Modulating Heat or one stage of Gas or Electric Heat.

Coil Suction (Saturated) Temperature Reset

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

Return Air Bypass Damper Control

The Return Air Bypass (RAB) Damper is only used on constant air volume units with space temperature configured as the HVAC Mode Enable sensor. The RAB 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 RAB Damper needs to be at 100% before the modulating Hot Gas Reheat can be used. The RAB Damper modulates from 0-100% as the Space Temperature falls below the Cooling Setpoint. When the Space Temperature is equal to the Cooling Setpoint, the RAB Damper will be at 0%. When the Space Temperature falls to halfway between the Cooling and Heating Setpoints, the RAB 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 RAB 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 RAB Damper opens is to allow more air to bypass the evaporator coil through the RAB Damper. If you want more air to pass through the RAB Damper, enter a larger number in the Return Air Damper Factor setpoint. If you want less air to pass through the RAB Damper, enter a smaller number in the Return Air Damper Factor setpoint.

SEQUENCE OF OPERATIONS

Heating Mode, Ventilation Mode & Off Mode

Heating Mode

Available heating options are Staged Gas, Modulating Gas, Staged Electric, On/Off Hot Water, Modulating Hot Water, and Modulating SCR Electric.

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.

In the Heating Mode, as the Supply Air Temperature falls below the Active Supply Air Heating Setpoint (see Supply Air Temperature Setpoint Reset section for explanation), the heating will begin to stage on or to modulate. Each stage must meet its Minimum Off Time (adj.) before it is allowed to energize, and successive stages are subject to a Heating Stage Up Delay (adj.).

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 (adj.) before it is allowed to stage off, and successive stages are subject to a Heating Stage Down Delay (adj.).

Mechanical heating is disabled if the Outdoor Air Temperature (OAT) rises 1° above the Heating Lockout Setpoint and will remain disabled until the OAT falls 1° below the Heating Lockout Setpoint. If the OAT 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 VCC-X 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 AOUT3 on the VCC-X Controller with a user-adjustable voltage range between 0-10 VDC. Modulating Gas, which is controlled by the ModGas-X Controller, is not included in this section. Whichever form of Modulating Heating is used, the VCC-X 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 °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.

Hot Water Coil Protection

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 back 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 ten 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 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.

Primary and Secondary Heating

The VCC-X can activate two forms of Heating, which are classified as Primary and Secondary Heat Sources. The following section describes that operation.

Primary Modulating Heat with Secondary Staged Heat

The Modulating Heat source can be ModGas, 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 operate as described above to 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.

Ventilation 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.

Remote Contact Control, Space Sensor, Morning Warm-Up/Cool-Down**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. Space Sensor Operation

VCC-X Remote Contact Control

A Remote Contact Control option can be configured on the VCC-X 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 VCC-X Controller. This is a single configuration option that applies to all three modes. When using this Remote Contact Control, configure the Outdoor Air Sensor as the controlling sensor.

If both the Forced Heating and Forced Cooling inputs are inactive or if both are simultaneously active, then the unit is in a Vent mode (neutral) 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 just 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 you have configured. The four configuration options are described in the Dehumidification Mode section on [page 62](#).

Space Sensor Operation

Space Sensors are available as a Plain Sensor, Sensor with Override, Sensor with Setpoint Slide Adjust, and Sensor with Override and Setpoint 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 Setpoint Slide Adjust can be programmed to allow Space Setpoint adjustment of up to $\pm 10^\circ \text{ F}$.

If the Space Temperature is the SAT/Reset Source, then the Slide Adjust will adjust the HVAC Mode Enable Setpoints and the SAT/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 3 seconds) for a user-defined override duration of up to 8.0 hours. Pressing the button between 3 to 10 seconds cancels the override.

IAQ (CO_2) Control Operation

If you have configured the VCC-X Controller 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 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 will begin to be reset higher. The Economizer Minimum Position 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 will be reset to the Maximum Reset Position.

3. The Maximum Reset Position Setpoint is the highest the Economizer Minimum Position 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.

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 VCC-X Controller is configured for Morning Warm-Up and switches to the Occupied Mode of Operation (not Override or a Forced Mode from an Operator Interface Device), the unit compares the Return Air Temperature to a Morning Warm-Up/Morning Cool-Down 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 you have stand-alone VAV boxes that need to be forced wide open during the Warm-Up Mode, you can 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 VCC-X Controller is configured for Morning Cool-Down and switches to the Occupied Mode of Operation (not Override or a Forced Mode from an Operator Interface Device), the unit compares the Return Air Temperature to a Morning Warm-Up/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.

SEQUENCE OF OPERATIONS

Single Zone VAV & Supply Air Temperature Reset

This Mode remains in effect until the Return Air Temperature drops below the Target Temperature or a user-adjustable Time Period expires. Cool-Down 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 you have stand-alone VAV boxes that need to be forced wide open during the Cool-Down Mode, you can 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.

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, Heating, or Vent Mode of operation.

Whenever the unit is in CO₂ override operation of the Outdoor Air Damper, the minimum VFD Fan Speed is forced to 75% and can modulate up from there.

If the Hood On/Off operation is used on a SZ 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 still control to maintain the Space Temperature Setpoints.

Single Zone VAV

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 determines the heating or cooling mode of operation. Heating and cooling are enabled and disabled as described previously in the Heating and Cooling sections.

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 VAV 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) and Heating will occur as described in the Heating Section of this sequence.

Supply Air Temperature Setpoint Reset

Various sources can be configured to reset the Supply Air Temperature (SAT) Setpoint. Since the Supply Air Temperature Setpoints are not fixed during reset, we refer to them as "Active Supply Air Temperature Setpoints." The following Reset Source options are available in this release:

1. Space Temperature
2. Outdoor Air Temperature
3. Return Air Temperature
4. Fan VFD Signal
5. Remote SAT 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 SAT 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 SAT Setpoint will be reset to its lowest configured setpoint. When the Reset Source is at its lowest configured setpoint, the SAT 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 SAT Setpoints.

If a Remote SAT 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. You can configure what voltage will correspond to the Low SAT Setpoint and what voltage will correspond to the High SAT Setpoint in both the Heating and the Cooling Modes.

NOTE: This Supply Air Temperature reset cannot be used on a Single Zone VAV unit.

Airflow Monitoring and Duct Static Pressure Control**Airflow Monitoring**

Outdoor, Supply, Return and Exhaust Airflow can be monitored using the EBTRON® GTC116 or HTN 104 series, Paragon MicroTrans^{EQ} series, or GreenTrol GA-200-N Module in conjunction with a GreenTrol GF series of airflow station. Contact WattMaster Controls for information on other airflow station options. The VCC-X will control the Outdoor Air Damper to maintain an Outdoor Air CFM Setpoint. This operation can be overridden higher by normal Economizer control.

Pre-Heater Operation

A Pre-Heat relay can be configured to energize anytime the Supply Fan is operating and the Outdoor Air Temperature is below the Pre-Heat Setpoint. This option allows pre-heating of cold outside air before it reaches the evaporator coils and is useful in Hot Water/ Chilled Water applications or during CO₂ control of the economizer in low temperature conditions. This operation only occurs in the Occupied Mode of Operation.

If using the Preheat-X Controller, 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 Pre-Heat Setpoint, then preheat will be controlled to either a Cooling, Heating or Vent Mode Preheater Leaving Air Setpoint - depending on if the VCC-X is currently in the Cooling, Heating, or Vent mode of operation. These setpoints are all set in the VCC-X Controller. See the *PREHEAT-X Controller 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 configured for Economizer Operation, this relay will disable the Heat Wheel when the unit goes into Economizer Mode. If the Heat Wheel Relay is active, a Heat Wheel Defrost Cycle will occur that will disable the Heat Wheel Relay for 2 minutes if the Outdoor Air Temperature is below the Heat Wheel Defrost Setpoint and 30 minutes have elapsed since the last Heat Wheel Defrost Cycle.

Duct Static Pressure Control

If the VCC-X 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 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 VCC-X 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 0.5" above the Duct Static Pressure Setpoint, the Duct Static Pressure Control Output Signal will be cut in half every control period until the Static Pressure is brought under control. This is to prevent damage to the ductwork if all the VAV boxes are closed or some other blockage occurs in the ductwork.

WARNING: The manufacturer does not assume responsibility for protecting the equipment from over-pressurization! You should always install mechanical high static protection cutoffs to protect your system!

Any time the Supply Fan is off, the Duct Static Pressure Control Output Signal will remain at zero volts. 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.

SEQUENCE OF OPERATIONS

Building Pressure Control and MUA

Duct Static Pressure Control for Filter Loading

In order to maintain a constant CFM through the supply air ducts on a mixed air CAV unit, the VCC-X 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 VCC-X 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.

Building Pressure Control

The VCC-X can maintain Building Static Pressure anytime the Supply Fan is operating. A Building Pressure Transducer must be connected to the VCC-X 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 (AOUT4 – Building Pressure Output on the VCC-X Controller) 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%.

Reverse Acting Building Pressure Control

- **Outdoor Air Damper**—If this option is configured, the VCC-X will use the user-adjustable Economizer/ Outdoor Air Damper output signal (AOUT2 – 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 CO₂ IAQ operation will be available.

- **Supply Fan VFD**—Careful consideration should be made regarding the effects of potential reduced airflow when using this option. Contact WattMaster if you have questions. If this option is selected, the user-adjustable Supply Fan VFD Output (AOUT1 on the VCC-X) 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.

MUA Operation

- **Occupied Mode**—The VCC-X will use the normal Cooling and Heating Mode Enable Setpoints (not the Hood On Setpoints) in conjunction with the Outdoor Air (OA) temperature sensor to determine the mode of operation. The Outdoor Air Dewpoint Setpoint will initiate the Dehumidification Mode. See the Cooling, Heating and Dehumidification Modes of Operation sections for those details. 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 30°F) 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 VCC-X Controller will use the Space Humidity Setpoint for unoccupied Dehumidification calls.

CAV/MUA Dual Mode (Hood On/Off Operation)

The VCC-X Controller 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 VCC-X Controller. Under normal operation (CAV), the unit will operate as a recirculating Space Temperature (and Space Humidity) controlled unit.

CAV/MUA and Condenser Fan/Water Valve Operation

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 will then be 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 would then be initiated by an Outdoor Dewpoint Setpoint.

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.

