Controls, Start-Up, Operation and Troubleshooting

CONTENTS

This document is to be used in conjunction with the following Carrier Corporation manuals:
- Equipment Touch Installation and Setup Guide
- Terminal Controller Installation and Setup Guide
- MS/TP Networking and Wiring Installation Guide

SAFETY CONSIDERATIONS

Improper installation, adjustment, alteration, service, maintenance, or use can cause explosion, fire, electrical shock or other conditions which may cause personal injury or property damage. Consult a qualified installer, service agency, or your distributor or branch for information or assistance. The qualified installer or agency must use factory-authorized kits or accessories when modifying this product. Refer to the individual instructions packaged with the kits or accessories when installing.

Follow all safety codes. Wear safety glasses and work gloves. Use quenching cloths for brazing operations and have a fire extinguisher available. Read these instructions thoroughly and follow all warnings or cautions attached to the unit. Consult local building codes and appropriate national electrical codes (in USA, ANSI/NFPA70, National Electrical Code (NEC); in Canada, CSA C22.1) for special requirements.

It is important to recognize safety information. This is the safety-alert symbol ⚠. When you see this symbol on the unit and in instructions or manuals, be alert to the potential for personal injury.

Understand the signal words DANGER, WARNING, CAUTION, and NOTE. These words are used with the safety-alert symbol. DANGER identifies the most serious hazards which **will** result in severe personal injury or death. WARNING signifies hazards which **could** result in personal injury or death. CAUTION is used to identify unsafe practices, which **may** result in minor personal injury or product and property damage. NOTE is used to highlight suggestions which **will** result in enhanced installation, reliability, or operation.

⚠ WARNING

ELECTRICAL SHOCK HAZARD

Failure to follow this warning could cause personal injury or death.

Disconnect all power to the unit before performing maintenance or service. Unit may automatically start if power is connected.

GENERAL

The VAV-RTU Open controller (see Fig. 2) is an integrated component of the Variable Air Volume (VAV) Carrier rooftop unit system (see Fig. 1). Its internal application programming provides optimum performance and energy efficiency. VAV-RTU Open enables the unit to operate with Carrier's i-Vu® Open network with i-Vu VAV zone controllers (Fig. 3 and 4) and monitored by Third Party BACnet[1] Building Automation System (BAS). VAV-RTU Open operates as part of an Open Air Terminal system using Carrier Airside Linkage or as a Standalone air source using BACnet to communicate with a third party system which is available with the version 2 or later release. On-board DIP switches allow you to select your baud rate. (See Fig. 2.) Carrier's i-Vu user interface Equipment Touch or System Touch and the Field Assistant technician tool can be used with the VAV-RTU Open controller. Access is available via a 5-pin J12 access port or Rnet communication network. Carrier's System Touch interface can be used to configure the VAV rooftop and air terminal controllers when connected to the BACnet MS/TP network.

SENSOR/ACCESSORY INSTALLATION

There are a variety of sensors and accessories available for the VAV-RTU Open and VAV zones. Some of these can be factory or field installed, while others are only field installable. The VAV-RTU Open controller requires connection to the building zoning VAV system. All field control wiring that connects to the VAV-RTU Open must be routed through the raceway built into the corner post of the unit or secured to the unit control box with electrical conduit. The unit raceway provides the UL required clearance between high and low-voltage wiring. Pass the control wires through the hole provided in the corner post, then feed the wires thorough the raceway to the VAV-RTU Open. Connect the wires to the removable Phoenix connectors and then reconnect the connectors to the board. See Fig. 2 and Table 1 for board connections and Fig. 5 - 10 for Typical Factory VAV-RTU Open wiring.

IMPORTANT: Refer to the specific sensor or accessory instructions for its proper installation and for rooftop unit installation refer to base unit installation instructions and the unit's wiring diagrams.

⚠ WARNING

ELECTRICAL SHOCK HAZARD

Failure to follow this warning could result in personal injury, death and/or equipment damage.

Disconnect electrical power and use lock-out tags before wiring the VAV-RTU Open controller.

1. BACnet is a registered trademark of ASHRAE (American Society of Heating, Refrigerating, and Air-Conditioning Engineers).

