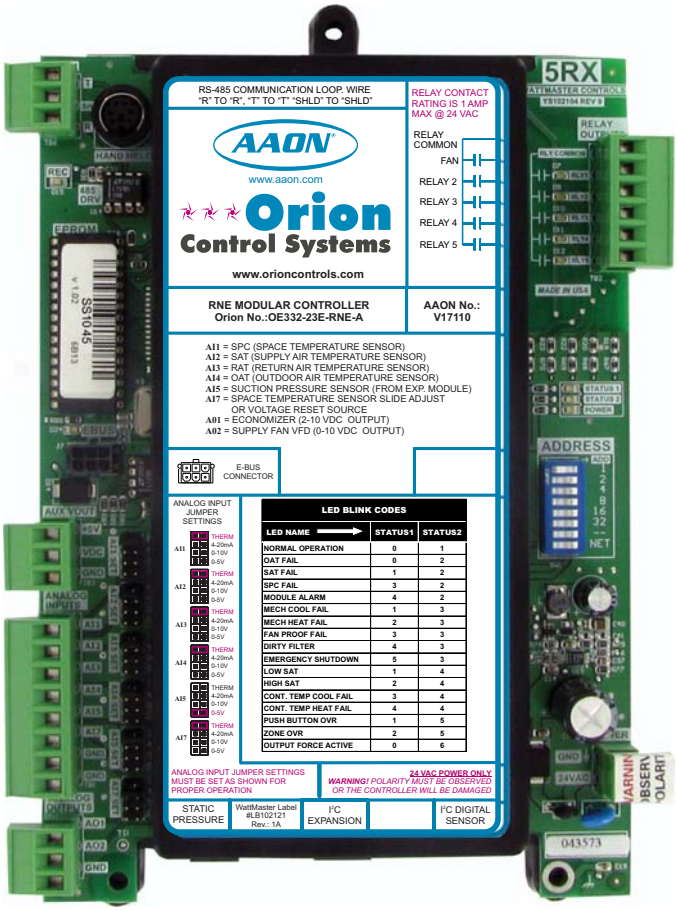
Factory Packaged Controls

RNE Modular Controller Technical Guide

RNE Modular Controller: Tulsa - SS1045
Requires Service Tool Code: SS1056 Version 1.0 and up



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WattMaster Form: AA-RNE-TGD-01H

AAON Manual Part Number: V20490

Features and Applications

Features

The RNE Modular Controller (OE332-23E-RNE-A) is designed with 7 analog inputs, 2 analog outputs, and 5 relay outputs. Each RNE Controller's input and output capabilities can be expanded with the VCM-X Expansion Module (OE333-23-EM), the 12 Relay Expansion Module (OE358-23-12R), and the 4 Binary Input Expansion Module (OE356-01-BI) by means of a modular cable.

The RNE Controller also allows various E-BUS modules to connect directly to it. These would include the Full Digital Module, the Two Condenser Head Pressure Module, and the Water Source Heat Pump Modules.

Each RNE Controller can be configured for control of VAV Units (with or without VAV/Zone Controllers), Constant Volume Units, and Make-Up Air Units. Features include the following:

- Up to a Combined Total of 20 Stages of Heating & Cooling
- Modulating Cooling Outputs (VFD Compressor or Chilled Water Valve Control)
- Modulating Heating Output (Hot Water Valve, Steam Valve, SCR Electric Heat Control)
- Full Integration with the AAON® MODGAS-X Modulating Natural Gas Controller
- Full Integration with the AAON® MHGRV-X Modulating Hot Gas Reheat Controller
- Configurable for Heat Pump Applications
- Advanced Dehumidification Capabilities
- Air Flow Monitoring of Outdoor Air, Supply Air, and Return Air Streams
- Air Flow Control of Outdoor Air Damper
- Single Zone VAV Control
- Primary/Secondary Heating Control
- Adaptive Supply Air Reset
- Selectable Control Sensor
- Fan Proving Interlock
- Dirty Filter Alarm
- Emergency Shutdown Input (Smoke Detector/Firestat or other Shutdown Conditions)
- Drybulb/Wetbulb Control of Economizer Operation
- Building Pressure Control
- Remote Override Capabilities
- IAQ Economizer Reset
- Title 24 Economizer Certified
- 7-Day, 2-Event-per-Day Scheduling
- 14 Holiday Event Scheduling
- Optimal Start Scheduling
- Trend Logging Capability
- Static Pressure Control for Filter Loading Applications
- Accepts Remote HVAC Mode Selection Via Contact Closure On VCM-X Expansion Module
- Configurable for AAON® PAC and DPAC Applications
- Heat Wheel - On/Off Control
- Configurable for R22 and R410-A refrigerant
- Head Pressure Control
- Full Digital Control
- Water Source Heat Pump Monitoring

Most common HVAC unit control applications can be configured using only the RNE Controller. If the application requires more inputs and/or outputs, optional expansion modules are available to provide for additional analog, binary, or digital inputs and outputs as required.

The available expansion module configurations allow for 4 or 8 additional binary inputs, 4 additional analog inputs, 5 additional analog outputs, and up to 16 additional binary (relay) outputs. The various expansion modules plug into the RNE Controller by means of a modular cable.

E-BUS Module Applications

The RNE Controller will interface with the Two Condenser Head Pressure Module (OE370-23-HP2C2-A), the Full Digital Module (OE370-23-FD-A), and the Water Source Heat Pump Modules (OE334-23-WPM-A, OE334-23-WPM-A20, OE334-23-WPM-A25, OE334-23-WPM-A40, and OE334-23-WPM-22-A).

These E-BUS Modules allow independent control of multiple VFD compressors, control of the condenser fan(s) or valve(s), and monitoring functions for Water Source Heat Pump Units. See **pages 40-47** of this manual for detailed wiring and application details.

RNE Controller Applications

Variable Air Volume Unit

The RNE Controller can be configured to control a VFD Supply Fan for Duct Static Pressure control. If the unit is not equipped with a VFD, but Duct Static Pressure control is needed, a modulating Zoning Bypass Damper can be controlled by the RNE Controller.

VAV units are typically designed for occupied Cooling with Morning Warm-up Heating. This option is available with the RNE Controller. The RNE Controller can also be used for a Zoning System that needs Duct Static Pressure control and Occupied Cooling and Heating. The RNE Controller also has the ability to be configured for Duct Static Pressure Control by controlling the Supply Fan VFD for the purpose of maintaining proper Duct Static Pressure in response to varying filter loading conditions.

The RNE Controller allows Dehumidification Priority on a VAV unit. This could be useful on a building with a very low internal sensible load, but which has a high internal and/or external latent load. During VAV Dehumidification, the RNE Controller activates Cooling based on the Evaporator Coil Temperature and activates AAON® Modulating Hot Gas Reheat to warm the Supply Air Temperature to the Active Supply Air Temperature Setpoint.

Constant Air Volume Unit

The RNE Controller can be configured to activate a Constant Volume Supply Fan. In most cases, this is a very basic unit with Space Temperature control. The RNE Controller can be used for kitchen, restaurant, or lab environments that are 100% Outdoor Air part of the time and Return Air part of the time. The Hood On input allows the RNE Controller to know when to switch to 100% Outdoor Air control based on an exhaust hood activating. The RNE Controller requires Outdoor and Indoor Air Temperature Sensors to accomplish this application.

Make-Up Air Unit

The RNE Controller can be configured for 100% Outdoor Air control for Make-Up Air. All HVAC Modes are determined from the Outdoor Air Sensors. The Outdoor Air Volume must always be at least 50% or higher to be configured for Outdoor Air control.

AAON® PAC (Precision Air 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 a Space Temperature Sensor as the Controlling Sensor.

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

For AAON® PAC configured units, the Return Air Bypass Damper is only used during the Dehumidification Mode. When the RNE Controller is in Dehumidification Mode, the Return Air Bypass Damper will modulate open as the Space Temperature falls below the Cooling Setpoint. Modulation of the Return Air Bypass Damper is controlled using a proportional range from 0% (when the Space Temperature is equal to the Cooling Setpoint) up to 100% (when the Space Temperature falls to the halfway point between the Cooling and Heating Setpoints). A separate Return Air Damper Actuator will modulate the Return Air Damper slightly further towards its closed position as the Return Air Bypass Damper opens. This is to ensure that enough Return Air is bypassed around the Evaporator Coil through the Return Air Bypass Damper to raise its temperature. The rate which the Return Air Damper closes while the Return Air Bypass Damper is open is user-adjustable.

AAON® DPAC (Digital Precision Air Control)

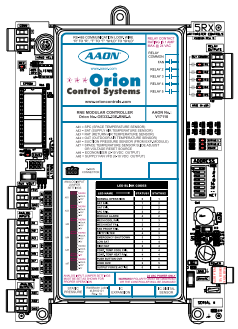
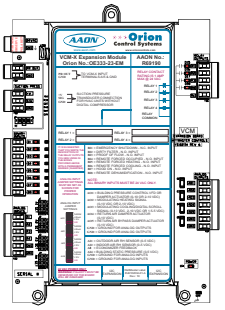
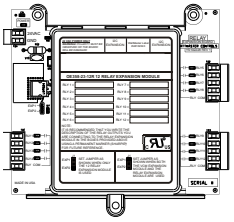
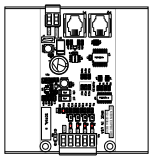
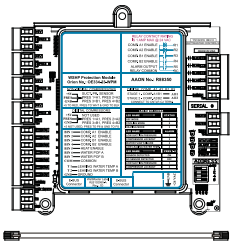
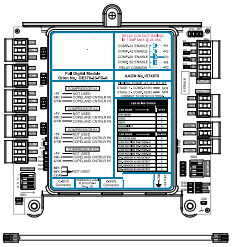
This control scheme can only be used on Constant Volume HVAC units that are equipped with a Return Air Bypass Damper and VFD Compressor(s). AAON® DPAC also uses a Space Temperature Sensor as the Controlling Sensor.

The AAON® DPAC control scheme provides improved moisture removal capabilities over the AAON® PAC control scheme and provides for tighter temperature control by combining a VFD Compressor with the Return Air Bypass Damper. See the Cooling Mode section starting on **page 53** for detailed VFD Compressor operation. Refer to AAON® PAC Control previously described for detailed Return Air Bypass Damper operation.

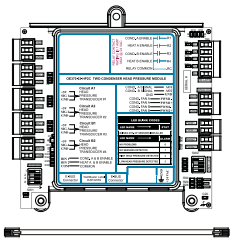
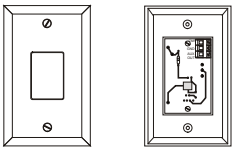
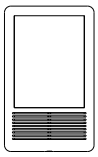
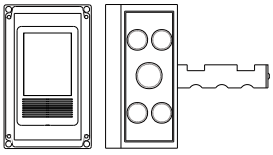
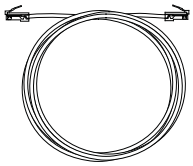
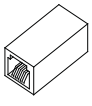
The VFD Compressor is used during both Cooling and Dehumidification Modes. The Return Air Bypass Damper is used only during the Dehumidification Mode.

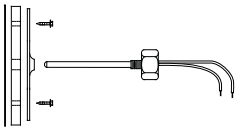
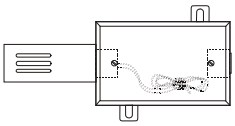
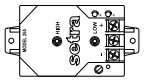
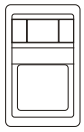
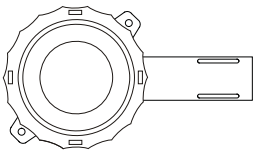
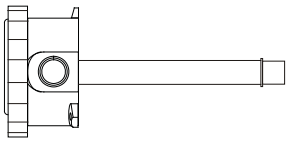
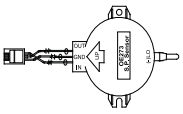
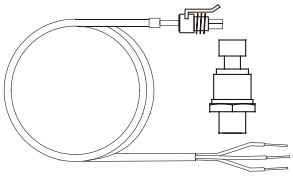
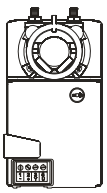
Part Number Cross Reference

PART DESCRIPTION	ORION PART NUMBER	AAON TULSA PART NUMBER
RNE Modular Controller	OE332-23E-RNE-A	V17110
VCM-X Expansion Module	OE333-23-EM	R69190
VCM-X 12-Relay Expansion Module	OE358-23-12R	R69180
VCM-X 4 Binary Input Expansion Module	OE356-01-BI	R82940
Full Digital Module	OE370-23-FD-A	R74870
Two Condenser Head Pressure Module II	OE370-23-HP2C2	V20660
WSHP-X2 Module	OE334-23-WSHP-X2	V48820
MHGRV-X Module	OE377-00-00042	N/A
MODGAS-X Module	OE377-00-00041	N/A
Building Static Pressure Sensor	OE258-01	R37030
Bypass Damper Actuator	OE281-04	N/A
Cable Coupler for TSDRSC Cables	MS000029	N/A
CO_2 Sensor - Duct Mounted	OE256-02	R82970
CO_2 Sensor - Space	OE256-01	R82960
CommLink 5 Communications Interface	OE361-13	V32950
Digital Room Sensor - Temp & Humidity	OE217-01	R83870
Digital Room Sensor - Temp. Only	OE217-00	R83860
Digital Sensor Cable Assembly	TSDRSC-XX	N/A
Duct Static Pressure Sensor	OE271	P87100
Duct Temperature Sensor - 12" Probe	OE231	R44940 / P87140
Duct Temperature Sensor - 6" Probe	OE230	R36340
E-BUS Adapter Board	OE365-15-EBA	V15840
GPC-X Controller	OE332-23-GPCX	N/A
IP Module Kit	OE415-02	R66770
MiniLink Polling Device	OE364-22	N/A
Modular Service Tool SD - Operator Interface	OE391-12	V28140
Modular System Manager SD - Operator Interface	OE392-12	V36570
Outdoor Air RH Sensor - 3% - 0-5 VDC Output	OE265-13	R34700
Outdoor Air Temperature Sensor	OE250	P87150
Return Air RH Sensor - 3% - 0-5 VDC Output	OE265-14	R34650
Room Mounted RH Sensor - 3% - 0-5 VDC Output	OE265-11	R34690
Standard Room Sensor - Plain	OE210	R31480
Standard Room Sensor - W/ Override	OE211	P87040
Standard Room Sensor - W/ Override & Slide Adjust	OE213	P94320
Standard Room Sensor - W/ Slide Adjust	OE212	P94100
Static Pressure Pickup Tube	OE290	S18780
Suction Pressure Transducer	OE275-01	N/A
System Manager TS II - Operator Interface	OE392-10	N/A
USB-Link 2 Kit	OE366	R71870

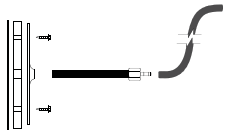
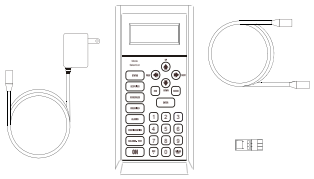
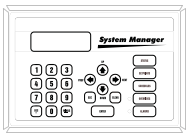
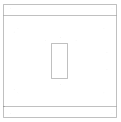
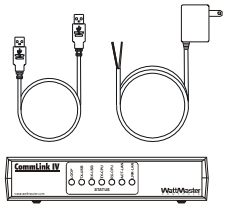
PART NO.	PART DESCRIPTION	ILLUSTRATION	PAGE NO.
OE332-23E-RNE-A	RNE Controller The RNE Controller provides 7 analog inputs, 2 analog outputs, and 5 relays. It presently allows for the addition of the VCM-X Expansion Module, the 12 Relay Expansion Module, and hte 4 Binary Input Expansion Module described below. NOTE: Set-up, programming, and monitoring of the RNE Controller requires one of the following communication interfaces—Prism 2 Front-End Software used with a personal computer, System Manager Touch Screen II, or Modular Service Tool.		*Page 18*
OE333-23-EM	VCM-X Expansion Module Includes: VCM-X Expansion Module mounted in plastic enclosure and 10 ft. I²C cable. The VCM-X Expansion Module adds VAV applications, building pressure control, head pressure control, water source heat pump monitoring, and other functions. It provides 4 additional analog inputs, 2 binary inputs, 5 additional relays, and 3 analog outputs. It connects with a modular cable to the RNE Controller.		*Pages 26-28*
OE358-23-12R	VCM-X 12 Relay Expansion Module Includes: 12 Relay Expansion Module mounted in plastic enclosure and 10 ft. I²C cable. The VCM-X 12 Relay Expansion Module adds 12 configurable relays to the RNE Control System. It connects to the RNE Controller using the included I²C cable.		*Page 38*
OE356-01-BI	VCM-X 4 Binary Input Expansion Module Includes: 4 Binary Input Expansion Module mounted in Snap Track and 10 ft. I²C cable. Use the 4 Binary Input Expansion Module if your HVAC unit only requires a Smoke Detector/Firestat, Dirty Filter, Proof of Flow, or Remote Forced Occupied Inputs or all of these 4 inputs and you don't need any of the other inputs or outputs provided by the OE333-23-EM VCM-X Expansion Module. The module connects to the RNE Controller using the included I²C cable.		*Page 29*
OE334-23-WSHP-X2	Water Source Heat Pump X2 Module Includes: Water Source Heat Pump X2 Module in a plastic enclosure with LCD display and E-BUS Modular cable. Provides monitoring and compressor control for AAON Tulsa Water Source Heat Pump Units. Used with the RNE Controller.		*Pages 41,44*
OE370-23-FD-A	Full Digital Module Includes: Full Digital Module in a plastic enclosure and E-BUS Modular cable.Used with the RNE Controller. For AAON Tulsa units with multiple Digital Scroll Compressors and that are not Water Source Heat Pump Units.		*Pages 40,43*

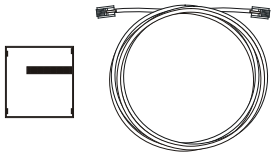
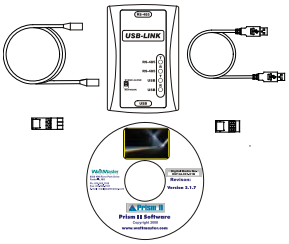
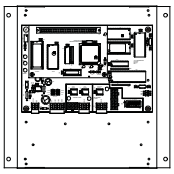
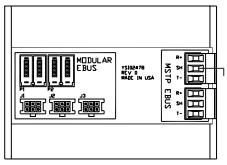
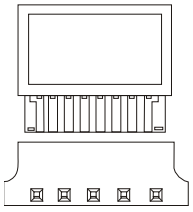
Parts and Descriptions

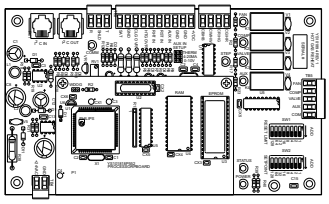
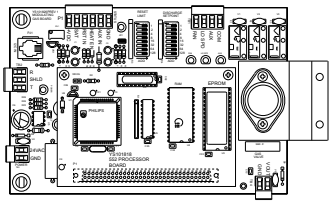
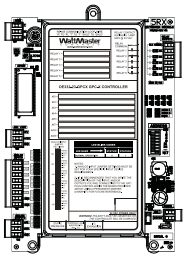
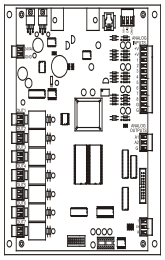
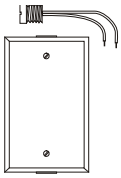
PART NO.	PART DESCRIPTION	ILLUSTRATION	PAGE NO.
OE370-23-HP2C2-A	**Two Condenser Head Pressure Module** Includes: Two Condenser Head Pressure Module in a plastic enclosure and E-BUS Modular Cable. This module is used on units with 2 physically separate condenser sections and is able to monitor up to 4 individual head pressure transducers (2 per section) to control the Condenser Fans or Water Valves based on the highest of the 2 readings for each section. It is also capable of monitoring a Heating Enable control signal (Heat Pump Mode) and forces the Condenser Signal to 100% while in this mode. This module can be used as a communicating module with the RNE Controller.		*Pages 42,46*
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 RNE Controller only. Connects to controller via field fabricated wiring.		*Page 21*
OE217-00	**Digital Room Sensor - Temp. Only** LCD Display and keypad allow for setpoint adjustment, override, and display of certain status and setpoints. The OE217-00 is used with the RNE Controller for room air temperature sensing applications. Uses I^2C cable.		*Page 19*
OE217-01	**Digital Room Sensor - Temp and Humidity** LCD Display and keypad allow for setpoint adjustment, override, and display of certain status and setpoints. The OE217-01 is used with the RNE Controller for room air temperature and humidity sensing applications. Uses Uses I^2C cable.		*Page 19*
OE256-01	**CO_2 Wall-Mounted Sensor** Used with the RNE for CO_2 sensing applications where wall mounting in the space is desired. Connects to the RNE Controller with an I^2C cable of required length. Cable sold separately.		*Page 19*
OE256-02	**CO_2 Duct Sensor with Pickup Tube** Used with the RNE Controller for duct mounted CO_2 sensing applications. Connects to the RNE Controller with an I^2C cable of required length. Includes: Duct Mounted CO_2 Sensor, Integral Aspiration Box, Airflow Pickup Tube and 10 ft. I^2C Cable.		*Page 20*
TSDRSC-05 TSDRSC-10 TSDRSC-25 TSDRSC-40 TSDRSC-80 TSDRSC-120 TSDRSC-160	**Digital Sensor Cable Assembly** Includes: Digital Sensor Cable Assembly. Cable assembly has male RJ-45 modular connectors on both ends. For use with the Digital Room Temperature Sensor, Digital Room & Temperature Sensor, Wall Mounted CO_2 Sensor & Duct Mounted CO_2 Sensor. These cables are used with the OE332-23E-RNE – RNE Controller and the OE742-31-VAVZ, OE742-32-VAVZ, OE744-31-VAVZ, and OE744-32-VAVZ – VAV/Zone Controller Actuator Packages. The TSDRSC Cables are available in 5, 10, 25, 40, 80, 120 & 160 feet lengths. The maximum length of cable allowed is 160 feet for a CO_2 Sensor and 160 Feet for a Digital Room Sensor. The total combined length of cable allowed when both a CO_2 Sensor and Digital Room Sensor is used is 160 feet.		*Page 19*
MS000029	**Cable Coupler for TSDRSC Cables** Includes: Sensor Cable Coupler. Used to connect TSDRSC cables together when lengths inbetween available cable sizes are required. Female RJ-45 to Female RJ-45. Maximum 1 Cable Coupler per cable run.		*Page 19*

PART NO.	PART DESCRIPTION	ILLUSTRATION	PAGE NO.
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.		*Page 22*
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 23*
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 33*
OE265-11	Room Mounted RH Sensor - 3% - 0-5 VDC Output Includes: 0-5 VDC, Room Mounted Relative Humidity Transmitter only. Used for room air humidity sensing applications.		*Page 31*
OE265-13	Outdoor Air Temperature & Humidity Sensor Includes: 0-5 VDC, Outside Air Relative Humidity Transmitter mounted in a weatherproof, round handy box only. Used for outside air humidity sensing applications.		*Page 30*
OE265-14	Return Air RH Sensor - 3% - 0-5 VDC Output Includes: 0-5 VDC, Return Air Relative Humidity Transmitter mounted in a weatherproof, round handy box only. Used for return air humidity sensing applications.		*Page 32*
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 18*
OE275-01	Suction Pressure Transducer Includes: Suction Line Pressure Transducer with modular cable. The cable is supplied with a modular connector on one end and bare stripped wires on the other end. The OE275-01 Suction Pressure Transducer is used to monitor refrigerant suction line pressure of a DX cooling coil when a digital compressor is used. The Suction Pressure Transducer is provided with a ¼″ SAE Flare connection for connection to the refrigerant suction line.		*Pages 40,41 43,44*
OE281-04	Bypass Damper Actuator Includes: OE281-04 Modulating Damper Actuator. Used when a terminal unit is to be used as a bypass damper for field or factory controls mounted by others. Accepts a 0-10 VDC signal.		*Page 37*

Parts and Descriptions

PART NO:	PART DESCRIPTION	ILLUSTRATION	PAGE NO.
OE290	**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 18*
OE392-10	**System Manager TS II Operator Interface** The System Manager TS II provides a direct, graphic-enhanced, menu-driven link to enable the system operator to view the status and adjust the setpoints of any controller on the RNE control system. The System Manager TS II is equipped with a 4.3" 480 x 272 WQVGA RGB TFT LCD Touch Screen Display. The System Manager TS is furnished with hardware for flush mounting into hollow drywall or surface mounting on concrete brick or plaster surfaces. Includes: System Manager TS with 12 ft. long pigtail cable assembly.		*See the System Manager Touch Screen II Technical Guide*
OE391-12	**Modular Service Tool SD** Includes: Modular Service Tool SD, power supply, communication cables, adapter plug, and (4) AA batteries. Used to program and monitor all Orion controllers.		*See the RNE 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. Modular System Manager and communication cables.		*See the RNE Controller Operator Interfaces SD Technical Guide*
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.		*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*

PART NO.	PART DESCRIPTION	ILLUSTRATION	PAGE NO.
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 IV 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*
OE364-22	**MiniLink Polling Device** Control enclosure is for indoor use only. 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 mounted in the EE000075-01 control enclosure. Control Enclosure cover is shown removed in picture.		*See the CommLink IV Technical Guide*
OE365-15-EBA	**E-BUS Adapter Board** The E-BUS Adapter Board is used for connecting the EBTRON®, GreenTrol™ or Paragon Airflow Measurement Digital Transmitter to the VCB-X Control System. The E-BUS Adapter Board connects to the VCB-X Controller with an EBC E-BUS cable. Cable supplied separately.		*See Page 39.*
OE508	**Prism 2 Front-End Computer Software** Prism 2 provides standard, easy to understand status screens for each type of RNE 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.		*See the Prism 2 Technical Guide*
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*

PART NO.	PART DESCRIPTION	ILLUSTRATION	PAGE NO.
OE377-00-00042	MHGRV-X Controller The MHGRV-X Controller controls a Modulating Hot Gas Reheat Valve to maintain a desired Supply Air Temperature and Dehumidification setpoint. The MHGRV-X Controller connects to the RNE Controller via an I²C cable. Available only from AAON®.		*N/A*
OE377-00-00041	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 RNE Controller via an I²C cable. Available only from AAON®.		*N/A*
OE332-23-GPCX	GPC-X Controller 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.		*See GPC-X Technical Guide*
OE310-21-LP	Lighting Controller Adds lighting control capability to the RNE Control System. Lighting Controller provides up to (7) independent time schedules. Provisions for photocell or light sensor light level control are also provided. Lighting Controller only provides Pilot Duty Relay Outputs. An external Lighting Contactor must be provided by others. If a Light Sensor OE259 is to be used with the Lighting Controller, it must also be ordered from WattMaster. Includes: Lighting Controller with Backplate.		*N/A*
OE259	Light Sensor Ambient Light Sensor (Use with Lighting Controller for light sensing.) 24VDC power, 1m Ohm to 1.5k Ohm output signal. Supplied with weatherproof handy box for outdoor or indoor mounting. Light Sensor threads into conduit fitting. Includes: Light Sensor and weatherproof handy box.		*N/A*