Space Temperature Control of High Percentage Outside Air Units

This option allows for Space Temperature control of 100% Outside Air MUA Units or units with a high percentage of Outdoor Air (normally 50% or greater). For this application you would configure "Space Temperature w/High Percentage OA" for the Controlling Sensor option. The intent of this sequence is to allow Space Temperature control of the unit while preventing the dumping of hot or cold outside air into the space during the Space Vent Mode of operation.

Once the Space Temperature is satisfied, before switching to Vent Mode, the controller compares the Outside Air Temperature to the Hood On HVAC Setpoints (Hood On MUA Setpoints) to determine if a continued demand for heating or cooling is required to prevent dumping. If there is no demand, the VCC-X Controller switches to Vent Mode. If the Outside 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 VCC-X Controller 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 Vent Mode Tempering operation, indoor humidity (space or return air) will continue to control the dehumidification operation. So, if dehumidification is configured and the humidity is above setpoint, the unit will be in Vent Mode Dehumidification (see the Dehumidification Mode section for more details). Reheat will be controlled to the calculated Vent Mode Supply Air Setpoint described earlier.

A call for Heating or Cooling from the Space Sensor will cancel the Outdoor Air Tempering operation.

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

VAV Operation with Supply Air Tempering (VAV 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 VCC-X Controller accomplishes the same result using the Hood-On Outdoor Air (OA) Setpoints to initiate Cooling and Heating.

To utilize this sequence, the HVAC Mode Enable Source must be configured as Supply Air Tempering. Then, configure the Hood On HVAC Setpoints for the OA temperature values that will enable Cooling and Heating. The Hood On Heating Setpoint should be set at or above the OA Temperature, that when mixed with the Return Air (with the economizer at its minimum position), will require Heating in order to achieve the Heating Supply Air Setpoint. The Hood On Cooling Setpoint would be set above that, which will allow a Vent Mode in between.

Then, configure the Cooling and Heating Supply Air Setpoints. While not set at the same value (see below), 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 OA 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 OA 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 OA Temperature falls below the Hood On Heating Setpoint, the unit will be in Heating Mode controlling to the Heating Supply Air Setpoint. The Heating Supply Air Setpoint should be set at least 2°F below the Cooling Supply Air Setpoint. The economizer can still modulate if necessary to maintain the Cooling Supply Air Setpoint. Configured this way, even if the OA Temperature is below the Hood On Heating Setpoint, if the Supply Air Temperature is too warm (above the Cooling Supply Air Setpoint), the economizer can modulate open to maintain the Cooling Supply Air Setpoint. If the Supply Air Temperature drops below the Cooling Supply Air Setpoint, the economizer will have time to close off before heating is energized below the Heating Supply Air Setpoint.

During Morning Warm-Up, heating will be controlled to the Morning Warm-Up Supply Air Setpoint (see the Morning Warm-Up/Cool-Down Mode Operation section for complete details).

In this operation, if Night Setback operation will be initiated by a space sensor connected to the VCC-X 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 VCC-X for Duct Static Pressure Control (see the Duct Static Pressure Control section for complete details).

SEQUENCE OF OPERATIONS

EXV Operation, Head Pressure Control & Temperature Protection

Electronic Expansion Valve (EXV) Operation

If using EXVs with Bitzer VFD Compressors and the RSMV 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 RSMV Module. This temperature will be used in conjunction with the calculated saturated refrigerant temperature to calculate the Superheat of each evaporator coil. The EXV for each coil will then be controlled to maintain the Superheat Setpoint.

Head Pressure Control

The Refrigerant System Module (RSM) can monitor a Head Pressure Transducer and control a Condenser Fan to maintain a Head Pressure Setpoint.

In the Cooling Mode, the Condenser Signal will modulate to maintain the Cooling Head Pressure Setpoint.

In the 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.

Temperature Protection

Temperature Protection is activated when the Supply Air Temperature (SAT) rises above the High Cutoff Temperature (immediate) or drops below the Low Cutoff Temperature (for 10 minutes). Both cutoff setpoints are user-adjustable. This mode shuts off the unit. This mode is cancelled when the SAT falls 5° below the High Cutoff Temperature or rises 5° above the Low Cutoff Temperature.

This mode is cancelled when the SAT drops 5 degrees below the High Cutoff Temperature Setpoint or rises 5 degrees above the Low Temp Cutoff Temperature Setpoint or when the unit changes back into Occupied Operation.

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.

System Broadcasts

You can configure the VCC-X Controller to broadcast Building Pressure, Outdoor Air Temperature, Outdoor Air Humidity, Space Temperature, Space Humidity, and CO₂ to any other VCC-X Controller that does not have one or more of these sensor(s).

Alarm Detection and Reporting

The VCC-X Controller continuously performs self diagnostics during normal operation to determine if any operating failures have occurred.

These failures (alarms) can be reported to a Touch Screen System Manager, a Hand Held Modular Service Tool, or to a computer running Prism 2 software.

The following are the available alarm designations for the VCC-X Controller:

- Bad SAT Sensor
- Bad RAT Sensor
- Bad OAT Sensor
- Bad Space Sensor
- Bad CO₂ Sensor
- Missing Outdoor CFM Sensor
- Missing Exhaust CFM Sensor
- Missing Supply CFM Sensor
- Missing Return CFM Sensor
- Mechanical Cooling Failure
- Mechanical Heating Failure
- Fan Proving Alarm
- Dirty Filter Alarm
- Emergency Shutdown
- Relay Runtime
- No Economizer Feedback
- Title 24 Economizer Air Temperature Sensor Failure
- Title 24 Economizer Damper Failure
- Title 24 Economizer Excess Outdoor Air
- Title 24 Economizer Not Economizing When It Should
- Title 24 Economizer Economizing, But Shouldn't
- High Supply Air Temperature Cutoff
- Low Supply Air Temperature Cutoff
- High Control Temperature
- Low Control Temperature
- Preheat Low Temperature
- Missing RSM #1
- Missing RSM #2
- Missing RSM #3
- Missing RSM #4
- Missing PREHEAT-X
- Missing MHGRV-X
- Missing MODGAS-X
- Missing EM1
- Missing 12RLY
- RSM 1 Operating Alarm
- RSM 2 Operating Alarm
- RSM 3 Operating Alarm
- RSM 4 Operating Alarm

Sensor and Mechanical Failure Alarms**Sensor Failure Alarms****Supply Air Temperature Sensor Failure Alarm**

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.

Space Temperature Sensor Failure Alarm

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, 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.

Outdoor Air Temperature Sensor Failure Alarm

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 the cooling and the heating to continue operating.

Return Air Sensor Failure Alarm

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

CO₂ Sensor Failure Alarm

This alarm is generated if the controller is configured to have a CO₂ sensor, but does not detect it. IAQ 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 be return to CO₂ control.

Airflow Alarms

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

If the controller is configured to have any of the above air flow 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.

Missing Expansion Module Alarm

Preheat-X Board Missing
EM1 Expansion Missing
RSM Modules #1 - #4 Missing
Reheat Board Missing
ModGas Board Missing
12 Relay Board Missing

If the controller is configured to have any of the above Expansion Boards (Modules), but the 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.

Mechanical Failure Alarms**Mechanical Cooling Failure**

The Mechanical Cooling Failure Alarm is generated if the Supply Air Temperature fails to drop 5 degrees (within a user-adjustable time period) from the temperature the supply air was at when the cooling was activated and the Supply Air Temperature is not within 5 degrees of Setpoint. The alarm will be cleared when the Supply Air Temperature drops the 5 degrees and sets the failure timer back to zero.

Mechanical Heating Failure

The Mechanical Heating Failure Alarm is generated if the Supply Air Temperature fails to rise 5 degrees (within a user-adjustable time period) from the temperature the supply air was at when the heating was activated and the Supply Air Temperature is not within 5 degrees of Setpoint. The alarm will be cleared when the Supply Air Temperature rises the 5 degrees and sets the failure timer back to zero.

Proof of Flow Interlock Alarm

A Proof of Flow switch (by others) 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, and a Fan Proving Alarm is generated. Fan Proving needs to be configured for this alarm to occur.

Dirty Filter Alarm

A differential pressure switch (by others) 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 N.C. Smoke Detector, Firestat, or other shutdown condition occurs. If this contact opens, it will initiate shutdown of the VCC-X and will generate an alarm condition.

SEQUENCE OF OPERATIONS

Failure Mode and Title 24 Economizer Alarms

Failure Mode Alarms

High and Low Supply Temp Alarm

These alarms are activated when the Supply Air Temperature (SAT) rises above the High Cutoff Temperature Setpoint (immediate) or drops below the Low Cutoff Temperature Setpoint (for 10 minutes). Both cutoff setpoints are user-adjustable. This mode shuts off the unit (with a 3 minute fan off delay) until the mode is cancelled.

This mode is cancelled when the SAT drops 5 degrees below the High Cutoff Temperature Setpoint or rises 5 degrees above the Low Temp Cutoff Temperature Setpoint, or when the unit changes back into Occupied Operation.

High and Low Control Temp Failure

When the Controlling Sensor Temperature rises above the Cooling Mode Enable Setpoint plus the Control Mode High Alarm Offset setpoint, the controller will generate a High Control Temp Failure Alarm. When the Controlling Sensor Temperature drops below the Heating Mode Enable Setpoint minus the Control Mode Low Alarm Offset setpoint, the controller will generate a Low Control Temp Failure Alarm. Both offset setpoints are user-adjustable.

Preheat Low Temperature

This alarm indicates a Leaving Air Temperature Cutoff Alarm condition which is activated if the Controlling Leaving Air Temperature has dropped below 35°F for more than 2 minutes. The alarm will be disabled if after a fixed delay period the Leaving Air Temperature has risen above 35°F.

RSM Module (1-4) Operating Alarm

This alarm indicates numerous alarm conditions. Please refer to the individual *RSM Technical Guides* for details.

Title 24 Economizer Alarms

Economizer Temperature Sensor Failure

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

Economizer Not Economizing When it Should

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

Economizer Is Economizing When It Should Not

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

Economizer Damper Not Modulating

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

Economizer Excess Outdoor Air Filter

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

Trend Logging

The VCC-X Controller continuously maintains an Internal Trend Log in memory which records a fixed set of values at a user-defined interval.

120 log positions (timed retrievals) are available on the controller. Once these positions are full, the controller begins overwriting the oldest data.