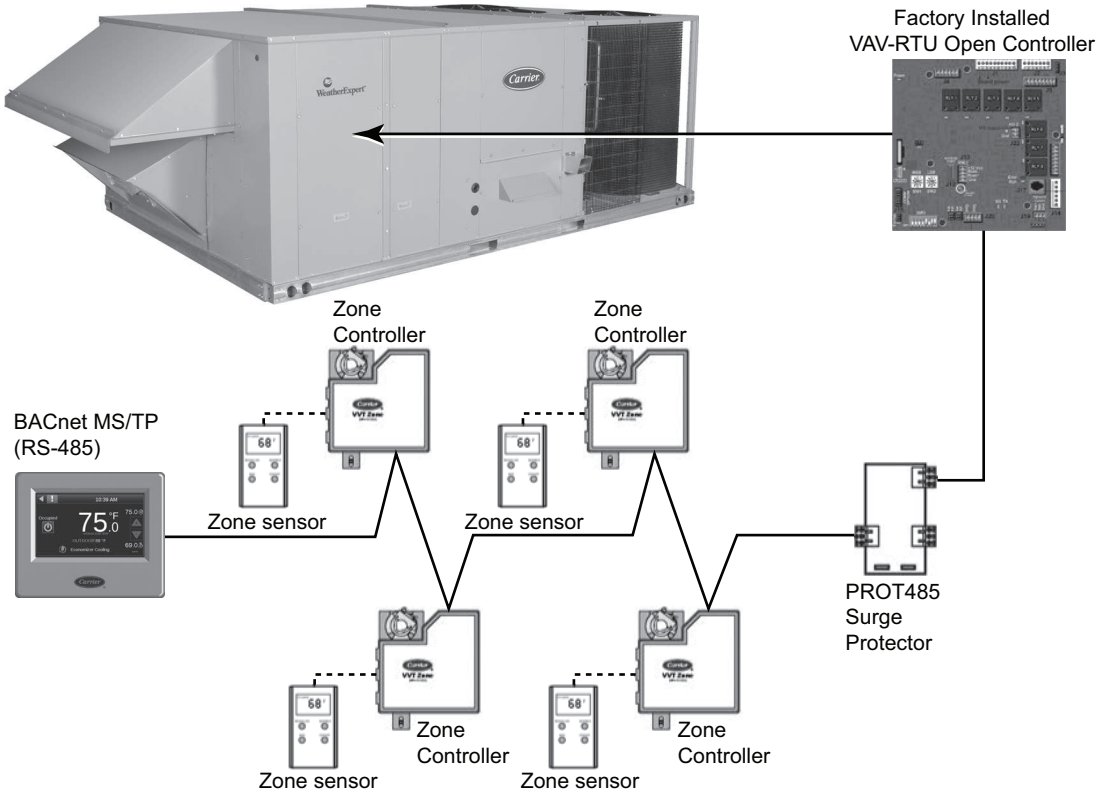

Fig. 1 — Typical VAV-RTU Open System

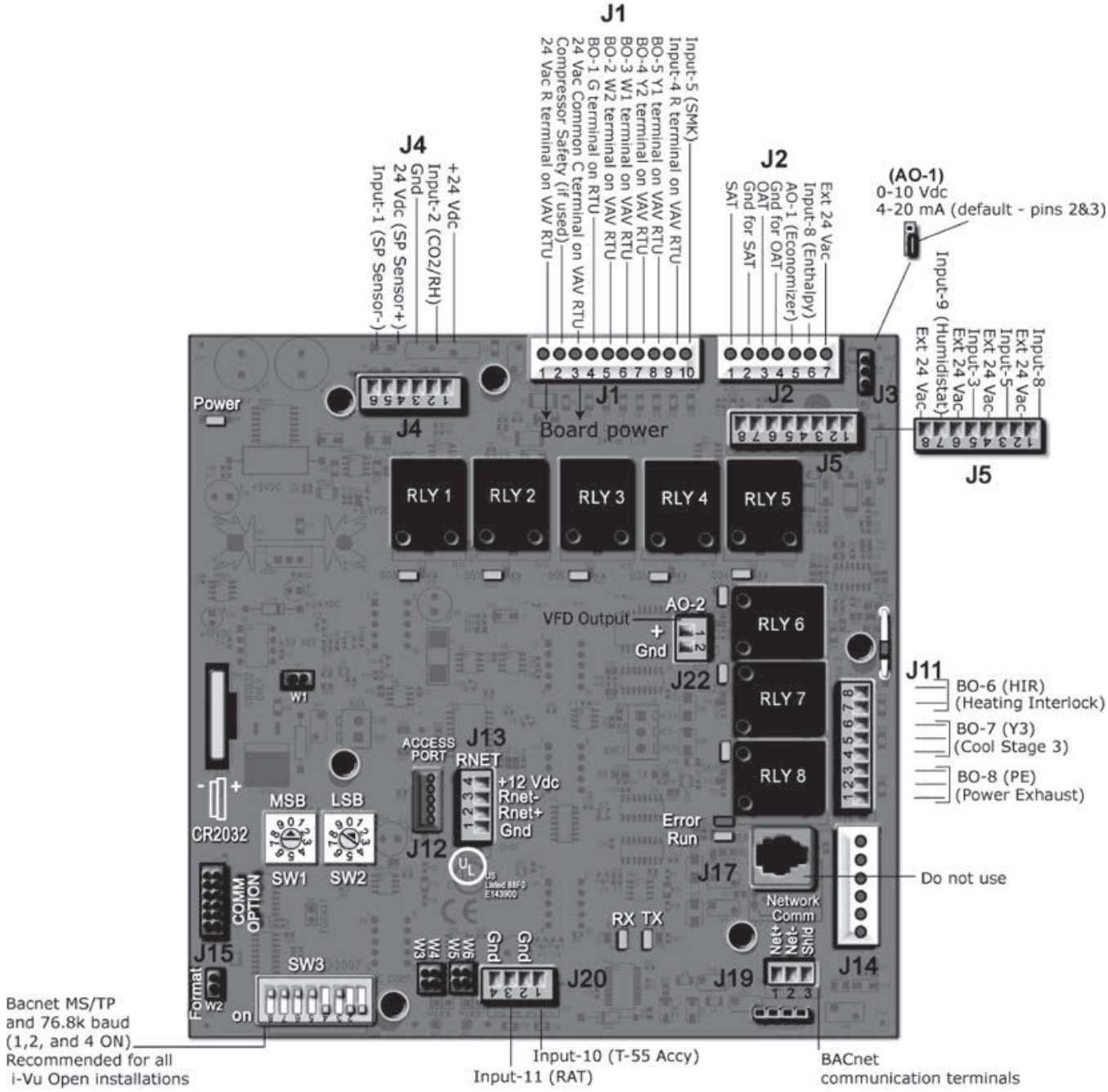

Fig. 2 — VAV-RTU Open Control Module

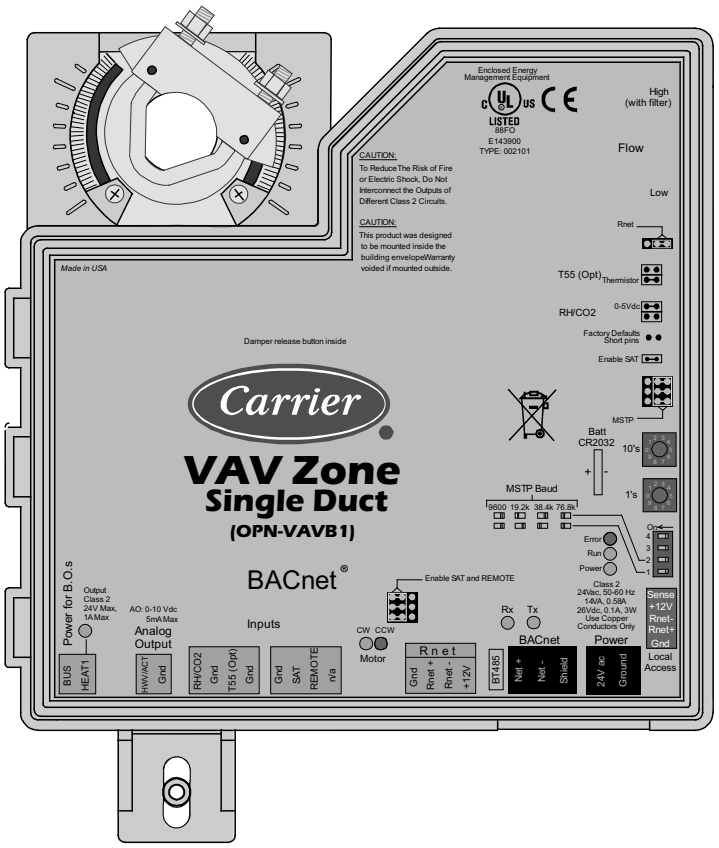

Fig. 3 — VAV Zone Single Duct Controller

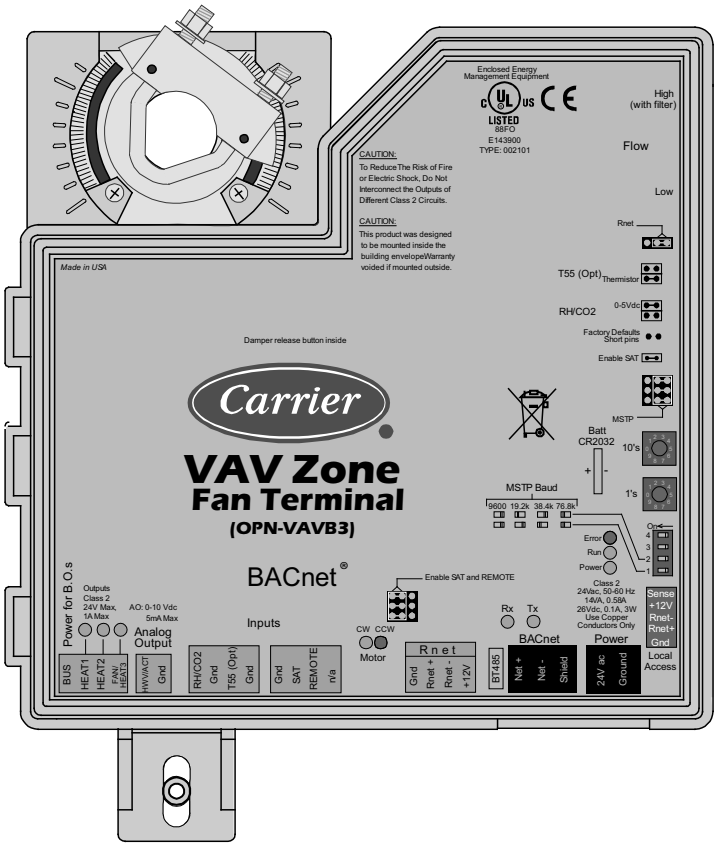

Fig. 4 — VAV Zone Fan Terminal Controller

Table 1 — VAV-RTU Open Inputs and Outputs

POINT NAME	BACnet OBJECT NAME	TYPE OF I/O	CONNECTION PIN NUMBER(S)	CHANNEL DESIGNATION
DEDICATED INPUTS				
Return Air Temperature	ra_temp	AI (10K Thermistor)	J20- 3 and 4	Analog Input 11
Space Temperature	n/a	AI (10K Thermistor)	J20-1 and 2	Analog Input 10
Supply Air Temperature	sa_temp	AI (10K Thermistor)	J2- 1 and 2	Analog Input 6
Outdoor Air Temperature	oa_temp	AI (10K Thermistor)	J2- 3 and 4	Analog Input 7
Static Pressure Sensor	static_press	AI (4- 20 mA)	J4- 4 and 5	Analog Input 1
Safety Chain Feedback	safety_status	BI (24 VAC)	J1- 9	Binary Input 4
Compressor Safety Status (1)	comp_status	BI (24 VAC)	J1- 2	Binary Input 3
Fire Shutdown Status	firedown_status	BI (24 VAC)	J1- 10	Binary Input 5
Enthalpy Status	enthalpy_status	BI (24 VAC)	J2- 6 and 7	Binary Input 8
Zone Temperature	n/a	n/a	J13- 1- 4	Rnet
CONFIGURABLE INPUTS (4)				
Indoor Air CO_2	iaq	AI (4- 20 mA)	J4-2 and 3	Analog Input 2