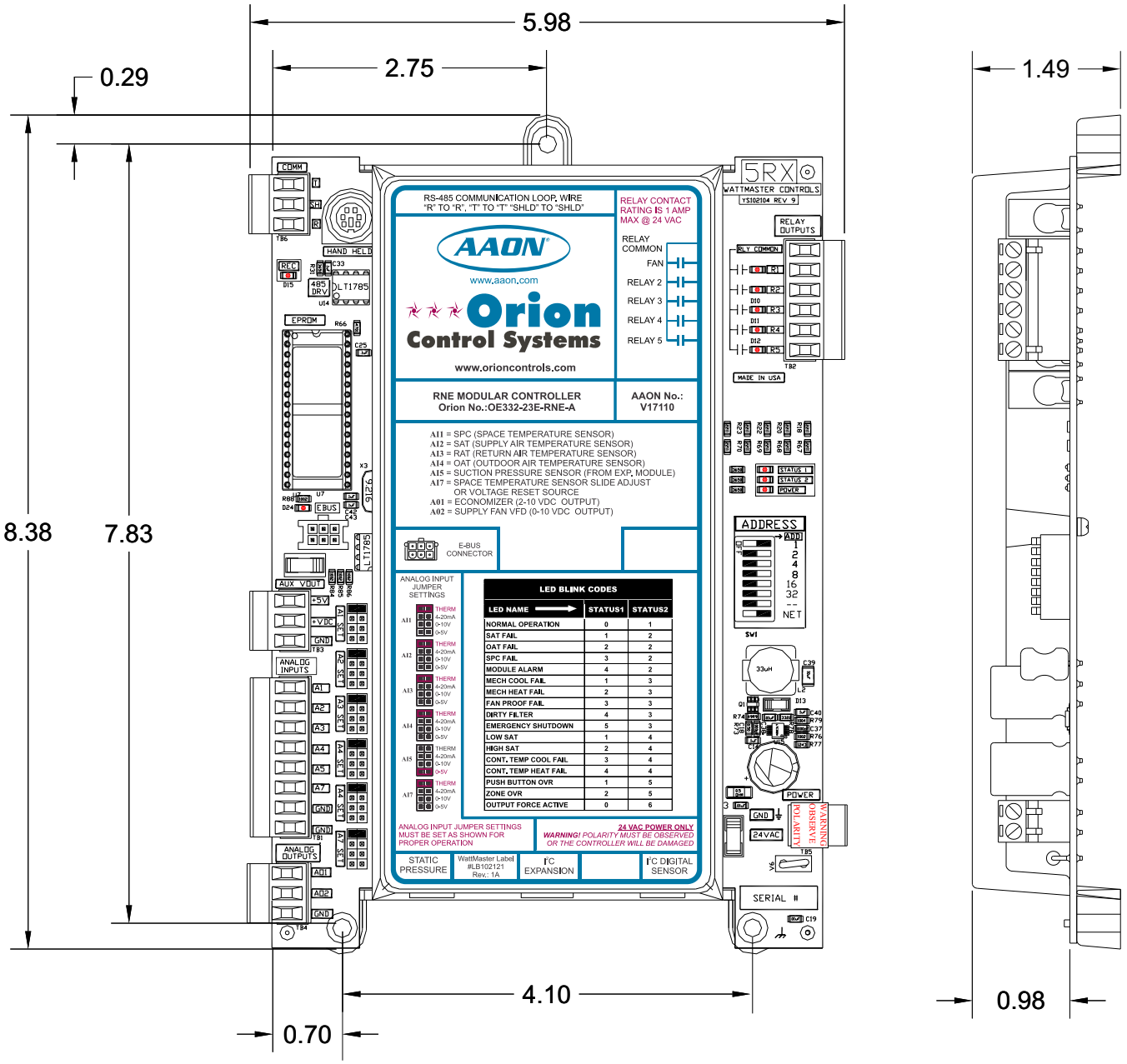


Figure 1: OE332-23E-RNE – RNE Modular Controller Dimensions

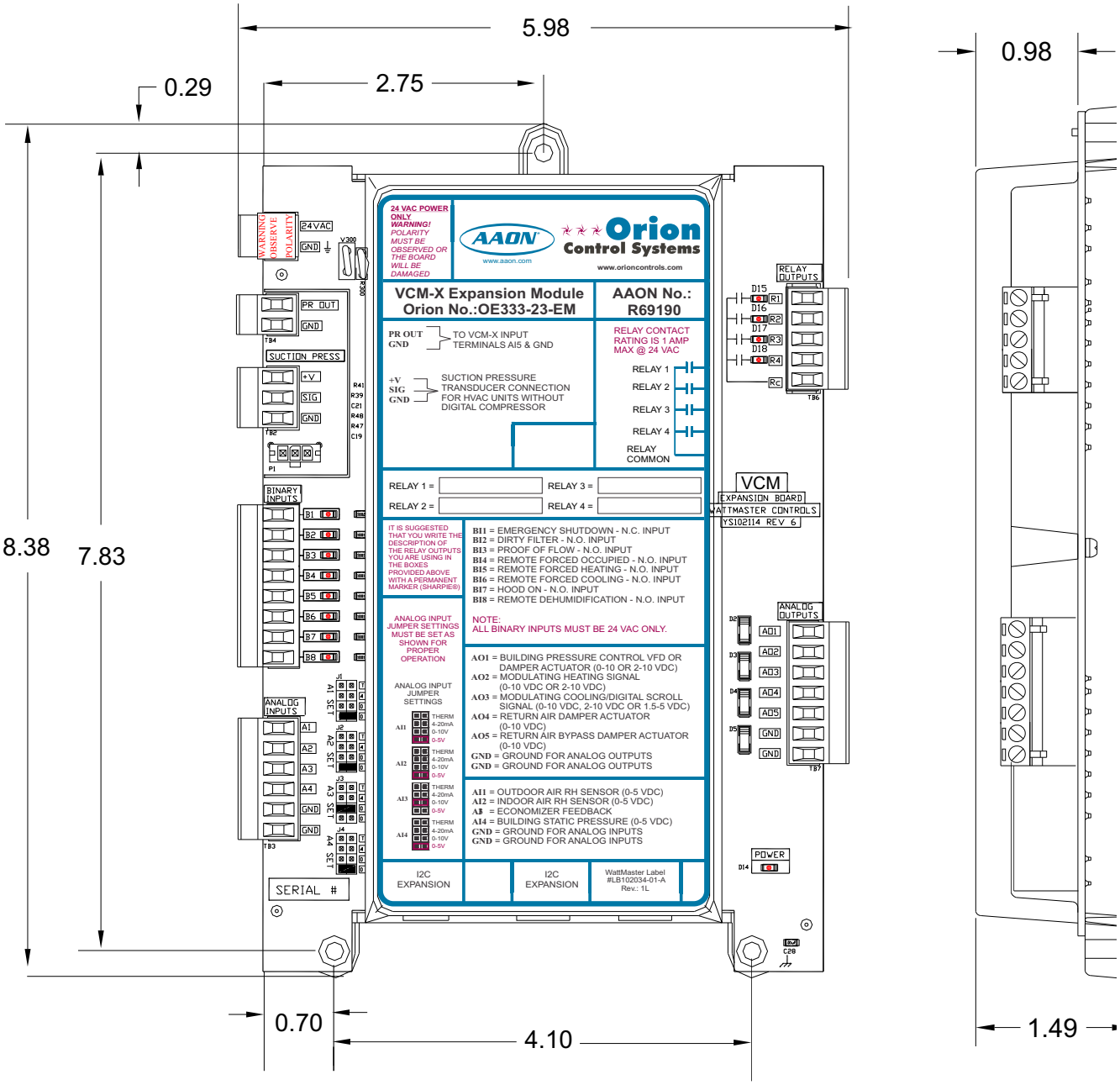


Figure 2: OE333-23-EM – VCM-X Expansion Module for RNE Dimensions

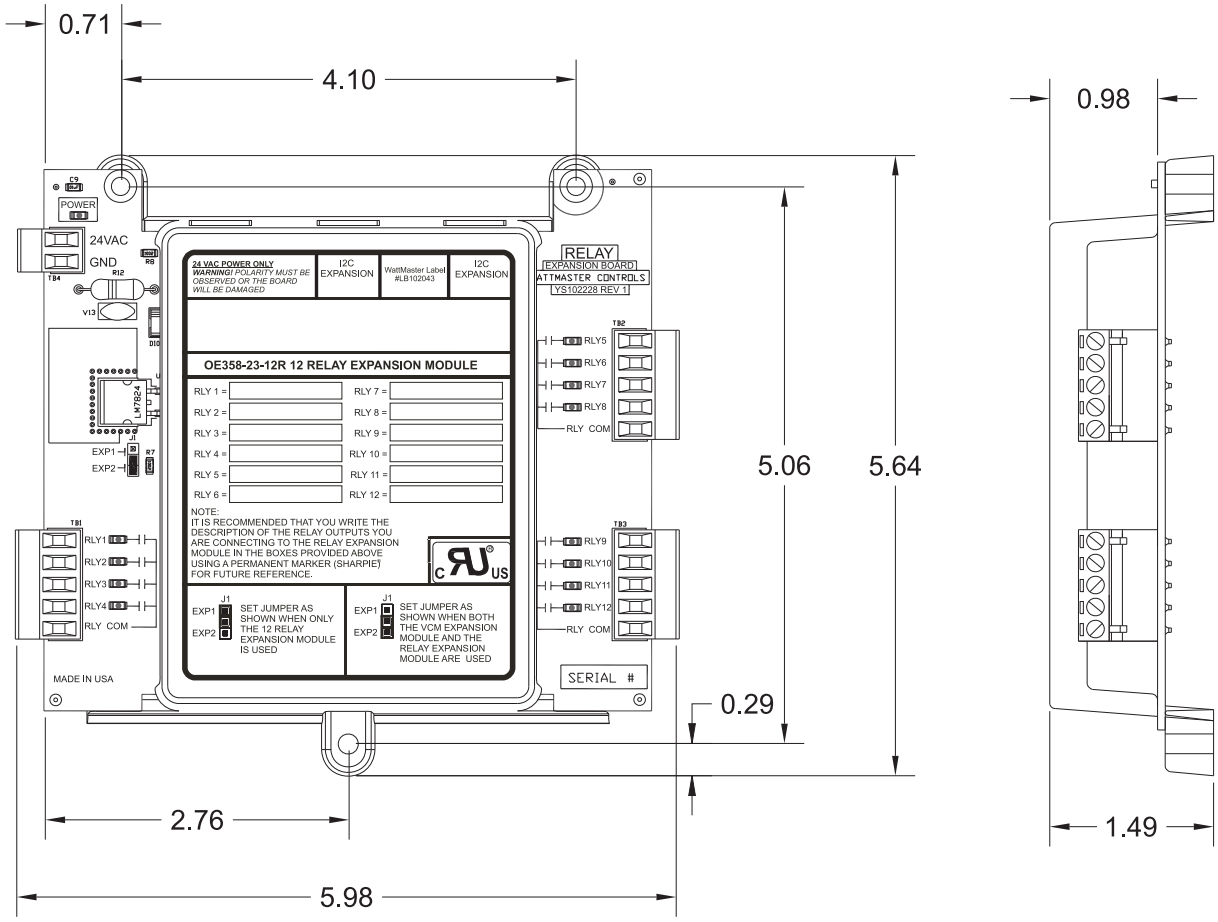


Figure 3: OE358-23-12R – 12-Relay Expansion Module Dimensions

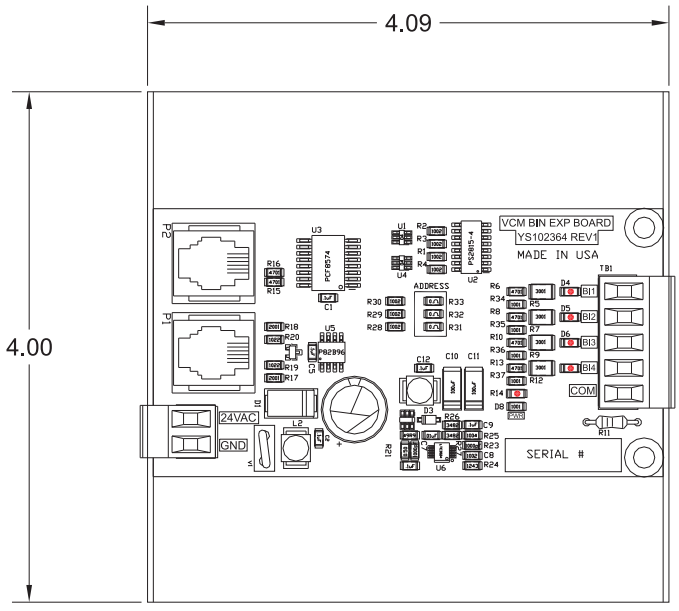


Figure 4: OE356-01-BI – 4 Binary Input Expansion Module Dimensions

RNE Controller Component Locations

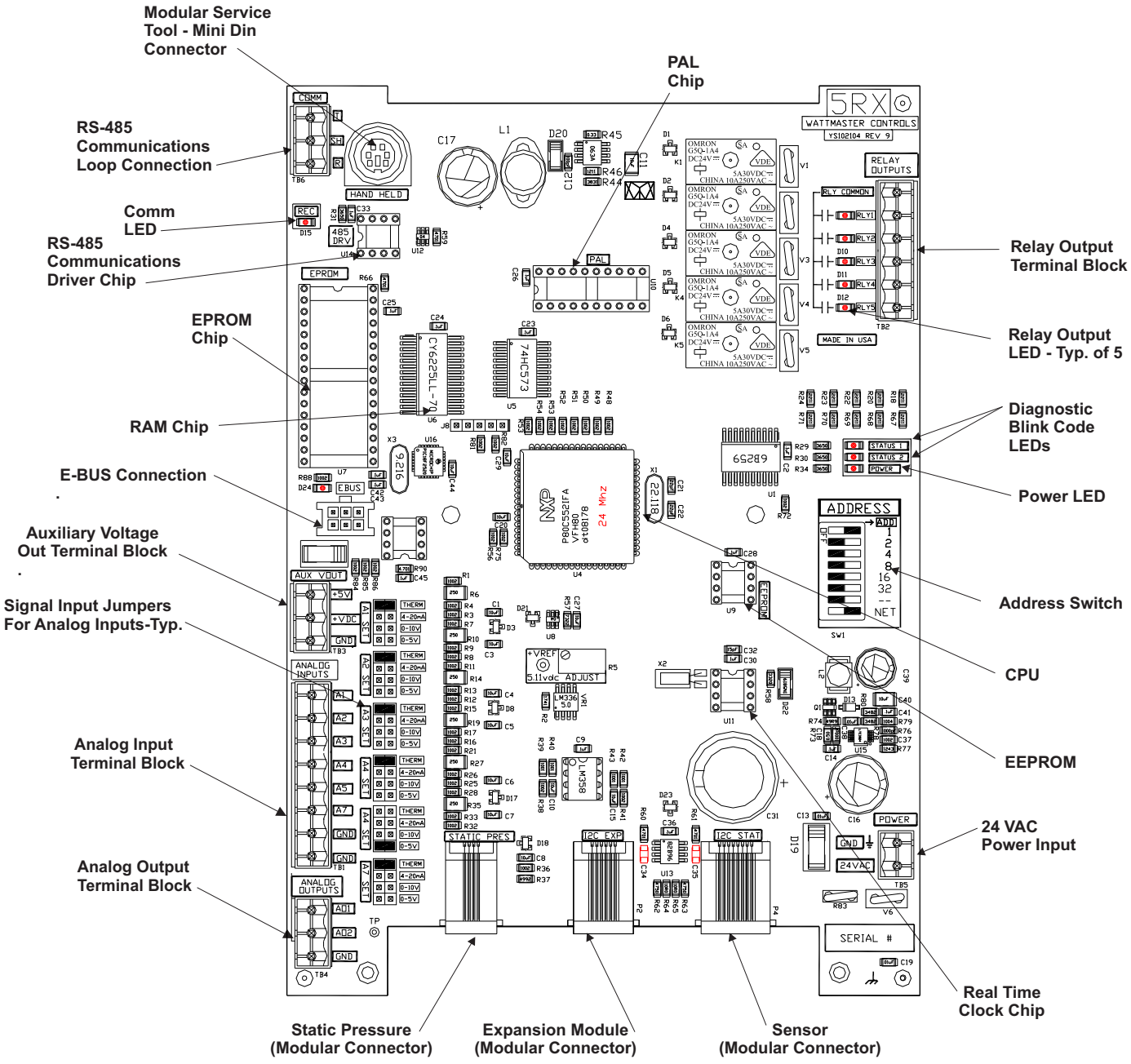


Figure 5: OE332-23E-RNE – RNE Modular Controller Component Locations

General

Correct wiring of the RNE Modular Controller is the most important factor in the overall success of the controller installation process. In general, most RNE 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 since it was pre-wired at the factory. However, in the unlikely event that 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

The RNE Controller is housed in a plastic enclosure. It is designed to be mounted by using the 3 mounting holes in the enclosure base. The RNE 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). It is important to mount the controller in a location that is free from extreme high or low temperatures, moisture, dust, and dirt. Be careful not to damage the electronic components when mounting the controller. See **Table 1** for a list of the required operating conditions for the RNE Controller and associated expansion modules.

Considerations

The RNE 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)
OE332-23E-RNE RNE Modular Controller	24VAC	8	-30°F to 150°F	90% RH
OE333-23-EM VCM-X Expansion Module	24VAC	10	-30°F to 150°F	90% RH
OE358-23-12R 12 Relay Expansion Module	24VAC	15	-30°F to 150°F	90% RH
OE356-01-BI 4 Binary Expansion Module	24VAC	5	-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 RNE Controller and expansion modules.

Please carefully read and apply the following information when wiring the RNE Controller or the Expansion Modules. See **Figure 6** on **page 18** for the RNE Controller wiring diagram. See **Figures 17** and **18** on **pages 26 and 27** for Expansion Module Wiring.

1. All wiring is to be in accordance with local and national electrical codes and specifications.

2. Minimum wire size for 24 VAC wiring should be 18-gauge.

3. Minimum wire size for all sensors should be 24-gauge. Some sensors require 2-conductor wire and some require 3-or 4-conductor wire.

4. 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.

5. When communication wiring is to be used to interconnect RNE 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.

6. Before applying power to the RNE Controller, be sure to recheck all wiring connections and terminations thoroughly.

RNE Controller Wiring

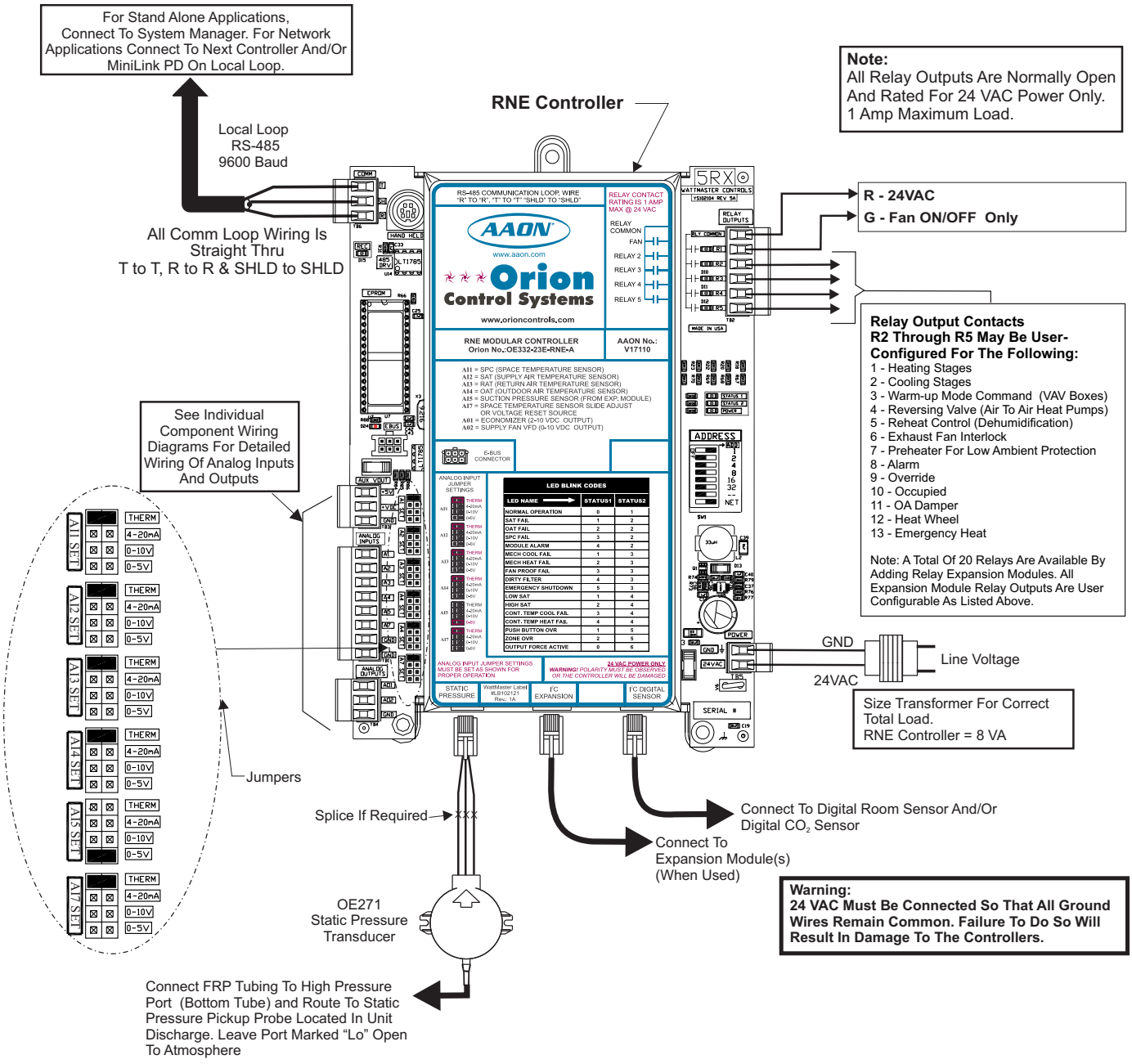


Figure 6: OE332-23E-RNE – RNE Controller Wiring

Digital Room Sensor & Wall Mounted Space CO_2 Sensor

Digital Room Sensor

The OE217-00 Digital Room Sensor is used to sense Space Temperature and the OE217-01 Digital Room Sensor is used to sense Space Temperature and Space Humidity. The Sensor connects to the RNE Controller with the TSDRSC modular cable. It can be daisy-chained with the OE256-01 CO_2 Sensor for applications requiring both a room CO_2 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 7** for wiring details.

Wall Mounted Space CO_2 Sensor

The OE256-01 Wall Mounted Space CO_2 Sensor is used to monitor CO_2 levels in the space served by the HVAC unit. The CO_2 Sensor connects to the RNE Controller with the TSDRSC modular cable. It can be daisy-chained with the Digital Room Sensor (OE217) for applications requiring both a room CO_2 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 8** for wiring details and installation notes. A Duct Mounted CO_2 Sensor can be used if desired instead of the Wall Mounted Space CO_2 Sensor. See **Figure 9** on **page 20** for Duct Mounted CO_2 Sensor wiring details.

Note: When Only The Digital Room Sensor Is Used, It Connects Directly To The RNE Controller Using A TSDRSC Cable Of The Appropriate Length. The Maximum Length Allowed Is 160 Feet. See **Figure 8** For Connection When The Space CO_2 Sensor Is Also Used.

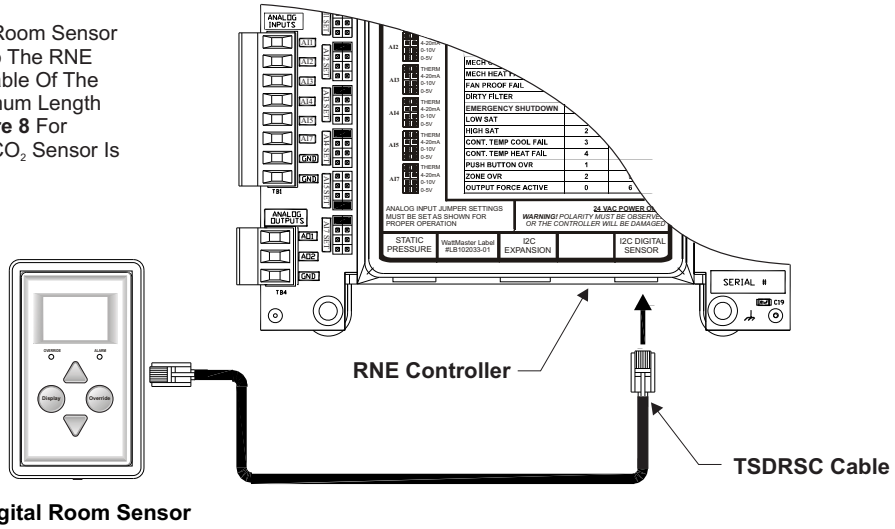


Figure 7: OE217-00/01 – Digital Room Sensor Wiring

Note: When a Digital Room Sensor Is Used In Combination With The CO_2 Sensor, The CO_2 Sensor Always Connects To The RNE Controller First Using a TSDRSC Cable Of The Required Length. The Digital Room Sensor Then Connects To The CO_2 Sensor With Another TSDRSC Cable. Mount Sensor(s) At Least 5 Feet Above Floor. See The *CO_2 Sensor Technical Guide* For Further Wiring Details.

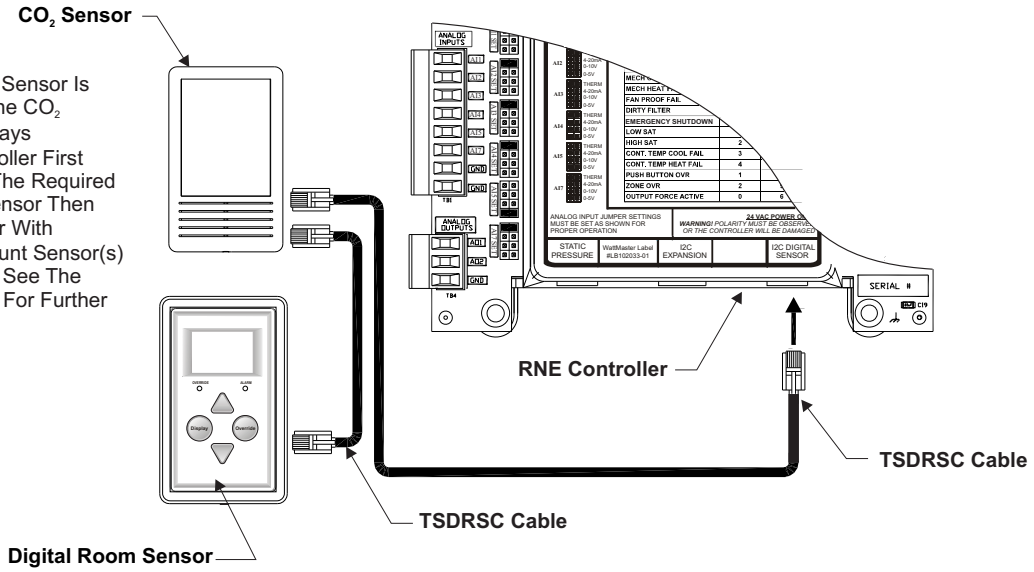


Figure 8: OE256-01 – Wall Mounted Space CO_2 Sensor Wiring

Ducted Mounted CO_2 Sensor

Duct Mounted CO_2 Sensor

The OE256-02 CO_2 Sensor is used for sensing the current CO_2 level in the HVAC unit's return air stream. This is useful when you want an average CO_2 reading in the area served by the HVAC unit or when you don't want a wall mounted CO_2 sensor due to sensor tampering concerns in the space.

The OE256-02 Duct Mounted Return Air CO_2 Sensor is comprised of the OE256-01 CO_2 Sensor and the WattMaster Aspiration Box Assembly.

The Duct Mounted Return Air CO_2 Sensor is designed to be mounted in the return air duct of the HVAC unit and uses its integral aspiration box to sample the CO_2 level in the duct. See the dimensional and installation information in **Figure 9** below for wiring and installation details.

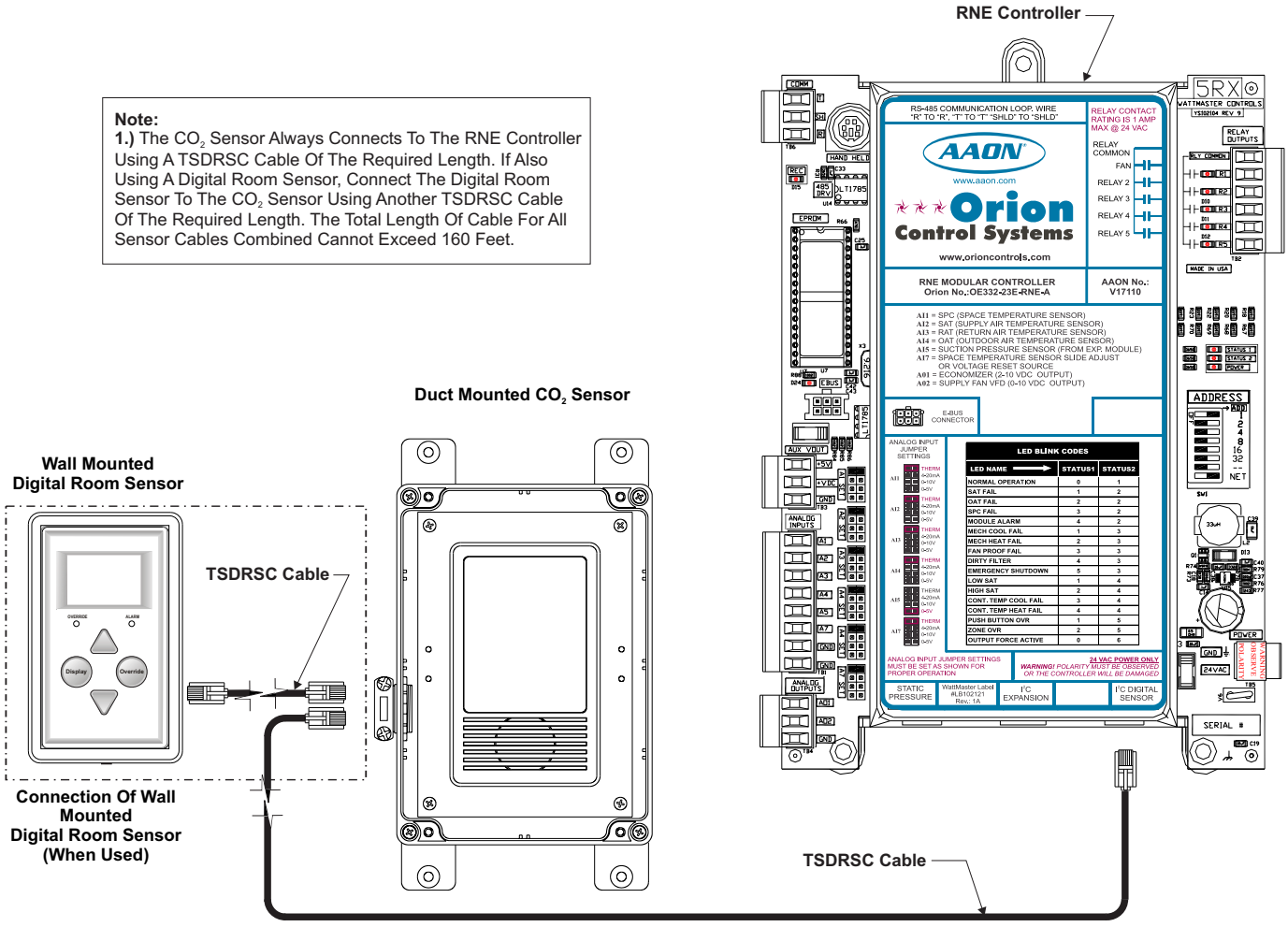


Figure 9: OE256-02 - Duct Mounted CO_2 Sensor Wiring

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.

When the Remote Supply Air Temperature Reset Signal option is needed, the Slide Offset option on the Room Sensor cannot be used. Only one of these options may be used on the RNE Controller.

See **Figure 10** below for complete Space Temperature Sensor wiring details.

Remote SAT Reset Signal

A Remote Supply Air Temperature Reset Signal can be connected to AI7 for applications requiring remote reset of the Supply Air Temperature Setpoint.

When the Slide Offset option on the Room Sensor is used, the Remote Supply Air Temperature Reset Signal cannot be used. Only one of these options may be used on the RNE Controller.

The RNE Controller can accept either a 0-5 VDC signal or a 0-10 VDC signal on this input.

See **Figure 11** below for complete Remote SAT Reset Signal wiring details.

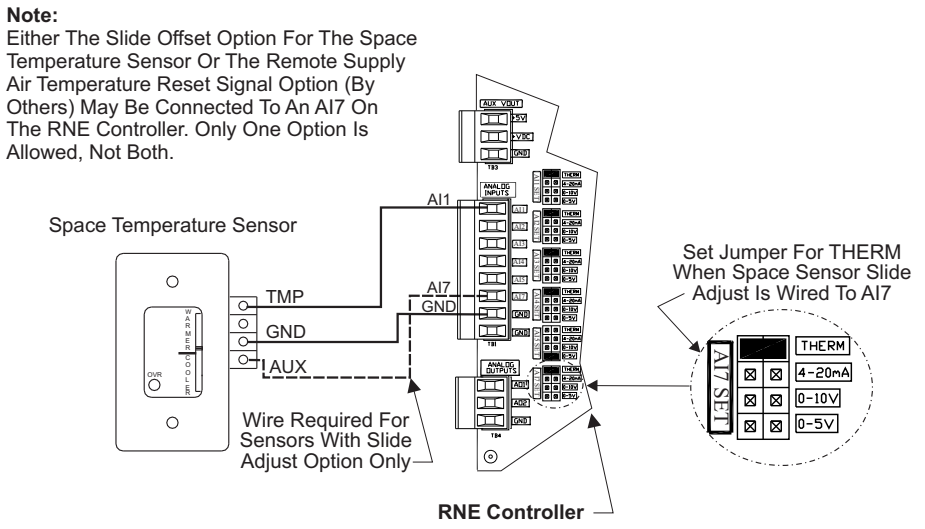


Figure 10: OE210, OE211, OE212, OE213 – Space Temperature Sensor Wiring

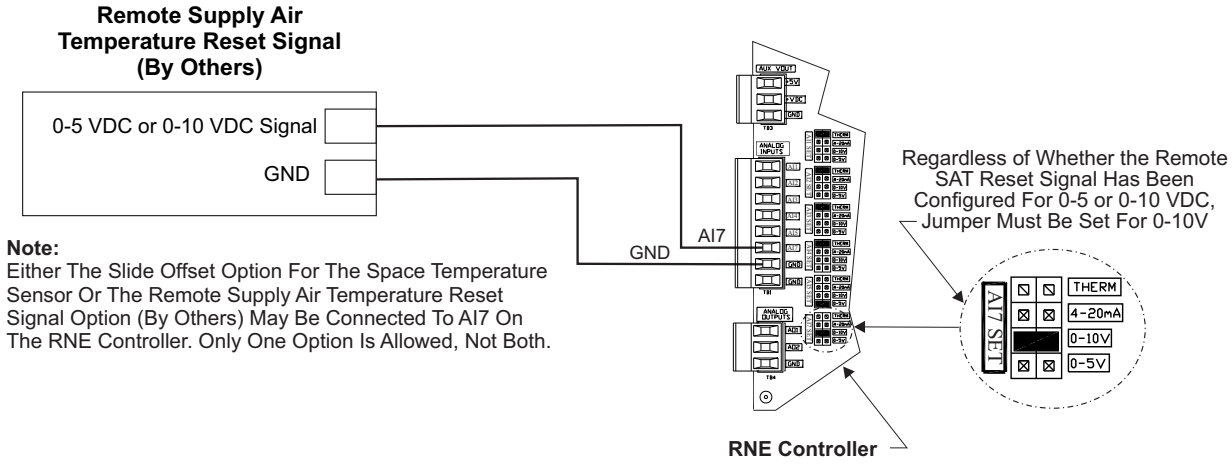


Figure 11: Remote Supply Air Temperature Reset Signal Wiring

SAT & RAT Sensor Wiring

Supply Air & Return Air Temperature Sensor

The OE231 Supply Air & Return Air Temperature Sensors must be wired as shown in **Figure 12** below for proper operation. The Supply Air & Return Air Temperature Sensors are 10K Type III thermistor sensors. The Supply Air Temperature Sensor should be mounted in the unit discharge plenum or in the supply air duct. 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.

NOTE: If your AAON® HVAC unit is using the AAON® MODGAS-X Controller and/or the AAON® MHGRV-X Controller, the Supply Air Temperature Sensor must always be connected to the RNE Controller unless you are using the AAON® MODGAS-X and/or AAON® MHGRV-X Controllers as stand-alone.

Note: The Supply Air Temperature Sensor Always Wires To The AI2 Input On The RNE Controller Unless Using The MODGAS II And/Or MHGRV II Controllers As Stand-Alone.

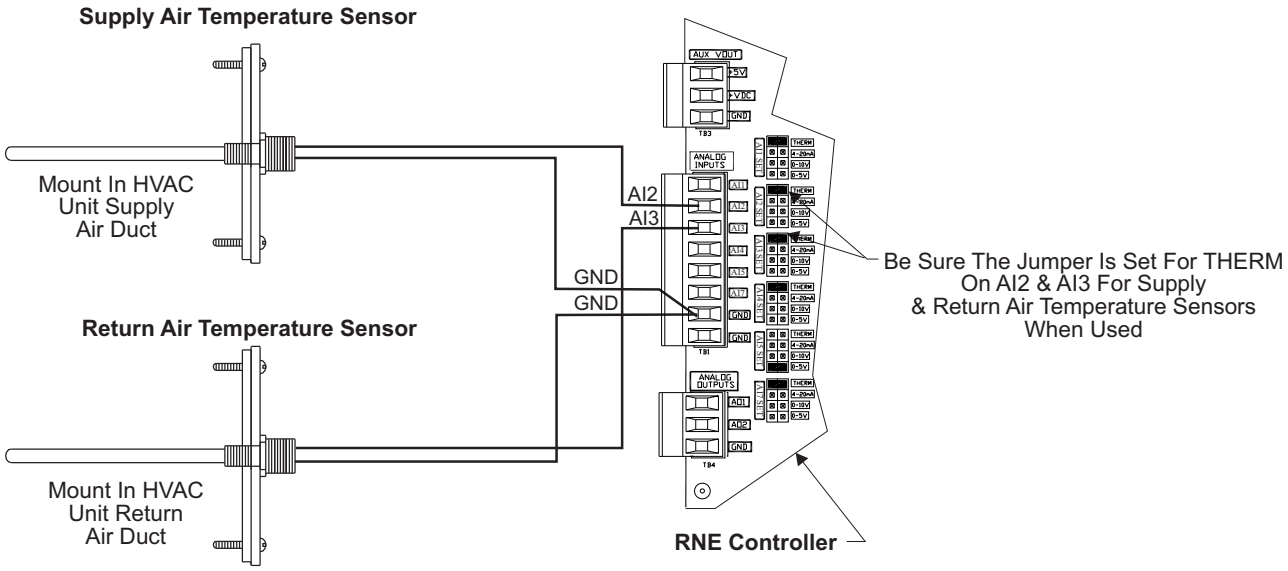


Figure 12: OE230 / OE231 – Supply Air and Return Air Temperature Sensor Wiring

Outdoor Air Temperature Sensor

The OE250 Outdoor Air Temperature Sensor must be wired as shown in **Figure 13** below for proper operation of the RNE 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.

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.

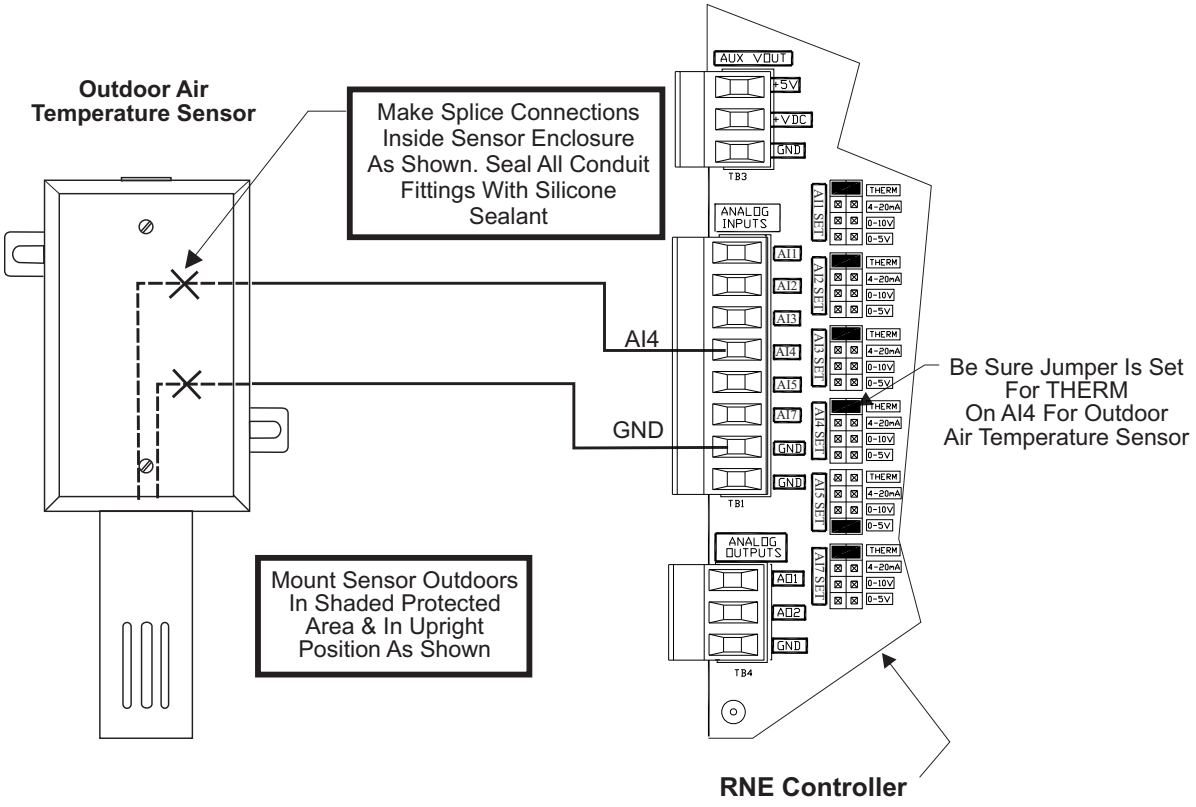


Figure 13: OE250 – Outdoor Air Temperature Sensor Wiring

Economizer Damper Actuator Wiring

Economizer Damper Actuator

The Economizer Damper Actuator signal voltage output is a 2-10 VDC output. This signal output is used by the RNE 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 14** 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 RNE Controller.