Values can be retrieved using the Prism 2 software program. With Prism 2 running continuously, values can be saved to the computer hard drive at regular intervals to keep from losing data.

VCC-X Controller Trend Logs

The following are the fixed items that can be logged for the VCC-X Controller:

Date
Time
Mode of Operation (Occupied / Override / Unoccupied)
HVAC Mode
Space Temperature
Indoor Humidity
Mode Cooling Setpoint
Mode Heating Setpoint
Supply Air Temperature
Supply Air Setpoint
Coil Temperature Setpoint
Return Air Temperature
Return Air Humidity
Outdoor Air Temperature
Outdoor Air Humidity
Outdoor Air Wetbulb
Outdoor Air Dewpoint
Carbon Dioxide
Outdoor Airflow CFM
Supply Airflow CFM
Return Airflow CFM
Exhaust Airflow CFM
Building Pressure
Duct Static Pressure
MHGRV Valve Position
MODGAS Valve Position
Main Fan Speed VFD Signal
Economizer Position
Modulating Heat Signal
Building Pressure Relief VFD Signal
Modulating Cooling Signal
Compressor Alarms
Expansion Board Alarms
Temperature Limit Alarms
Mode of Operation Alarms
Sensor Alarms
Binary Inputs (1=Emergency, 2=Proof of Flow,
4=Dirty Filter, 8=Defrost, 16=Hood On,
32=Remote Occupied, 64=Water POF)
Relays Status (Binary Values)

Refrigerant Module Trend Logs

The following are the fixed items that can be logged for the Refrigerant Modules:

Compressor A1 Modulating Position
Compressor A2 Modulating Position
Condenser A1 Modulating Position
Condenser A2 Modulating Position
A1 Suction Pressure
A2 Suction Pressure
A1 Head Pressure
A2 Head Pressure
A1 Saturation Temperature
A2 Saturation Temperature
A1 Suction Line Temperature
A2 Suction Line Temperature
A1 Condenser Suction Temperature
A2 Condenser Suction Temperature
A1 Superheat
A2 Superheat
Condenser A1 Superheat
Condenser A2 Superheat
A1 Expansion Valve
A2 Expansion Valve
Condenser A1 Expansion Valve
Condenser A2 Expansion Valve
A1 Discharge Temperature
A2 Discharge Temperature
Leaving Water Temperature
VFD 1 Status
VFD 2 Status
A1 Compressor Enable
A2 Compressor Enable
A1 Alarms
A2 Alarms
Defrost Switch
Emergency Shutdown
Relay 1 Status
Relay 2 Status
Relay 3 Status
Relay 4 Status
Relay 5 Status
Compressor A1 Not Running
Compressor A2 Not Running

TROUBLESHOOTING

VCC-X Controller & EM1 LED Diagnostics

VCC-X Controller LEDs

The VCC-X 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 VCC-X Controller has 26 LEDs—10 used for operation & status, 8 used for relays, and 8 used for binary inputs. See **Figure 40, page 75** for the LED locations. The LEDs associated with these inputs and outputs allow you to see what is active without using a voltmeter. The LEDs and their uses are as follows:

Operation LEDs - Factory Troubleshooting

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

APP HB - This green LED will light up and blink continuously to indicate the application software is working properly.

OS HB - This green LED will light up and blink continuously to indicate the operating system is working properly.

WDOG - This green LED will light up and stay lit to indicate the operating system is working properly.

Diagnostic LEDs

ALARM - This red LED is a diagnostic blink code LED. It will light up and stay lit when there is an alarm present. The type of alarm will display 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 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 1 blink every 10 seconds. If there is an override, the LED will blink 2 times every 10 seconds. And finally, if one of the outputs is in force mode, the LED will blink 3 times every 10 seconds.

Communication LEDs

EBUS - This yellow LED will blink to signal E-BUS communications.

LOOP COMM - This yellow LED will light up and blink continuously to indicate the VCC-X Controller is communicating.

BACNET - This yellow LED will light up and blink continuously to indicate BACnet communications.

Relay LEDs

RLY1 - This green LED will light up when the Supply Fan is enabled and will stay lit as long as the Supply Fan is active.

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

Binary Input LEDs

BIN1 - This green LED will light up when the Proof of Flow contact is closed.

BIN2 - This green LED will light up when the Dirty Filter switch is closed.

BIN3 - This green LED will light up when the Hood On/Off switch is closed.

BIN4 - This green LED will light up when the Remote Occupied switch is closed.

BIN5 - This green LED will light up when the Remote Cooling contact is closed.

BIN6 - This green LED will light up when the Remote Heating switch is closed.

BIN7 - This green LED will light up when the Remote Dehumidification switch is closed.

BIN8 - This green LED will light up when the Emergency Shutdown contact is closed.

VCC-X EM1 Expansion Module LEDs

The VCC-X EM1 Expansion Module is equipped with 4 LEDs that can be used as very powerful troubleshooting tools. See **Figure 41, page 75** for LED locations. The LEDs and their uses are as follows:

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

ALARM - If the module does not receive communications for more than 1 minute, this LED will light up, the relays will turn off, and the Analog Outputs will go to 0 VDC.

STAT - If the software is running, this LED should blink at a rate of 1 blink per second.

COMM - Every time the module receives a valid E-BUS request from the VCC-X Controller, this LED will blink on and then off, signifying that it received a valid request and responded.

RSM LEDs

The RSM LEDs are described in the RSM Technical Guides.

TROUBLESHOOTING

VCC-X Controller & EM1 LED Diagnostics

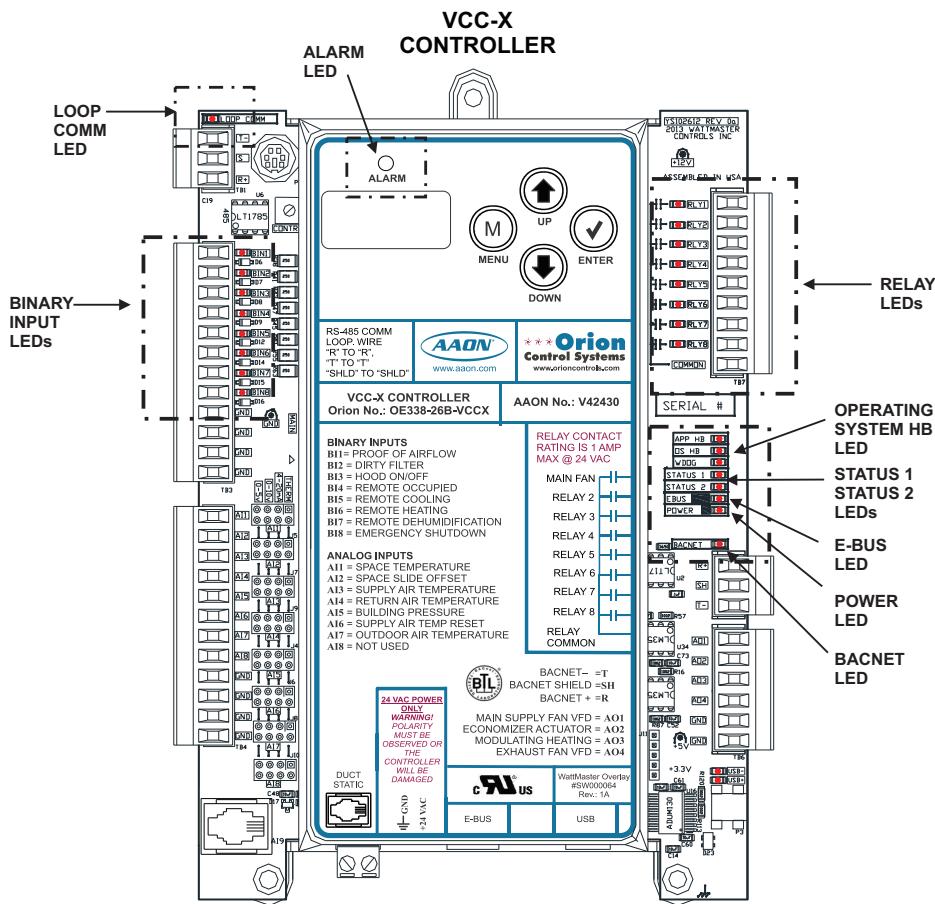


Figure 40: VCC-X Controller LED Locations

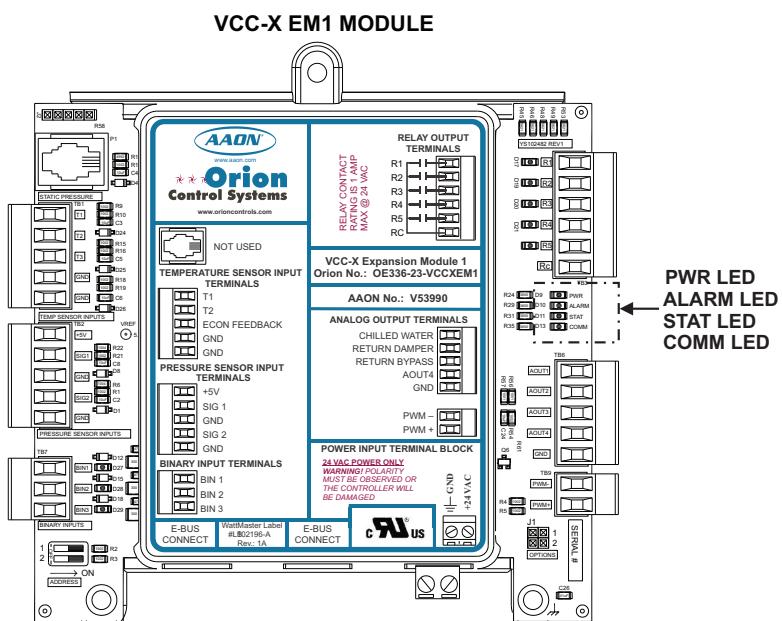


Figure 41: VCC-X Expansion Module EM1 LED Locations

TROUBLESHOOTING

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 that the sensor is operating correctly per the tables. Please follow the notes and instructions that appear after the chart when checking sensors.