Outdoor Air CO_2	oaq	AI (4-20 mA)		
Space Relative Humidity	space_rh	AI (4- 20 mA)		
Supply Fan Status (2)	sfan_status	BI (24 VAC)	J5-1 and 2 or J5-3 and 4, J5-5 and 6 or J5-7 and 8 (3)	Binary Input 3, 5, 8, or 9, except where intrinsic input is used
Filter Status (2)	filter_status	BI (24 VAC)		Binary Input 3, 5, 8, or 9, except where intrinsic input is used
IGC Override (2)	igcovr_status	BI (24 VAC)		Binary Input 9. Mandatory input on gas heat units.
OUTPUTS				
Economizer Output	econ_output	AO (4-20mA)	J2- 4 and 5	Analog Output 1
Supply Fan VFD	vfd_output	AO (2- 10Vdc)	J22- 1 and 2	Analog Output 2
Supply Fan Relay State	sfan	BO Relay (24VAC, 1A)	J1- 4	Binary Output 1 (G)
Cool Stage 1 Relay State	comp_1	BO Relay (24VAC, 1A)	J1- 8	Binary Output 5 (Y1)
Cool Stage 2 Relay State	comp_2	BO Relay (24VAC, 1A)	J1- 7	Binary Output 4 (Y2)
Cool Stage 3 Relay State	comp_3	BO Relay (24VAC, 1A)	J11- 5 and 6	Binary Output 7 (Y3)
Heat Stage 1 Relay State	heat_1	BO Relay (24VAC, 1A)	J1- 6	Binary Output 3 (W1)
Heat Stage 2 Relay State	heat_2	BO Relay (24VAC, 1A)	J1- 5	Binary Output 2 (W2)
Power Exhaust Relay State	pexh	BO Relay (24VAC, 1A)	J11-2 and 3 (N.O.)	Binary Output 8 (PE)
Heat Interlock Relay State	ht- interlock	BO Relay (24VAC, 1A)	J11- 7 and 8	Binary Output 6 (HIR)