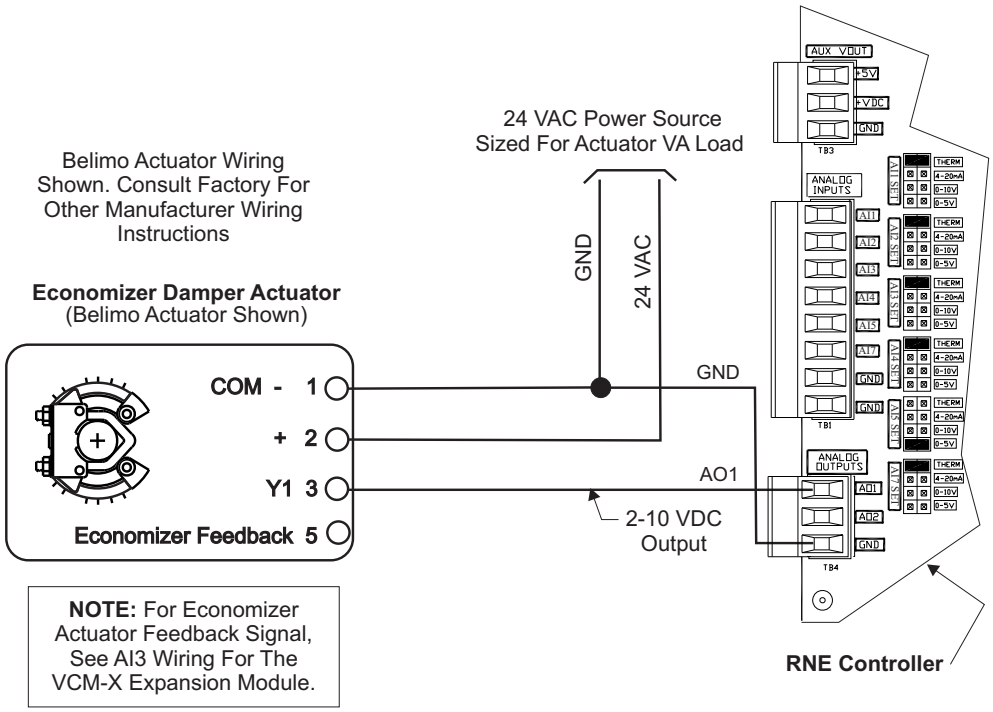


Figure 14: Economizer Damper Actuator Wiring

Supply Fan VFD Signal or Zoning Bypass Damper Actuator Signal

The Supply Fan VFD or Zoning Bypass Damper Actuator Signal is a 0-10 VDC output. This signal output can be connected to the Supply Fan Variable Frequency Drive to modulate the Supply Fan speed and control Duct Static Pressure utilizing the Duct Static Pressure Sensor connected to the RNE Controller. Alternatively, it can be connected to a Zoning Bypass Damper Actuator that will modulate the Zoning Bypass Damper Actuator to control Duct Static Pressure utilizing the Duct Static Pressure Sensor connected to the RNE Controller. A Duct Static Pressure Sensor must be connected in order for the VFD or Zoning Bypass Damper Actuator to operate. See **Figures 15** and **16** 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.

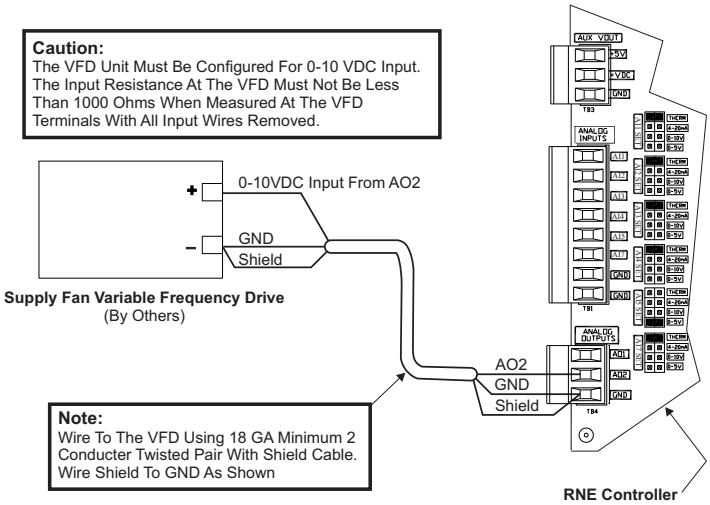


Figure 15: Supply Fan VFD Wiring

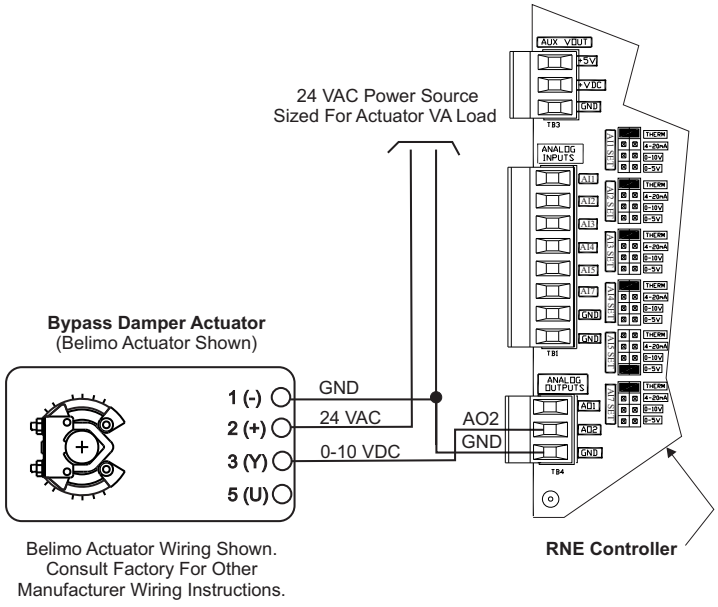


Figure 16: Zoning Bypass Damper Actuator Wiring

VCM-X Expansion Module Input Wiring for the RNE Controller

VCM-X Expansion Module for RNE

Three different Expansion Modules are available for use with the RNE Controller to provide additional inputs and outputs beyond those found on the RNE Controller.

The VCM-X Expansion Module (OE333-23-EM) provides 8 Binary Inputs, 4 Analog Inputs, 4 Relay Outputs, and 5 Analog Outputs. See **Figures 17 and 18** for complete wiring details.

The VCM-X Expansion Module can be used in conjunction with the 12-Relay Expansion Module (OE358-23-12R-A).

The 4 Binary Input Expansion Module (OE356-01-BI) can be used in place of the VCM-X Expansion Module if your system does not need any other inputs or outputs.

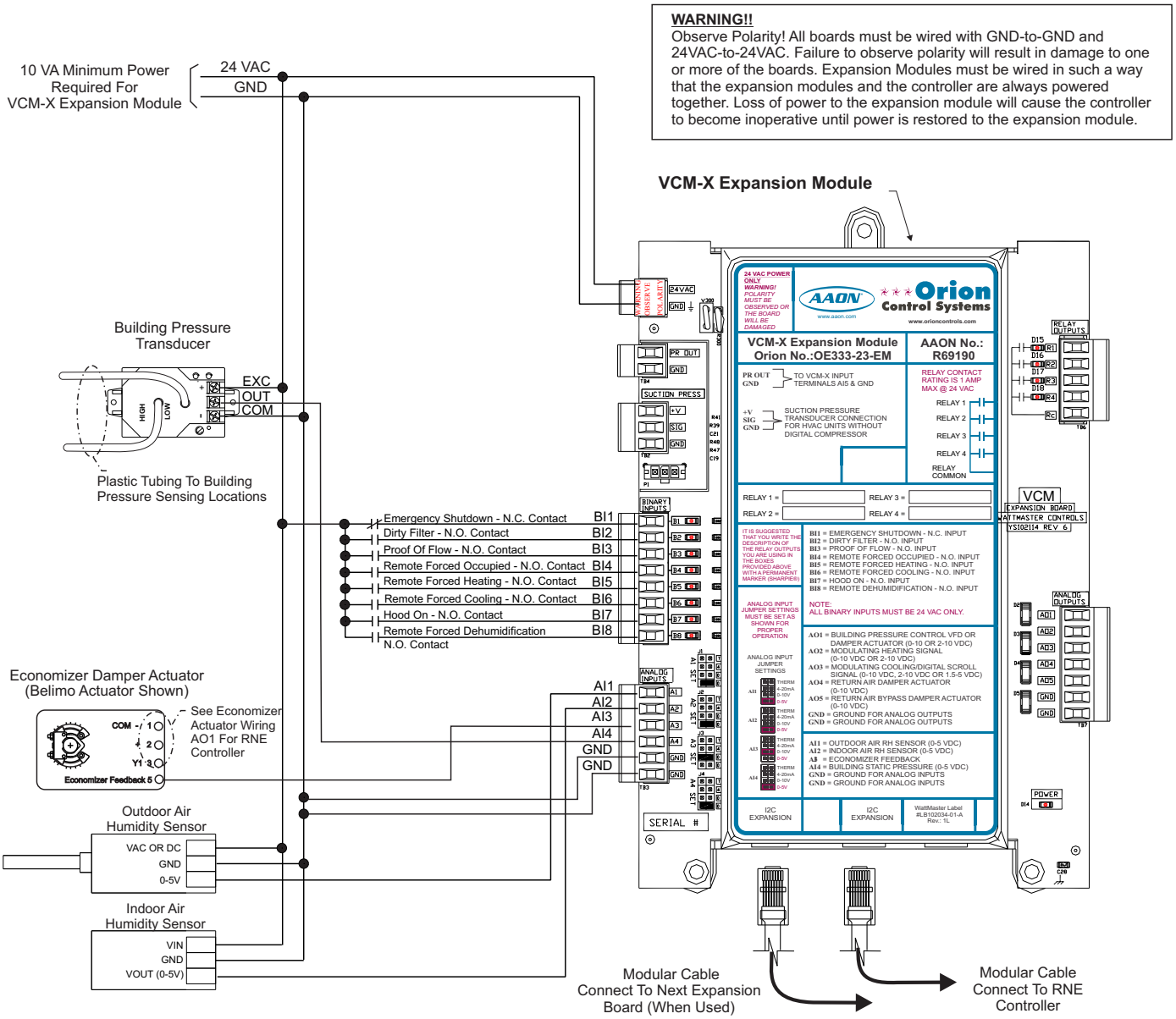


Figure 17: OE333-23-EM – VCM-X Expansion Module for RNE Input Wiring

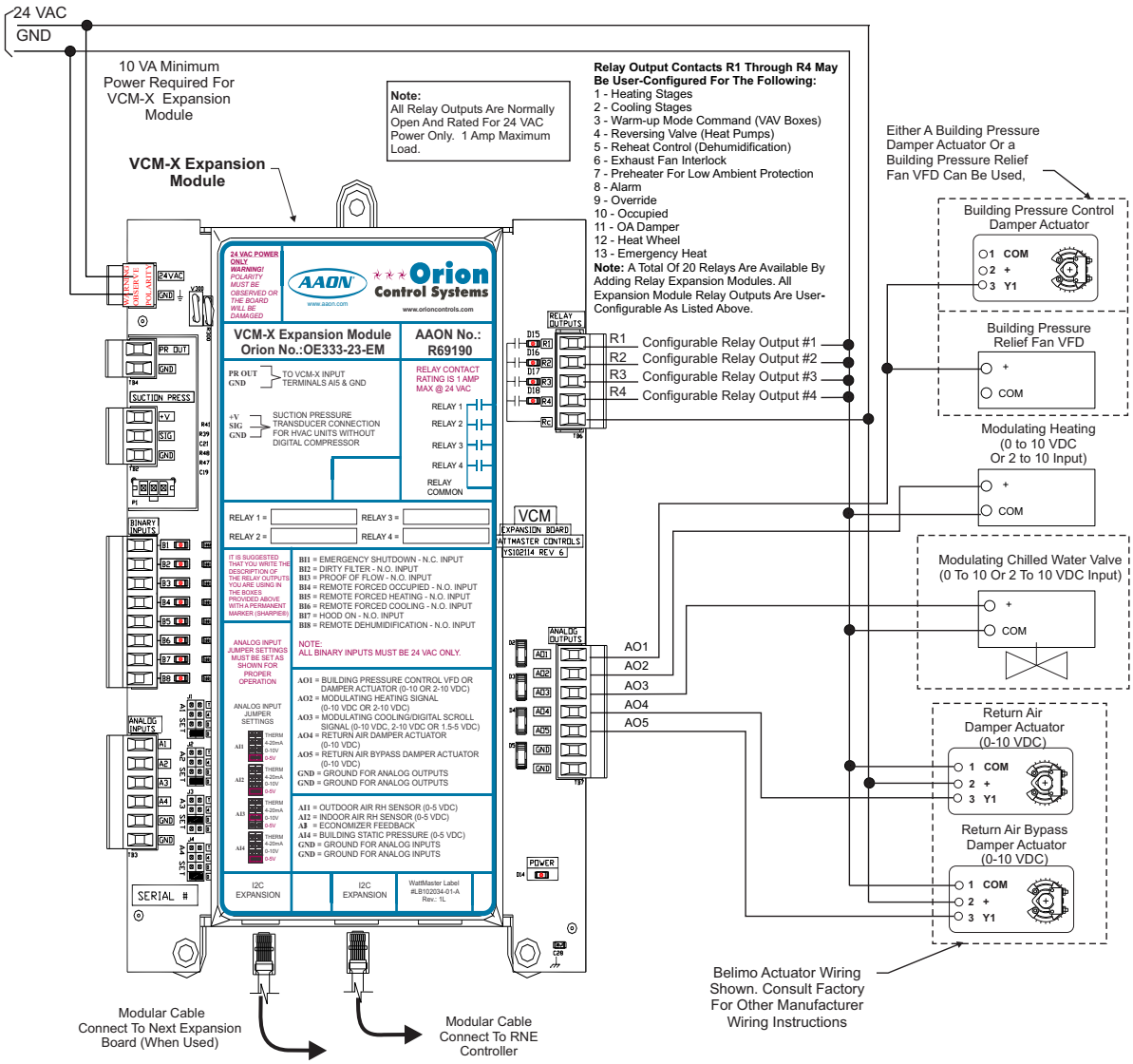
VCM-X Expansion Module Output Wiring for the RNE Controller

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

The VCM-X Expansion Module must be connected to 24 VAC as shown in the wiring diagram below. Please see **Table 1** on **page 17** for correct VA requirements to use when sizing the transformer(s) used for powering the expansion module.

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

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.



Notes:
1.) The Modulating Chilled Water Valve Used Must Be Capable Of Accepting Either A 0-10 VDC or 2-10 VDC Input. The Modulating Cooling Output Voltage Is User Configurable For These Voltages. The Modulating Heating Devices Used Must Be Capable of Accepting Either A 0-10 VDC or 2-10 VDC Input. The Modulating Heating Output Voltage Is User- Configurable For These Voltages. These Voltage Outputs Must Also Be Configured When You Are Setting Up The RNE Controller(s) Operating Parameters.

2.) Each Modulating Heating Or Cooling Device Used On The RNE Controller Must Have (1) Relay Output Configured For Each Device Used, In Order To Enable The Modulating Heating And/Or Cooling Device's Sequence. This Relay Output Must Be Configured When Setting Up The RNE Controller Operating Parameters.

Figure 18: OE333-23-EM – VCM-X Expansion Module for RNE Output Wiring

8 Binary Inputs Located On VCM-X Expansion Module

If your HVAC unit only requires an Emergency Shutdown (Smoke Detector/Firestat or other shutdown conditions), Dirty Filter, Proof of Flow or Remote Forced Occupied Inputs or all of these 4 inputs and you don't need any of the other inputs or outputs provided on the OE333-23-EM VCM-X Expansion Module, you can use the OE356-01-BI 4 Binary Input Expansion Module for these inputs. See **Figure 20** on **page 29** for OE356-01-BI wiring. If you require any other Binary Inputs or require any other of the Analog Inputs or Outputs that are provided on the VCM-X Expansion Module, you will need to use it instead for all of your Binary Inputs.

The transformer used for powering the VCM-X Expansion Module must also be used to power the binary inputs. See **Figure 19** below for detailed wiring.

WARNING: Do not apply any voltage greater than 24 VAC to the binary inputs. Higher voltages will damage the expansion module and possibly other components on the system.

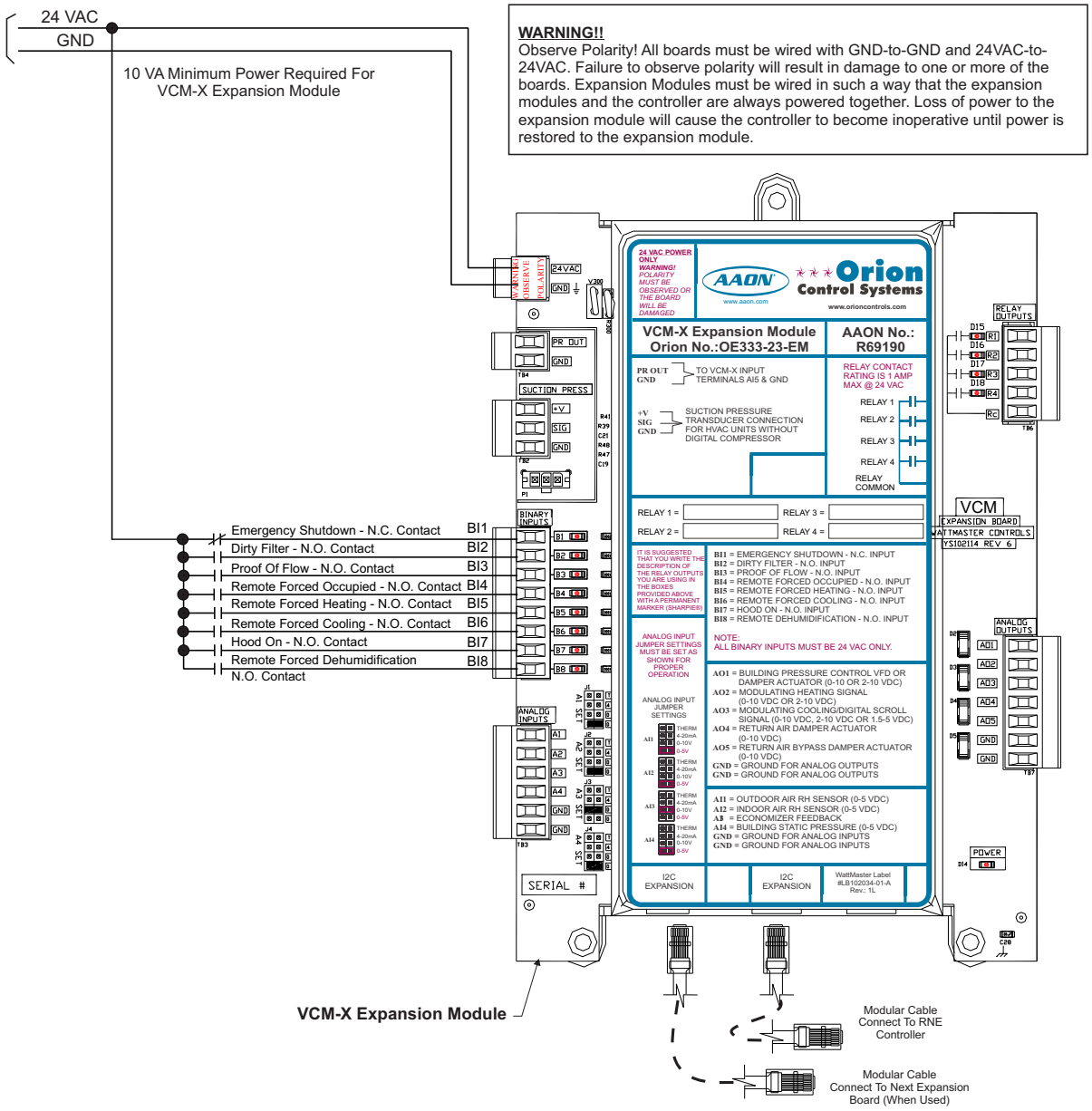


Figure 19: OE333-23-EM – VCM-X Expansion Module 8 Binary Inputs Wiring

4 Binary Inputs Located On 4 Binary Input Expansion Module

If your HVAC unit only requires an Emergency Shutdown (Smoke Detector/Firestat or other shutdown conditions), Dirty Filter, Proof of Flow or Remote Forced Occupied Inputs or any combination of these 4 inputs and you don't need any of the other inputs or outputs provided on the OE333-23-EM VCM-X Expansion Module, you can use the OE356-01-BI 4 Binary Input Expansion Module for these inputs.

The transformer used for powering the 4 Binary Input Expansion Module must also be used to power the binary inputs. See **Figure 20** below for detailed wiring.

WARNING: Do not apply any voltage greater than 24 VAC to the binary inputs. Higher voltages will damage the expansion module and possibly other components on the system.

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.

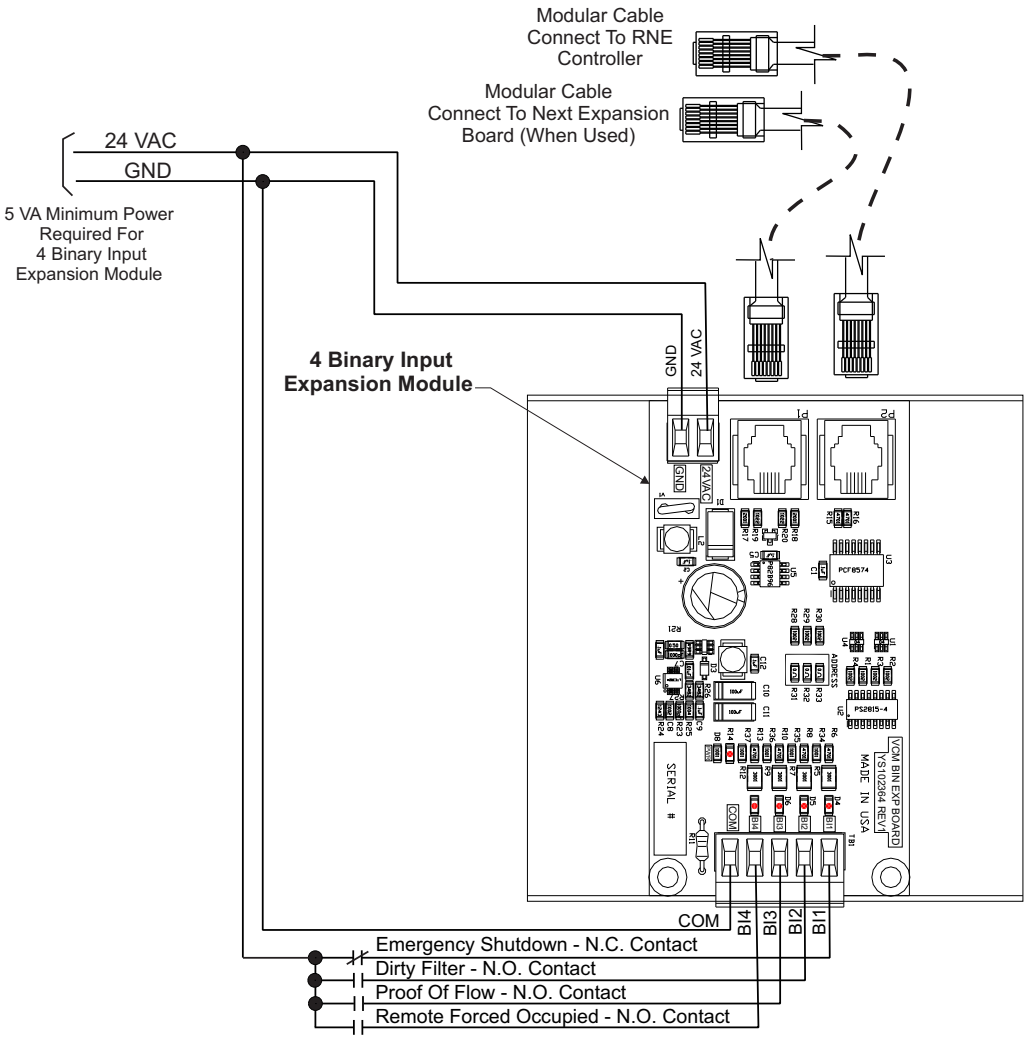


Figure 20: OE356-01-BI – 4 Binary Input Expansion Module Wiring

Outdoor Air Humidity Sensor Wiring

Outdoor Air Humidity Sensor

The OE265-13 Outdoor Air Humidity Sensor is connected to the system by wiring it to the AI1 input on the VCM-X Expansion Module. It must be wired as shown in **Figure 21** below for proper controller operation.

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 OA Humidity Sensor or VCM-X Expansion Module.

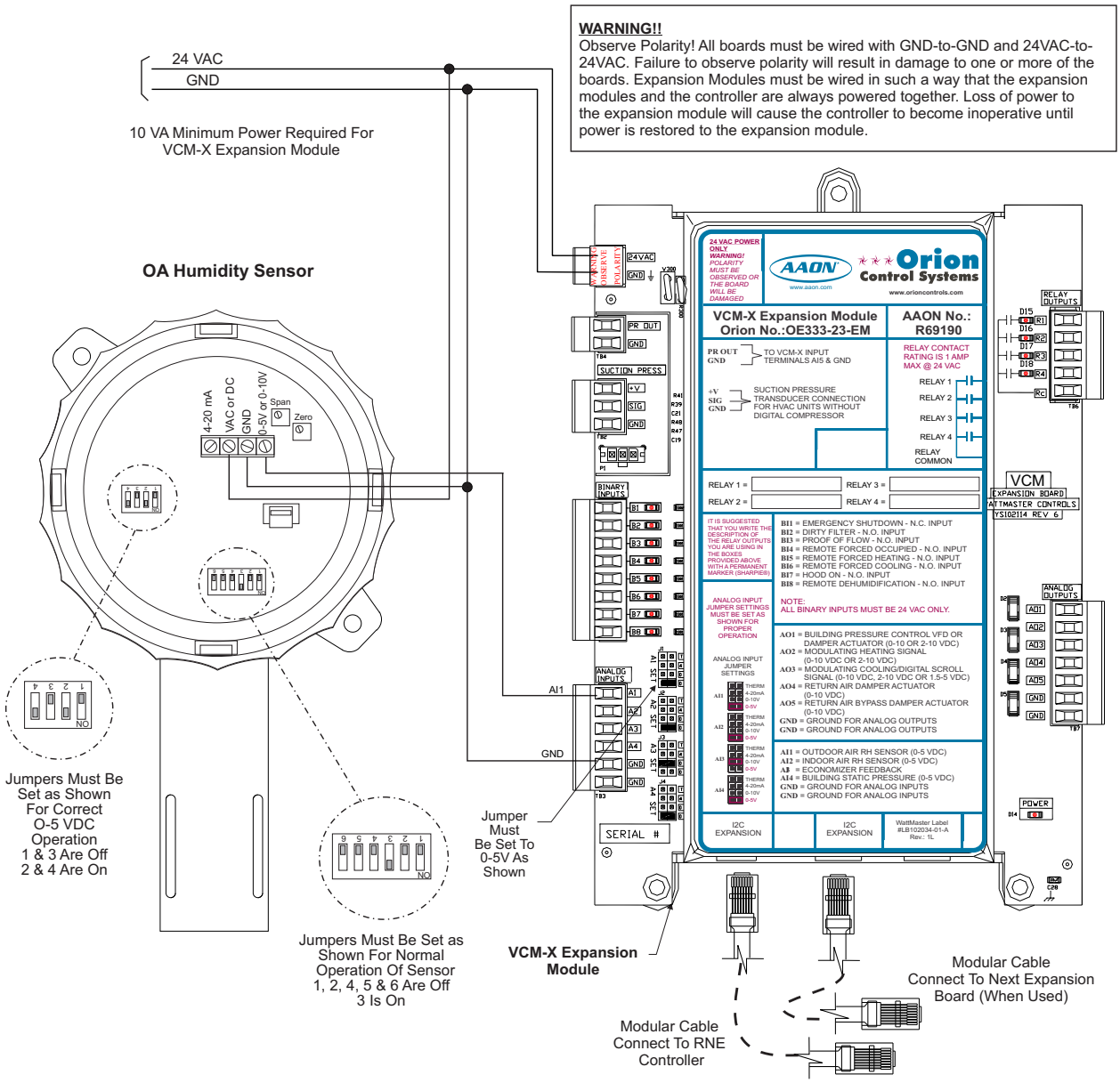


Figure 21: OE265-13 – Outdoor Air Humidity Sensor Wiring

Indoor Wall-Mounted Humidity Sensor

When used, the OE265-11 Indoor Wall-Mounted Humidity Sensor is connected to the system by wiring it to the AI2 input on the VCM-X Expansion Module. It must be wired as shown in **Figure 22** below for proper controller operation. Either the Space Humidity Sensor or the RA Humidity Sensor can be wired into this input, but not both.

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 Space Humidity Sensor or VCM-X Expansion Module.

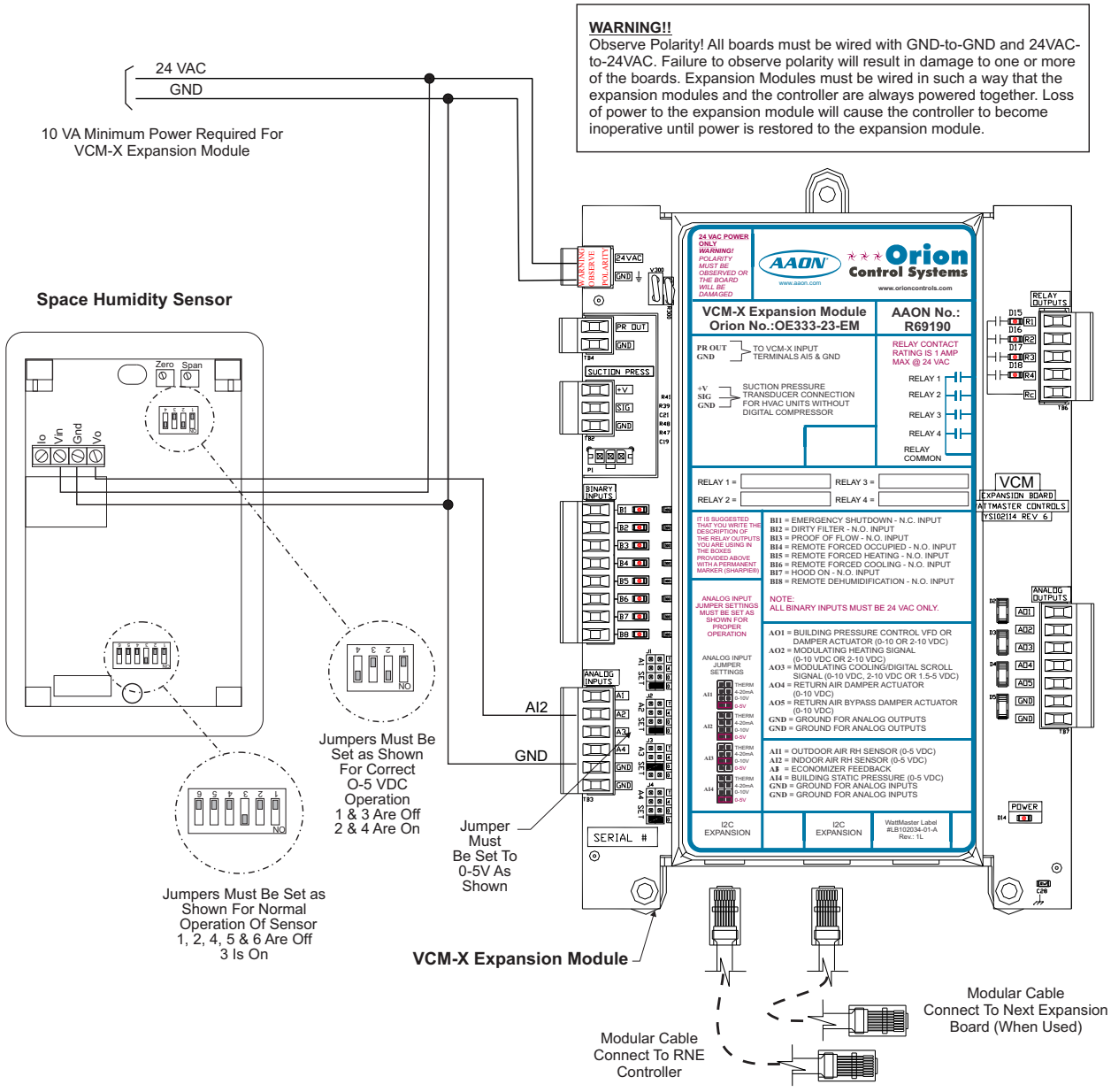


Figure 22: OE265-11 – Indoor Wall-Mounted Humidity Sensor Wiring

Return Air Mounted Humidity Sensor

When used, the OE265-14 Return Air Mounted Humidity Sensor is connected to the system by wiring it to the AI2 input on the VCM-X Expansion Module. It must be wired as shown in **Figure 23** below for proper controller operation. Either the RA Humidity Sensor or the Space Humidity Sensor can be wired into this input, but not both.

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 RA Humidity Sensor or controller.