Temperature – Resistance – Voltage for Type III 10 K Ohm Thermistor Sensors			
Temp (°F)	Temp (°C)	Resistance (Ohms)	Voltage @ Input (VDC)
-10	-23.33	93333	4.51
-5	-20.55	80531	4.45
0	-17.77	69822	4.37
5	-15	60552	4.29
10	-12.22	52500	4.2
15	-9.44	45902	4.1
20	-6.66	40147	4.002
25	-3.88	35165	3.891
30	-1.11	30805	3.773
35	1.66	27140	3.651
40	4.44	23874	3.522
45	7.22	21094	3.39
50	10	18655	3.252
52	11.11	17799	3.199
54	12.22	16956	3.143
56	13.33	16164	3.087
58	14.44	15385	3.029
60	15.55	14681	2.972
62	16.66	14014	2.916
64	17.77	13382	2.861
66	18.88	12758	2.802
68	20	12191	2.746
69	20.55	11906	2.717
70	21.11	11652	2.691
71	21.66	11379	2.661
72	22.22	11136	2.635
73	22.77	10878	2.605

Table 5: Temperature/Resistance for Type III 10K Ohm Thermistor Sensors

Temperature – Resistance – Voltage for Type III 10 K Ohm Thermistor Sensors			
Temp (°F)	Temp (°C)	Resistance (Ohms)	Voltage @ Input (VDC)
74	23.33	10625	2.576
75	23.88	10398	2.549
76	24.44	10158	2.52
77	25	10000	2.5
78	25.55	9711	2.464
80	26.66	9302	2.41
82	27.77	8893	2.354
84	28.88	8514	2.3
86	30	8153	2.246
88	31.11	7805	2.192
90	32.22	7472	2.139
95	35	6716	2.009
100	37.77	6047	1.884
105	40.55	5453	1.765
110	43.33	4923	1.65
115	46.11	4449	1.54
120	48.88	4030	1.436
125	51.66	3656	1.339
130	54.44	3317	1.246
135	57.22	3015	1.159
140	60	2743	1.077
145	62.77	2502	1.001
150	65.55	2288	0.931

Table 5, cont.: Temperature/Resistance for Type III 10K Ohm Thermistor 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.

OE271 & OE258-01 Pressure Sensor Testing**OE271 Pressure Sensor Testing**

The table below is used to troubleshoot the OE271 Duct Static Pressure Sensors.

OE271 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 6: Duct Static Pressure/Voltage for OE271 Duct Static Pressure Sensors

OE271 Pressure Sensor Testing Instructions

Use the voltage column 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.

OE258-01 Pressure Sensor Testing

The table below is used to troubleshoot the OE258-01 Building Pressure Sensors.

OE258-01 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 7: Building Static Pressure/Voltage for OE258-01 Building Pressure Sensors

OE258-01 Building Pressure Sensor Testing Instructions

Use the voltage column 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 A15 on the VCC-X Controller.

TROUBLESHOOTING

OE275-01 Suction Pressure Transducer Testing

OE275-01 Suction Pressure Transducer Testing for R410A Refrigerant

The Evaporator Coil Temperature is calculated by converting the Suction Pressure to Temperature. The Suction Pressure is obtained by using the OE275-01 Suction Pressure Transducer, which is connected into the Suction Line of the Compressor.

Use the voltage column to check the Suction Pressure Transducer while connected to the RSMV/RSMD Module(s). The VCC-X and the RSMV/RSMD Module(s) must be powered for this test. Read voltage with a meter set on DC volts. Place the positive lead from the meter on the SP-1 and SP-2 on the RSMD and SP on the RSMV terminal block. Place the negative lead from the meter on the ground (GND) terminal block. Use a refrigerant gauge set and/or an accurate electronic thermometer to measure the temperature or suction line pressure near where the Suction Pressure Transducer is connected to the suction line. Measure the Voltage at the terminals SP-1 and SP-2 on the RSMD and SP on the RSMV and GND terminals and compare it to the appropriate chart depending on the refrigerant you are using. If the temperature/voltage or pressure/voltage readings do not align closely with the chart, your Suction Pressure Transducer is probably defective and will need to be replaced.

See the OE275-01 Suction Pressure Transducer, Pressure, Temperature, and Voltage Chart for R410A Refrigerant testing (**Table 8**). The charts show a temperature range from 20°F to 80°F. For troubleshooting purposes, the DC Voltage readings are also listed with their corresponding temperatures and pressures.

OE275-01 Suction Pressure Transducer Coil Pressure – Temperature – Voltage Chart for R410A Refrigerant					
Temperature °F	Pressure PSI	Signal DC Volts	Temperature °F	Pressure PSI	Signal DC Volts
21.19	80.94	1.8	59.03	168.10	3.2
24.49	87.16	1.9	61.17	174.32	3.3
27.80	93.39	2.0	63.19	180.55	3.4
30.99	99.62	2.1	65.21	186.78	3.5
33.89	105.84	2.2	67.23	193.00	3.6
36.80	112.07	2.3	69.24	199.23	3.7
39.71	118.29	2.4	71.15	205.46	3.8
42.30	124.52	2.5	72.95	211.68	3.9
44.85	130.75	2.6	74.76	217.91	4.0
47.39	136.97	2.7	76.57	224.14	4.1
49.94	143.2	2.8	78.37	230.36	4.2
52.23	149.42	2.9	80.18	236.59	4.3
54.50	155.65	3.0			
56.76	161.88	3.1			

Table 8: Coil Pressure/Voltage/Temp for OE275-01 Suction Pressure Transducers - R410A Refrigerant

Head Pressure Transducer Troubleshooting**Head Pressure Transducer
Troubleshooting**

If you suspect there is a problem related to head pressure transducer measurements, reference **Table 9, below.**

Head Pressure Transducer Chart			
Voltage	Pressure	Voltage	Pressure
0.5	0	2.6	350
0.6	17	2.7	367
0.7	33	2.8	384
0.8	50	2.9	400
0.9	67	3.0	417
1.0	83	3.1	434
1.1	100	3.2	450
1.2	117	3.3	467
1.3	133	3.4	484
1.4	150	3.5	500
1.5	167	3.6	517
1.6	183	3.7	534
1.7	200	3.8	550
1.8	217	3.9	567
1.9	233	4.0	584
2.0	250	4.1	600
2.1	267	4.2	617
2.2	283	4.3	634
2.3	300	4.4	650
2.4	317	4.5	667
2.5	334		

Table 9: Head Pressure Transducer Chart

APPENDIX A - SYSTEM CONFIGURATIONS

System Configurations

System Configuration Options

The VCC-X Controller can be used as a Stand-Alone System (one VCC-X Controller only), connected together on an Interconnected System (multiple VCC-X Controllers only) or connected together on a Network System (multiple VCC-X Controllers, VAV/Zone Controllers, or Add-On Controllers) to form a complete Controls System that can be programmed and monitored with one or more of the available Operator Interfaces.

Operator Interfaces

The Operator Interfaces are designed to provide for programming and monitoring of VCC-X Controller(s) and/or any VAV/Zone or Add-on Controller(s) connected to your System. See **Figure 42, below**. The available Operator Interfaces are as follows:

- Modular Service Tool SD (OE391-12)
- Modular System Manager SD (OE392-12)
- System Manager Touch Screen 3 (OE392-11) (**Future - Monitoring Only**)
- Computer with Prism 2 & CommLink 5

You can use any one of these interfaces or all of them on the same VCC-X Control System.

Stand-Alone System

The Stand-Alone System is used when you have a single VCC-X Controller only. Programming and status monitoring are accomplished by selecting and installing one or more of the Operator Interfaces.

See **Figure 43, page 81** for a Typical Stand-Alone System Layout diagram.

Interconnected System

The Interconnected System is used when you have multiple VCC-X Controllers on your job. With this system, you simply connect the controllers together using WattMaster communications wire or 18-gauge, 2-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 from one or more of the available Operator Interfaces connected on the communications loop.

See **Figure 44, page 82** for a Typical Interconnected System Layout diagram.

Networked System

If you have 1 to 59 VCC-X Controllers that require information sharing, simply connect the controllers together using WattMaster communications wire or 18-gauge, 2-conductor twisted pair with shield wire (Belden #82760 or equivalent). The Networked Single Loop System requires that either a MiniLink PD communication interface and/or CommLink communication interface are purchased and wired into the communications loop in a similar manner to the VCC-X Controllers.

The Networked Multiple Loop system is used when you have more than 59 VCC-X Controllers and/or are using multiple VCC-X Controllers that are connected to VAV/Zone controllers. These groups of controllers are broken up into multiple “Local Loops” that connect to each other via the “Network Loop.” Each individual 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 together with this configuration. This provides the capability for over 3500 controllers to be networked together.

See **Figure 45, page 83** for a Typical Networked System Layout diagram.