(1) Safety Chain Feedback: 24Vac required at this terminal to provide “Run Enable” status. See Input/Output section for additional instructions.
(2) These inputs are configurable. If installed, they take the place of the default input on the specific channel. See appropriate Input Configuration Section for wiring and setup instructions.
(3) Parallel pins J5 - 1 = J2 - 6, J5 - 3 = J1 - 10, J5 - 5 = J1 - 2 are used for field installation.
(4) Refer to the input configuration and accessory sections for more detail.

Sensors and Accessories

The VAV-RTU Open controller and i-Vu Open VAV zone controllers are configurable with the following field-supplied sensors. Some may be wired directly to the VAV-RTU Open controller and are noted:

NOTE: Supply air temperature sensor (33ZCSENSAT) and return air temperature sensor (CRCBDIOX005A00) are factory-installed.

- Indoor air quality sensor. Wired directly to VAV-RTU Open or VAV zone controllers: (ZS-C-CAR, ZS-HC-CAR, 33ZC-SPT-CO2-01, 33ZCSPTCO2LCD-01, 33ZCT55-CO2-02, or 33ZCT56CO2-02) required for demand control ventilation.
- Outdoor air quality sensor (33ZCSPTCO2-01, 33ZC-SPT-CO2LCD-01).
- CO_2 aspirator box (C33ZCCASPCO2) required for CO_2 return duct/outside air applications with 33ZCSPTCO2-01 and 33ZCSPTCO2LCD-01 sensors.
- Outdoor air enthalpy switch (33CSENTHSW).
- Return air enthalpy sensor (33CSENTSEN) required for differential enthalpy control.
- Space relative humidity sensor (33ZCSENSRH-02) refer to VAV zoning controller.
- Duct relative humidity (33ZCSENDRH-02).
- Smoke Detectors (CRSMKSEN002A00, CRSMK-KIT002A00).
- Fan and/or Filter Status (CRSTATUS001A00, CRS-TA-TUS005A00).

User Interfaces

- Field Assistant (USB-TKIT required)
- Wall mounted Equipment Touch
- Wall mounted System Touch

Install Analog Sensors

SUPPLY AIR SENSOR (SAT)

The factory supplies the discharge (supply) air sensor with the unit and is pre-wired.

UNIT/SIZE	SAT SHIPPING LOCATION/ INSTALLATION LOCATION
LC 07-12	The SAT is secured to the unit's supply duct opening. This sensor must be relocated into the supply duct during unit installation.
LC 14-26	The SAT is mounted through the side of the heat chamber below the fan deck, and does NOT require relocation.

OUTDOOR AIR SENSOR (OAT)

The OAT is supplied with the economizer for 48/50LC*B07-12 units. It is wired through the 12-pin plug (PL6) in the return air section of the unit and is mounted on the economizer assembly. For 48/50LC*B14-26 units, the OAT is supplied with the unit and mounted near the condenser coil. It is wired through the supply air section and wired to the VAV-RTU Open board at J2-3 and 4.