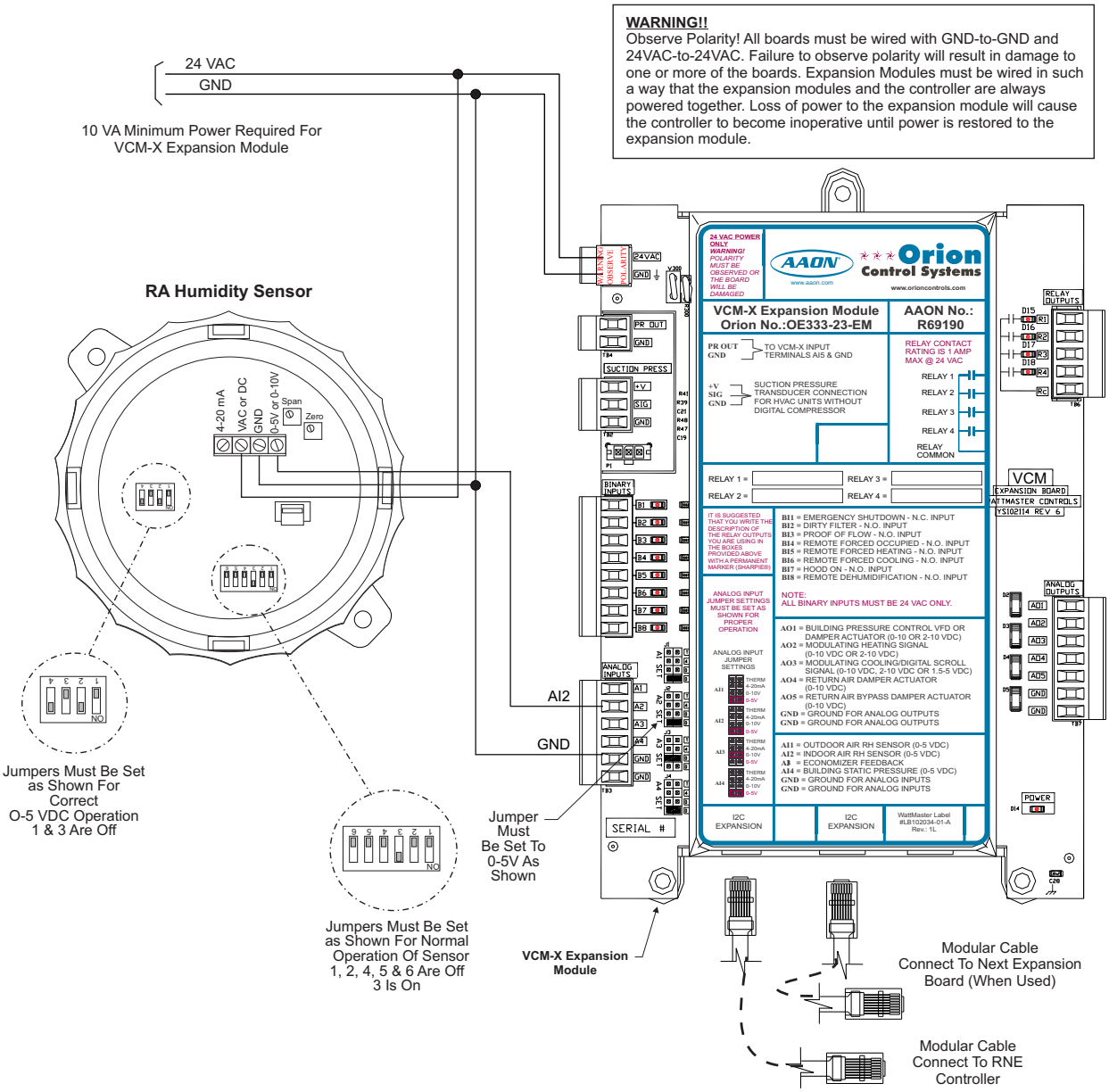


Figure 23: OE265-14 – Indoor Return Air-Mounted Humidity Sensor Wiring

Title 24 Economizer Actuator Feedback & Building Pressure Sensor

Title 24 Economizer Actuator Feedback

If the controller has been configured for Title 24 Economizer operation, the Economizer Actuator Feedback signal is wired to the AI3 input on the VCM-X Expansion Module. It must be wired as shown in **Figure 24** below for proper controller operation.

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 and the VCM-X Expansion Module.

Building Pressure Sensor

The OE258-01 Building Pressure Sensor must be wired as shown in the illustration below for proper operation. 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 AI4 on the VCM-X Expansion Module terminal block. See **Figure 25** below for detailed wiring. The AI4 Jumper on the expansion module must be set for 0-5VDC operation for the Building Pressure Sensor to operate correctly.

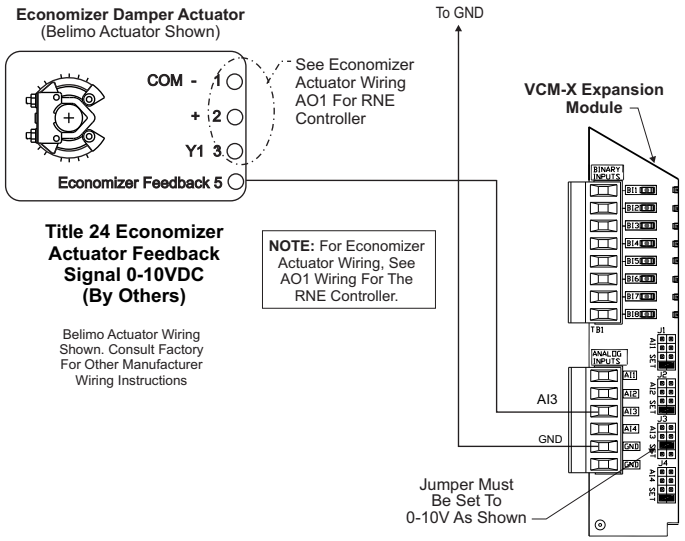


Figure 24: Title 24 Economizer Actuator Feedback Wiring

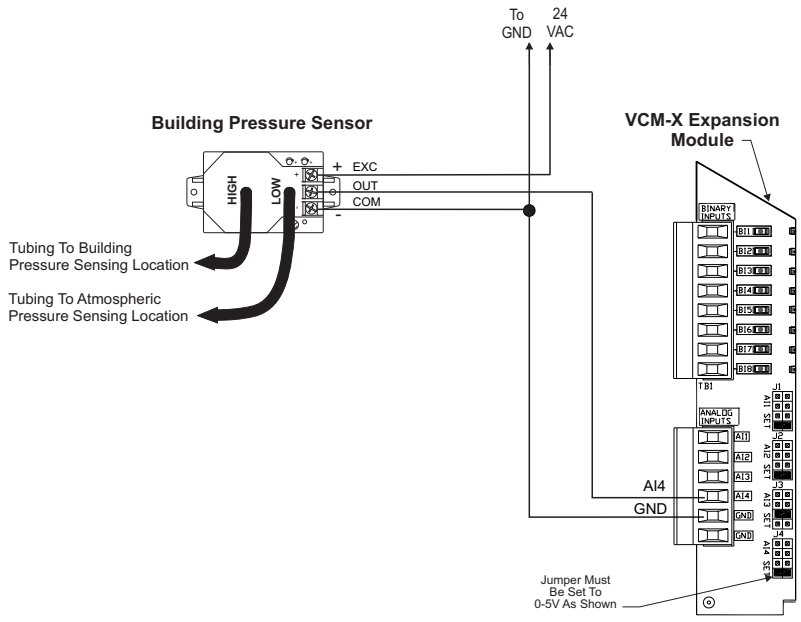


Figure 25: OE258-01 — Building Pressure Sensor Wiring

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 VCM-X Expansion Module. 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. When used in this manner, the output signal must be configured for Direct Acting operation.

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 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 AI4 on the VCM-X Expansion Module is used to sense and control the signal to the Building Pressure Output. The OE258-01 Building Pressure Sensor must be connected in order for the Building Pressure Output to operate correctly.

See **Figure 26** below for detailed wiring of the Building Pressure Control Output Signal.

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.

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.

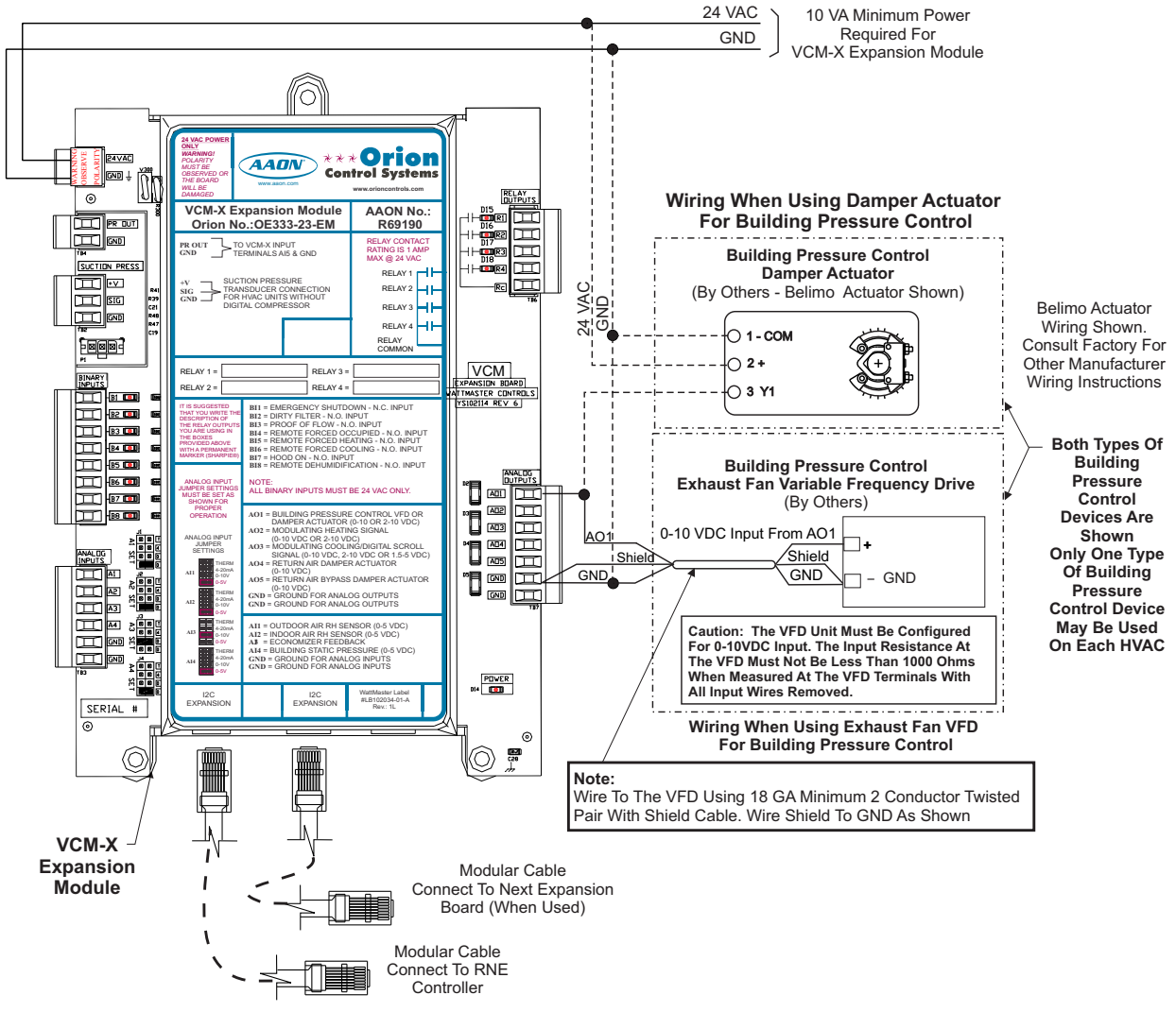


Figure 26: Building Pressure Control Output Wiring

Modulating Heating Device

The Modulating Heating Device signal can be configured for either a 0-10 VDC or 2-10 VDC output signal 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 27** 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 VCM-X Expansion Module.

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.

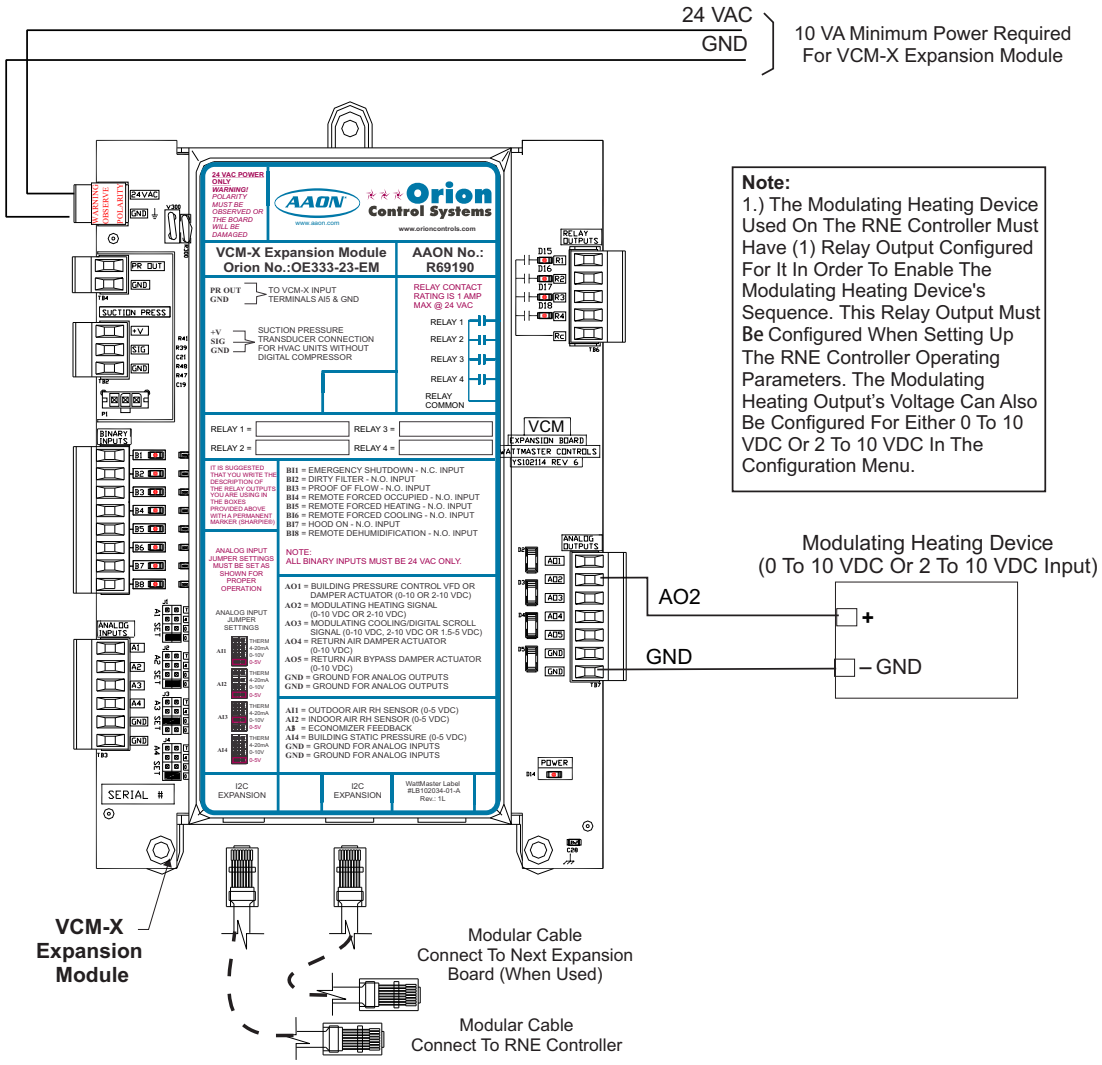


Figure 27: Modulating Heating Device Wiring

Modulating Chilled Water Valve Wiring

Modulating Chilled Water Valve

The Modulating Chilled Water Valve signal can be configured for either a 0-10 VDC or 2-10 VDC output signal when programming the controller. The output signal can also be configured for either Direct Acting or Reverse Acting Water Valve operation as required by your application. See **Figure 28** below for wiring details.

For VFD Compressor wiring, see **Figures 32-33** on **pages 40-41** and **Figures 35-36** on **pages 43-45**.

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 Chilled Water Valve or the VCM-X Expansion Module.

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.

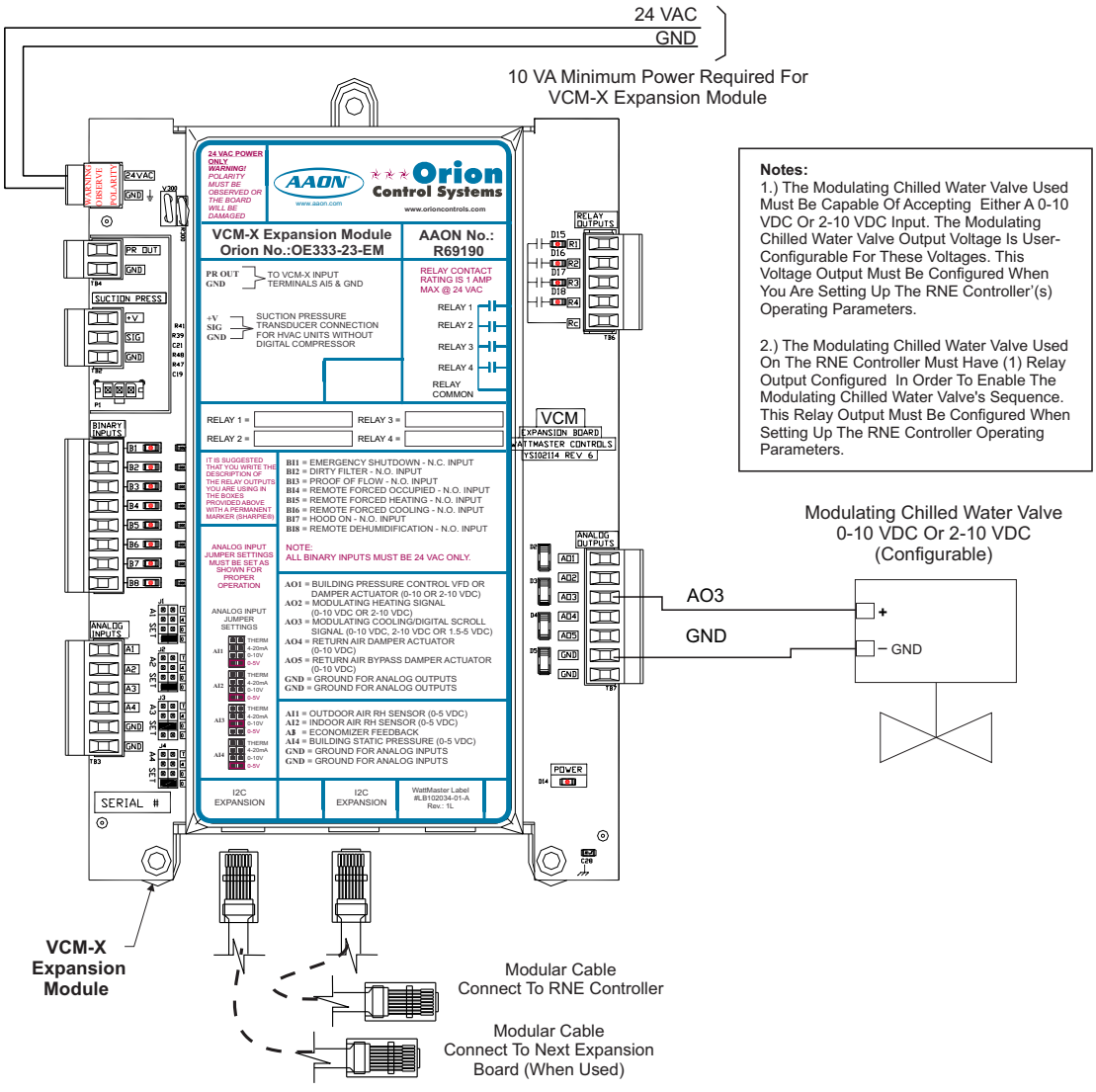


Figure 28: Modulating Chilled Water Valve Wiring

Return Air Bypass

The RNE Controller can be configured for AAON® PAC or DPAC control schemes. Both AAON® PAC and DPAC control schemes provide improved moisture removal capabilities while utilizing internal space loads for reheat by redirecting the Return Air around the Evaporator Coil instead of through the coil. See the AAON® PAC and DPAC applications section of this manual on **page 5** for complete operation details.

The AAON® PAC and DPAC control schemes 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.

The AAON® DPAC control scheme provides improved moisture removal capabilities and tighter temperature control than the AAON® PAC controls scheme by combining VFD Compressor control in addition to Return Air Bypass control.

See **Figure 29** 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 VCM-X Expansion Module.

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.

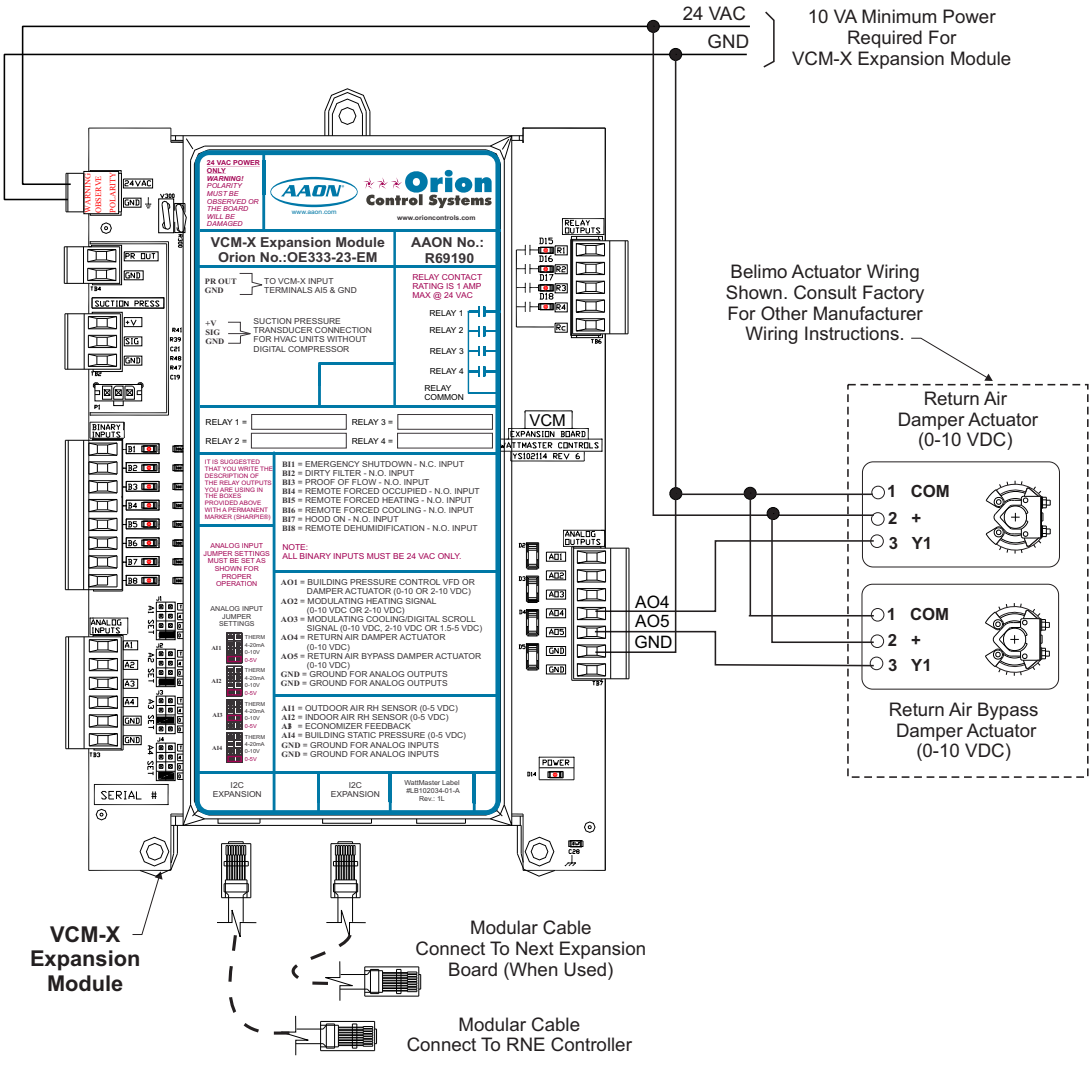


Figure 29: Return Air Bypass Wiring

12-Relay Expansion Module Wiring and Jumper Settings

12-Relay Expansion Module

Three different Expansion Modules are available for use with the RNE Controller to provide additional inputs and outputs beyond those found on the RNE Controller. They are the VCM-X Expansion Module (OE333-23-EM), the 4 Binary Input Expansion Module (OE356-01-BI) which can be used in place of the VCM-X Expansion Module if your system does not need any other inputs or outputs, and the 12-Relay Expansion Module (OE358-23-12R).

The 12-Relay Expansion Module provides for 12 Dry Contact Configurable Relay Outputs. See **Figure 30** below for complete wiring details.

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

When using the 12-Relay Expansion Module, you must correctly configure a set of jumpers on the board depending on whether it will be used by itself or in addition to the VCM-X Expansion Module.

The jumpers are located on the edge of the 12-Relay Expansion Module on the same side of the module as the power connection. See **Figure 31** below for details regarding setting the switch correctly for your application.

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.

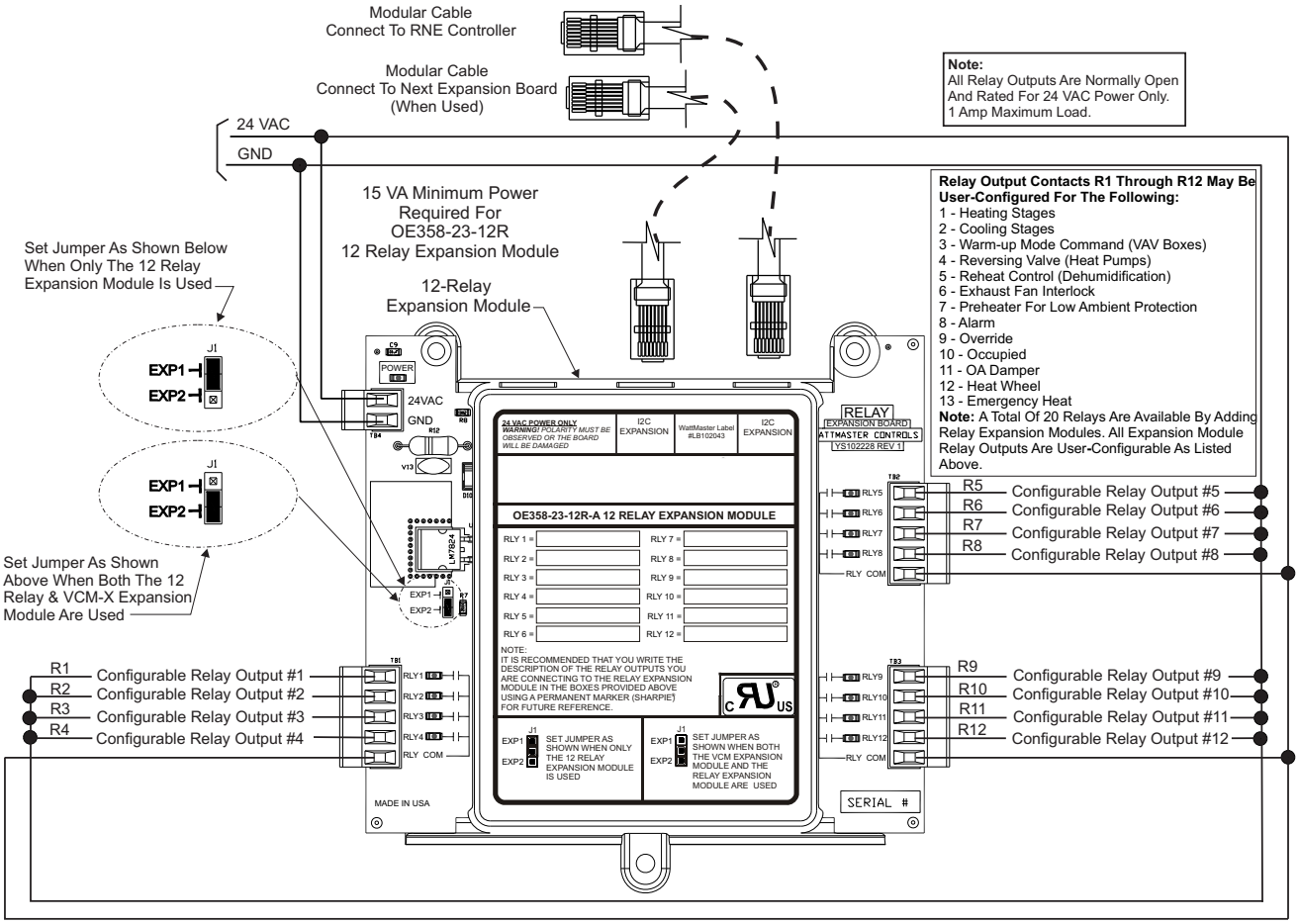


Figure 30: OE358-23-12R – 12-Relay Expansion Module Wiring and Jumper Settings

Air Flow Monitoring Station Installation and Wiring

The OE365-15-EBA E-BUS Adapter Board is used to connect selected Air Flow Monitoring Stations to the RNE Controller. Currently, there are two Air Flow Monitoring Station options that are supported in our standard software.

- EBTRON® - GTC-116 Series Air Flow Monitoring Station*
- GreenTrol™ Automation – GA-200-N Module used with any GF Series Air Flow Monitoring Station

The wiring for the two Air Flow Monitoring Stations are the same and are shown in **Figure 31**.

*NOTE: When configuring the GTC-116 Series, be sure to set the Parity to "NO PARITY, 1 STOP BIT."

NOTE: Up to 3 EBTRON® or GreenTrol™ 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.

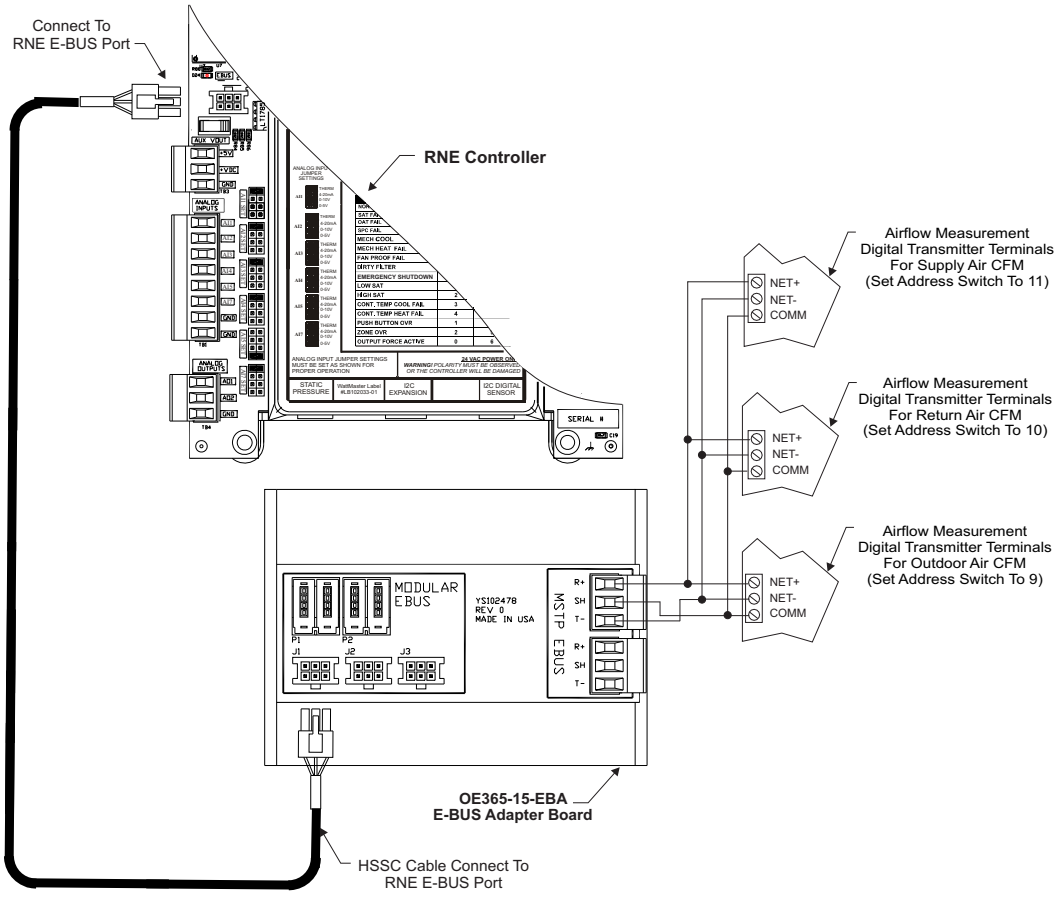


Figure 31: OE365-15-EBA - Airflow Monitoring Station To E-BUS Wiring

RNE 55 - 105 Ton Unit Compressor and Condenser Wiring

Full Digital Module

RNE Units with DX Cooling will have either a Half VFD/Half Fixed compressor configuration or a Full VFD compressor configuration. The RNE 55 - 105 Ton units have two compressors and will have either one VFD and one Fixed Compressor or will have two VFD Compressors. The operation of these compressors is described in the Sequence of Operation section of this manual.

If this is not a Water Source Heat Pump unit, the outputs to the compressors will always be wired from the Full Digital Module (OE370-23-FD-A). Each compressor will need to have a relay configured and wired from this module and the VFD output(s) will be wired from this module. Each compressor will also have a Suction Pressure Transducer wired into this module. See **Figure 32** below for the wiring diagram.

The Full Digital Module connects to the RNE Controller or the Two Condenser Head Pressure Module with an HSSC Cable. This allows setpoints, status values, and alarms to be communicated between the RNE Controller and the Full Digital Module. This module requires a 24 VAC power connection with an appropriate VA rating.

NOTE: The Compressor Relays on the Full Digital Module are used rather than the relay outputs on the RNE Controller.

NOTE: For more information, see the *Full Digital Module Technical Guide* on our website orioncontrols.com.

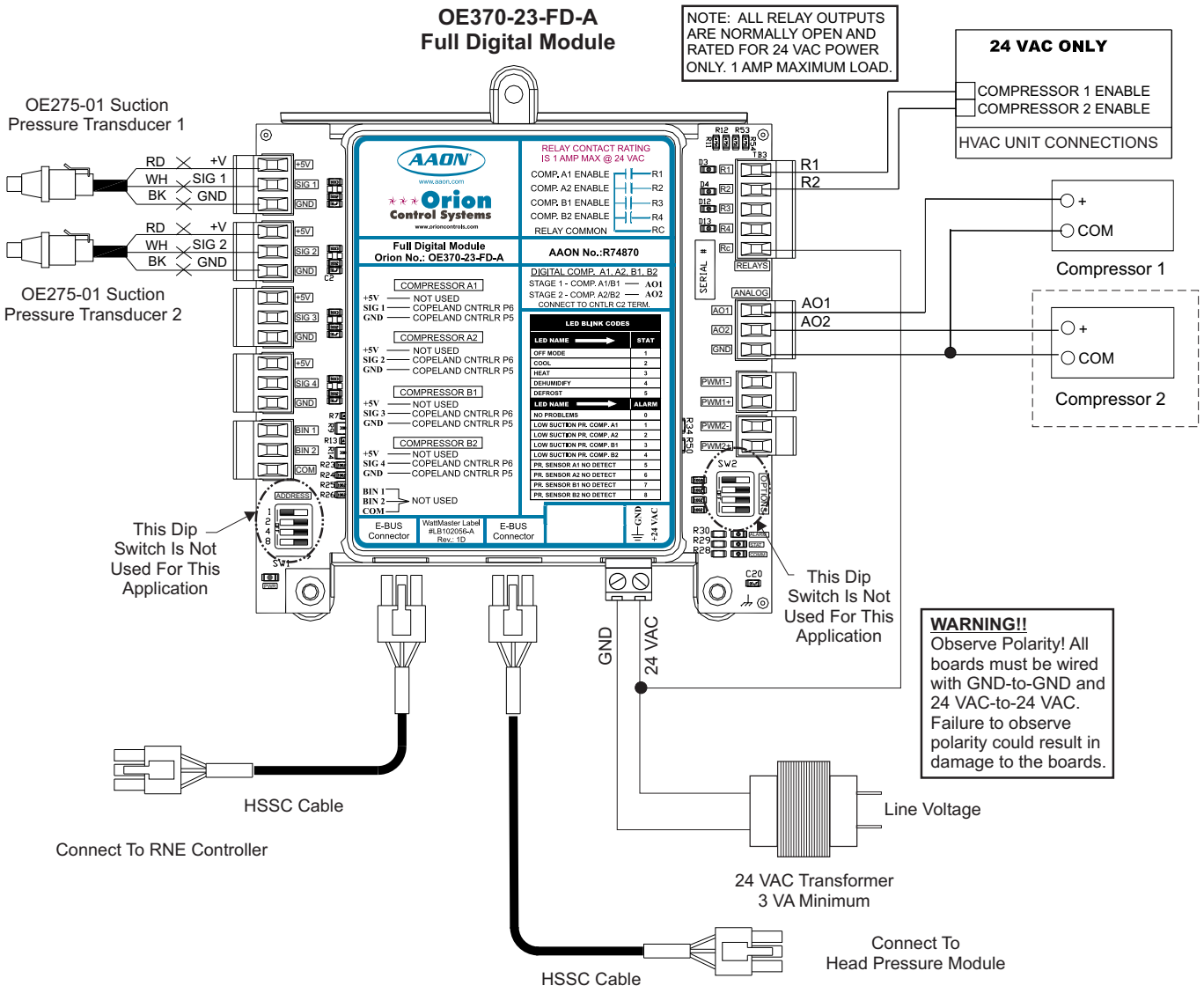


Figure 32: RNE 55 - 105 Ton Unit Two Compressor Full Digital Wiring

WSHP-X2 Module

RNE Units with DX Cooling will have either a Half VFD/Half Fixed compressor configuration or a Full VFD compressor configuration. The RNE 55 - 105 Ton units have two compressors and will have either one VFD and one Fixed Compressor or will have two VFD Compressors. The operation of these compressors is described in the Sequence of Operation section of this manual.