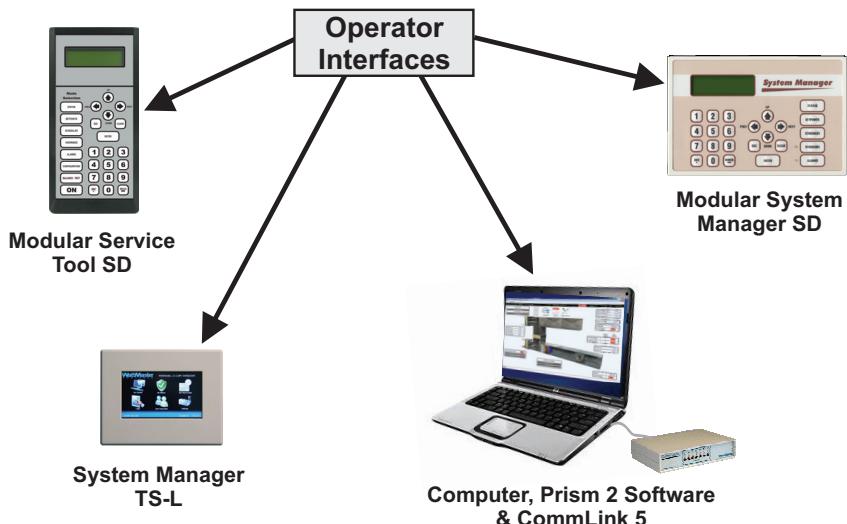


Figure 42: Available Operator Interfaces

APPENDIX A - SYSTEM CONFIGURATIONS
Stand-Alone System Layout



Figure 43: Typical Stand-Alone System Layout

APPENDIX A - SYSTEM CONFIGURATIONS

Interconnected System Layout

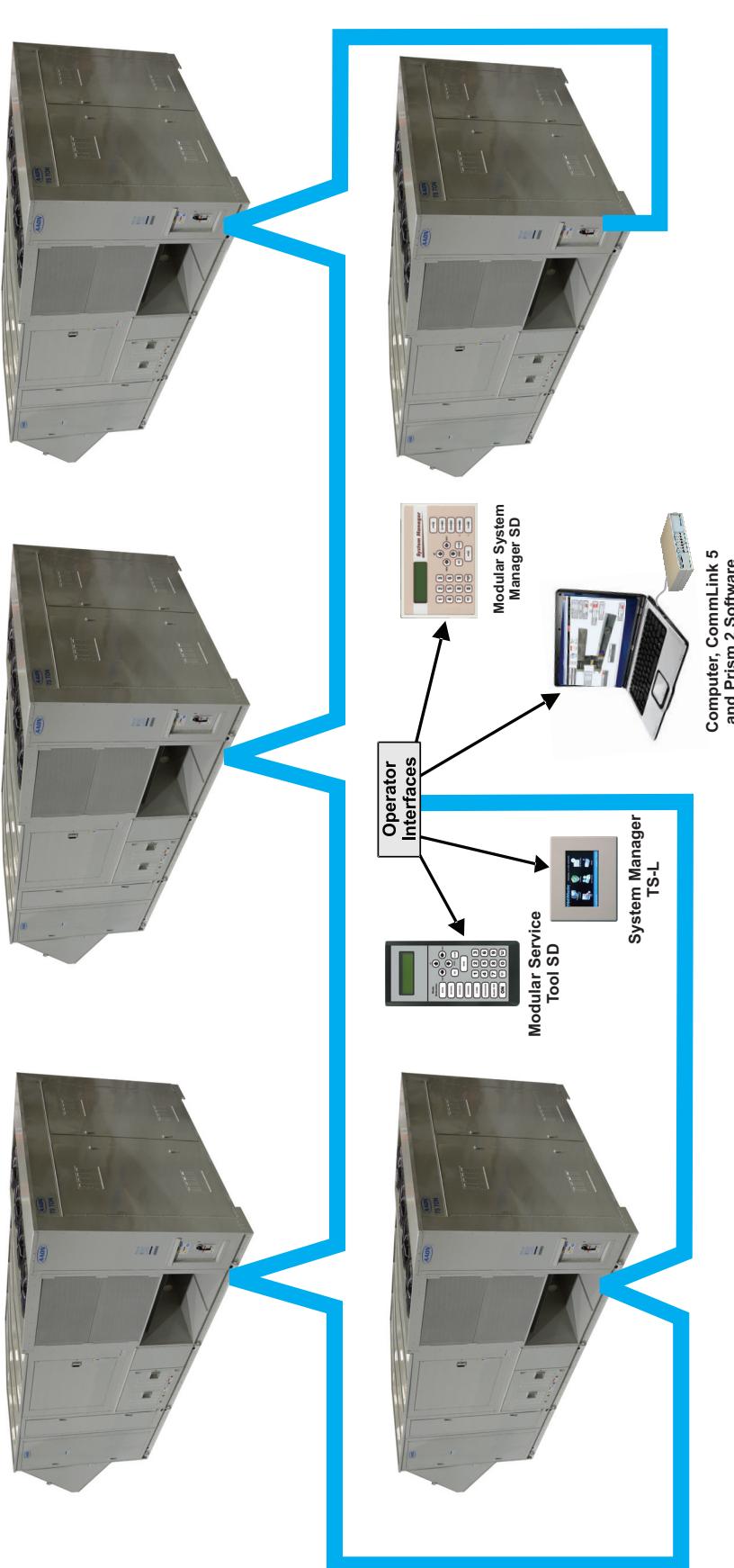


Figure 44: Typical Interconnected System Layout

APPENDIX A - SYSTEM CONFIGURATIONS

Networked System Layout

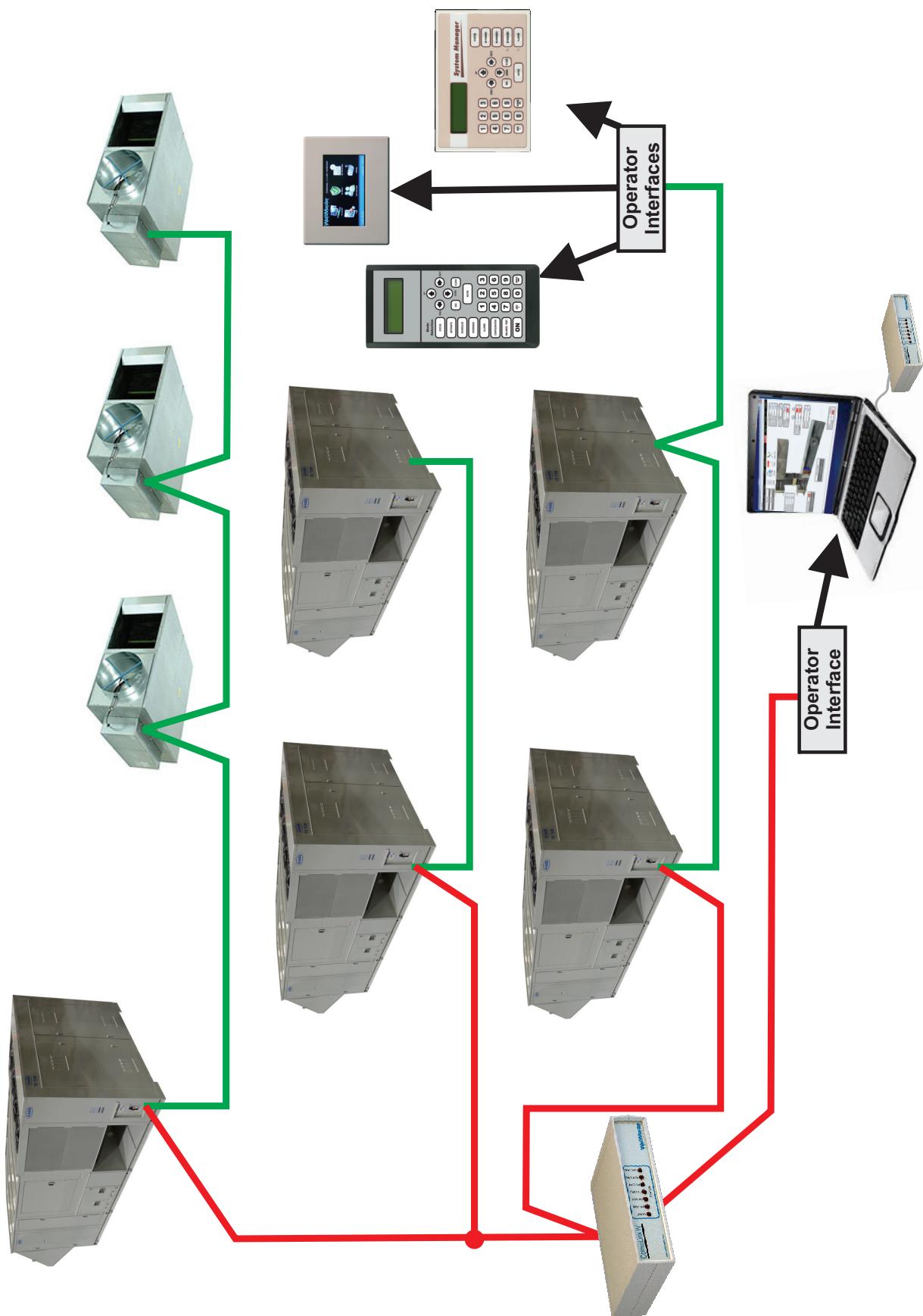


Figure 45: Typical Networked System Layout

Navigation Keys

LCD Display Screen & Navigation Keys

The LCD display screens and buttons allow you to view status and alarms, enable force modes, and make BACnet® configuration changes. See **Figure 46**, below and refer to **Table 10** for descriptions.

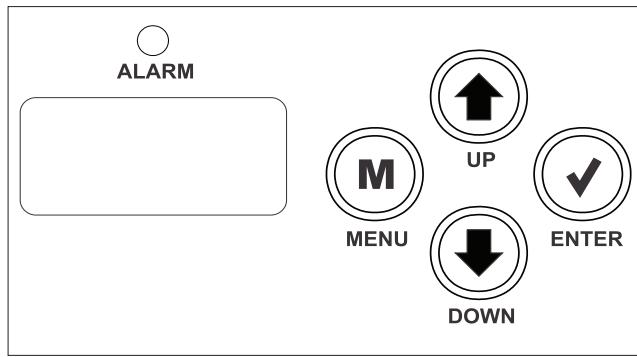


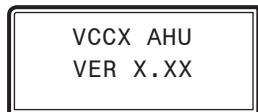
Figure 46: LCD Display and Navigation Keys

NAVIGATION KEY	KEY FUNCTION
MENU 	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 10: Navigation Key Functions

Main Screens Map

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

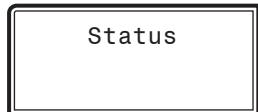


Press to go to *Settings Screen*.



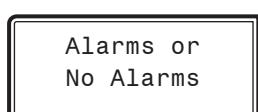
Press to scroll through the *Settings Screens*.

Press to go to the *Status Screen*.



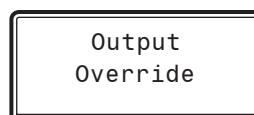
Press to scroll through the *Status Screens*.

Press to go to the *Alarms Screen*.



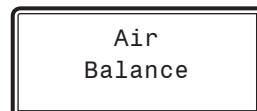
Press to scroll through the *Alarms*.

Press to go to the *Output Override Screen*.



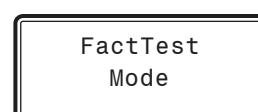
Press to scroll through *Output Override Screens*.

Press to go to the *Air Balance Screen*.



Press to scroll through *Air Balance Screens*.

Press to go to the *Factory Test Mode Screen*.



NOTE: This screen is for Factory Use Only.

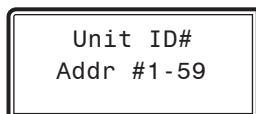
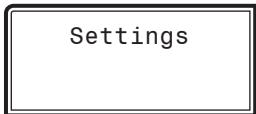
Press to return to the first *Main Menu Screen*.