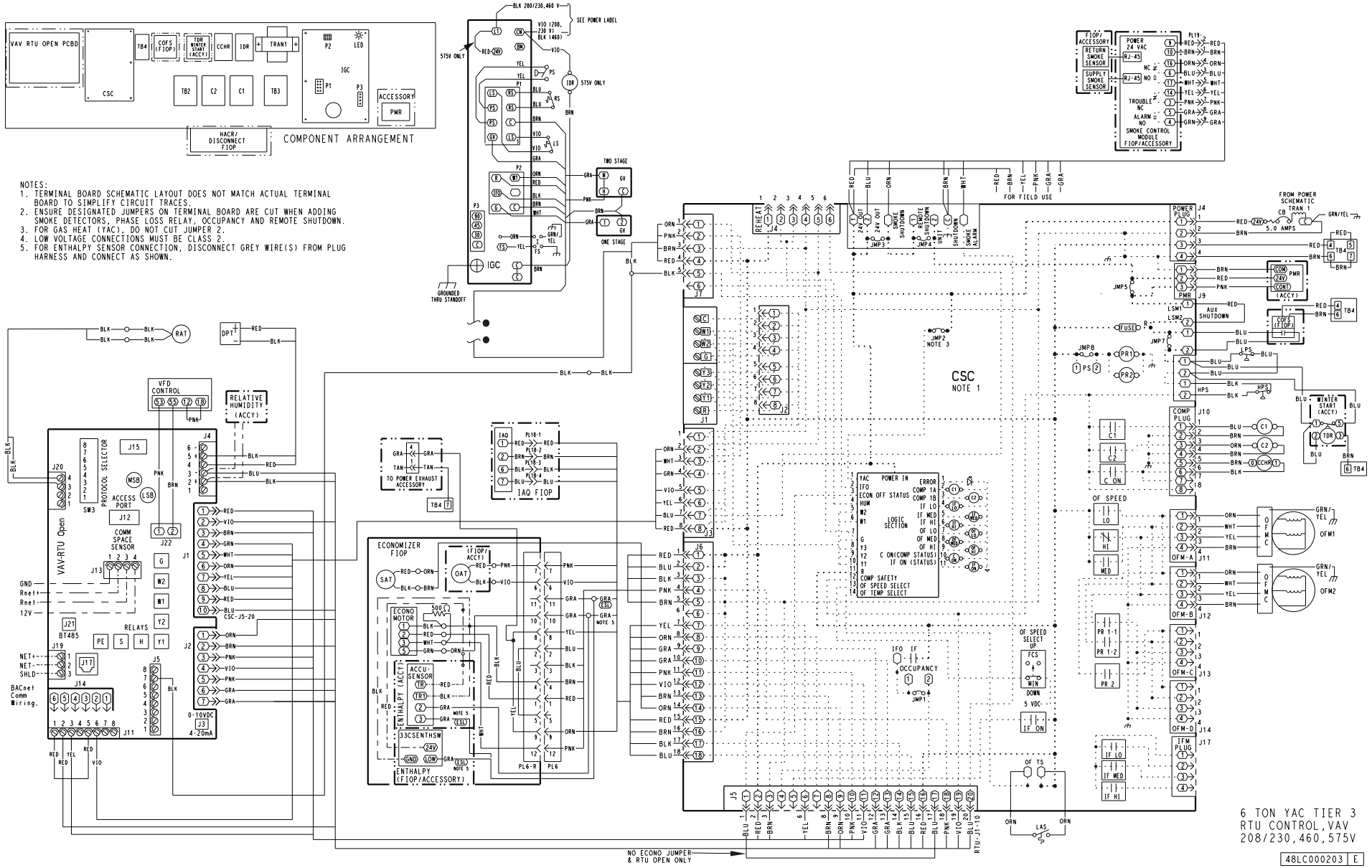

Fig. 5 — VAV-RTU Open Control Wiring Diagram — 48LC*B07

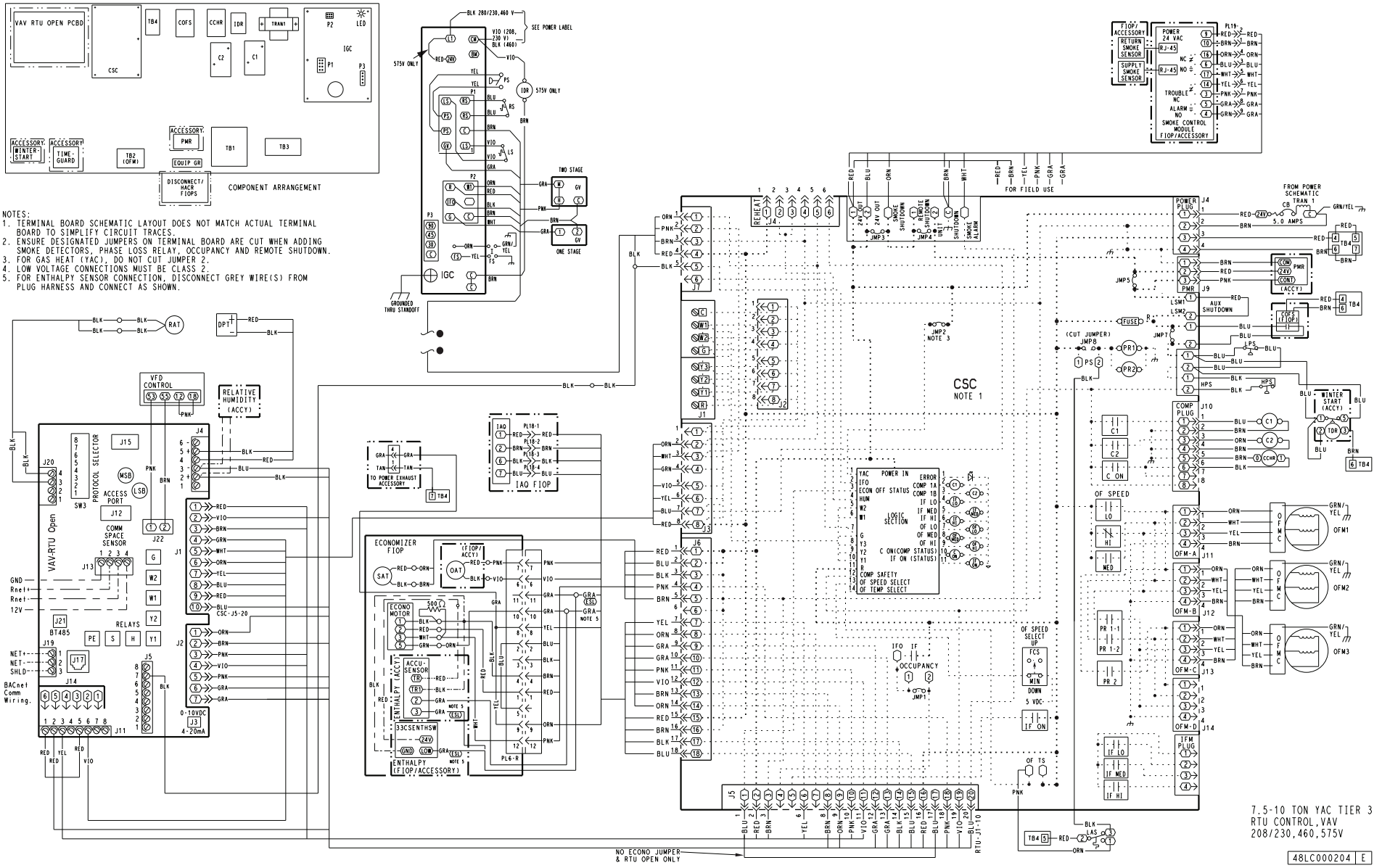

Fig. 6 — VAV-RTU Open Control Wiring Diagram — 48LC*B08-12

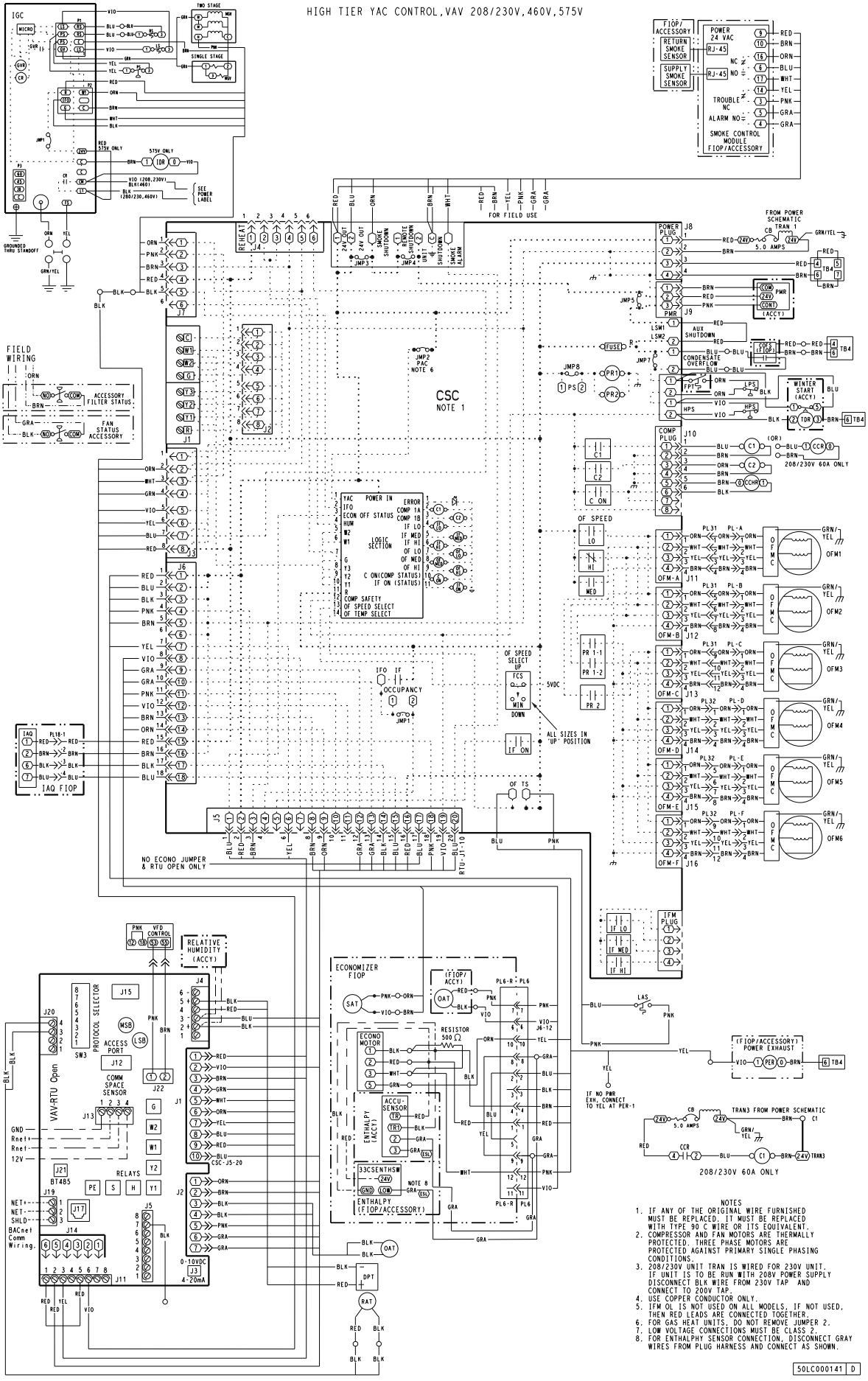