On Water Source Heat Pump (WSHP) units, the outputs to the compressors will always be wired from the WSHP-X2 Module. Each compressor will need to have a relay configured and wired from this module, and the VFD output(s) will be wired from this module. The Suction Pressure Transducer for each compressor and the Proof of Flow switch for each water circuit will also be wired into this module. See **Figure 33** below for the wiring diagram. The WSHP-X2 Module monitors conditions on the unit and can disable compressors based on Low Suction Pressure, Low Leaving Water Temperature, or a loss of Water Proof of Flow. It also utilizes a Delay Timer to prevent the compressors from turning on at the same time.

The WSHP-X2 Module connects to the RNE Controller or the Two Condenser Head Pressure II Module with an HSSC Cable. This allows setpoints, status values, and alarms to be communicated between the RNE Controller and the WSHP-X2 Module. This module requires a 24 VAC power connection with an appropriate VA rating.

NOTE: The Compressor Relays on the WSHP-X2 Module are used rather than the relay outputs on the RNE Controller.

NOTE: For more information, see the *WSHP-X2 Module Field Technical Guide*.

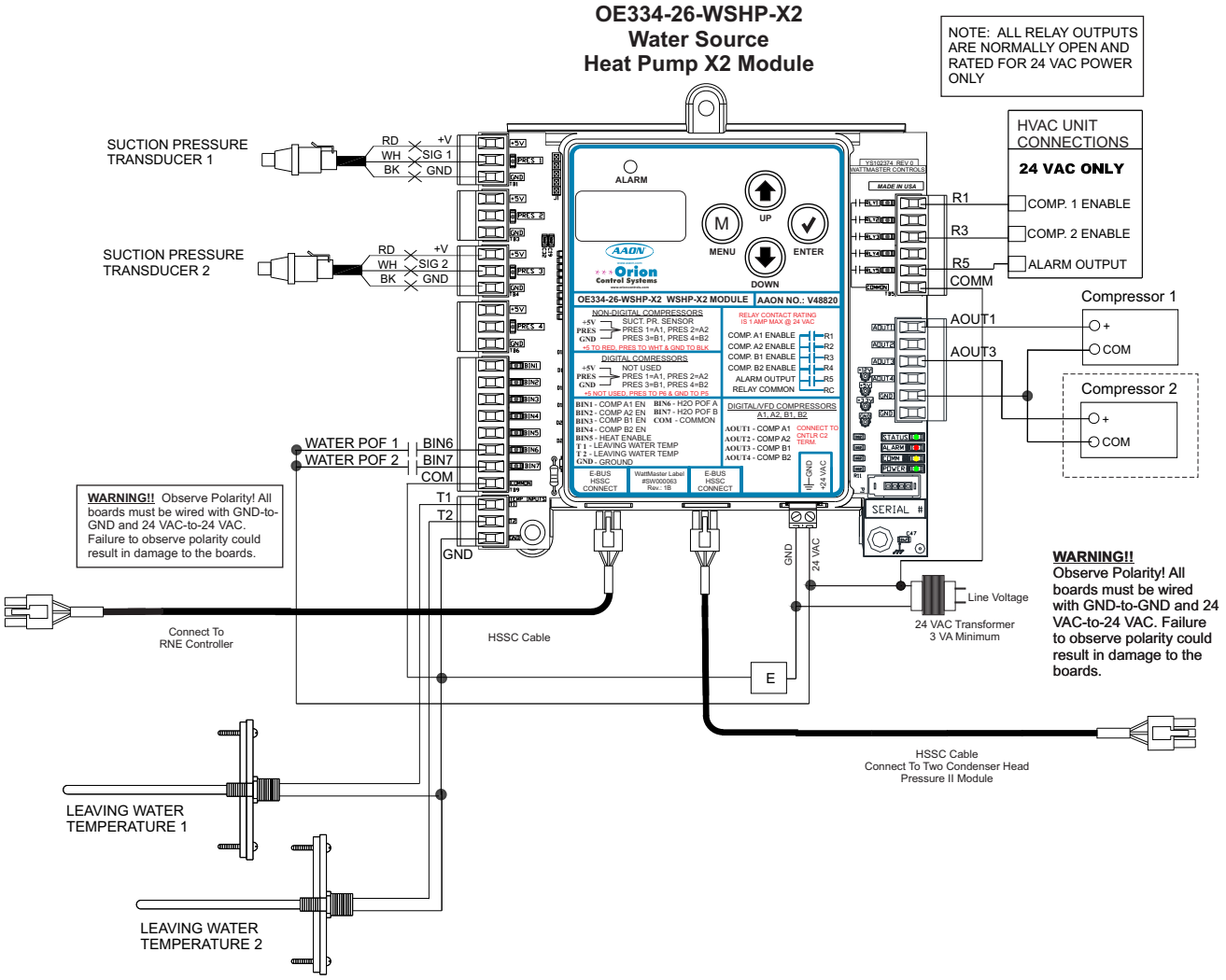


Figure 33: RNE 55 - 105 Ton Unit Two Compressor WSHP-X2 Wiring

RNE 55 - 105 Ton Unit Compressor and Condenser Wiring

Two Condenser Head Pressure II Module

For RNE 55 - 105 Ton units, the Two Condenser Head Pressure II Module (OE370-23-HP2C2) will monitor two head pressure transducers and control two condenser fans or water valves. A pulse width modulation (PWM) signal or a 0-10 VDC output signal is used to control these condenser devices. See **Figure 34** below for the wiring diagram.

The Two Condenser Head Pressure II Module connects to the Full Digital Module, the Water Source Heat Pump Module, or the RNE Controller with an HSSC cable. This allows setpoints, status values, and alarms to be communicated between the RNE Controller and the Two Condenser Head Pressure II Module. This module requires a 24 VAC power connection with an appropriate VA rating.

NOTE: For more information, see the *Two Condenser Head Pressure Module II Technical Guide* found on our website orioncontrols.com.

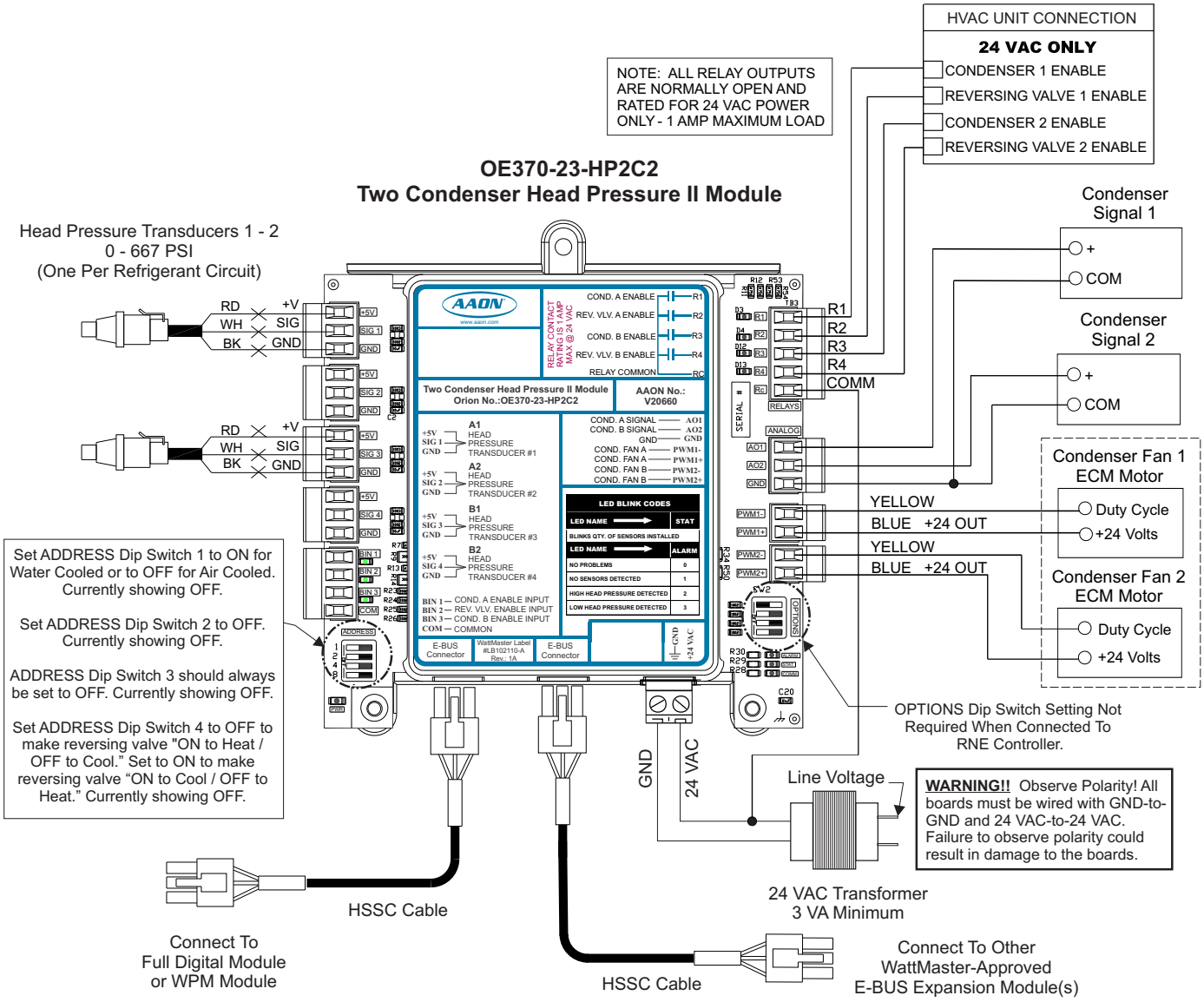


Figure 34: RNE 55 - 105 Ton Unit Two Compressor Two Condenser Head Pressure II Module Wiring

Full Digital Module

RNE Units with DX Cooling will have either a Half VFD/Half Fixed compressor configuration or a Full VFD compressor configuration. The RNE 120 - 140 Ton units have four compressors and will have either two VFD and two Fixed Compressors or will have four VFD Compressors. The operation of these compressors is described in the Sequence of Operation section of this manual.

If this is not a Water Source Heat Pump unit, the outputs to the compressors will always be wired from the Full Digital Module (OE370-23-FD-A). Each compressor will need to have a relay configured and wired from this module, and the VFD output(s) will be wired from this module. Each compressor will also have a Suction Pressure Transducer wired into this module. See **Figure 35** below for the wiring diagram.

On units configured for Half VFD/Half Fixed operation, the two VFD Compressors will both be driven from Analog Output (AO) #1, although the individual compressor relays will be enabled separately as needed.

On units configured for Full VFD operation, the 1st two VFD Compressors will be driven from AO #1 and the 2nd two VFD Compressors will be driven from AO #2, although all four compressor relays will be enabled separately as needed.

The Full Digital Module connects to the RNE Controller or a Two Condenser Head Pressure Module with an HSSC Cable. This allows setpoints, status values, and alarms to be communicated between the RNE Controller and the Full Digital Module. This module requires a 24 VAC power connection with an appropriate VA rating.

NOTE: The Compressor Relays on the Full Digital Module are used rather than the relay outputs on the RNE Controller.

NOTE: For more information, see the *Full Digital Module Technical Guide* found on our website orioncontrols.com.

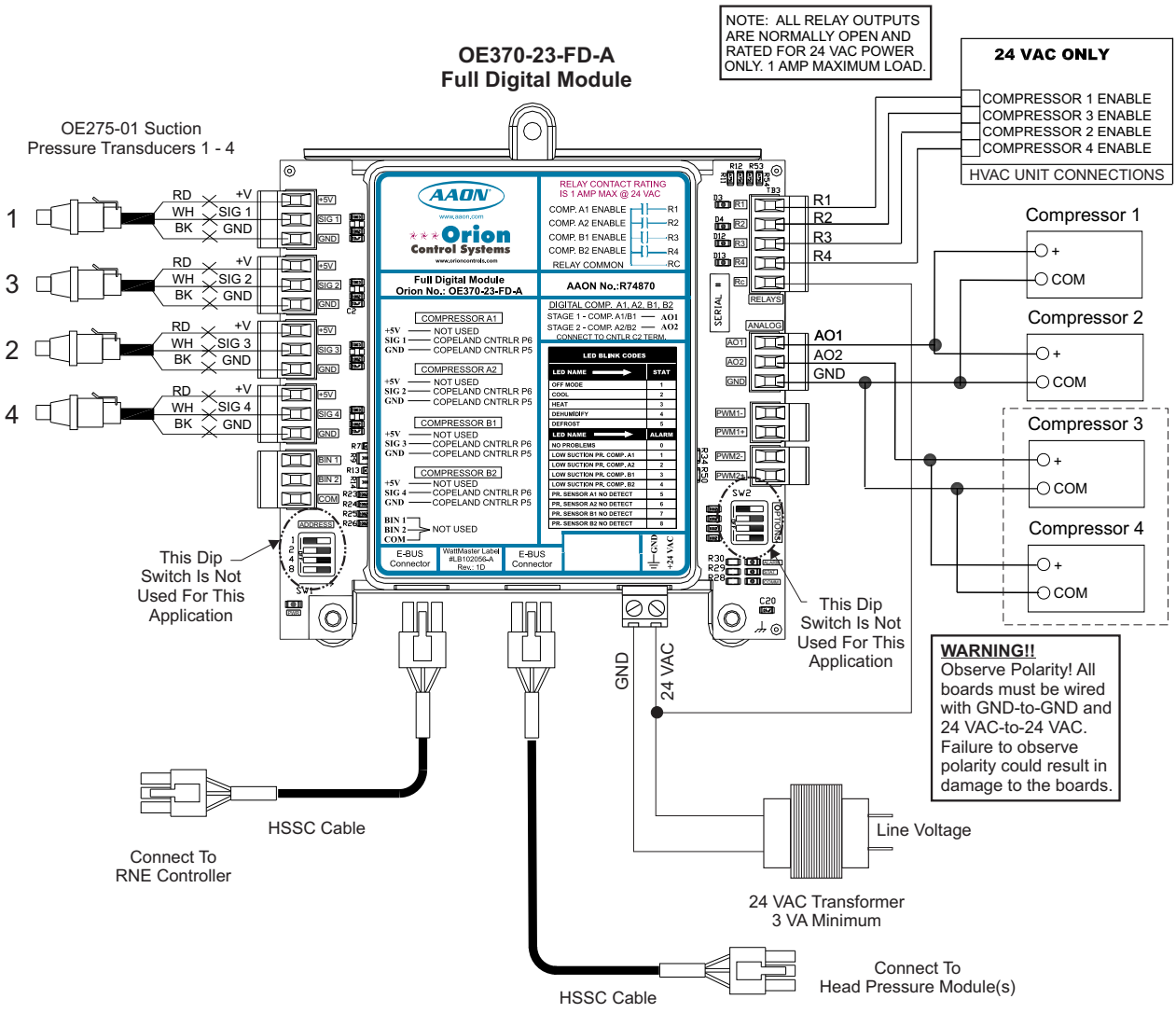


Figure 35: RNE 120 - 140 Ton Unit Four Compressor Full Digital Module Wiring

RNE 120 - 140 Ton Unit Compressor and Condenser Wiring

Water Source Heat Pump Module

RNE Units with DX Cooling will have either a Half VFD/Half Fixed compressor configuration or a Full VFD compressor configuration. The RNE 120 - 140 Ton units have four compressors and will have either two VFD and two Fixed Compressors or will have four VFD Compressors. The operation of these compressors is described in the Sequence of Operation section of this manual.

For Water Source Heat Pump (WSHP) units, the outputs to the compressors will always be wired from the Water Source Heat Pump Modules. For RNE 120 - 140 Ton units, two WSHP-X2 Modules will always be used. Each compressor will need to have a relay configured and wired from these modules, and the VFD outputs will be wired from these modules. The Suction Pressure Transducer for each compressor and the Proof of Flow switch for each water circuit will also be wired into these modules. See **Figure 36 below and on page 45** for the wiring diagram.

On units configured for Half VFD/Half Fixed operation, the two VFD Compressors will be driven from AOUT #1 & 3 on the 1st WSHP-X2 Module, although the individual compressor relays will be enabled separately as needed. On units configured for Full VFD operation, the 1st two VFD Compressors will be driven from AOUT #1 & #2 on the 1st WSHP-X2 Module and the 2nd two VFD Compressors will be driven from AOUT #1 & #3 on the 2nd WSHP-X2 Module. All four compressor relays will be enabled separately as needed.

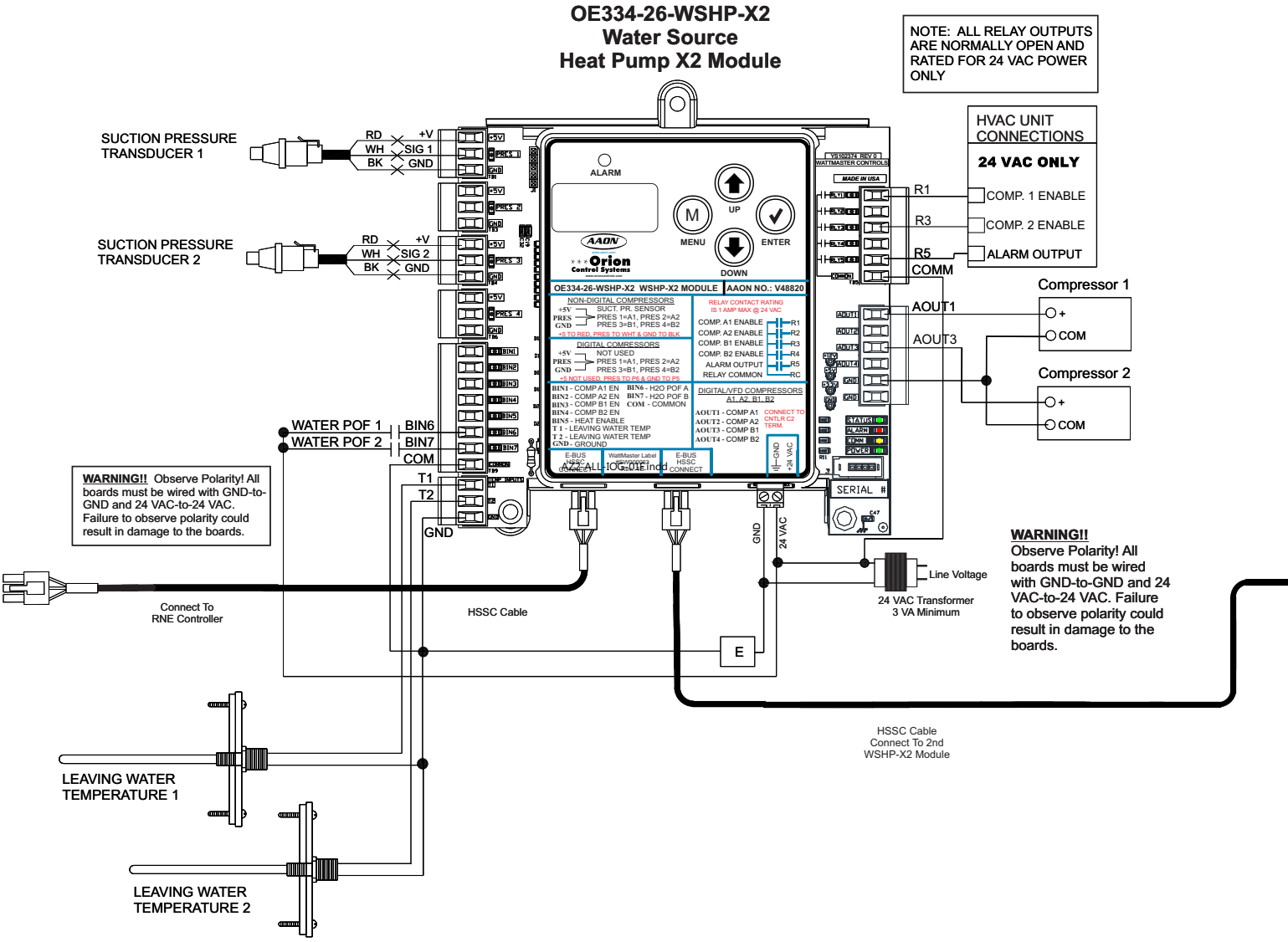


Figure 36: RNE 120 - 140 Ton Unit Four Compressor WSHP Module Wiring

The WSHP-X2 Module monitors conditions on the unit and can disable compressors based on Low Suction Pressure, Low Leaving Water Temperature, or a loss of Water Proof of Flow. It also utilizes a Delay Timer to prevent the compressors from turning on at the same time.

The WSHP Modules connect together and then connect back to the RNE Controller or the Two Condenser Head Pressure Modules with HSSC cables. This allows setpoints, status values, and alarms to be communicated between the RNE Controller and the WSHP Module. This module requires a 24 VAC power connection with an appropriate VA rating.

NOTE: The Compressor Relays on the WSHP Module are used rather than the relay outputs on the RNE Controller.

NOTE: For more information, see the *WSHP-X2 Module Field Technical Guide*.

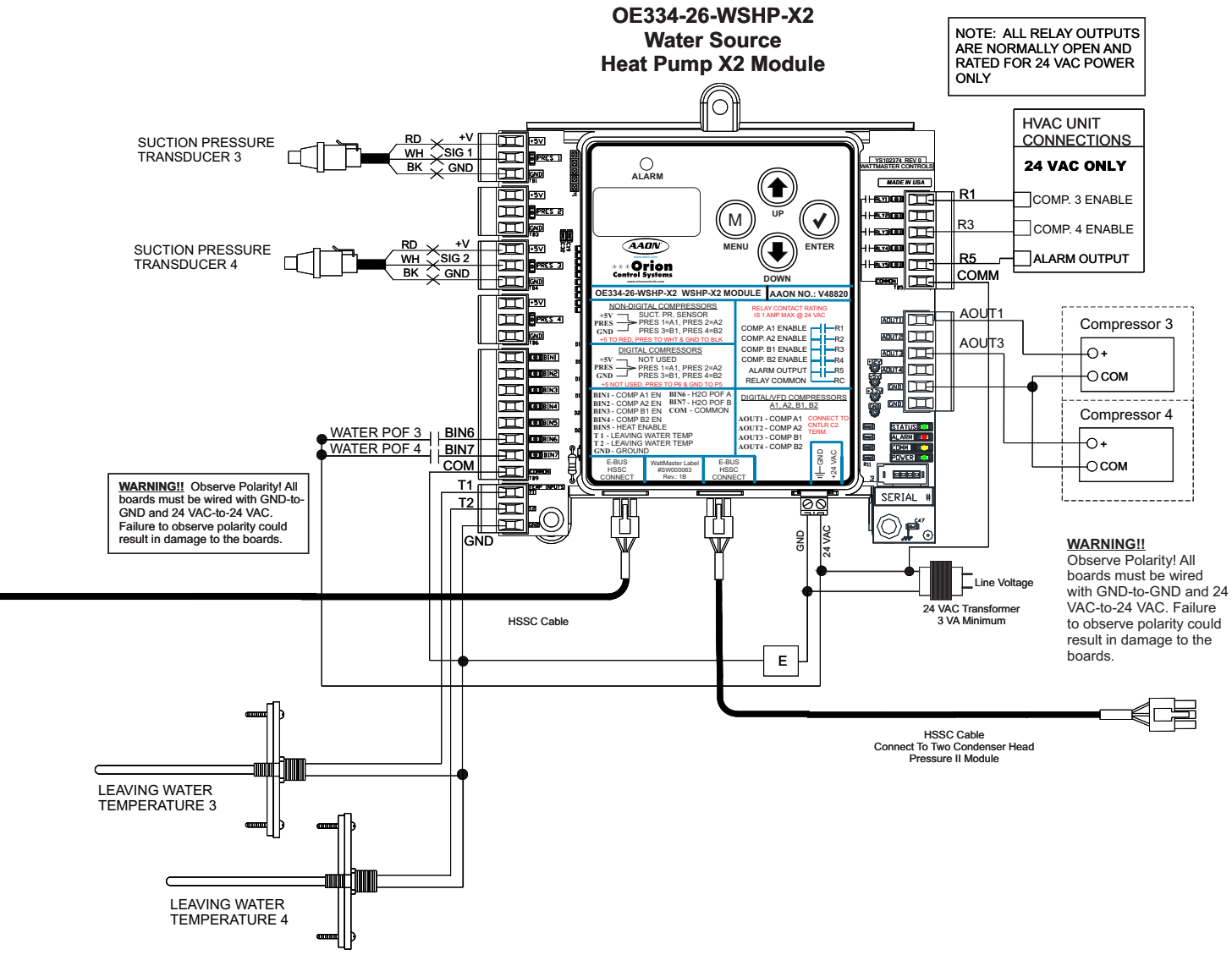


Figure 36, cont.: RNE 120 - 140 Ton Unit Four Compressor WSHP Module Wiring

RNE 120 - 140 Ton Unit Compressor and Condenser Wiring

Two Condenser Head Pressure II Module

For RNE 120 - 140 Ton units, (2) Two Condenser Head Pressure II Modules (OE370-23-HP2C2) will be used to monitor four head pressure transducers and control four condenser fans or water valves (two circuits per module). A pulse width modulation (PWM) signal or a 0-10 VDC output signal is used to control these condenser devices. See **Figure 37 below and on page 47** for the wiring details.

The Two Condenser Head Pressure II Modules are connected together and then back to the Full Digital Module, a Water Source Heat Pump Module, or the RNE Controller with HSSC cables. This allows setpoints, status values, and alarms to be communicated between the RNE Controller and the Two Condenser Head Pressure II Modules. This module requires a 24 VAC power connection with an appropriate VA rating.

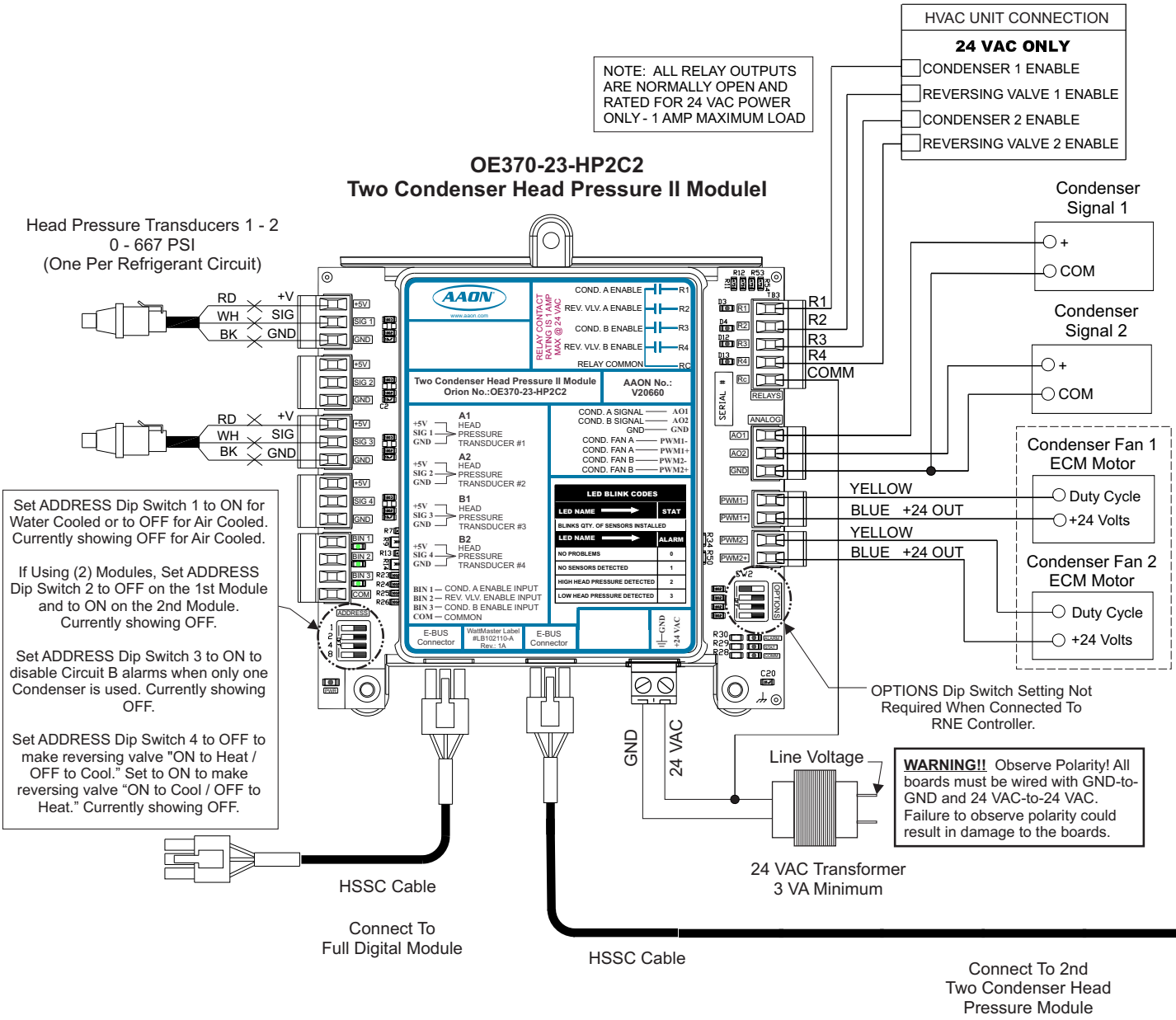


Figure 37: RNE 120 - 140 Ton Unit Four Compressor Two Condenser Head Pressure II Module Wiring

NOTE: For more information, see the *Two Condenser Head Pressure Module II Technical Guide* found on our website orioncontrols.com.

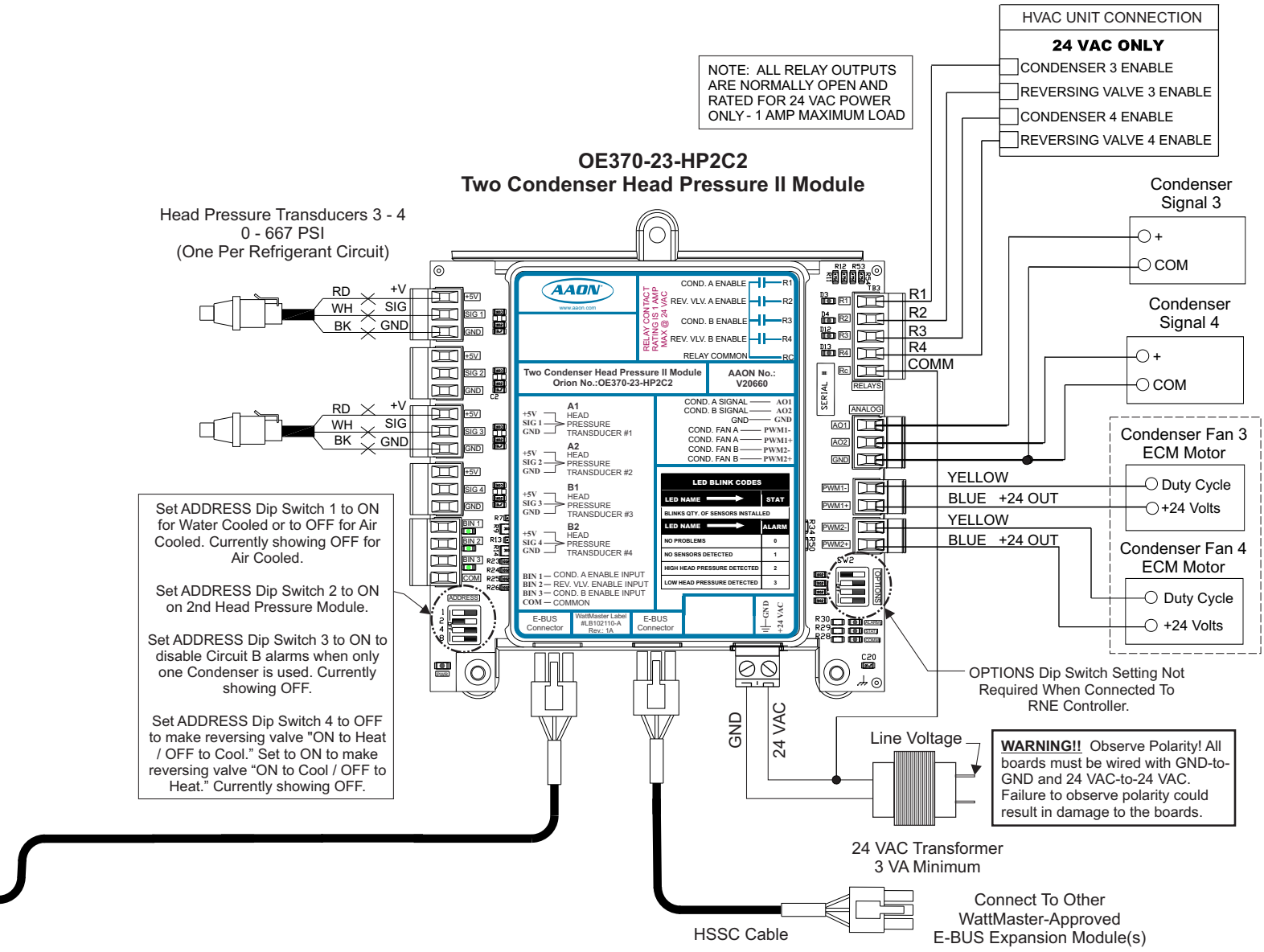


Figure 37, cont.: RNE 120 - 140 Ton Unit Four Compressor Two Condenser Head Pressure II Module Wiring

Addressing & Powering Up

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.