APPENDIX B - VCC-X LCD SCREENS

Settings Screens

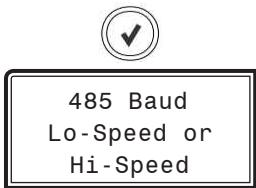
Settings Screens

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



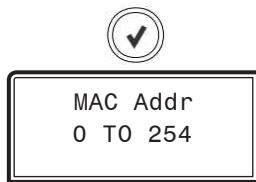
UNIT ADDRESS

Unit address. Valid range is 1-59. Default is 59.



BAUD RATE SPEED

485 baud rate speed. Valid range is Lo-Speed or Hi-Speed.
Default is Hi-Speed.



BACnet® - CURRENT MAC ADDRESS

Valid range is 0 to 254. Default is 1.



BACnet® - CURRENT DEVICE ID

A Device ID of up to 7 digits can be entered.

The left and right arrow keys move the cursor between the digit fields.
Once the cursor is under a field, use the up and down arrow keys to
select a number between 0 and 9.



BACnet® - CURRENT BAUD RATE

9600, 19200, 38400, 57600, 76800. Default is 38400.

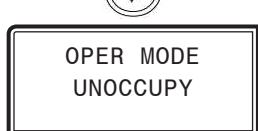
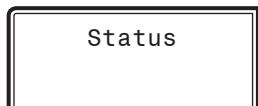


E-BUS COMMUNICATIONS

Hi Speed or Lo Speed. Default is Hi Speed.

Status Screens

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



OPERATION MODE

This screen displays the current mode of operation. Options are:

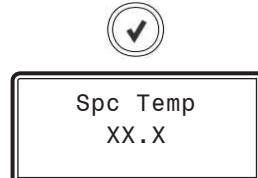
- UNOCCUPY (Unoccupied)
- OCCUPIED
- OVERRIDE
- HOL UNOC (Holiday Unoccupied)
- HOL OCC (Holiday Occupied)
- FRC OCC (Force Occupied)
- FRC UNOC (Force Unoccupied)
- REM OCC (Remote Occupied)
- ZONE HEAT
- ZONE COOL
- ZONE OVR (Zone Override)



HVAC MODE

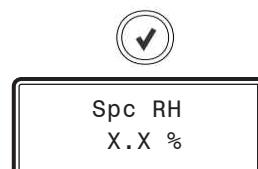
This screen displays the current HVAC Mode. Options are:

- OFF MODE
- VENT MODE
- COOL MODE
- HEAT MODE
- VENT RH
- COOL RH
- HEAT RH
- WARMUP
- PURGE
- DEFROST
- COOLDOWN



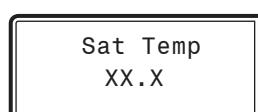
SPACE TEMPERATURE

40°F to 200°F or 5°C to 93°C.



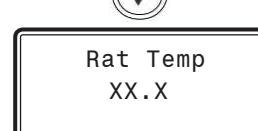
SPACE HUMIDITY

0.00% - 100%



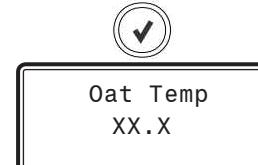
SUPPLY AIR TEMPERATURE

40°F to 200°F or 5°C to 93°C.



RETURN AIR TEMPERATURE

40°F to 200°F or 5°C to 93°C.



OUTDOOR AIR TEMPERATURE

40°F to 200°F or 5°C to 93°C.



OUTDOOR AIR HUMIDITY



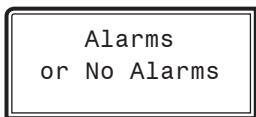
CO2 LEVEL

0.00 PPM to 9000 PPM

Alarm Screens

Alarm Screens

If there are no Alarms, the *Alarm Screen* will display “No Alarms.” If there are alarms present, the screen will display, “Alarms.” You can press <ENTER> to scroll through the alarms or you can let the alarms automatically scroll on the screen. For alarm definitions and troubleshooting, see pages 70-72.



Alarms

The screen will display the alarms as follows:

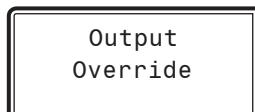
No Alarms

SAT SENSOR	Supply Air Temperature Sensor Failure Alarm
RAT SENSOR	Return Air Temperature Sensor Failure Alarm
OAT SENSOR	Outdoor Air Temperature Sensor Failure Alarm
SPC SENSOR	Space Temperature Sensor Failure Alarm
CO2 SENSOR	CO ₂ Sensor Failure Alarm
BLDGPRES SENSOR	Building Pressure Sensor Failure Alarm
OA CFM SENSOR	Outdoor Air Airflow Alarm
EX CFM SENSOR	Exhaust Air Airflow Alarm
SA CFM SENSOR	Supply Air Airflow Alarm
RA CFM SENSOR	Return Air Airflow Alarm
COOLING FAILURE	Mechanical Cooling Failure Alarm
HEATING FAILURE	Mechanical Heating Failure Alarm

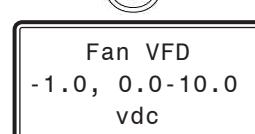
FAN POF FAILURE	Proof of Flow Interlock Alarm
DIRTY FILTER	Dirty Filter Alarm
EMERG SHUTDOWN	Emergency Shutdown Alarm
ECONO FAILURE	Title 24 Economizer Alarms
HI SAT ALARM	High Supply Temperature Cutoff Alarm
LO SAT ALARM	Low Supply Temperature Cutoff Alarm
CONTROL TEMP HI	High Control Temperature Failure
CONTROL TEMP LO	Low Control Temperature Failure
REHEAT ALARM	Reheat Board Missing Alarm
MODGAS ALARM	MODGAS Board Missing Alarm
PREHEAT ALARM	PREHEAT Board Missing Alarm
MODULE 1 ALARM	Refrigerant Module #1 Operating Alarm
MODULE 2 ALARM	Refrigerant Module #2 Operating Alarm
MODULE 3 ALARM	Refrigerant Module #3 Operating Alarm
MODULE 4 ALARM	Refrigerant Module #4 Operating Alarm
EM1 MISSING	Missing Expansion Module Alarm
12 RELAY MISSING	Missing E-BUS 12-Relay Module Alarm
UNKNOWN ALARM	This screen should never display. But if it does, it means the controller doesn't know what the alarm is.

Output Override Screens**Output Override Screens**

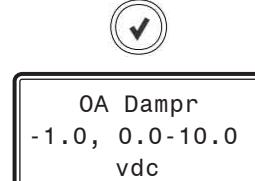
Refer to the following map when navigating through the Output Override Screens. From the *Output Override Screen*, press **<ENTER>**.

**VCC-X CONTROLLER RELAYS 1-8**

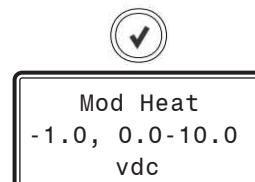
Press the **<UP>** button to change the value.
Default is **AUTO**.

**SUPPLY FAN VFD**

0.0 to 10.0 = Active Force Mode.
Press the **<UP>** and **<DOWN>** buttons to increase and decrease the value. Default is **-1.0 = AUTO**.

**OUTDOOR AIR DAMPER VFD**

0.0 to 10.0 = Active Force Mode.
Press the **<UP>** and **<DOWN>** buttons to increase and decrease the value. Default is **-1.0 = AUTO**.

**MODULATING HEATING**

0.0 to 10.0 = Active Force Mode.
Press the **<UP>** and **<DOWN>** buttons to increase and decrease the value. Default is **-1.0 = AUTO**.



Exhaust
-1.0, 0.0-10.0
vdc

EXHAUST FAN

0.0 to 10.0 = Active Force Mode.
Press the **<UP>** and **<DOWN>** buttons to increase and decrease the value. Default is **-1.0 = AUTO**.



Mod Cool
-1.0, 0.0-10.0
vdc

MODULATING COOLING

0.0 to 10.0 = Active Force Mode.
Press the **<UP>** and **<DOWN>** buttons to increase and decrease the value. Default is **-1.0 = AUTO**.



RA Dampr
-1.0, 0.0-10.0
vdc

RETURN AIR DAMPER

0.0 to 10.0 = Active Force Mode.
Press the **<UP>** and **<DOWN>** buttons to increase and decrease the value. Default is **-1.0 = AUTO**.



RA Bypas
-1.0, 0.0-10.0
vdc

RETURN AIR BYPASS

0.0 to 10.0 = Active Force Mode.
Press the **<UP>** and **<DOWN>** buttons to increase and decrease the value. Default is **-1.0 = AUTO**.

APPENDIX B - VCC-X LCD SCREENS

Air Balance Screens & Factory Test Mode Screen

Air Balance Screens

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



MAXIMUM FAN VOLTAGE

0.0 to 10.0 vdc

Press the **<UP>** and **<DOWN>** buttons to increase and decrease the value. **Default is 10.0.**



MINIMUM FAN VOLTAGE

0.0 to 10.0 vdc

Press the **<UP>** and **<DOWN>** buttons to increase and decrease the value. **Default is 0.0.**