Fig. 7 — VAV-RTU Open Control Wiring Diagram — 48LC*B14-26

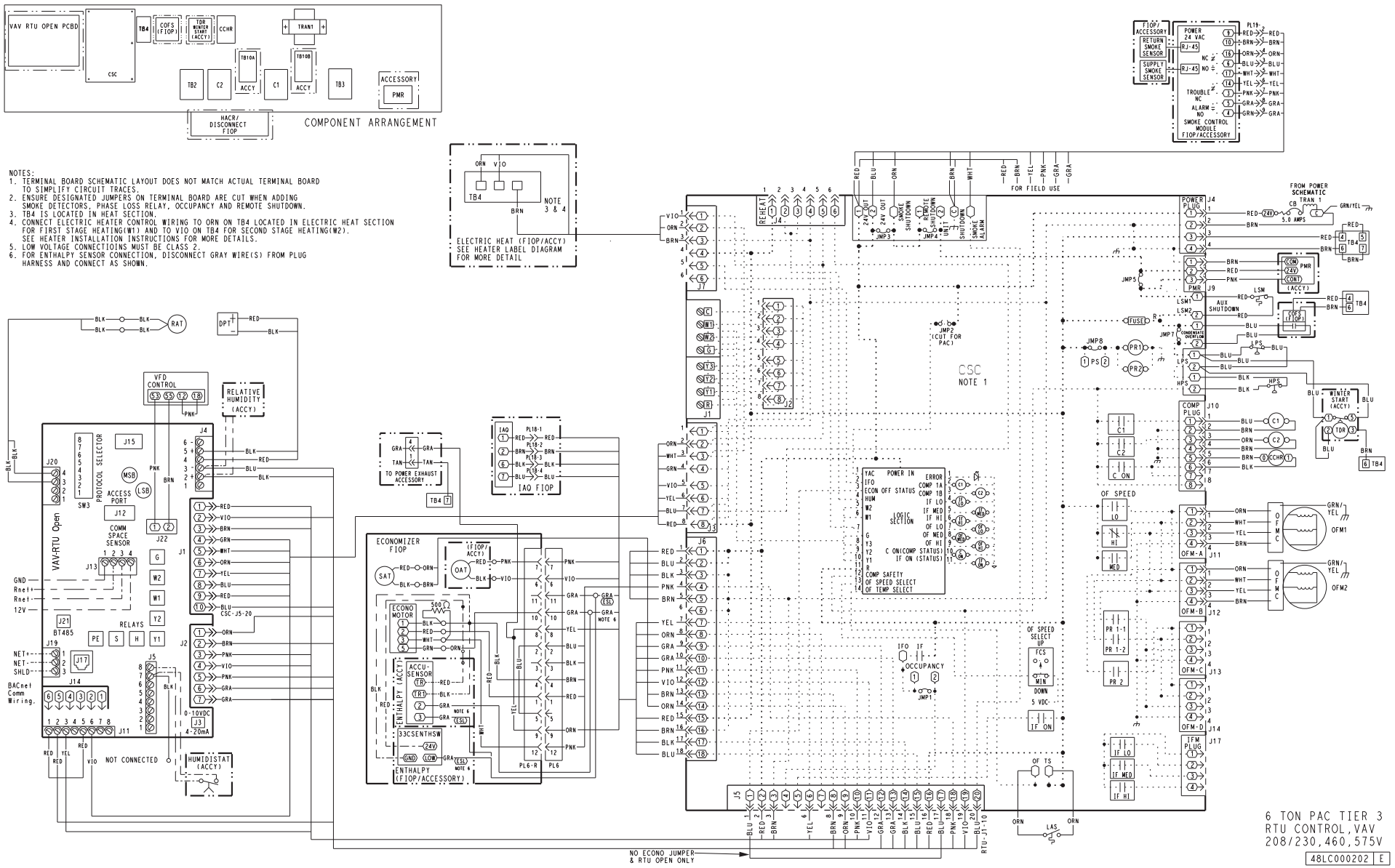

Fig. 8 — VAV-RTU Open Control Wiring Diagram — 50LC*B07

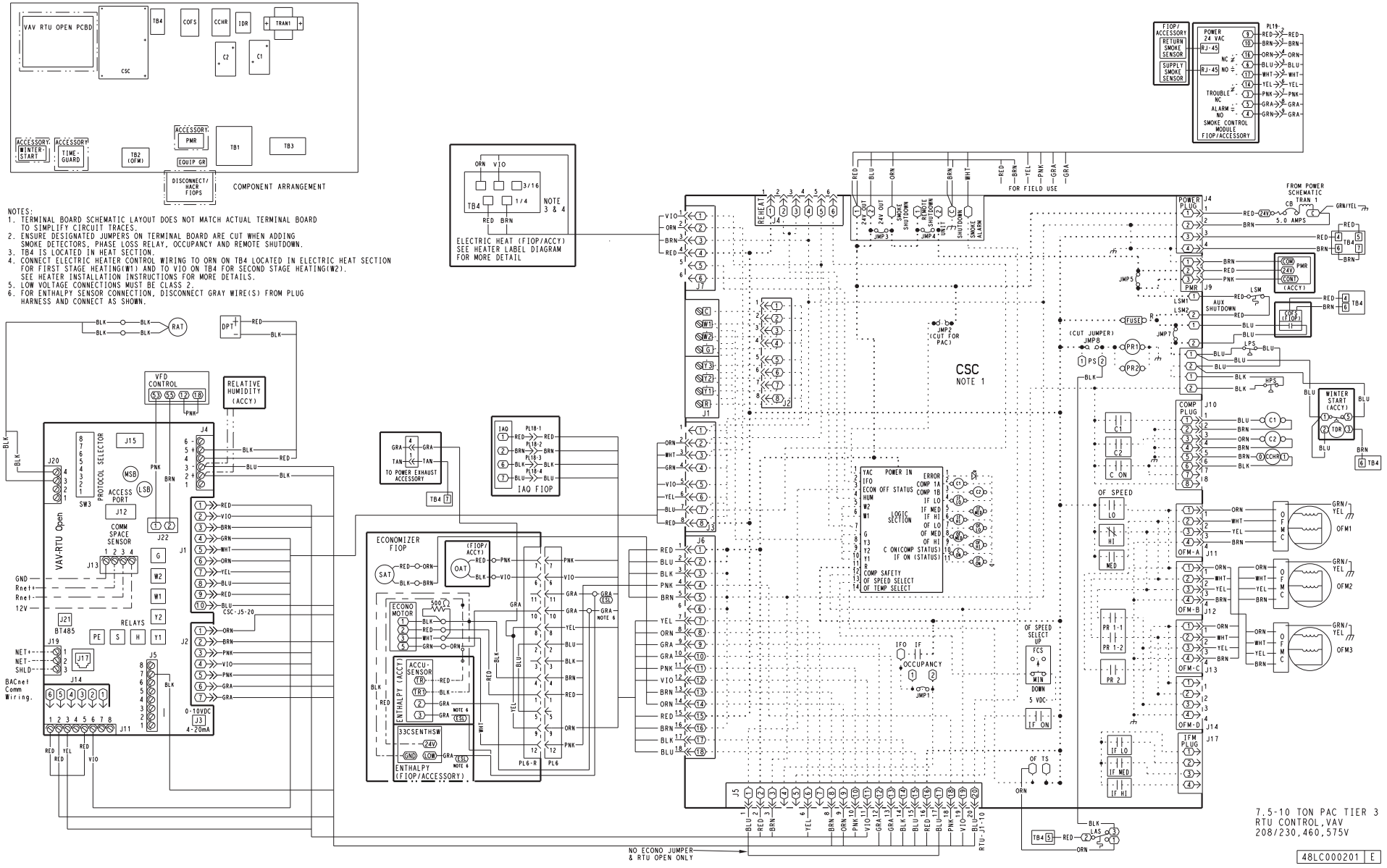

Fig. 9 — VAV-RTU Open Control Wiring Diagram — 50LC*B08-12