Controller Addressing

All RNE Controllers are equipped with address switches. If the RNE Controller is to operate as a stand-alone system (not connected to any other HVAC unit or VAV/Zone Controllers), the controller address switch should be set for address 1. When using the Modular Service Tool or System Manager to program and configure the RNE Controller, you would enter this address to communicate with the controller. When the system is to be connected to other HVAC unit controllers on a communication loop, each controller's address switch must be set with a unique address between 1 and 59. When the RNE Controller will be used with VAV/Zone Controllers, the RNE Controller's address switch must be set as address 59, no exceptions. See **Figure 38** below for address switch setting information. For detailed information regarding communication wiring and connection for interconnected and networked systems, please see the *Orion Systems Technical Guide—OR-SYS-TGD*.

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 RNE Controller requires 8 VA of power delivered to it at 24 VAC. Each VCM-X Expansion Module requires 10 VA at 24 VAC and each 12-Relay Expansion Module requires 15 VA 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.

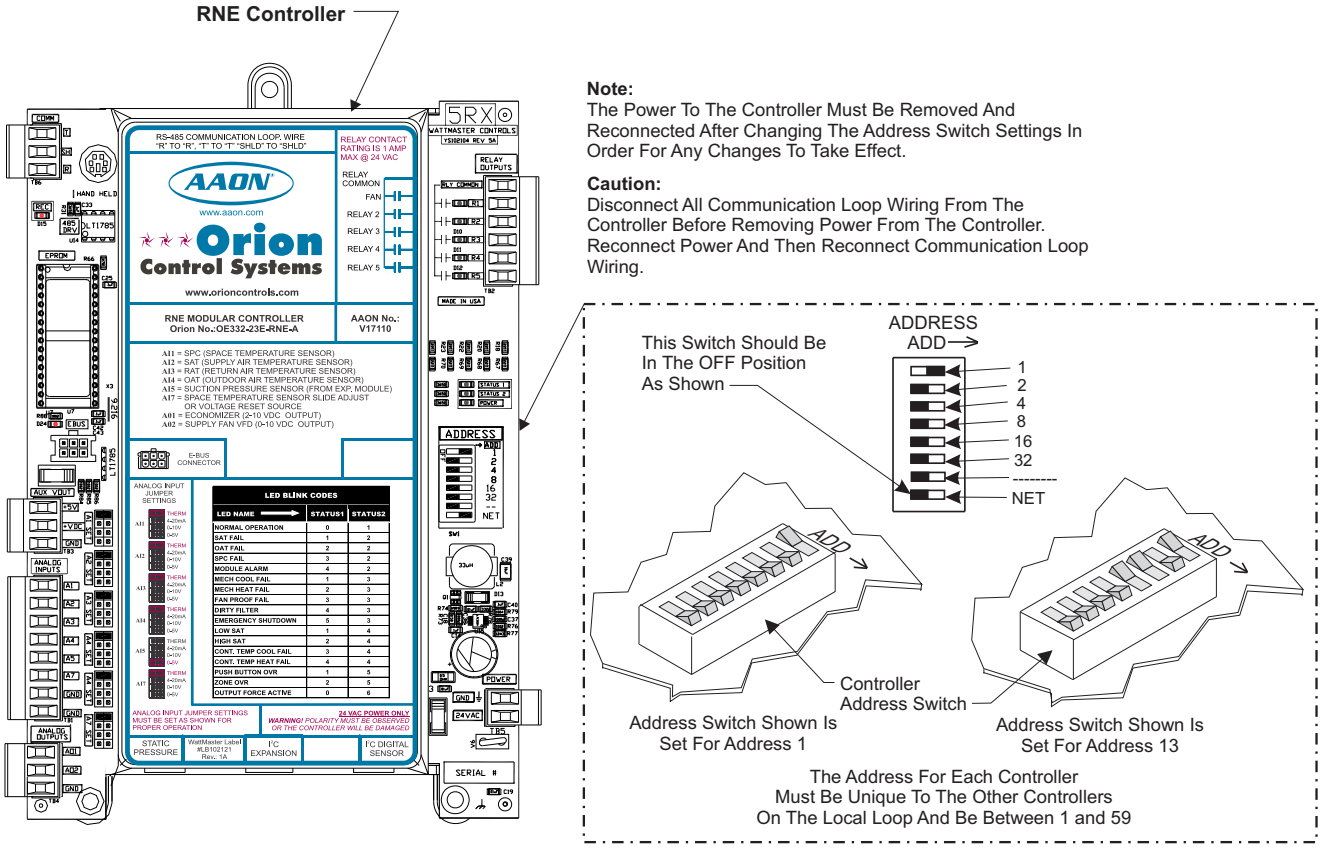


Figure 38: RNE Controller Address Switch Setting

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

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 RNE Controller. Be sure any expansion modules connected to the RNE Controller are also correctly wired just as you did for the RNE Controller.

After all the above wiring checks are complete, apply power to the RNE Controller and all expansion modules connected to it.

Initialization

On system power up, a 30-second startup delay is performed where all default setpoints are initialized, LED's are initialized, and all outputs are turned off.

When power is first applied, LED1 and LED2 will flash out the controller address. LED1 will flash to represent the tens position. LED2 will flash to represent the ones position. After the controller address is complete, there will be a short pause and then 60 fast flashes to represent controller initialization. There will be no controller operation or communications during initialization. After initialization, LED1 and LED2 will continuously flash the status code.

Example of a controller address of 59:

LED1 will flash 5 times. LED2 will flash 9 times.

See **Table 3 on page 71** in the RNE Controller Troubleshooting section of this manual for detailed diagnostic blink code information.

Operating Summary

There is a standard set of operating instructions that are continuously repeated during normal operations. They are listed below.

1. Read Analog Inputs for Temperatures, Pressures, and Binary Contact Closures.
2. Calculate Occupied/Unoccupied Mode of Operation.
3. Calculate HVAC Mode of Operation.
4. Set all outputs to match calculations for Heating or Cooling or Vent Mode.
5. Broadcast information to other controllers if configured.
6. Log all temperatures and output conditions.
7. Repeat steps 1 through 6 continuously.

Programming the Controller

The next step is programming the controller for your specific requirements. In order to configure and program the RNE Controller, you must use an operator interface. Four different operator interfaces are available for programming and monitoring of the RNE Controller These are depicted in **Figure 39** and are as follows:

- Modular Service Tool SD and Modular System Manager SD
- System Manager TS II
- Computer with Prism 2 Software Installed and the CommLink 5 Communications Interface

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, Modular System Manager SD, or System Manager Touch Screen II with your system, refer to the *VCM-X / RNE Controller Operator Interfaces SD Technical Guide* or *System Manager TS II Technical Guide* for programming instructions.

If using a computer and the Prism 2 Software, refer to the *Prism 2 Technical Guide*.

No matter which operator interface you use, we recommend that you proceed with the programming and setup of the RNE 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.

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

RNE Controller Inputs

AI1 - Space Temperature Sensor Input

If you want to generate Occupied or Unoccupied Heating and Cooling demands based on Space Temperature, select this Sensor for the HVAC Mode enable. The Space Temperature Sensor can be used for Night Setback control regardless of the HVAC Mode Sensor selected. If the Space Temperature Sensor used is equipped with the optional Push-Button Override Feature, this input will detect user overrides from Unoccupied back to Occupied operation for a user-adjustable amount of time. This Sensor is not required for Cooling Only HVAC units configured for Supply Air Temperature control as the HVAC Mode Enable Sensor unless Night Setback operation is required. The Space Temperature can also be configured to reset the Supply Air Temperature Setpoint. The Space Temperature Sensor is the only Sensor that can be used for Night Setback operation during the Unoccupied Mode.

AI2 - Supply Air Temperature Sensor Input

The Supply Air Temperature Sensor is the default HVAC Mode Enable Sensor. For typical VAV units that are Cooling Only with Morning Warm-up, this Sensor should be configured as the HVAC Mode Enable Sensor. Heating will only occur during Morning Warm-up. After Morning Warm-up expires, the Supply Air Temperature will be maintained at the Supply Air Temperature Cooling Setpoint. The HVAC unit must always have a Supply Air Temperature Sensor installed.

AI3 - 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 Period on VAV-configured units. This temperature must be at least 5°F above the Outdoor Air Temperature to allow Economizer Cooling operation.

AI4 - 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. The Outdoor Air Temperature Sensor can also be used to provide Low Ambient Temperature Protection in the building. If the Outdoor Air Temperature is below the Low Ambient Temperature Setpoint, the Preheat Relay Output will be maintained during Occupied operation and will not be allowed to stage off unless the Supply Fan is turned off. When using 100% (MUA Units) Outdoor Air applications, the Outdoor Air Temperature Sensor should be configured as the HVAC Mode Enable Sensor. The Outdoor Air Temperature Sensor is also used in combination with the Outdoor Air Humidity Sensor for Dewpoint calculations.

AI5 - Not Used

AI6 - Duct Static Pressure Sensor Input

This special phone jack-style input connection accepts a Duct Static Pressure Sensor input modular cable. 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.

AI7 - Space Temperature Sensor Slide Adjust or Remote SAT Reset Signal Input

AI7 on the RNE Controller is a dual-purpose input. It can be used for the Space Sensor Slide Adjust option or for connection of the Remote Supply Air Setpoint Reset Signal option. Only one or the other can be used, not both.

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. The Slide Adjustment adjusts whichever Temperature Sensor has been configured as the HVAC Mode Enable Sensor, even if that Sensor is not the installed Space Temperature Sensor.

If Space Temperature or Return Air 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.

Remote Supply Air Temperature Reset Signal

When a 0-5 VDC Remote Supply Air Temperature Reset Signal is to be used, the controller must be configured for it, and the Room Sensor Slide Offset setpoint must be set to zero for this option. If the slide offset is not set to zero, the Supply Air Temperature Reset will not function.

The Remote Supply Air Temperature Reset signal must be configured so that its setpoint will be at the coldest Supply Air Temperature, or 0 VDC, and so that its setpoint will be at the warmest Supply Air Temperature, or 5 VDC.

The jumper AI7 must be set to 0-10V regardless of whether the controller is configured for 0-5 or 0-10VDC operation. See the wiring diagram on **page 21** for details.

RNE Controller Outputs

AO1 - Economizer Control Signal

This voltage signal (2-10 VDC) is used to position the Outdoor Air Damper during Economizer Control. It is also used to maintain the Outdoor Air Damper at its Minimum Position during the Occupied Mode when the Outdoor Air Temperature and/or Outdoor Humidity is not suitable for Economizer Cooling purposes.

AO2 - Duct Static Pressure Control Signal

This voltage signal (0-10 VDC) can be connected to a Supply Fan VFD or to Proportional Inlet Vanes to control the Duct Static Pressure. This signal can also be connected to a 0-10 VDC Modulating Zoning Bypass Damper Actuator to control Duct Static Pressure. When this signal is used to control a Zoning Bypass Damper Actuator, the Zoning Bypass Damper Actuator needs to be mechanically configured to close the Zoning Bypass Damper on an increase of the 0-10 VDC output signal. This is necessary because the signal is Direct Acting and is not configurable as a Reverse Acting Signal on the RNE Controller.

R1 - Supply Fan (Enable)
This is a non-configurable output.

R2-R5 - User-Configurable Relays
These relays are configurable by the user. For all the available configuration options, see **Table 2 on page 52**.

By using all (4) of the available relay outputs on the RNE Controller and the (4) relay outputs on the VCM-X Expansion Module, you have the ability to configure up to a combined total of (8) relay outputs for Heating Stages, Cooling Stages, and options 3 through 12 listed in **Table 2 on page 52**. With the addition of the 12-Relay Expansion Module, you have an additional (12) relay outputs available for a combined total of 20.

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.

VCM-X Expansion Module

AI1 - Outdoor Air Humidity Sensor Input
This input is used to connect an Outdoor Air Humidity Sensor that when combined with the Outdoor Air Temperature Sensor reading is used to calculate a Dewpoint and/or Wetbulb Temperature. The Outdoor Air Dewpoint Temperature is used to activate the Dehumidification Mode on MUA and CAV configured units which utilize the CAV/MUA Dual Damper Mode (Hood On/Off) control feature. The Wetbulb Temperature is used for Economizer enthalpy control.

AI2 - Indoor Air Humidity Sensor Input
The Indoor Air Humidity Sensor is used to activate Dehumidification Mode on a VAV or CAV unit. The Sensor can be a Wall-Mounted Space Humidity Sensor or a Return Air Duct Mounted Humidity Sensor.

AI3 - Economizer Feedback
If Title 24 Economizer operation has been configured, this input will be used for the 0-10 VDC Feedback Signal from the Economizer actuator.

AI4 - Building Pressure Sensor Input
This Sensor is only required if you wish to configure the RNE 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. 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.

SIG - Not Used

+V - 5 VDC Power - Not Used

AO1 - Building Pressure Control Signal
This voltage signal (0-10 VDC) is used to provide an output signal to a Building Pressure Control device. The output signal can be connected to either an Exhaust Fan VFD or an Exhaust Damper Actuator when Direct Acting Building Pressure Control is required. When Reverse Acting Building Pressure Control is required, the output signal would be connected to an Outdoor Air Damper Actuator. When used in this application, the output signal must be configured for Reverse Acting Operation.

AO2 - Modulating Heating Signal
This output signal can be configured for either a 0-10 VDC or a 2-10 VDC output signal. This signal can be configured for either Direct Acting or Reverse Acting operation. This output signal is used to operate a AAON® Modulating Heating Device to maintain the Heating Supply Air Temperature Setpoint.

AO3 - Modulating Cooling Signal
This output signal can be configured for either 0-10 VDC or 2-10 VDC output signals. This signal can be configured for either Direct Acting or Reverse Acting operation. This output signal is used to operate a Modulating Cooling Device to maintain the Cooling Supply Air Temperature Setpoint. VFD Compressors will be controlled out of the appropriate outputs from either the Full Digital Module or Water Source Heat Pump Module as shown on **pages 40-45**.

AO4 - Return Air Damper Signal
This output signal is a Direct Acting 0-10 VDC output signal that is used to modulate a Return Air Damper Actuator in concert with a Return Air Bypass Damper Actuator for AAON® PAC or DPAC control schemes.

AO5 - Return Air Bypass Damper 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 concert with a Return Air Damper Actuator for AAON® PAC or DPAC control schemes.

PR OUT - Not Used

R1-R4 - User-Configurable Relay Outputs
Configure relays as indicated by the factory wiring diagram when mounted controls are used. The options are listed in **Table 2 on page 52**.

BI1 - Emergency Shutdown Input
This wet contact input is used to initiate shutdown of the HVAC unit when an 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.

BI2 - Dirty Filter Contact Closure Input
This wet contact input is required for Filter Status Indication and requires a Differential Pressure Switch to initiate “Dirty Filter” indication.

*BI3 - Proof of Flow Input
A Proof of Flow Switch 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. The Proof of Flow Switch is an optional input. This means that you must configure the RNE Controller to recognize this input signal.

Expansion Modules Inputs & Outputs

BI4 - Remote Forced Occupied Mode Input

When this wet contact input closes, it will force the RNE 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.

BI5 - Remote Forced Heating Mode Input

This wet contact input is used to provide a means for another BAS or control device (by others) to force the unit into Heating Mode when it closes. See the note regarding Remote Force Mode Setting that follows.

BI6 - Remote Forced Cooling Mode Input

This wet contact input is used to provide a means for another BAS or control device (by others) to force the unit into Cooling Mode when it closes. See the note regarding Remote Force Mode Setting that follows.

NOTE: Remote Forced Heating or Cooling Modes require that you enter a value of 1 for both the Heating and the Cooling Setpoints for the HVAC Mode Enable and the Mode Enable Sensor must be set as Supply Air Temperature. The RNE Controller will then look for wet contact closures on the Remote Forced Cooling Mode and Remote Forced Heating Mode inputs to enable the HVAC Modes. If both the Remote Forced Heating and Remote Forced Cooling Modes are active, the unit will operate in Vent Mode. The unit may also be operated in Vent Mode by providing a wet contact closure signal to the Remote Occupied Input.

BI7 - Exhaust Hood On Input

When this wet contact input closes, the RNE Controller switches from Indoor Air Control to Outdoor Air Control. This is typically used on CAV applications requiring MUA/CAV Dual Damper (Hood On/Off) Modes.

BI8 - Remote Forced Dehumidification

This wet contact input is used to provide a means for another BAS or control device (by others) to force the RNE Controller into Dehumidification Mode. You must set the Humidity Setpoint to 100% for the Remote Forced Dehumidification feature to function.

*4 Binary Input Expansion Module

A 4 Binary Input Module can be used in lieu of using the VCM-X Expansion Module when only the first 4 Binary Inputs are required. You can use the VCM-X Expansion Module or the 4 Binary Input Expansion Module, but not both.

12-Relay Expansion Module

Please refer to the user-configurable relays in **Table 2** for relay definitions.

No.	Relay Description	Details
1	Heating Stages	Configure (1) Relay for each stage of heat. Configure (1) Relay for Mod heat.
2	Cooling Stages	Configure (1) Relay for each stage of cooling. For chilled water, configure (1) Relay for cooling.
3	Warm-Up Mode (VAV Boxes)	Configure (1) Relay for Warm-Up Mode when Non-Orion VAV/Zone Controllers are used.
4	Reversing Valve (Heat Pumps)	Configure (1) Relay for Reversing Valve operation. Can be configured for heating or cooling.
5	Reheat	Configure (1) Relay for On/Off reheat when used.
6	Exhaust Fan	Configure (1) Relay for enabling exhaust fan when building pressure control is used.
7	Pre-Heater (Low Ambient Protection)	Configure (1) Relay for pre-heat coil when required. Activated when the outdoor air temperature drops below the ambient protection setpoint.
8	Alarm	Configure (1) Relay to initiate an alarm output when any VCM-X alarm occurs.
9	Override	Configure (1) Relay to initiate an output signal when space temperature override button is pushed.
10	Occupied	Configure (1) Relay to initiate an output signal any time the VCM-X is in occupied mode.
11	OA Damper	Configure (1) Relay to initiate an output signal when the OA damper moves beyond its minimum during economizer operation, or when the OA damper opens in a MUA application, or when the damper opens during Hood On operation.
12	Heat Wheel	Configure (1) Relay that turns heat wheel on when in occupied operation and turns heat wheel off when in economizer mode.
13	Emergency Heat	Configure (1) Relay for fixed stage Emergency Heat in a heat pump unit. Not available on VCM-X WSHP E-BUS controller.

Table 2: User-Configurable Relay Outputs

Occupied/Unoccupied Mode

The RNE 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

Forced Schedule

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

Remote Forced Occupied Signal

When this wet contact input closes, it will force the RNE 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.

NOTE: When using Remote Forced Occupied Mode, set all the Internal Week Schedules to '0' so that the Internal Schedule always commands the Unoccupied Mode.

Internal Week Schedule

An Internal Week Schedule, which supports up to two start/stop events per day, is available for determining Occupied and Unoccupied Schedules. If you are using the Internal Schedule, an Optimal Start calculation is also available. See the Scheduling Section on **page 68** for more information on the Optimal Start feature.

Push-Button Override Signal

During Unoccupied hours, you can force the RNE Controller back to Occupied operation by pressing the Override Button on the Space Temperature Sensor for a period of less than 3 seconds. This initiates the Override or resets the Override Timer back to zero during Unoccupied hours of operation.

During Override operations, you can cancel the Override by pressing the Override Button for a period of time between 3 seconds and 10 seconds. This restores the RNE Controller to Normal Unoccupied Operation.

If the Override Button is held for more than 10 seconds, it causes a Space Sensor Failure Alarm. This is due to the fact that the Override Button actually shorts the Space Temperature Sensor input to ground. If this input is shorted to ground or left floating with no Space Temperature Sensor detected for more than 10 seconds, it is considered a Space Temperature Sensor failure.

You can still use the Space Temperature Sensor input for an Override Command even when a Space Temperature Sensor is not connected. Simply provide a Momentary Push-Button connected between AI1 and the Ground Terminal on the same terminal block. Follow the same procedure for initiating Overrides, even on Supply Air Temperature Controlled Cooling-Only HVAC units.

HVAC Modes of Operation

There are 7 possible HVAC Modes of Operation. They are as follows:

- Vent Mode
- Cooling Mode
- Dehumidification Mode
- Heating Mode
- Heat Pump
- Warm-Up Mode
- Off Mode

Vent Mode Operation

This Mode only applies to the Occupied Mode of Operation. The Vent Mode is defined as the Supply Fan running with no Heating, Cooling, or Dehumidification demand.

Vent Mode can occur during the Occupied Mode if the Space, Return, or Outdoor Air Temperature Sensor is selected as the HVAC Mode Enable Sensor. Vent Mode can also occur if the Supply Air Temperature Sensor is the HVAC Mode Enable Sensor and the RNE Controller has been configured for Remote Forced Heating and Cooling. See the Remote Control of HVAC Mode section on **page 61** for complete details.

NOTE: During Vent Mode, all Cooling and Heating Stages are deactivated and the Economizer Damper is maintained at a Minimum Position to provide fresh air into the building. The Static Pressure is still maintained by the Supply Fan VFD or Zoning Bypass Damper Signal since the Supply Fan is still operating in this Mode.

Cooling Mode of Operation

Occupied Cooling Mode occurs whenever the HVAC Mode Enable Temperature is above the HVAC Mode Enable Cooling Setpoint. Unoccupied Cooling Mode only occurs if a Space Temperature Sensor is connected to the RNE Controller and a Night Setback Cooling Offset has been configured.

The Mechanical Cooling will be disabled if the Outdoor Air Temperature is below the Cooling Lockout Setpoint by 1°F. This gives a 2°F hysteresis around the Cooling Lockout Setpoint to prevent unwanted cycling in and out of Mechanical Cooling Mode. If the Outdoor Air Temperature disables the Mechanical Cooling while it is currently operating, the Mechanical Cooling will stage off if all staging and run times are satisfied.

If the Economizer has been enabled for operation, it is used as the first stage of Cooling, and the Mechanical Cooling will be activated if necessary. See the Economizer Operation section on **page 55** for a more detailed operating sequence.

No matter which Sensor is configured for the HVAC Mode Enable or if the Remote BAS sets the Mode through Remote Forced Cooling, the Supply Air Temperature is always regulated to the Active Supply Air Cooling Setpoint while in the Cooling Mode.

Cooling Mode

Cooling Options

There are 3 types of Cooling available. They are as follows:

- Half VFD Compressor(s) and Half Fixed Compressor(s)
- Full VFD Compressors
- Modulating Chilled Water

Cooling Staging and the Stage Control Window

In the Cooling Mode, as the Supply Air Temperature rises above the Active Supply Air Temperature Setpoint, Cooling will begin to modulate or to stage. Successive stages will stage up based on the Stage Up Delay period. Cooling Stages will continue to run until the Supply Air Temperature falls below the Active Supply Air Cooling Setpoint minus the Cooling Stage Control Window. For example, if the Active Supply Air Cooling Setpoint is 55° and the Cooling Stage Control Window is 5°, as the Supply Air Temperature falls below 50°, the Cooling Stages will begin to stage off based on the Cooling Stage Down Delay period.

Cooling Staging Delays

Minimum Off Time

A Cooling Stage cannot be activated unless it has been off for this amount of time.

Minimum Run Time

After a Cooling Stage has been activated, it must remain on for this amount of time.

Staging Up Delay

After the first Cooling Stage has been activated, this delay prevents additional stages from activating too quickly before they are needed to achieve the Active Supply Air Temperature Setpoint.

Staging Down Delay

After a Cooling Stage has met its Minimum Run Time and is not needed, this delay prevents additional stages from deactivating too quickly in case they are needed to maintain the Active Supply Air Temperature Setpoint Temperature.

Modulating Chilled Water

The RNE Controller can modulate a Chilled Water Valve with a 0-10 VDC or 2-10 VDC signal. The valve will modulate to maintain the Active Supply Air Cooling Setpoint and is subject to a Minimum Run Time and Minimum Off Time.

Half VFD Compressor(s) and Half Fixed Compressor(s)

The RNE Controller will initiate and stage compressors based on the above Staging and Time Delay descriptions.

2 Compressor Units (RNE 55-105)

The VFD Compressor will modulate as needed to maintain the Active Supply Air Cooling Setpoint. If the compressor signal reaches 80%, the Stage Up Timer will begin. If the Stage Up Delay period elapses and the compressor signal is still above 80%, the Fixed Compressor will stage on, and the VFD Compressor signal will be cut to half of its current signal. The VFD Compressor will then modulate as needed to maintain the Supply Air Setpoint.

With both compressors on, if the VFD Compressor signal falls to 30% for the Stage Down Delay period, then the Fixed Compressor will stage off. The VFD Compressor signal will then modulate as needed to maintain the Supply Air Setpoint. If the VFD Compressor then reaches 0% for the Stage Down Delay period, it will be deactivated.

4 Compressor Units (RNE 120-140)

The two VFD Compressors will both be driven out of one Analog Output, although the compressor relays will be enabled separately as needed. The 1st VFD Compressor will modulate to maintain the Active Supply Air Cooling Setpoint. If the compressor signal reaches 80%, the Stage Up Timer will begin. If the Stage Up Delay period elapses and the compressor signal is still at or above 80%, the 2nd VFD Compressor relay will be enabled. The VFD Compressor signal will then be cut to half of its current value, and both VFD Compressors will modulate together as needed to maintain the Supply Air Setpoint.

If the VFD Compressor signal again reaches 80% and remains there for the Stage Up Delay period, the 3rd compressor (a fixed stage) will be enabled to run. The VFD Compressor signal will be cut to half its current value and will then modulate as necessary to maintain the Supply Air Setpoint. This will be repeated for the 4th compressor (the second fixed stage).

If more than one compressor is active and the VFD Compressor signal falls to 30% for the Stage Down Delay period, the last compressor staged on will then stage off. The VFD Compressor will then modulate as needed. This will repeat as compressors stage off. If the last compressor remaining on then reaches 0% for the Stage Down Delay period, it will be deactivated.

Full VFD Compressors

2 Compressor Units (RNE 55-105)

The 1st VFD Compressor will be driven out of Analog Output (AO) #1, and the 2nd VFD Compressor will be driven out of AO #2. The 1st VFD Compressor will modulate to maintain the Active Supply Air Cooling Setpoint. If the compressor signal reaches 80%, the Stage Up Timer will begin. If the Stage Up Delay period elapses and the compressor signal is still at our above 80%, the 2nd VFD compressor will be enabled. The signals to both VFD Compressors will then go to half of the current value of the 1st VFD Compressor. Both VFD Compressors will then modulate together as needed to maintain the Supply Air Setpoint.

With both compressors on, if the VFD Compressor signal falls to 30% for the Stage Down Delay period, the 2nd VFD Compressor will stage off. The remaining VFD Compressor will then modulate as needed to maintain the Supply Air Setpoint. If the last compressor reaches 0% for the Stage Down Delay period, it will be deactivated.

4 Compressor Units (RNE 120-140)

The 1st two VFD Compressors will both be driven out of the Analog Output (AO) #1, and the second two VFD Compressors will be driven out of the AO #2. All four compressor relays will be enabled separately as needed. The 1st VFD Compressor will modulate to maintain the Active Supply Air Cooling Setpoint. If the compressor signal reaches 80%, the Stage Up Timer will begin. If the Stage Up Delay period elapses and the compressor signal is still at our above 80%, the 2nd VFD Compressor relay will be enabled. The VFD Compressor signal from AO #1 will then be cut to half of its current value and these first two VFD Compressors will modulate together as needed to maintain the Supply Air Setpoint.

If the VFD Compressor signal on AO #1 again reaches 80%, the Stage Up Timer will begin. If the Stage Up Delay period elapses and the compressor signal is still at or above 80%, the 3rd VFD Compressor will be enabled and will modulate from AO #2. The signals from AO #1 and AO #2 will then go to half of the current value of the signal from AO #1 and modulate as needed. If the VFD Compressor signal on AO #2 reaches 80%, the Stage Up Timer will begin. If the Stage Up Delay period elapses and the compressor signal is still at or above 80%, the 4th VFD Compressor will be enabled. The compressor signals will again be cut to half their current value and will then modulate together as necessary to maintain the Supply Air Setpoint.

If more than one compressor is active and the VFD Compressor signal(s) falls to 30% for the Stage Down Delay period, the last compressor staged on will then stage off. The VFD Compressor signal(s) will then modulate as needed. This will repeat as compressors stage off. If the last compressor remaining on then reaches 0% for the Stage Down Delay period, it will be deactivated.

Economizer Operation

This section assumes you have configured your HVAC unit to control the Outdoor Air Dampers in an Economizer Mode of operation.

The Economizer is used as the first stage of Cooling if the Outdoor Air or Wetbulb Temperature is below the Economizer Enable Setpoint. For Wetbulb control of the Economizer, an Outdoor Air Humidity Sensor must be installed. If the unit is equipped with a Return Air Temperature Sensor, the Outdoor Air or Wetbulb temperature must be at least 5°F colder than the Return Air Temperature to allow the Economizer to modulate. By using the Return Air Temperature reference, it allows the RNE to calculate whether the Outdoor Air Temperature will assist in Free Cooling. The Return Air Temperature and Space Temperature must be above 50°F for the Economizer operation to occur.

The RNE Controller can monitor an Outdoor Air Humidity Sensor and combine that reading with the Outdoor Air Temperature reading to calculate a Wetbulb Temperature. If this Wetbulb Temperature is not available, only the Outdoor Air Temperature will be used. Whichever temperature is available, it must be below the Economizer Enable Setpoint by 1°F to enable the Economizer during the Cooling Mode of operation. When the temperature rises 1°F above the Economizer Enable Setpoint, the Economizer will be disabled and return to the Minimum Position.

As soon as the Cooling Mode is started, the Economizer will calculate a starting damper position based on the Outdoor Air Temperature and the differential between the Supply Air Temperature and the Active Supply Air Temperature Setpoint. After it moves to this initial Setpoint, further adjustments will be made in small increments to fine tune the damper position to maintain the Active Supply Air Temperature Setpoint. If the Economizer reaches 100% open and the Supply Air Temperature is still too warm, the Mechanical Cooling will be enabled to operate to provide additional stages of Cooling. Once a Mechanical Cooling Stage has been activated, the Economizer will remain full open until the Mechanical Cooling Stages are off or until the Outdoor Air Temperature or Wetbulb Temperature causes the Economizer to be disabled.

If the Economizer is not enabled to provide Cooling during the Occupied Mode, it will still maintain the Minimum Position programmed to provide minimum fresh air into the building. During the Unoccupied Mode, the Economizer will be closed. If during the Unoccupied Mode there is a call for Cooling and the Economizer is enabled by Outdoor Air Drybulb or Wetbulb temperature, it will modulate between full closed and full open to provide Free Cooling.

The Supply Air Temperature must be above the Supply Air Temperature Setpoint before the Mechanical Cooling can be activated.

During Dehumidification, the Economizer will remain at its minimum position.

Supply Air Tempering

WARNING: Because of the lower compressor lockouts used for Water Source Heat Pump Units, the Supply Air Tempering sequence will not function in those applications.

For units configured as VAV units (Supply Air Temperature Sensor is configured as the controlling sensor), unit heat can be used to maintain a leaving air temperature near the Cooling Leaving Air Setpoint. This may be necessary in conditions very cold outdoor air is being introduced into the unit preventing it from maintaining the Supply Air Temperature (SAT) Cooling Setpoint of 55º (Adj). There are four conditions that must be met before the heating can be activated in this sequence:

1. The outdoor air temperature must fall below the Low Ambient Protection Setpoint (the Low Ambient Protection Setpoint must always be below the Mechanical Cooling Lockout Setpoint).
2. The SAT must fall below a special Tempering SAT Heating Setting (used only in this sequence) which is 2º below the SAT Cooling Setpoint (not adjustable).
3. The economizer must be at its minimum position. This prevents heating from coming on before the controller has had a chance to bring the SAT under control by closing the economizer to its minimum position.
4. The VFD must be operating above the Heating Minimum VFD Setpoint.

Once these conditions are met, the RNE Controller will activate and stage heat as needed to try to achieve the Tempering SAT Heating Setting. If a stage of heat or MODGAS heat overshoots the Tempering SAT Heating Setting, the economizer will be allowed to modulate open to bring the SAT down to the SAT Cooling Setpoint. If, after the heating minimum run time has been satisfied, the economizer has not been able to bring the SAT down within the heat staging window, then the controller will stage down/off the heat.

If this is an Air to Air Heat Pump unit, heating for the Supply Air Tempering operation will only use Auxiliary Heat (and Emergency Heat if available). Compressor heat cannot be use for the tempering function.

NOTE: During this mode of operation, the standard Heating Staging Window will be used.

There is a Maximum OA Damper Position During Tempering Setpoint that allows you to set a maximum damper position the economizer can open to while the heat is running during this tempering mode (to prevent potential wasting of energy).

Dehumidification Mode Operation

On VAV or CAV applications, the Indoor Air Humidity initiates Dehumidification when the Indoor Air Humidity rises 5% above the Indoor Air Humidity Setpoint during the Occupied Mode of operation and likewise stops Dehumidification when the Indoor Air Humidity drops more than 5% below the Indoor Air Humidity Setpoint during the Occupied Mode of operation.

On 100% Outdoor Air applications, the Outdoor Air Dewpoint initiates the Dehumidification Mode when the Outdoor Air Dewpoint rises 2°F above the Outdoor Air Dewpoint Setpoint during the Occupied Mode of operation and likewise stops Dehumidification when the Outdoor Air Dewpoint drops more than 2°F below the Outdoor Air Dewpoint Setpoint during the Occupied Mode of operation. The Outdoor Air Dewpoint is calculated by using an Outdoor Air Temperature Sensor and an Outdoor Air Humidity Sensor.

Chilled Water Dehumidification

Once Dehumidification is initiated, the RNE Controller will open the Chilled Water Valve to a fixed 100% position to provide for full moisture removal capability.

DX Dehumidification

During Dehumidification, the RNE Controller will stage or modulate compressors to maintain an Average Coil Suction Temperature (the average Coil Temperature of all compressors that are currently on) to the Evaporator Coil Suction Temperature Setpoint. The Coil Temperature is calculated by using a Suction Pressure Sensor and converting the pressure to temperature. The Staging Delays, Minimum Run Times, and Minimum Off times described in the Cooling Mode Section will also apply during Dehumidification.

If the Average Coil Temperature remains above setpoint, additional compressor stages will be activated based on the Stage Up Delay timer. If the Average Coil Temperature falls below the Coil Temperature Setpoint minus the Cooling Stage Control Window, compressor stages will stage off based on the Stage Down Delay timer.

Fixed DX Compressors

Once in Dehumidification, the RNE Controller will initially bring on half of the compressor stages. Additional stages will stage on and off per the above staging description.

Half VFD Compressor(s) and Half Fixed Compressor(s)

2 Compressor Units (RNE 55-105)

The VFD Compressor will modulate as needed to maintain the Coil Temperature Setpoint. If the compressor signal reaches 100%, the Stage Up Timer will begin. If the Stage Up Delay period elapses and the compressor signal is still above 100%, the Fixed Compressor will stage on. The VFD Compressor will then be allowed to modulate between 70% and 100% to maintain the Average Coil Temperature at the Coil Temperature Setpoint.