MAXIMUM EXHAUST VOLTAGE

0.0 to 10.0 vdc

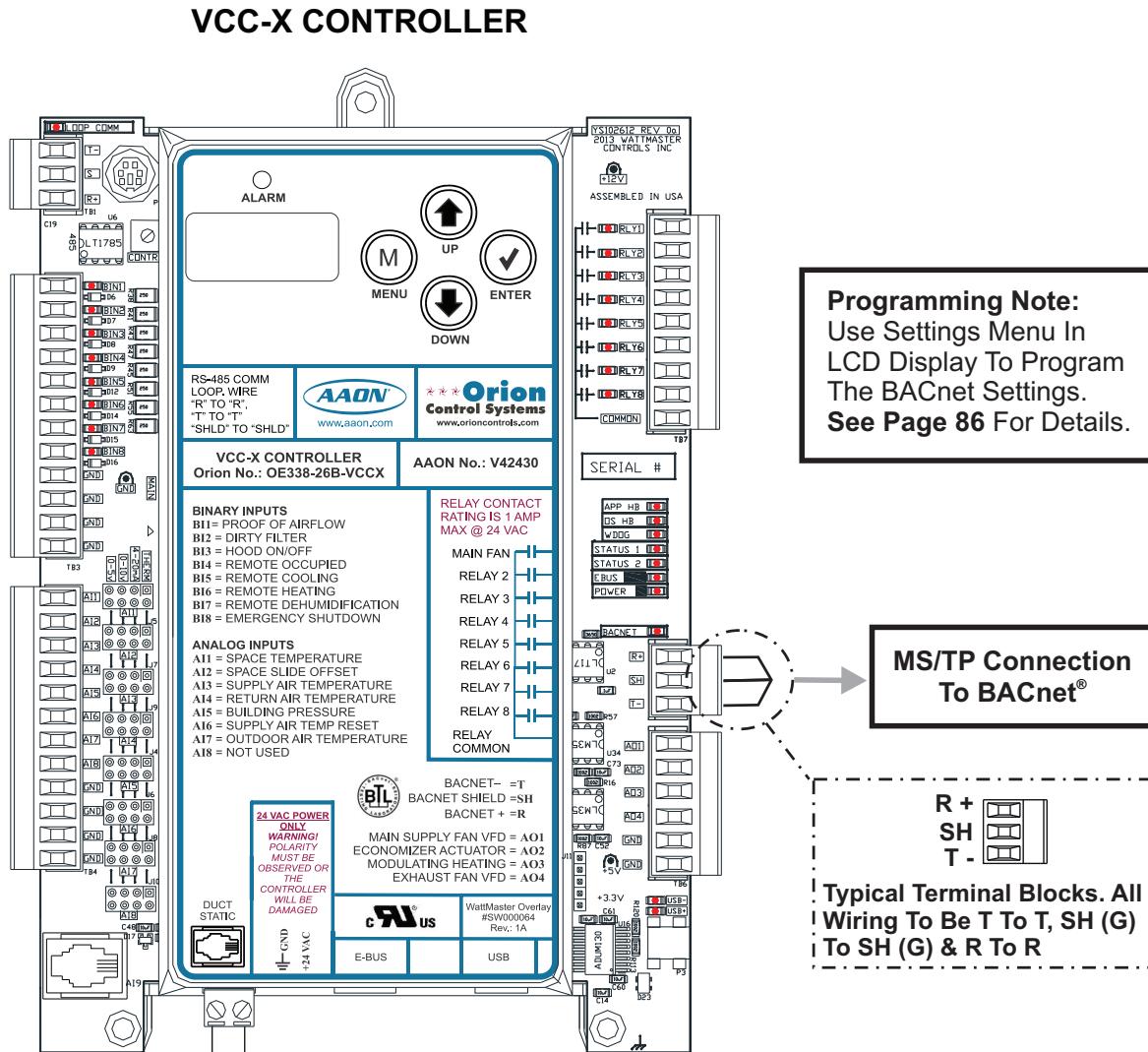
Press the **<UP>** and **<DOWN>** buttons to increase and decrease the value. **Default is 10.0.**



MINIMUM EXHAUST VOLTAGE

0.0 to 10.0 vdc

Press the **<UP>** and **<DOWN>** buttons to increase and decrease the value. **Default is 10.0.**

VCC-X BACnet® Connection To MS/TP 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, 2 conductor twisted pair with shield. Use Belden #82760 or equivalent.

Figure 47: VCC-X BACnet Connection to MS/TP Network

APPENDIX C - VCC-X BACnet®

VCC-X BACnet® Parameters

NOTE: Objects labeled AI and BI are read-only. Objects labeled AV are read/writeable. You cannot write directly to Sensor Inputs.

NOTE: When a new setpoint is received from BACnet, it is maintained and used in temporary memory until the unit reaches midnight. It is then stored in permanent memory and will become the new default setpoint even if power is cycled. Therefore, if power is cycled prior to reaching midnight, the setpoint will not have been stored in permanent memory.

BACnet® Properties for the VCC-X Controller

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 Bits on page 104.
Control Status	AI: 3	Current Occupied/Unoccupied Status.	See Control Status Bits on page 104
Hvac Mode	AI: 4	Current operational status.	See HVAC Mode Bits on page 104.
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 Offset	
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.	

BACnet® Properties for the VCC-X Controller

Parameter	Object	Description	Limits
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 CO ₂ 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.	

BACnet® Properties for the VCC-X Controller

Parameter	Object	Description	Limits
Modulating Cooling Position	AI: 34	Current percentage of the Modulating Cooling Signal (Chilled Water or Digital Compressor).	
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	
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	

BACnet® Properties for the VCC-X Controller

Parameter	Object	Description	Limits
A1 Suction Line Temperature	AI:54	Current Compressor A1 Suction Line Temperature	
A2 Suction Line Temperature	AI:55	Current Compressor A2 Suction 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	
B2 Compressor Signal	AI:70	Current Compressor B2 Modulating Cooling Signal	
B1 Condenser Signal	AI:71	Current B1 Condenser Signal	

APPENDIX C - VCC-X BACnet®

VCC-X BACnet® Parameters

BACnet® Properties for the VCC-X Controller			
Parameter	Object	Description	Limits
B2 Condenser Signal	AI:72	Current B2 Condenser 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	

BACnet® Properties for the VCC-X Controller			
Parameter	Object	Description	Limits
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	
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)	
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	

BACnet® Properties for the VCC-X Controller

Parameter	Object	Description	Limits
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	
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	

BACnet® Properties for the VCC-X Controller

Parameter	Object	Description	Limits
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 C1 Discharge Temperature	
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.	See Alarm Group Bits on page 104.
Occupied Cooling Setpoint	AV: 1	If the control temperature rises one degree above this setpoint, the control will activate 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.	1 110

APPENDIX C - VCC-X BACnet®

VCC-X BACnet® Parameters

BACnet® Properties for the VCC-X Controller

Parameter	Object	Description	Limits	
Occupied Heating Setpoint	AV: 2	If the control temperature drops one degree below this setpoint, the control will activate 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	110
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	110
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	110
Unoccupied Cooling Offset	AV:5	During the Unoccupied Mode of Operation, this Setpoint offsets the Occupied Cooling Setpoint up by this user-adjustable amount. If you do not want Cooling to operate during the Unoccupied Mode, use the default setting of 30°F for this setpoint.	0	30
Unoccupied Heating Offset	AV:6	During the Unoccupied Mode of Operation, this Setpoint offsets the Occupied Heating Setpoint down by this user-adjustable amount. If you do not want Heating to operate during the Unoccupied Mode, use the default setting of 30°F for this setpoint.	0	30
Mode Select Deadband	AV:7	This value is added to and subtracted from the HVAC Mode Setpoints to create a control deadband range.	0	10
Max Coil Setpoint Reset Limit	AV:8	This is the highest that the Coil Temperature will be reset 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	70

BACnet® Properties for the VCC-X Controller

Parameter	Object	Description	Limits	
Min Coil Setpoint Reset Limit	AV:9	This is the lowest that the Coil Temperature will be reset 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	70
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	80
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	240
Max SAT Cooling Setpoint Reset Limit	AV: 12	If Supply Air Reset is configured this is the High SAT Cooling Reset Value.	0	100
Max SAT Heating Setpoint Reset Limit	AV: 13	If Supply Air Reset is configured this is the High SAT Heating Reset Value.	0	250
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, a Cooling Stage will be deactivated after its Minimum Run Time.	1	30
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, a Heating Stage will be deactivated after its Minimum Run Time.	1	50
Warm-Up/Cool-Down Target Temperature	AV:16	If Morning Warm-Up or Morning Cool-Down is configured then upon entering the occupied mode, the Warm-Up Mode will be activated if the return air is below this temperature by one degree. If the return air is above this temperature by one degree, the Cool-Down Mode will be activated.	50	90

BACnet® Properties for the VCC-X Controller

Parameter	Object	Description	Limits	
Warm-Up Mode Supply Air Setpoint	AV:17	During Morning Warm-Up, the Supply Air Temperature will be controlled to this Setpoint.	40	240
Cool-Down Mode Supply Air Setpoint	AV:18	During Morning Cool-Down, the Supply Air Temperature will be controlled to this Setpoint.	30	80
Mechanical Cooling Outdoor Air Lockout	AV:19	Mechanical Cooling will be locked out when the Outdoor Air Temperature is below this Setpoint.	-30	100
Mechanical Heating Outdoor Air Lockout	AV:20	Mechanical Heating will be locked out when the Outdoor Air Temperature is above this Setpoint.	-30	150
Low Supply Temp Cutoff Alarm	AV:21	Cooling will be disabled if the Supply Air Temperature falls below this value. See sequence for more details.	0	100
High Supply Temp Cutoff Alarm	AV:22	Heating will be disabled if the Supply Air Temperature rises above this value. See sequence for more details.	0	250
Preheater Cooling Mode Setpoint	AV:23	If the Preheater is enabled, and the unit is in the Cooling Mode, this setpoint will be sent to the Preheat-X Controller to control Leaving Air Temperature.	35	90
Preheater Venting Mode Setpoint	AV:24	If the Preheater is enabled, and the unit is in the Vent Mode, this setpoint will be sent to the Preheat-X Controller to control Leaving Air Temperature.	35	90
Preheater Heating Mode Setpoint	AV:25	If the Preheater is enabled, and the unit is in the Heating Mode, this setpoint will be sent to the Preheat-X Controller to control Leaving Air Temperature.	35	90
Outdoor Air Dewpoint Setpoint	AV:26	On an MUA unit, if the OA dewpoint rises above this setpoint, Dehumidification is initiated.	35	80
Economizer Enable Setpoint	AV:27	The economizer is enabled if the outdoor drybulb, dewpoint, or wetbulb temperature falls below this setpoint.	-30	80

BACnet® Properties for the VCC-X Controller

Parameter	Object	Description	Limits	
Heat Wheel Defrost Enable Setpoint	AV:28	The unit will go into Heat Wheel Defrost if the Outdoor Air is below this setpoint.	0	50
PreHeat Enable Set-point	AV:29	If the Supply Fan is energized this is the temperature at which the Preheat Relay will activate or the Preheat-X Controller will activate. Operates only in the Occupied Mode.	-30	70
Sensor Slide Offset Max Effect	AV:30	If your 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	10
Space Sensor Calibration Offset	AV:31	If the Space Temperature Sensor is reading incorrectly, you can use this option to enter an offset temperature to adjust the Sensor's Temperature.	-100	100
Supply Air Sensor Calibration Offset	AV:32	If the Supply Air Temperature Sensor is reading incorrectly, you can use this option to enter an offset temperature to adjust the Sensor's Temperature.	-100	100
Return Air Sensor Calibration Offset	AV:33	If the Return Temperature Sensor is reading incorrectly, you can use this option to enter an offset temperature to adjust the Sensor's Temperature.	-100	100
Outdoor Air Sensor Calibration Offset	AV:34	If the Outdoor Temperature Sensor is reading incorrectly, you can use this option to enter an offset temperature to adjust the Sensor's Temperature.	-100	100
Carbon Dioxide Sensor Calibration Offset	AV:35	If the CO ₂ Sensor is reading incorrectly, you can use this option to enter an offset value to adjust the Sensor's CO ₂ reading.	-500	500
Low Ambient Protection Setpoint	AV:36	Temperature at which the Low Ambient Relay will activate in the Occupied or Unoccupied Mode.	-30	70
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 will correspond to the Supply Air Cool High Reset Setpoint.	-30	150