If the VFD Compressor modulates down to 70% for the Stage Down Delay, the Fixed Compressor will stage off. If the VFD Compressor modulates down to 0% for the Stage Down Delay period, it will stage off.

4 Compressor Units (RNE 120-140)

The two VFD Compressors (both driven out of the Analog Output #1) will be enabled together and will modulate to maintain the Average Coil Temperature at the Coil Temperature Setpoint. If the compressor signal reaches 100%, the Stage Up Timer will begin. If the Stage Up Delay period elapses and the compressor signal is still at 100%, the 3rd compressor (fixed) will be enabled. The VFD Compressors will then be allowed to modulate between 70% and 100% to maintain the Average Coil Temperature at the Coil Temperature Setpoint. This stage up would be repeated for the 4th compressor (fixed) with the VFD Compressors again allowed to modulate between 70% and 100%.

If all four compressors are on and the VFD Compressor signal modulates down to 70% for the Stage Down Delay, the 4th compressor will stage off while the VFD Compressors can again modulate between 70% and 100%. This would be repeated to stage off the 3rd compressor. The VFD Compressors will then be allowed to modulate from 0% to 100%. If the VFD Compressors modulate down to 0% for the Stage Down Delay, they will stage off.

Full VFD Compressors

2 Compressor Units (RNE 55-105)

The 1st VFD Compressor will be driven out of Analog Output (AO) #1, and the 2nd VFD Compressor will be driven out of AO #2. The 1st VFD Compressor will modulate to maintain the Coil Temperature Setpoint. If the compressor signal reaches 100%, the Stage Up Timer will begin. If the Stage Up Delay period elapses and the compressor signal is still above 100%, the 2nd VFD Compressor will stage on. The 1st VFD Compressor will then be locked at 100%, while the 2nd VFD Compressor is allowed to modulate as needed to maintain Average Coil Temperature at the Coil Temperature Setpoint.

If the 2nd VFD Compressor modulates down to 0% for the Stage Down Delay period, it will stage off. If the 1st VFD Compressor modulates down to 0% for the Stage Down Delay period, it will stage off.

4 Compressor Units (RNE 120-140)

The first two VFD Compressors will be driven out of the Analog Output (AO) #1, and the second two VFD Compressors will be driven out of the AO #2. The first two VFD Compressors will enable and modulate together to maintain the Average Coil Temperature at the Coil Temperature Setpoint. If the signal to those compressors reaches 100% for the Stage Up Delay period, the 3rd compressor will stage on. The signal from AO #1 to the first two compressors will then be locked at 100% while the 3rd compressor modulates from AO #2 to maintain the Coil Temperature Setpoint. If the signal to the 3rd compressor reaches 80% for the Stage Up Delay period, the 4th compressor will enable. The signal from AO #2 will then be cut in half and the 3rd and 4th compressors will modulate together.

With all four compressors on, if the signal from AO #2 goes to 30% for the Stage Down Delay period, then the 4th compressor will stage off. If the signal from AO #2 then goes to 0% for the Stage Down Delay period, the 3rd compressor will stage off. If the signal from AO #1 to the first two VFD Compressors then goes to 0% for the Stage Down Delay period, those compressors will stage off.

Priority and Night Dehumidification

The Dehumidification Mode can be configured to have Dehumidification Priority. If configured, the RNE will enter the Dehumidification Mode when the Dewpoint or Humidity is above the Setpoint regardless of the current Heating or Cooling demands. The Reheat is always controlled to the Active Supply Air Temperature Setpoint. The Active Supply Air Temperature Setpoint will change during Heating, Cooling, or Vent Modes. During the Vent Mode, the Supply Air Temperature Setpoint will be a Calculated Setpoint that is halfway between the HVAC Mode Setpoints.

If Dehumidification Priority has not been configured, the RNE will only enter the Dehumidification Mode and use Reheat during the Vent Mode. The Reheat will be controlled to a Calculated Supply Air Temperature Setpoint that is halfway between the HVAC Mode Setpoints.

Night Dehumidification can also be configured and is used primarily for CAV units that require an Unoccupied Mode of Dehumidification. Night Dehumidification is only activated when the Indoor Air Humidity is above the Indoor Air Humidity Setpoint during the Unoccupied Mode.

NOTE: Compressor Lockout Setpoints are ignored during dehumidification as the compressors are controlled by coil temperature.

Remote Forced Dehumidification

Dehumidification Mode is normally controlled by using a Humidity Sensor connected to the VCM-X Expansion Module input AI1 or AI2. If desired, Dehumidification Mode can also be determined by using a remote BAS or other user-supplied remote device. The RNE will check BI8 input on the VCM-X Expansion Module for a 24 VAC signal. If the signal is present, it will force the RNE into Dehumidification Mode regardless of the mode it is currently operating in if Dehumidification Priority Mode has been configured. If Dehumidification Priority Mode has not been configured, the unit will only be forced into Dehumidification Mode if it is operating in the Vent Mode during the time the remote signal is being supplied to input BI8.

NOTE: When using the Remote Forced Dehumidification function, set the Dehumidification Spt Indoor RH to 100% for the Remote Forced Dehumidification feature to function.

Coil Temperature Reset

Any time an Indoor Humidity Sensor is used, the Coil Temperature Setpoint will be automatically reset as the humidity rises above or drops below the Indoor Humidity Setpoint. It can reset the Coil Temperature Setpoint by a maximum of 5ºF. For example, if the Coil Temperature Setpoint is 45ºF and the Indoor Humidity Setpoint is 50% with an actual humidity reading of 55%, the new Coil Temperature Setpoint will be 40ºF. If the humidity is below the Indoor Humidity Setpoint, then the Coil Temperature Setpoint will be increased by a maximum of 5ºF.

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.

NOTE: See **page 5** for specific AAON® DPAC and PAC operation.

Heating Mode

Dehumidification Reheat

During the Dehumidification Mode, the RNE activates Cooling to extract moisture from the Supply Air and utilizes either Modulating Hot Gas Reheat, On/Off Hot Gas Reheat, or Heating to warm the Supply Air before entering the building. Hot Gas Reheat is the standard form of Reheat. 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. 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.

If the unit is equipped with a Modulating Hot Gas Reheat Controller (MHGRV), it is automatically detected by the RNE Controller. In Dehumidification Mode, as the Cooling causes the Supply Air Temperature to drop, the MHGRV will bypass Hot Gas to the Hot Gas Reheat Coil, raising the Supply Air Temperature back up to the Active Supply Air Temperature Setpoint.

If the unit is equipped with an On/Off Hot Gas Valve, then one of the relays will be configured for Reheat. The Reheat Relay will be activated if the Supply Air Temperature is less than the HVAC Mode Enable Heating 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.

When Heating is used for Reheat instead of Hot Gas Reheat, the RNE can activate the Heat Source(s) discussed in the Heating Mode section. Heating can also be used in conjunction with Hot Gas Reheat to add additional Reheat for applications that require a higher Supply Air Drybulb Temperature than what Hot Gas Reheat can provide. When Heating is used in conjunction with Reheat, the RNE restricts the Heating to one form of Modulating Heat or one stage of Gas or Electric Heat.

NOTE: MODGAS cannot be used in conjunction with Hot Gas Reheat to add additional Reheat.

Heating Mode Operation

Occupied Heating Mode occurs whenever the HVAC Mode Enable Temperature is below the HVAC Mode Enable Heating Setpoint. Unoccupied Heating Mode only occurs if a Space Temperature Sensor is connected to the RNE or a broadcast of Space Temperature is being received from an Averaging Broadcast Controller.

The Mechanical Heating will be disabled if the Outdoor Air Temperature is above the Heating Lockout Setpoint by 1°F. This gives a 2°F hysteresis around the Heating Lockout Setpoint to prevent unwanted cycling in and out of Mechanical Heating Mode. If the Outdoor Air Temperature disables the Mechanical Heating while it is currently operating, the Mechanical Heating will stage off if all staging and run times are satisfied.

No matter which Sensor is configured for the HVAC Mode Enable or if the Remote BAS sets the Mode through Remote Forced Heating, the Supply Air Temperature is always controlled to the Active Supply Air Temperature Setpoint while in Heating Mode.

Stage Control Window

The Heating Stage Control Window Setpoint determines when the Heating Stages begin to stage up and stage down. In the Heating Mode, as the Supply Air Temperature falls below the Active Supply Air Temperature Setpoint, the Heating Stages will begin to stage on based on the Heating Stage Up Delay. The 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. For example, if the Supply Air Temperature Setpoint is 140°F and the Heating Stage Control Window is 5°F, as the Supply Air Temperature rises above 145°F, the Heating Stages will begin to stage off based on the Heating Stage Down Delay.

Heating Staging Delay

Minimum Off Time

A Heating Stage cannot be activated unless it has been off for this amount of time.

Minimum Run Time

After a Heating Stage has been activated, it must remain on for this amount of time.

Staging Up Delay

After the first Heating Stage has been activated, this delay prevents additional stages from activating too quickly before they are needed to achieve the Active Supply Air Temperature Setpoint.

Staging Down Delay

After a Heating Stage has met its Minimum Run Time and is not needed, this delay prevents additional stages from deactivating too quickly in case they are needed to maintain the Active Supply Air Temperature Setpoint.

AAON® MODGAS-X Controller

The AAON® MODGAS-X Controller is treated as a single stage of gas heating when connected to the RNE's expansion port. The Supply Air Temperature is broadcast from the AAON® MODGAS-X Controller to the RNE. The Supply Air Temperature Setpoint is broadcast from the RNE to the AAON® MODGAS-X Controller. When the RNE enters the Heating Mode, it broadcasts a command to activate the MODGAS Controller. The AAON® MODGAS-X Controller modulates the Natural Gas Valve to maintain the Supply Air Temperature Setpoint. See the *MODGAS-X Controller Technical Guide* for detailed operation information of the AAON® MODGAS-X Controller.

AAON® MODGAS-X Controller with Additional Stages of Heat

The RNE can activate the AAON® MODGAS-X Controller and additional stages of heating if needed. If this configuration is needed, a heating relay must be configured on the RNE for the AAON® MODGAS-X Controller, but it will not be connected to anything. The AAON® MODGAS-X Controller will always be the first stage of heating in this configuration. Additional heating relays can be configured and connected to Staged Heating sources, such as Natural Gas or Electric Heat. In order for the additional stages to activate, the AAON® MODGAS-X Controller must be at 100%, and then the Stage Up Delay begins. Once the Stage Up Delay expires and the Gas Valve is still at 100%, another Fixed Stage of Heating will activate. This will be the RNE's second stage of heat. The AAON® MODGAS-X Controller will modulate to achieve the Active Supply Air Temperature Setpoint.

If the AAON® MODGAS-X Controller modulates to 0% and the Supply Air Temperature is above the Active Supply Air Setpoint plus the Heating Stage Control Window, the Stage Down Delay begins. Once the Stage Down Delay expires and the Supply Air Temperature has remained above the Active Supply Air Setpoint plus the Heating Stage Control Window, the Fixed Stage of Heating will be deactivated. The AAON® MODGAS-X Controller will remain active, even at the minimum valve position unless the Supply Air Temperature remains above the Active Supply Air Setpoint plus the Heating Stage Control Window. The AAON® MODGAS-X Controller will be the last stage of heating to be deactivated.

Modulating Heating

The RNE supports various forms of Modulating Heat such as SCR Electric Heat, Modulating Hot Water Heat, and Modulating Steam Heat. Whichever form of Modulating Heating is used, the RNE will modulate the Heat Source to achieve the Active Supply Air Temperature Setpoint. Modulating Natural Gas is a form of Modulating Heat, but is controlled by the AAON® MODGAS Controller. The RNE only activates the AAON® MODGAS as a stage of heat; therefore, the Modulating Heating Proportional Window does not apply when the RNE is connected to the AAON® MODGAS Controller and is the only form of Heating activated by the RNE.

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. The RNE can activate two forms of Heating that are classified as Primary and Secondary Heat Sources. The Primary Heat Source used can be SCR Electric Heat, Modulating Hot Water Heat, or Modulating Steam Heat. The Secondary Heat Source used can be Modulating Natural Gas (AAON® MODGAS-X Controller), Staged Gas Heat, or Staged Electric Heat.

Primary Modulating Heat and Secondary Heat with AAON® MODGAS-X Controller

The Modulating Heating Proportional Window is used to determine the signal to the Primary Heat Source and is user-adjustable. The Heating Stage Control Window is used to determine stage up and stage down of the Secondary Heat Source. In the Heating Mode, the Primary Heat Source will modulate to achieve the Active Supply Air Temperature Setpoint. When the Primary Heat Source 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, which is controlled by the AAON® MODGAS-X Controller, will activate. The Primary Heat Source will then be forced to 0%, allowing the AAON® MODGAS-X Controller to modulate the gas valve to achieve the Active Supply Air Temperature Setpoint.

When the Secondary Heat Source reaches 100%, the Heating Stage Up Delay begins. If the Secondary Heat Source is still at 100% after the Heating Stage Up Delay expires, the Primary Heat Source will be forced to 100%. The Primary Heat Source will remain at 100% to allow the Secondary Heat Source to modulate to achieve the Active Supply Air Temperature Setpoint. If the Supply Air Temperature rises above the Active Supply Air Temperature Setpoint plus the Heating Stage Control Window, the Heating Stage Down Delay begins. If the Supply Air Temperature is still above the Active Supply Air Temperature Setpoint plus the Heating Stage Control Window and the Heating Stage Down Delay expires, the Primary Heat Source will forced to 0%. If the Secondary Heat Source modulates to 0%, the Heating Stage Down Delay begins. If the Secondary Heat Source remains at 0% and the Heating Stage Down Delay expires, the Secondary Heat Source will be deactivated, and the Primary Heat Source will modulate to achieve the Active Supply Air Temperature Setpoint. If the Supply Air Temperature rises above the Active Supply Air Temperature Setpoint plus the Heating Stage Control Window, the Primary Heat Source modulates as needed to allow the Supply Air Temperature to cool off.

Heating Mode and Morning Warm-Up

Primary Modulating Heat and Secondary Heat with Staged Gas or Electric Heat

The Modulating Heating Proportional Window is used to determine the signal to the Primary Heat Source and is user-adjustable. The Heating Stage Control Window is used to determine stage up and stage down of the Secondary Heat Source. In the Heating Mode, the Primary Heat Source will modulate to achieve the Active Supply Air Temperature Setpoint. When the Primary Heat Source 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 will then modulate to achieve the Active Supply Air Temperature Setpoint. 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 the Supply Air Temperature rises above the Active Supply Air Temperature Setpoint plus the Heating Stage Control Window, the Primary Heat Source will modulate to 0% to allow the Supply Air Temperature to cool off.

Heat Pump Operation

The RNE can be configured to control a Heat Pump. The compressors are used for both Heating and Cooling. With the RNE Controller, the Reversing Valve is activated during Heating operation as the default because AAON® units are typically built to fail to Cooling operation. The Reversing Valve can be configured to activate during Cooling operation for equipment that is built to fail to Heating operation.

Auxiliary Heating Stages are configured as Heat Relays and are used to supplement the Compressor Heating Stages. If the unit is not equipped with Auxiliary Heating Stages, Heating Relays do not need to be configured in order for the unit to provide Compression Heating. Auxiliary Heating can also be Modulating heat in the form of SCR Electric, Hot Water, or Steam.

The Cooling and Dehumidification Modes operate in the same manner as described under the Cooling and Dehumidification titled sections on **pages 53-58** of this manual. In the Heating Mode, the RNE activates the Reversing Valve and stages compressors to provide Heating if the Outdoor Air Temperature is above the OAT Cooling Lockout Setpoint. The compressor heating stages are activated in the same manner as described in the Cooling Mode of Operation, in this case to maintain the Active Supply Air Heating Setpoint. Staged or Modulating Auxiliary Heat can be activated to supplement Compressor Heating in order to achieve the Active Supply Air Setpoint if the Outdoor Air Temperature is below the OAT Heating Lockout Setpoint. If the Outdoor Air Temperature is below the OAT Cooling Lockout Setpoint, only Auxiliary Heating will occur. If the Outdoor Air Temperature is above the OAT Heating Lockout, only Compressor Heating will occur.

Emergency Heat stages can also be configured. If the Outdoor Air Temperature is above the Compressor Lockout Temperature, Emergency Heating is disabled. If the Outdoor Air Temperature is below the Compressor Lockout Temperature, Emergency Heating is enabled and can stage up after Auxiliary Heat.

NOTE: If the RNE Controller is used to control a Water Source Heat Pump unit, the Compressor Lockouts are ignored. Since Emergency Heat can only be used below the Compressor Lockouts, Emergency Heat is therefore not available.

If a heat pump unit is used in a VAV application using Supply Air Tempering, then Morning Warm-Up mode will only use Auxiliary Heat. Heating for the Supply Air Tempering operation will only use Auxiliary Heat (and Emergency Heat if available).

For RNE applications with an installed Suction Pressure Transducer, a Head Pressure Module and a Head Pressure Transducer(s), a Defrost Mode is available during the Heat Pump Heating operation. The RNE Controller converts the Suction Pressure to a Suction Temperature. A user-adjustable Suction Temperature Setpoint determines when the unit will go into Defrost Mode during Heat Pump Heating. The unit will operate in Defrost Mode for 10 minutes or until the Head Pressure reaches 450 PSIG.

An Adaptive Defrost Adjustment configuration is available that will automatically adjust the length of the Defrost Timer (interval between Defrost Modes) depending on if the unit stays in Defrost Mode for the full 10 minutes or leaves the Defrost Mode early because of reaching a Head Pressure of 450 PSIG. If Adaptive Defrost is configured and the Defrost Mode is terminated because the 10 minute timer has elapsed, this could indicate that the unit needs more Defrost time. In this case, the Adaptive Defrost Adjustment value will be subtracted from the original Defrost Timer to shorten the interval between Defrost Cycles. If the Defrost Cycle is terminated between the 8th and 9th minute, the Defrost Timer value will not be changed. If the Defrost Cycle is terminated before the 8th minute, this could indicate that the Defrost Timer is too short. In this case, the Adaptive Defrost Adjustment value will be inversely proportionally added to the original Defrost Timer as the termination time shortens from 8 minutes to 0 minutes.

NOTE: For other details specific to Water Source Heat Pump operation, see the Water Source Heat Pump Module Troubleshooting Section on **page 78**.

Morning Warm-Up Mode Operation

When the RNE Controller is configured as a VAV unit (Cooling only)and switches to the Occupied Mode of Operation (not Override Mode), the unit compares the Return Air Temperature to a Morning Warm-Up Target Temperature. If the Return Air Temperature is below this Setpoint, the Warm-Up Mode is initiated. 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.

Off Mode

If the schedule has set the Unoccupied Mode and no Heating, Cooling, or Dehumidification demands exist, the RNE Controller enters the Off Mode. During the Off Mode, the Supply Fan is off and the Outdoor Air Dampers are closed.

Head Pressure Control

If Head Pressure Control is being utilized, the Two Condenser Head Pressure Module will be used, and each compressor will have a corresponding condenser fan or water valve. Units with two compressors will use (1) Two Condenser Head Pressure Module. Units with four compressor will use (2) Two Condenser Head Pressure Modules. The condenser outputs will be controlled to maintain that circuit's Head Pressure Setpoint.

Cooling/Dehumidification Mode

When a compressor is called to run (for either Cooling or Dehumidification), the corresponding Condenser Enable Relay will be energized to enable the Condenser Fan or Water Valve. In a water cooled system, the signal to the water valve will start at 75% for 3 minutes. In an air cooled system, the signal to the condenser fan will start at 50% for 30 seconds. The condenser signal will then modulate between 0 and 100% to maintain the appropriate Head Pressure Setpoint. Both a Cooling and a Dehumidification Head Pressure Setpoint can be configured. The output signal to a water valve can be configured as 0-10 VDC or 2-10 VDC. The output to the ECM motor of a condenser fan is a 0-100% PWM signal. Both outputs mirror each other.

Heat Pump Mode

In the Heating Mode, the RNE Controller will communicate to the Two Condenser Head Pressure Module that Heating is enabled. The Heating Enable Relay(s) will energize, and the condenser output signal will go to 100% and remain there until the Heat Enable signal is removed.

NOTE: The Heating Enable Relay(s) outputs are for indication only and are not wired to anything.

NOTE: For other details specific to configuration and troubleshooting of the Two Condenser Head Pressure Module, see the Troubleshooting Section on **page 82**.

Remote Control of HVAC Mode

NOTE: When using the Remote Control of HVAC Mode, both of the Heating and Cooling HVAC Mode Enable Setpoints must be set to 1 and the Mode Enable Sensor must be set as Supply Air Temperature.

The Heating Mode, Cooling Mode, and Vent Mode can be determined by a remote Building Automation System (BAS). The RNE will check the VCM-X Expansion Module for a 24 VAC input signal on BI5 and BI6. BI5 is used for Remote Forced Heating Mode. BI6 is used for Remote Forced Cooling Mode. If a 24 VAC signal is present on both BI5 and BI6, the RNE will be in Remote Forced Venting Mode. Remote Forced Venting Mode is considered to be Occupied Fan-Only operation. Once the Remote Forced Mode has been set, normal Heating, Cooling, or Venting Modes of operations will occur. All other user-adjustable setpoints, such as the Heating and Cooling Supply Air Temperature Setpoints, are used in the actual control of the equipment.

During Dehumidification, if a Reset Source is not configured, the Supply Air Temperature Setpoint will be 70°F.

The Remote Occupied Input on the VCM-X Expansion Module, BI4, can also be used for Occupied Fan Only operation when the Remote Forced Heating or Cooling inputs are not activated.

Supply Air Temperature Setpoint Reset

The RNE Controller incorporates a dynamic Supply Air Temperature Reset function based on a selected Reset Source. The available Reset Source options are Space Temperature, Return Air Temperature, Outdoor Air Temperature, Supply Fan VFD Signal, or a Remote Reset Signal. In each case, for the heating mode and the cooling mode, a Low and a High Reset Source Setpoint must be entered that will correspond to a Low and High Supply Air Setpoint. Since the Supply Air Setpoints are not fixed during reset, we refer to them as the "Active Supply Air Temperature Setpoints." The RNE uses the HVAC Mode Enable Setpoints to determine the mode of operation. Once the HVAC Mode has been determined, the RNE will proportionally reset the Supply Air Temperature Setpoint based on the Reset Source condition relative to the Reset Source Low and High Setpoints. For each of the Reset Source options discussed below there is an example of how to set it up in the *RNE Controller Operator Interfaces Technical Guide* in the Supply Air Reset configuration screens #4 & #5 and setpoint screens #4 through #7.

If you configure Space Temperature, Return Air Temperature, or Outdoor Air Temperature as the Reset Source, then separately, for the heating mode and the cooling mode you will need to enter a Low and High Reset Source Setpoint and a Low and High Supply Air Temperature Setpoint. This creates a range of Reset Source Temperature Setpoints and a range of Supply Air Temperature Setpoints. As the Reset Source Temperature varies within its range, it will proportionally reset the Supply Air Temperature Setpoint within its reset range.

When the temperature at the Reset Source is at the Reset Source Low Setpoint, the Supply Air Temperature Setpoint would be reset to the Supply Air High Setpoint. When the temperature at the Reset Source is at the Reset Source High Setpoint, the Supply Air Temperature Setpoint would be reset to the Supply Air Low Setpoint. When the temperature at the Reset Source is in between its Low and High Setpoints, the Supply Air Setpoint will be proportionally reset between its High and Low Setpoints. When the unit is in the Vent Mode or Vent Dehumidification Mode, the Supply Air Temperature Setpoint will be calculated to be halfway between the HVAC Mode Enable Setpoints. If Dehumidification Priority has been configured and the unit is in Heating Dehumidification or Cooling Dehumidification Mode, the Supply Air Temperature Setpoint is proportionally reset in the same way as in the Heating and Cooling Modes described above in this paragraph.

If the Supply Fan VFD Signal is configured as the Reset Source, then separately, for the heating mode and the cooling mode, you will need to enter a Low and High VFD Signal Setpoint and a Low and a High Supply Air Setpoint. This creates a range of VFD Signal Setpoints and a range of Supply Air Temperature Setpoints. As the VFD Signal varies within its range, it will proportionally reset the Supply Air Temperature Setpoint within its range. For example, in the Cooling Mode, when the Supply Fan VFD Signal is at its low setpoint, the Supply Air Cooling Setpoint will be reset to its high setpoint; when the Supply Fan VFD signal is at its high setpoint, the Supply Air Cooling Setpoint will be reset to its low setpoint. In the heating mode, the Supply Air Heating Setpoint reset would react in the opposite fashion with the VFD signal at its highest setpoint the Supply Air Heating Setpoint is reset to its highest setpoint, and with the VFD signal at its lowest setpoint the Supply Air Heating Setpoint is reset to its lowest setpoint. In either mode, if the VFD signal is halfway (for instance) between the Low Signal Setpoint and the High Signal Setpoint, the Supply Air Setpoint would be reset to halfway between its High and Low Setpoint. If Dehumidification Priority has been configured and the unit is in Heating Dehumidification or Cooling Dehumidification Mode, the Supply Air Temperature Setpoint is proportionally reset in the same way as in the Heating and Cooling Modes described above in this paragraph. When the unit is in the Vent Mode or Vent Dehumidification Mode, the Supply Air Temperature Setpoint will be calculated to be halfway between the HVAC Mode Enable Setpoints.

If a Remote Reset Signal is configured as the Reset Source, a 0-5 or 0-10 VDC signal can be used to reset the Supply Air Temperature Setpoint (set jumper to 0-10V). Separately, for the Heating Mode and the Cooling Mode you will need to enter a Low and a High Supply Air Setpoint.

As an example when using a 0-5 VDC signal, when the Reset Signal is at 0 VDC, the Supply Air Setpoint will be at its lowest setpoint for both Heating and Cooling. When the Reset Signal is at 5 VDC, the Supply Air Setpoint will be at it highest setpoint for both Heating and Cooling. As the voltage signal changes between 0 VDC and 5 VDC, the Supply Air Setpoint will be proportionally reset between the Low and High Supply Air Temperature Setpoint for both Heating and Cooling. If Dehumidification Priority has been configured and the unit is in Heating Dehumidification or Cooling Dehumidification Mode, the Supply Air Temperature Setpoint is proportionally reset in the same way as in the Heating and Cooling Modes described above in this paragraph. When the unit is in the Vent Mode or Vent Dehumidification Mode, the Supply Air Temperature Setpoint will be calculated to be halfway between the HVAC Mode Enable Setpoints.

Air Flow Monitoring/Control

The RNE Controller with the E-BUS Distribution Module can monitor airflow of the outside air, the supply air, and the return/exhaust air streams by utilizing EBTRON® GTN116 and GTC116 Airflow Monitoring Stations. The RNE will control the Outdoor Air Damper to maintain an Outdoor Air CFM Setpoint. No other control functions are available at this time.

Supply Fan Control

Any time the Supply Fan is requested to start, a timer is checked to make sure the Supply Fan has been off for at least 1 minute. This 1-minute delay is a protection against rapid cycling of the Supply Fan. Once the 1-minute delay has been satisfied, the Supply Fan relay is activated and all other outputs are verified to be in the off condition for a period of 1 to 2 minutes. This short period of Supply Fan-Only Operation serves to purge the stagnant air from the duct before any Heating or Cooling occurs.

Normally, the Supply Fan runs continuously during the Occupied Mode of operation. If the fan is only required to run in the Occupied Mode during Heating, Cooling, or Dehumidification Modes, the RNE can be configured for Fan Cycle Mode.

Duct Static Pressure Control

The RNE Controller reads and controls Static Pressure in the duct system if the Supply Fan has been configured for Duct Static Pressure Control. Any time the Supply Fan is operating, the RNE Controller is controlling Duct Static Pressure. The Duct Static Pressure Setpoint and Deadband limits are user-adjustable along with a Control Interval. This Control Interval 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 is hunting and not maintaining a stable pressure reading. 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 Control Output Signal is a non-configurable Direct Acting Signal (0-10 VDC). This Output Signal can be used to directly connect to a Supply Fan VFD. The Output Signal increases (increases 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.

Since the Duct Static Pressure Control Output Signal is a non-configurable Direct Acting Signal (0-10 VDC), when you are using a Zoning Bypass Damper Actuator to control the Duct Static Pressure, you must set up the Zoning Bypass Damper Actuator or the Zoning Bypass Damper so that it is Reverse Acting in operation. The Output Signal increases (closes Zoning Bypass Damper) if the Duct Static Pressure is below the Duct Static Pressure Setpoint by the Deadband amount, and the Output Signal decreases (opens Zoning Bypass Damper) if the Static Pressure is above the 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 the Supply Fan control is not configured for Duct Static Pressure Control, you can still monitor the Duct Static Pressure if the Duct Static Pressure Sensor is installed; however, no control will occur.

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 RNE 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 VCM 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.

Building Pressure Control

The RNE can maintain Building Static Pressure any time the Supply Fan is operating by activating a Constant Volume Exhaust Fan, a VFD Exhaust Fan, or Modulating Exhaust Damper, or by modulating the Outdoor Air Damper. A Building Pressure Transducer must be connected to the VCM-X's Expansion Module. For Constant Volume Exhaust Fan applications, only an Exhaust Fan Relay needs to be configured for on/off operation of the Exhaust Fan. VFD or Modulating Building Pressure control must be configured in order for this feature to operate. An Exhaust Fan Relay can also be configured along with Modulating Building Pressure control for an Enable output. Building Pressure can be maintained by either Direct or Reverse Acting control.

Direct Acting Modulating Control

If configured, a VFD Exhaust Fan or Modulating Exhaust Damper will be controlled by varying a 0-10 or 2-10 VDC control signal. If an enable output is required, an Exhaust Fan Relay can also be configured. The Exhaust Fan Relay and the Modulating Signal will activate when the Building Static Pressure rises above the Building Static Pressure Setpoint plus the Deadband. The Exhaust Fan Relay will remain active until the Building Static Pressure falls below the Building Static Pressure Setpoint minus the Deadband and the Modulating Signal falls to 0%.

Direct Acting On/Off Control

If you do not require a Modulating Control Signal, you can also configure one of the Relay Outputs as an Exhaust Fan Relay to activate whenever the Building Static Pressure is above the Building Static Pressure Setpoint plus the Deadband. The Exhaust Fan Relay will deactivate when the Building Static Pressure falls below the Building Static Pressure Setpoint minus the Deadband. Only one Relay Output should be configured for this operation. There is no staging of additional Exhaust Fan Relays.

Reverse Acting Modulating Control

If configured, on a drop-in building static pressure below the building pressure setpoint minus the deadband, a 2-10 VDC signal will modulate to open the outside air damper. When this option is selected, no economizer-free cooling or IAQ operation will be available.

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

The RNE 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 VOut wet contact closure is received on the Hood On binary input on a RNE Controller Expansion Module. Under normal operation (CAV), the unit will operate as a recirculating space temperature (and space humidity) controlled unit. When the Hood On contact is made, the unit will open the Outdoor Air Damper to its full open position. The Heating and Cooling Modes will then be determined by the Outdoor Air Temperature Sensor using the same Heating and Cooling Setpoints that were used in the CAV mode. 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.

MUA Unoccupied Operation

Normally, an MUA unit is off during the Unoccupied Mode. However, if the unit has Return Air, it can be configured to operate as a recirculating Night Setback Controlled unit during Unoccupied Hours. This is accomplished by simply configuring Night Setback Temperature Setpoints (anything other than the default 30ºF) on a unit that is also configured for Outdoor Temperature Control (MUA). With this configuration, when the unit goes Unoccupied, it will close the Outdoor Air Damper and begin to use a Space Temperature Sensor in conjunction with the existing Heating and Cooling Setpoints, offset by the Night Setbacks, to make Night Setback calls. If a Space Humidity Sensor is installed, and the unit is configured for Night Humidity control, the RNE Controller will use the Space Humidity Setpoint for unoccupied Dehumidification calls.

IAQ (CO_2) Operation

If you have configured the RNE Controller to monitor and control CO_2 levels, the Economizer operation will be modified as follows:

1. The Maximum Reset Position the Economizer can open to is determined by a user-adjustable setpoint called the CO_2 Protection Limit Max Level.
2. The Minimum Position the Economizer can close down to is reset higher as the level of CO_2 increases above the CO_2 Protection Limit Max Level programmed. As the CO_2 level increases above the adjustable CO_2 Setpoint, the Outdoor Air Damper will start opening beyond its Minimum Position. At the CO_2 Protection Limit Reset Range above Setpoint, the Economizer will be held to its Maximum Reset Position and not allowed to open any further.

Pre-Heater Operation

In colder climates where freezing temperatures are sometimes experienced, it is desirable to preheat the Outdoor Air being drawn into the HVAC unit before it reaches the Water Coils to prevent freezing. The Pre-Heater control option is available by setting a Low Ambient Protection Setpoint and by configuring one of the relay outputs as a Pre-Heater. Only one relay can be configured for this option, and therefore, staging of Pre-heater relays is not available. The Pre-Heater operation will only operate in the Occupied Mode.

The Pre-Heater sequence operates so that any time during the Occupied mode, if the Outdoor Air Temperature is below the Low Ambient Protection Setpoint and the Supply Fan is running, the Pre-heater Relay will activate. It will remain on until the Outdoor Air Temperature rises 1°F above the Setpoint or until the Supply Fan shuts down. If the Proof of Flow option is installed and configured, its signal must also be active for the Pre-Heater Relay to activate.

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.

Single Zone VAV Mode

In this application, the RNE will modulate the Supply Fan VFD to maintain the Space Cooling or Heating Setpoint while the unit's cooling or heating source is modulating to maintain the appropriate Supply Air Setpoint. This sequence will operate optimally when the HVAC unit has modulating heating and cooling. Staged heating and cooling should not be used and will not provide satisfactory performance.

When the Space Temperature rises one deadband above the Space Cooling Setpoint, the cooling mode is initiated. The Supply Fan will energize and begin operating at 30% speed. Cooling will modulate to maintain the Active Supply Air Cooling Setpoint. The Supply Fan will then proportionally modulate as needed between 30% and 100% as the Space Temperature rises within the Space Reset Window created by configuring a Cooling Reset Source Low Setpoint and a Cooling Reset Source High Setpoint. The Cooling Mode is disabled when the space temperature falls one deadband below the Space Cooling Setpoint.

When the Space Temperature falls one deadband below the Space Heating Setpoint, the Heating Mode is initiated. The Supply Fan will energize and begin operating at 50% speed. Heating will modulate to maintain the Active Supply Air Heating Setpoint. The Supply Fan will then proportionally modulate as needed between 50% and 100% as the Space Temperature falls within the Space Reset Window created by configuring a Heating Reset Source High Setpoint and a Heating Reset Source Low Setpoint. When Heat Pump heating is operating, the Supply Fan VFD will operate from 75% to 100%. The heating mode is disabled when the space temperature rises one deadband above the Space Heating Setpoint.

When the Space Temperature is satisfied and the unit is in the Vent Mode of operation, the fan will operate at 30%. During Dehumidification, the fan will operate as described above, depending on if the Space Temperature is calling for Heating, Cooling, or Vent Mode operation.

Whenever the unit is in CO_2 override operation of the Outdoor Air Damper, the minimum VFD fan speed is forced to 75% and can modulate up from there.

In order for the RNE to operate in Single Zone VAV mode, the unit must be configured as follows:

Mode Enable Sensor = Space Temperature
Reset Source = Single Zone VAV
Duct Static Pressure Control = No

Configure the Cooling Reset Source High and Low Setpoints and the Heating Reset Source High and Low Setpoints to establish the Space Temperature Cooling and Heating range over which the VFD will modulate in those modes.

Outdoor Air Lockouts

The Outdoor Air Cooling and Heating Lockouts Setpoints are designed to prevent unwanted Mechanical Heating or Cooling operation during certain Outdoor Ambient Temperature conditions.

When the Outdoor Air Temperature is below the Cooling Lockout Setpoint, no Mechanical Cooling can operate. However, if the unit is equipped with an Economizer and the RNE is configured to use the Economizer, it can be used to provide free Cooling when the Mechanical Cooling is locked out. For Heat Pumps, the Cooling Lockout also applies to Compressor Heating, which means it usually will be a lower setting than on Cooling units that are not Heat Pumps.

The Outdoor Air Heating Lockout operates so that when the Outdoor Air Temperature is above the Outdoor Air Heating Lockout Setpoints, no Mechanical Heating can operate. This applies to any type of Heating except Compressor Heating as used on Heat Pumps. The lockout for Compressor Heating is explained in the previous paragraph regarding Cooling Lockout Setpoints.

Supply Air Cutoffs

The Supply Air Temperature Cutoffs are designed to prevent extremely High and Low Temperature Supply Air from entering the building.

High Supply Air Temperature Cutoff

High Supply Air Temperature Cutoff is initiated when the Supply Air Temperature rises above the HI SAT Cutoff Setpoint. When this occurs, Heating stages will be deactivated until the Supply Air Temperature falls 5°F below the HI SAT Cutoff Setpoint. Also, the Outside Air Damper will move to its Minimum Economizer Position.

Low Supply Air Temperature Cutoff

Low Supply Air Temperature Cutoff is initiated when the Supply Air Temperature falls below the LO SAT Cutoff Setpoint. If the RNE is in Economizer Operation, Vent Mode, or Heating Mode and the Supply Air Temperature falls below the LO SAT Cutoff Setpoint for 10 minutes, it is assumed a Mechanical Failure has occurred and all Heating will be deactivated, the Supply Air Fan will shut off, and the Outdoor Air Dampers will close. If the RNE is in the Cooling or Dehumidification Mode and the Supply Air Temperature falls below the LO SAT Cutoff Setpoint, the Cooling Signal or Cooling Stages will immediately begin deactivating.

To restore normal operation, one of the following three things must occur:

1. The Supply Air Temperature rises above the LO SAT Cutoff Setpoint by 5°F.
2. The RNE goes from Occupied to Unoccupied or from Unoccupied to Occupied Mode.
3. The RNE's power is cycled.

Sensor Failure, Mechanical Failure, and Failure Mode 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.

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.

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.

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. The alarm will be cleared when the Supply Air Temperature drops the 5 degrees and sets the failure timer back to zero. This alarm does not apply for Modulating Cooling.

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. The alarm will be cleared when the Supply Air Temperature rises the 5 degrees and sets the failure timer back to zero. This alarm does not apply for Modulating Heating.

Proof of Air Flow 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, 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 (Smoke) 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 SA and will generate an alarm condition. This contact closure does not produce an instantaneous shutdown. Emergency Shutdown needs to be configured for this alarm to occur.

For instantaneous shutdown, the device initiating the open condition on this contact should also be wired to cut the 24 V common to the SA relay outputs.

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

These alarms only apply when Space or Return Air is configured ad the Mode Enable Sensor.

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.

Module Alarm

This alarm applies to any E-BUS Module communicating with the RNE Controller. The E-BUS modules include the Full Digital Module, the Two Condenser Head Pressure II Module, and the Water Source Heat Pump Module. If any of these modules stop communicating with the RNE Controller or if there is an alarm on one of these modules, this Module Alarm will be generated.

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.

VAV/Zone Controller Alarms

Space Sensor Failure Alarm

If the controller detects an open or short on the Space Sensor input, this alarm will be generated.

CFM Sensor Failure Alarm

If the Air Flow Constant (K Factor) is set to any value other than zero, and the controller does not detect the Airflow Sensor, this alarm will be generated.

Damper Opening Alarm

After initial calibration, if the damper is called to be fully open and cannot reach that position within approximately 2 minutes, this alarm will be generated.

Damper Closing Alarm

After initial calibration, if the damper is called to be fully closed and cannot reach that position within approximately 2 minutes, this alarm will be generated.

High Space Temp Alarm

If the zone temperature is above the Cooling Setpoint by the Hi Zone Alarm Offset (user adj.) for the Zone Alarm Delay Period (user adj.), this alarm will be generated.

Low Space Temp Alarm

If the zone temperature is below the Heating Setpoint by the Lo Zone Alarm Offset (user adj.) for the Zone Alarm Delay Period (user adj.), this alarm will be generated.

Damper Feedback Failure Alarm

If the controller fails to detect the actuator feedback signal, this alarm will be generated.

Scheduling and Internal Trend Logging

Scheduling

The RNE Controller has an internal power source for the Real Time Clock (RTC) that allows the controller to keep the time and accurately control scheduling. It can also broadcast the time to the VAV/Zone Controllers if that option is configured.

The RNE Controller has an internal 7-day Schedule with 2 Start/Stop Events per day. You can also have 1 Holiday Schedule with 2 Start/Stop Events per day. This Holiday Schedule can be used for 14 different Holiday periods.

You can change the time on the RNE Controller through the Modular Service Tool, Modular System Manager, or the System Manager TS. You can also broadcast the time and date to all RNE Controllers by using a Personal Computer and the Prism Computer Front-End Software.

The Internal Scheduling in the RNE Controller also includes a Self-Teaching Optimal Start Routine that can be activated by entering a value of 1.0 or greater for the Soak Multiplier Setpoint. The Optimal Start function can only be used if your RNE Controller has a Space Temperature Sensor installed and it is being used as the Controlling Sensor or if you are using WattMaster VAV/Zone controllers with the RNE Controller.

No adjustments other than the Soak Multiplier are required because the RNE Controller monitors how long it takes to reach the Target Temperature each day and adjusts the Starting Time accordingly. That means the first day you operate your HVAC unit, it will not be able to Optimally Start because it does not have a history of previous Starts and their results. After the first day, the RNE Controller will begin adjusting the Start Time, and after six Normally Scheduled Starts have occurred, the Optimal Start Routine will have gathered enough data to provide an accurate Pre-Start based on the learned conditions. This is an ongoing learning process of the six previous starts, so the unit automatically adjusts for the changing seasons. If you don't need this feature, but you are using the Space Temperature Sensor as the Controlling Sensor, you can set the Soak Multiplier to zero to eliminate the Optimal Start Routines.

Internal Trend Logging

The RNE Controller continuously maintains an Internal Trend Log, which records a fixed set of values at a user-programmed interval. These values can be retrieved only with the Prism 2 Computer Front-End Software. If you do not have a computer with Prism 2 Software installed and connected to the system communications loop, you do not have access to these logs.

There are 120 log positions available. Once the last (120th) position has been recorded, the log jumps back to the first position and begins overwriting the old data. This means the you will need to retrieve the logs at an interval that is shorter than the duration of the last 120 logs

Shown below are some log intervals and the duration of 120 logs.

1 minute interval = 2 hours
12 minute interval = 24 hours
15 minute interval = 30 hours
30 minute interval = 60 hours
60 minute interval = 120 hours

The fixed items in the log are listed below:

Date
Time
Mode (Status Bits)
Return Air Temperature
Outdoor Air Temperature
Supply Air Temperature
Supply Air Temperature Setpoint
Coil Suction Temperature
Outdoor Air Dewpoint
Indoor Air Humidity
Duct Static Pressure
Building Static Pressure
Economizer Signal Percentage
Supply Fan VFD/Zoning Bypass Damper Signal Percentage
Exhaust Fan VFD/Exhaust Damper Signal Percentage
Modulating Heat Signal Percentage
Modulating Cooling Signal Percentage
Space Temperature
On Board Relay Status (Bit Pattern)
Expansion Module Relay Status (Bit Pattern)
Head Pressure
Condenser Fan Signal Percentage
Outdoor Air CFM
Supply Air CFM
Return or Space CO_2
MODGAS Module Signal Percentage
Modulating Hot Gas Reheat-X Module Signal Percentage

These items and values are explained in greater detail in the *Prism 2 Computer Front-End Software Technical Guide*.

Force Modes or Overrides

WARNING: No equipment protection is available during the Force Mode of operation. That means you could start a compressor without running the Supply Fan or could create other conditions that WILL damage the equipment. WattMaster Controls assumes no responsibility or liability for the misuse of Overrides that cause damage to the equipment!

The RNE Controller relay and analog outputs can be user-overridden if the Modular Service Tool or the Prism Computer Front-End Software is used. The System Manager cannot be used for these Force Modes. The Modes of operation for the relays are as follows:

0 = Normal Operation
1 = Forced ON
2 = Forced OFF

The Analog Outputs are Forced when you specify a value between 0.0 and 10.0 VDC. To cancel the Force Mode, you must enter a value less than zero, such as -1.0 VDC.

When the Analog Outputs are Forced, the display on the Modular Service Tool or Prism program can be interpreted as the actual voltage. During normal operation, the display indicates the percentage signal applied based on the user-defined voltage limits. For example, if you define a 2.0 VDC to 10.0 VDC range, then 50% would be 6.0 VDC instead of the 5.0 VDC applied when the range is 0.0 VDC to 10.0 VDC.

As previously mentioned, Force Modes can only be activated when using either the Modular Service Tool or the Prism Computer Front-End Software. Furthermore, the Override condition can only remain in effect as long as one of these Operator Interface devices is connected and communicating with the RNE. That means that you cannot Force an Override condition and then walk away from the equipment with the Override still active. The loss of communications, removal, or shutdown of the Operator Interface will automatically terminate the Override within 10 minutes. This protects the equipment and prevents an Override condition from remaining active indefinitely, resulting in inefficient or dangerous operation of the equipment.

VAV Terminal Unit Controller Compatibility

The RNE Controller is designed to communicate with Orion VAV/Zone Controllers. The RNE can be configured to broadcast its Internal Schedule, Time, and Date, Fan and Heat Status, and Supply Air Temperature. The RNE can also broadcast Force to Max or Force to Fixed Position during Morning Warm-up. The Orion VAV/Zone Controllers broadcast Push-Button Overrides from Unoccupied to Occupied. The controllers can also generate Unoccupied Heating and Cooling calls to the RNE Controller based on Setbacks.

If you are using another manufacturer's VAV Terminal Unit Controllers, the RNE Controller can activate a relay to inform the VAV/Zone Controllers that the RNE Controller is operating in Warm-up Mode. No other information can be passed between the RNE Controller and the other manufacturer's VAV Terminal Unit Controllers. This means that Overrides or Unoccupied Heating and Cooling calls cannot activate the RNE Controller. If you need any of these capabilities, you must use only Orion VAV/Zone Controllers for controlling all of your VAV Terminal Units.

VAV/Zone System

When the RNE goes into the Occupied Mode, it initiates Morning Warm-up if the Return Air Temperature is below the Morning Warm-up Target Temperature Setpoint. During Morning Warm-Up, the VAV/Zone Controllers will modulate open if the Space Temperatures are too cold. They can also move to their Maximum Airflow or Fixed Airflow Position Setpoint if they receive this broadcast from the RNE Controller. Once Morning Warm-up has been satisfied, the RNE enters the Cooling Mode and the VAV/Zone Controllers will modulate to satisfy their Space Temperature Setpoints. If the Space Temperature falls below the Heating Setpoint, staged or modulating Reheat can be activated to warm the space.

Communications between the RNE and the VAV/Zone Controllers are handled by the MiniLink Polling Device. Alarm Polling and Tenant Overrides are also monitored by the MiniLink Polling Device. Tenant Overrides are overrides generated by the Space Temperature Sensor's push button. The MiniLink Polling Device records the start and stop times and total run times of the overrides on a daily and monthly basis. A computer running Prism Computer Front-End Software is required to retrieve all data acquired by the MiniLink Polling Device.

Zoning System

The RNE Controller automatically configures itself for Voting Control when the MiniLink Polling Device is installed and is configured as a Voting System. The RNE Controller sets the HVAC Mode Enable to the Return Air Temperature Sensor as soon as communication is acquired with the MiniLink Polling Device. If the VAV/Zone controllers are configured for Voting, the MiniLink Polling Device totals the Heating and Cooling demands and determines which HVAC Mode the RNE should be in. The MiniLink Polling Device broadcasts a forced Heating, Cooling, or Vent Mode of operation to the RNE. Once the RNE receives the broadcast to set the HVAC Mode, it operates as previously described in the RNE Sequence of Operations. If communications are lost, the RNE returns to its own control and will maintain the HVAC Mode Enable Setpoints by using the Return Air Temperature Sensor as the Controlling Sensor.

LED Diagnostics

Using LEDs To Verify Operation

The RNE Controller is equipped with 4 LEDs that can be used as very powerful troubleshooting tools. See **Figure 40** below for the LED locations. The LEDs and their uses are as follows:

REC - This LED will light up to indicate system communications.

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

STATUS 1 - This is the diagnostic blink code LED. It will light up and blink out diagnostic codes. STATUS 1 LED also represents the tens column in the address blink code.

STATUS 2 - This is the diagnostic blink code LED. It will light up and blink out diagnostic codes. STATUS 2 LED also represents the ones column in the address blink code.

POWER LED Operations

When the RNE Controller is 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.

REC LED Operations

When power is applied to the controller, the REC LED will also light up. If this is a Stand Alone System (one controller only on the loop) or an Interconnected System (several RNE Controllers tied together without a CommLink), the REC LED will glow continuously. The REC LED will flicker when you are connected to the RNE Controller and you are entering setpoints with the Modular Service Tool or one of the System Managers. It will also flicker if this is a Networked System. If this is a Networked System (the system has a CommLink installed), the REC LED should flicker rapidly, indicating that the system is communicating. A "flicker" is defined as a brief moment when the LED turns off and then back on. It may be easier to see this "flicker" if you cup your hand around the LED.

If the REC LED does not operate as indicated above, first check the address switch setting. Verify the address switch as outlined in the Diagnostic LEDs Operations section on **page 71**. See **Figure 38 on page 48** for complete address switch setting instructions.

NOTE: STATUS 1 LED represents the tens position and STATUS 2 LED represents the ones position of the controller address. If the address of the controller is set to 59 with the address switch, first STATUS 1 LED will blink 5 times, and then STATUS 2 LED will blink 9 times.

If the address switch setting is correct and the REC LED still does not behave as indicated above, check to be sure the operator's interface is connected correctly. If you are using the Modular Service Tool, verify that it is plugged in securely to the DIN connection on the RNE Controller. If you are using one of the System Manager Operator's Interfaces, see the *RNE Controller Operator Interfaces Technical Guide* or the *System Manager TS Operator Interfaces Technical Guide* for a connection diagram.

If the REC LED still does not behave correctly, check the voltages at the communications terminal block. Be sure the Controller is powered up for this test. Unplug the communications terminal block from the controller and check the DC voltage between T and SHLD and between R and SHLD. Check the voltage with a digital multimeter set to DC volts. The voltage should be between 3.0 to 3.2 VDC between SHLD and either T or R. If the voltage is not in this range, you probably have a damaged driver chip that must be replaced.

For driver chip replacement instructions, contact the factory for further assistance.

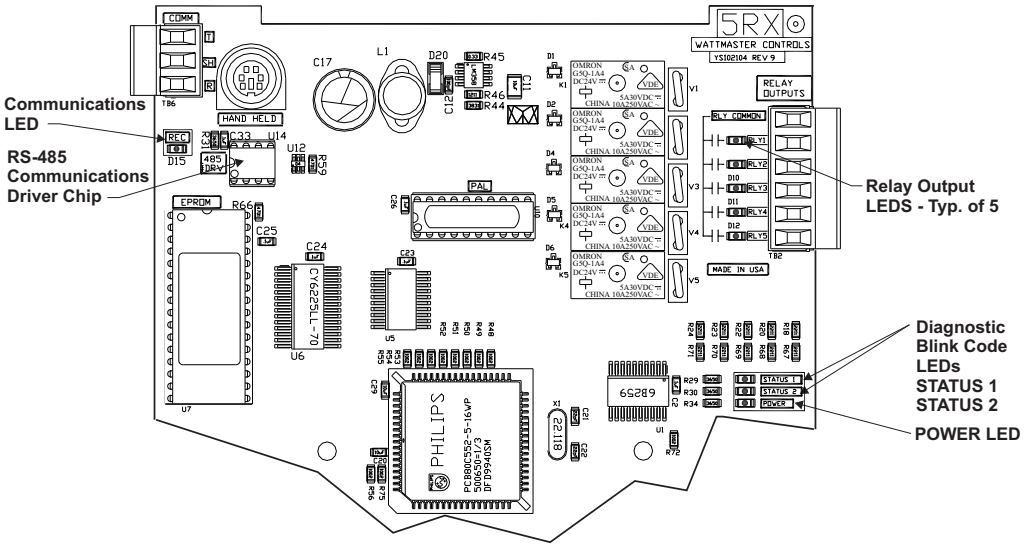


Figure 40: RNE Controller Diagnostic LED Locations

Diagnostic LED Operation

When power is first applied, the STATUS 1 and STATUS 2 LEDs will be off for 1 second. At this time, both LEDs will blink to indicate the setting of the address switch and then will extinguish for 5 seconds. Verify that the address switch setting is correct by counting the number of blinks.

If the address switch is not correct, first remove the communication loop terminal plug from the controller and then from the power terminal plug. Set the address dip switches correctly. See **Figure 38 on page 48** for correct address switch setting instructions. After you are sure the address switch setting is correct, first reconnect the power connection and then reconnect the communication loop connection to the controller.

NOTE: You must always cycle power to the Controller being addressed after changing address switch settings in order for the changes to take effect.

Reapply power to the controller and observe the blink code to verify the address is set correctly. If the STATUS 1 and STATUS 2 LEDs now blink the correct address, your controller is addressed correctly. If they don't light up at all, the controller is not operating correctly and could be defective. Once the controller is done blinking the address, STATUS 2 LED will blink continuously for 30 seconds while the controller calibrates. Once the controller is done calibrating, the LEDs will blink a code every 10 seconds to indicate controller status. See **Table 3** for a list of the various blink codes and their meanings.

If all of these tests are made and the controller still doesn't operate, please contact WattMaster Controls Technical Support at 866-918-1100.

Blink Code Description	STATUS 1 LED Blinks	STATUS 2 LED Blinks
Normal Operation	**0**	**1**
Outdoor Air Sensor Failure	**0**	**2**
Supply Air Sensor Failure	**1**	**2**
Space Sensor Failure	**3**	**2**
Module Alarm	**4**	**2**
Mechanical Cooling Failure	**1**	**3**
Mechanical Heating Failure	**2**	**3**
Fan Proving Failure	**3**	**3**
Dirty Filter Alarm	**4**	**3**
Emergency Shutdown	**5**	**3**
Low Supply Temp Alarm	**1**	**4**
High Supply Temp Alarm	**2**	**4**
Control Temp Cooling Failure	**3**	**4**
Control Temp Heating Failure	**4**	**4**
Push Button Override	**1**	**5**
Zone Override	**2**	**5**
Force Outputs Override	**0**	**6**

Table 3: Diagnostic LED Blink Code Interpretation

Temperature Sensor Testing

The following sensor voltage and resistance tables are 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 below each chart when checking sensors.

Temperature – Resistance – Voltage for Type III 10 K Ohm Thermistor Sensors		
Temp (ºF)	Resistance (Ohms)	Voltage @ Input (VDC)
-10	93333	4.620
-5	80531	4.550
0	69822	4.474
5	60552	4.390
10	52500	4.297
15	45902	4.200
20	40147	4.095
25	35165	3.982
30	30805	3.862
35	27140	3.737
40	23874	3.605
45	21094	3.470
50	18655	3.330
52	17799	3.275
54	16956	3.217
56	16164	3.160
58	15385	3.100
60	14681	3.042
62	14014	2.985
64	13382	2.927
66	12758	2.867
68	12191	2.810
69	11906	2.780
70	11652	2.752
71	11379	2.722
72	11136	2.695
73	10878	2.665

Table 4: Temperature/Resistance for Type III 10K Ohm Thermistor Sensors

Temperature – Resistance – Voltage for Type III 10 K Ohm Thermistor Sensors		
Temp (ºF)	Resistance (Ohms)	Voltage @ Input (VDC)
74	10625	2.635
75	10398	2.607
76	10158	2.577
78	9711	2.520
80	9302	2.465
82	8893	2.407
84	8514	2.352
86	8153	2.297
88	7805	2.242
90	7472	2.187
95	6716	2.055
100	6047	1.927
105	5453	1.805
110	4923	1.687
115	4449	1.575
120	4030	1.469
125	3656	1.369
130	3317	1.274
135	3015	1.185
140	2743	1.101
145	2502	1.024
150	2288	0.952

Table 4, 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 5.08 VDC, then the sensor or wiring is "open." If the voltage is less than 0.05 VDC, then the sensor or wiring is shorted.

OE265 Series RH Sensor Testing

The chart below is used to troubleshoot the OE265-11, OE265-13, and OE265-14 Relative Humidity Sensors.

OE265-11, -13 & -14 Relative Humidity Transmitters – Humidity vs. Voltage for 0-5 VDC Sensors			
Humidity Percentage (RH)	Voltage @ Input (VDC)	Humidity Percentage (RH)	Voltage @ Input (VDC)
0%	0.00	52%	2.60
2%	0.10	54%	2.70
4%	0.20	56%	2.80
6%	0.30	58%	2.90
8%	0.40	60%	3.00
10%	0.50	62%	3.10
12%	0.60	64%	3.20
14%	0.70	66%	3.30
16%	0.80	68%	3.40
18%	0.90	70%	3.50
20%	1.00	72%	3.60
22%	1.10	74%	3.70
24%	1.20	76%	3.80
26%	1.30	78%	3.90
28%	1.40	80%	4.00
30%	1.50	82%	4.10
32%	1.60	84%	4.20
34%	1.70	86%	4.30
36%	1.80	88%	4.40
38%	1.90	90%	4.50
40%	2.00	92%	4.60
42%	2.10	94%	4.70
44%	2.20	96%	4.80
46%	2.30	98%	4.90
48%	2.40	100%	5.00
50%	2.50		

Table 5: Humidity/Voltage for OE265-11, -13 & -14 Humidity Sensors

OE265-11, OE265-13, OE265-14 Relative Humidity Sensor Testing Instructions

Use the voltage column to check the Humidity Sensor while connected to a powered expansion module. Read voltage with meter set on DC volts.

Place the "-" (minus) lead on the terminal labeled GND and the "+" lead on the AIN terminal that the Humidity sensor is connected to on the Analog Input/Output Expansion Module.

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 0-5 pin terminal on (TP) with the jumper removed. 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 AIN4 on the Analog Input/Output Expansion Module.

OE275-01 Suction Pressure Transducer Testing for R22 and 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 VCM-X Expansion Module. The RNE and the VCM-X Expansion Module must be powered for this test. Read voltage with a meter set on DC volts. Place the positive lead from the meter on the PR OUT terminal located on the VCM-X Expansion Module terminal block. Place the negative lead from the meter on the ground (GND) terminal located adjacent to the PR OUT terminal on the VCM-X Expansion Module 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 PR OUT 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 R22 and R410A Refrigerant testing (**Tables 8 and 9)**. 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 R22 Refrigerant					
Temperature °F	Pressure PSI	Signal DC Volts	Temperature °F	Pressure PSI	Signal DC Volts
20.00	31.13	1.0	55.32	93.39	2.0
20.00	37.36	1.1	58.86	99.62	2.1
20.46	43.58	1.2	62.13	105.84	2.2
25.71	49.80	1.3	65.27	112.07	2.3
30.84	56.03	1.4	68.42	118.29	2.4
35.41	62.26	1.5	71.39	124.52	2.5
39.98	68.49	1.6	75.20	130.75	2.6
44.00	74.71	1.7	77.00	136.97	2.7
48.00	80.94	1.8	79.80	143.20	2.8
51.78	87.16	1.9	80.00	149.42	2.9

Table 8: Coil Pressure/Voltage/Temp for OE275-01 Suction Pressure Transducers - R22 Refrigerant

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

System Configuration Options

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

For detailed information about the various Orion Controls Systems that are available and their related wiring requirements and options, please see the *Orion Systems Technical Guide*.

Operator Interfaces

The Orion Operator Interfaces are designed to provide for programming and monitoring of RNE Controller(s) and/or any VAV/Zone or Add-on Controller(s) connected to your Orion System. See **Figure 41**. The Operator Interfaces available for use with the Orion Systems are as follows:

- Modular Service Tool SD
- Modular System Manager SD
- System Manager TS II
- Personal Computer with Prism 2 Computer Front End Software Installed

You can use any one of these interfaces or all of them on the same Orion System.

Stand-Alone System

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

See **Figure 42** on **page 77** for a Typical Stand-Alone System Layout diagram.

Interconnected System

The Interconnected System is used when you have multiple RNE 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 43** on **page 78** for a Typical Interconnected System Layout diagram.

Networked System

If you have 1 to 59 RNE 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 RNE Controllers.

The Networked Multiple Loop system is used when you have more than 59 RNE Controllers and/or are using multiple RNE 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 44** on **page 79** for a Typical Networked System Layout diagram.

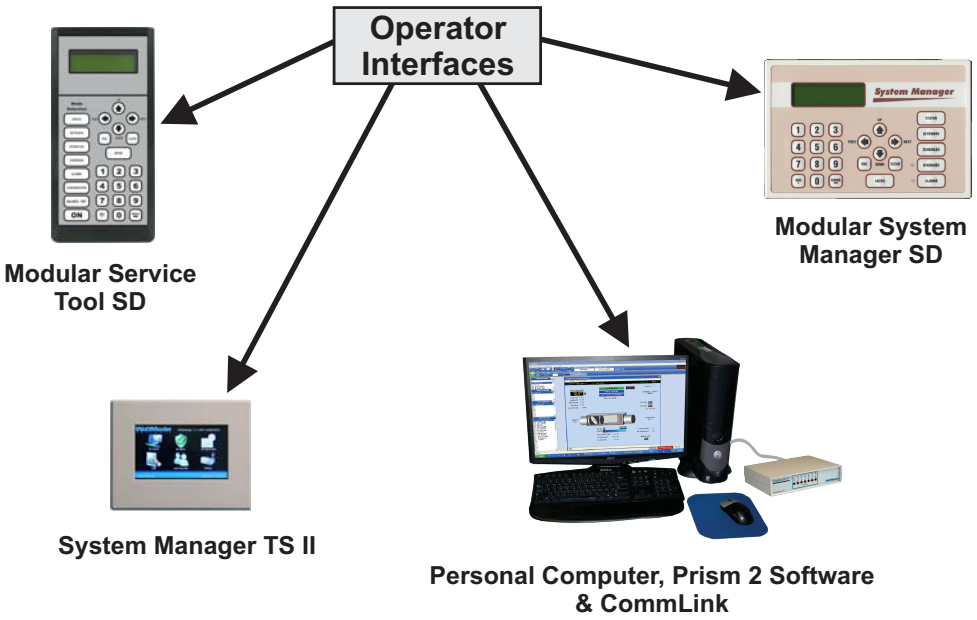


Figure 41: Available Operator Interfaces

Figure 42: Typical Stand-Alone System Layout

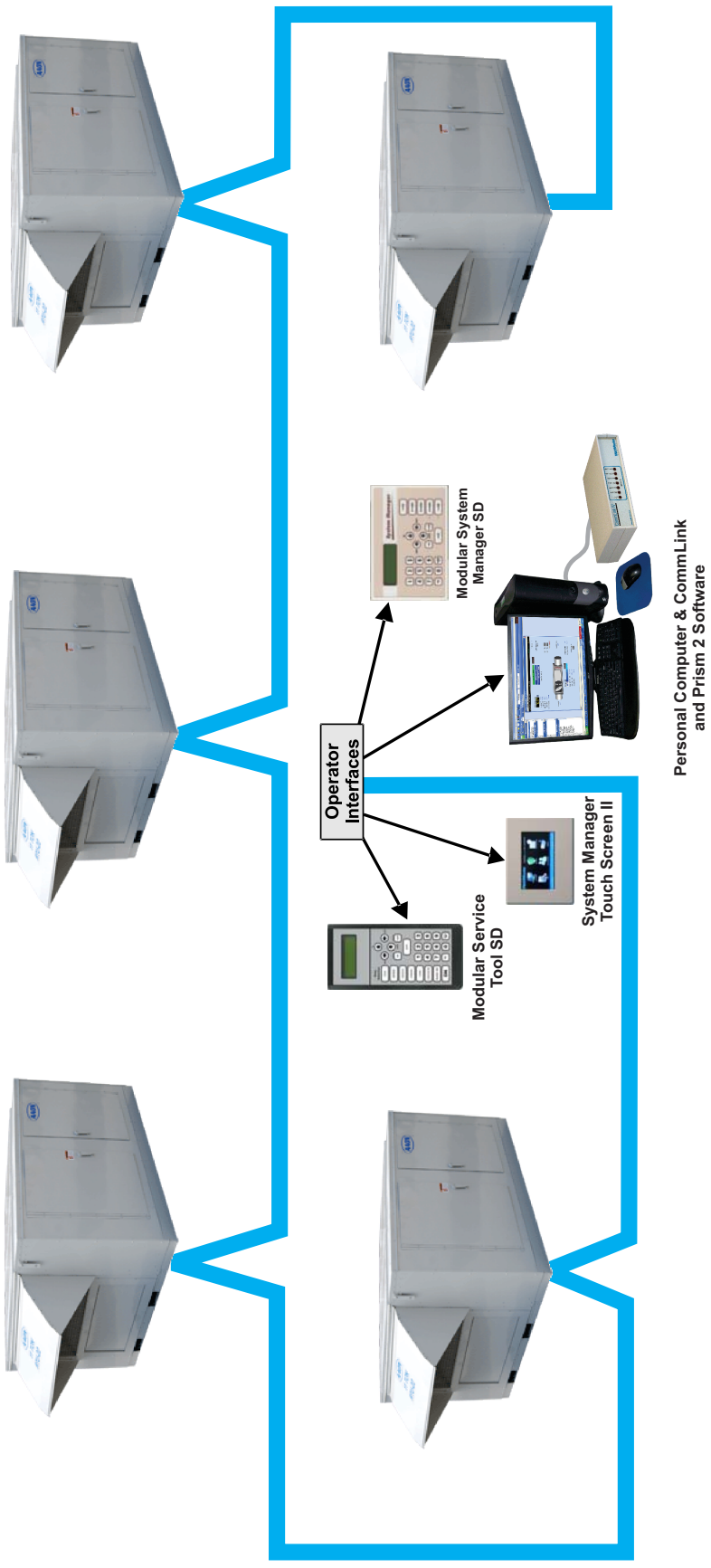


Figure 43: Typical Interconnected System Layout

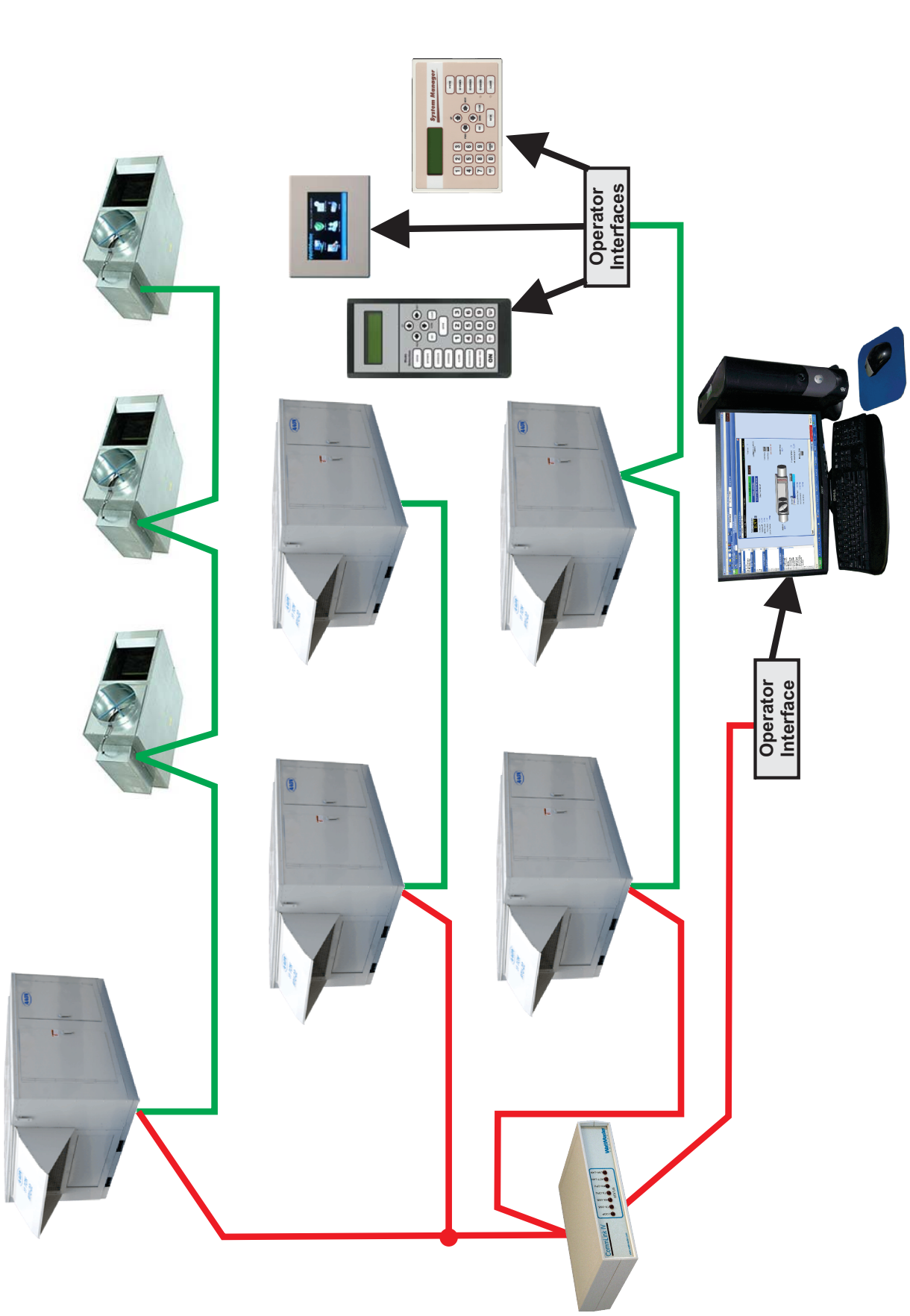


Figure 44: Typical Networked System Layout

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