APPENDIX C - VCC-X BACnet®

VCC-X BACnet® Parameters

BACnet® Properties for the VCC-X Controller			
Parameter	Object	Description	Limits
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 will correspond to the Supply Air Cooling Setpoint (Low Reset).	0 150
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 will correspond to the Supply Air Heating High Reset Setpoint.	-30 150
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 will correspond to the Supply Air Heating Setpoint (Low Reset).	1 150
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 will occur. Only applies if configured for Space or Return Air Temp Control, or as Single Zone VAV.	0 50
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 will occur. Only applies if configured for Space or Return Air Temp Control, or as Single Zone VAV.	0 50
Heat Pump Compressor Heat Lockout	AV:43	Compressor Heat will be locked out below this setpoint.	-30 100
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 will start 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

BACnet® Properties for the VCC-X Controller			
Parameter	Object	Description	Limits
Minimum Main Fan VFD in Heating Mode	AV:46	In Single Zone VAV configuration, this is the fan speed at which the VFD will start 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 will operate in the Vent Mode in Single Zone VAV.	0 100
Maximum Economizer in Heating Mode	AV:48	Max position the Economizer Damper can open to in Supply Air Tempering during Heating Mode. Takes priority over Max Position in High CO ₂ .	0 60
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 CO ₂ levels.	0 100
Maximum Economizer CO ₂ Reset Limit	AV:50	The maximum value the Economizer Minimum Position can be reset up to during CO ₂ override.	0 100
Minimum Carbon Dioxide Setpoint	AV:51	This is the threshold CO ₂ level at which the Economizer Min Damper Position Setpoint will begin to be reset higher.	0 2000
Maximum Carbon Dioxide Setpoint	AV:52	This is the CO ₂ level at which the Economizer Min Damper Position will be reset to the Economizer Max Position in High CO ₂ . In between the Min and Max CO ₂ levels the Economizer Min Damper Position will be proportionally reset between the configured Min Damper Position and the Max Position in High CO ₂ .	0 2000
Indoor Humidity Setpoint Low Reset Limit	AV: 53	On indoor controlled (non MUA) units, this is the Humidity setpoint that initiates Dehumidification. During Coil Temp Reset, this is the lowest Space RH value that corresponds to the High Coil Temp Setpoint.	0 100

BACnet® Properties for the VCC-X Controller				
Parameter	Object	Description	Limits	
Indoor Humidity Setpoint High Reset Limit	AV:54	During Coil Temp Reset, this is the highest Space RH value that corresponds to the Low Coil Temp Setpoint.	0	100
Duct Static Pressure Setpoint	AV:55	Current Static Pressure Setpoint.	.10	3.0
Duct Static Pressure Control Deadband	AV:56	Value above and below the Duct Static Pressure Setpoint where no control change occurs.	.01	.5
Building Pressure Control Setpoint	AV:57	Building Pressure Setpoint.	-.20	.20
Building Pressure Control Deadband	AV:58	Value above and below the Building Pressure Setpoint where no control change occurs.	.01	.1
Minimum Outdoor CFM Requirement	AV:59	Minimum Outdoor Airflow CFM Setpoint	.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

BACnet® Properties for the VCC-X Controller				
Parameter	Object	Description	Limits	
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	30
Condenser Head Pressure Setpoint	AV:66	Condenser Head Pressure Setpoint.	150	450
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 in order to force the unit into this desired mode. Configuring for "Auto" will restore 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.	
Fan VFD Override	AV: 69	Override to force the VFD to this percentage speed. Configuring "Auto" will restore normal unit control of the VFD speed.	0%	100%
			Auto=65535	
Outdoor Air Damper Override	AV: 70	Overrides all other Outdoor Air Damper position commands so as to maintain this fixed position. Configuring for "Auto" will restore normal unit control of the Outdoor Air Damper/Economizer operation.	0%	100%
			Auto=65535	

APPENDIX C - VCC-X BACnet®

VCC-X BACnet® Parameters

BACnet® Properties for the VCC-X Controller			
Parameter	Object	Description	Limits
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	
Remote Forced Cooling Status	BI: 9	Remote Forced Cooling Mode Binary Input Status	
Remote Forced Heating Status	BI: 10	Remote Forced Heating Mode Binary Input Status	
Remote Force Dehum Status	BI: 11	Remote Force Dehumidification Mode Binary Input Status	
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 will shut down.	
Bad Carbon Dioxide Sensor	BI: 16	Failure of the CO ₂ Sensor.	

BACnet® Properties for the VCC-X Controller			
Parameter	Object	Description	Limits
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 for 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. This does not apply for Modulating Heating.	
Fan Proving Alarm	BI: 24	Alarm that indicates an airflow failure from the Main Fan. Heating and Cooling will be 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. Will shut 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.	

BACnet® Properties for the VCC-X Controller

Parameter	Object	Description	Limits
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 begin to deactivate and the fan continues to run.	
Low Supply Temp Cutoff	BI: 35	The Supply Air has fallen below the Low SAT Cutoff Setpoint and cooling stages will begin to deactivate. If the unit is in Economizer, Vent, or Heating Mode the Supply Fan will shut off.	
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.	
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.	

BACnet® Properties for the VCC-X Controller

Parameter	Object	Description	Limits
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	

VCC-X BACnet® Parameters

BACnet® Properties for the VCC-X Controller			
Parameter	Object	Description	Limits
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	

BACnet® Properties for the VCC-X Controller			
Parameter	Object	Description	Limits
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	
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 (RSM-D)	BI:83	Emergency Shutdown Input on Module A	
Refrigerant Module 1 Relay 1	BI:84	Current Status of Compressor 1 Enable	
Refrigerant Module 1 Relay 2	BI:85	Current Status of Compressor 2 Enable	
Refrigerant Module 1 Relay 3	BI:86	Current Status of Condenser 1 Enable	
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	

BACnet® Properties for the VCC-X Controller

Parameter	Object	Description	Limits
B1-2 Water Proof of Flow	BI:94	B1/B2 Switch for Water Proof of Flow	
B1-4 Emergency Shutdown (RSM-D)	BI:95	Emergency Shutdown Input on Module B	
Refrigerant Module 2 Relay 1	BI:96	Current Status of Compressor 1 Enable	
Refrigerant Module 2 Relay 2	BI:97	Current Status of Compressor 2 Enable	
Refrigerant Module 2 Relay 3	BI:98	Current Status of Condenser 1 Enable	
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 (RSM-D)	BI:107	Emergency Shutdown Input on Module C	
Refrigerant Module 3 Relay 1	BI:108	Current Status of Compressor 1 Enable	
Refrigerant Module 3 Relay 2	BI:109	Current Status of Compressor 2 Enable	
Refrigerant Module 3 Relay 3	BI:110	Current Status of Condenser 1 Enable	
Refrigerant Module 3 Relay 4	BI:111	Current Status of Relay #4	
Refrigerant Module 3 Relay 5	BI:112	Current Status of Relay #5	

BACnet® Properties for the VCC-X Controller

Parameter	Object	Description	Limits
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 (RSM-D)	BI:119	Emergency Shutdown Input on Module D	
Refrigerant Module 4 Relay 1	BI:120	Current Status of Compressor 1 Enable	
Refrigerant Module 4 Relay 2	BI:121	Current Status of Compressor 2 Enable	
Refrigerant Module 4 Relay 3	BI:122	Current Status of Condenser 1 Enable	
Refrigerant Module 4 Relay 4	BI:123	Current Status of Relay #4	
Refrigerant Module 4 Relay 5	BI:124	Current Status of Relay #5	
Preheat Alarm	BI:125	Preheater Alarm Indicator	

VCC-X BACnet® Parameters**VCC-X BACnet® Property Identifier:****BACNETPropertyIdentifier :**

VccxControlModeBits ::= ENUMERATED {
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)
}

VccxControlStatusBits ::= ENUMERATED {
Unoccupied (0),
Occupied (1),
Override Mode (2),
Holiday Unoccupied (3),
Holiday Occupied (4),
Forced Occupied (5),
Forced Unoccupied (6),
Remote Contact Occupied (7)
}

VccxHVACModeStatusBits ::= ENUMERATED {
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)
}

VccxAlarmGroupBits ::= BIT STRING {
Sensor Alarm (0),
Mode of Operation Alarm (1),
Temperature Limit Alarm (2),
Expansion Module Alarm (3),
Compressor Module Alarm (4)
}

**BACnet® Protocol Implementation Conformance Statement**

Vendor	Listing Status	
WattMaster Controls, Inc. 8500 NW River Park Drive, Suite 108A Parkville, MO 64152 USA	Listed Product	
Test Requirements	BACnet® Protocol Revision	Date Tested
Requirements as of December 2011	Revision 12 (135-2010)	April 2013

Product Name	Model Number	Software Version
VCC-X Controller	OE338-26B-VCCX	2.13

BACnet® Standardized Device Profile (Annex L)		
BACnet Application Specific Controller (B-ASC)		

BIBBs Supported		
Data Sharing	ReadProperty-B	DS-RP-B
	ReadPropertyMultiple-B	DS-RPM-B
	WriteProperty-B	DS-WP-B

Device and Network Management	Dynamic Device Binding-B	DM-DDB-B
	Dynamic Object Binding-B	DM-DOB-B
	DeviceCommunication Control-B	DM-DCC-B

Object Type Support		
Device	Analog Input	Analog Value
Binary Input	Binary Value	
Device does not support CreateObject, DeleteObject, and there are no Proprietary Properties.		

Data Link Layer Options		
Media	Options	
MS/TP Master	9600,19200, 38400, 57600, 76800	

Character Set Support		
ANSI X3.4		

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