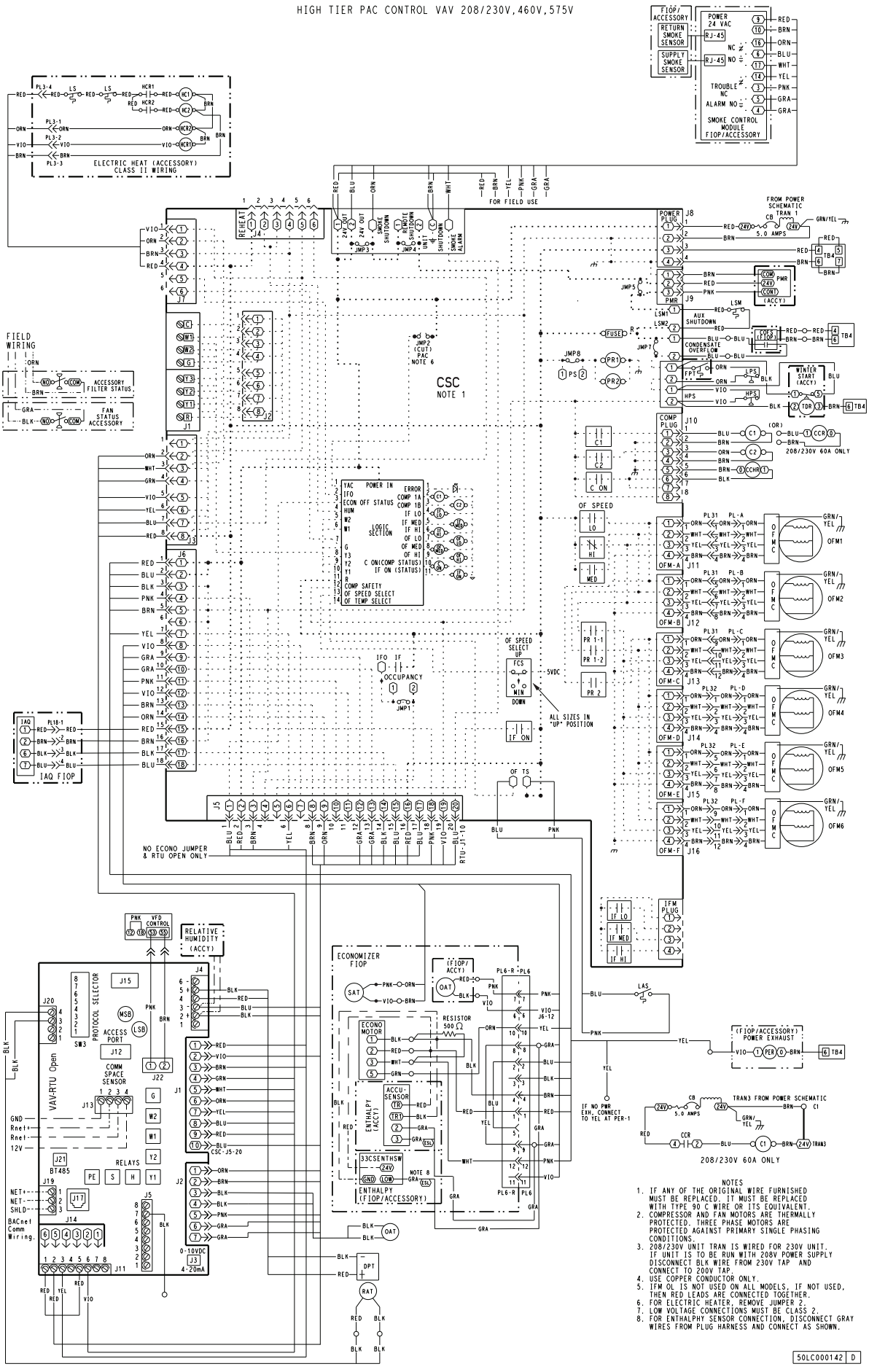

Fig. 10 — VAV-RTU Open Control Wiring Diagram — 50LC*B14-26

Rnet Communicating Sensor Wiring

The Rnet bus allows local communication with the VAV-RTU Open, including communicating sensors. The Rnet bus can support CO_2, RH or a combination of CO_2 and RH wired directly to VAV-RTU Open for demand control ventilation (CO_2) and enables adjustment to any supply air reset override when Supply Air Reset is enabled (RH control).

NOTE: Additional ZS sensors must be addressed. Use the jumpers on the ZS sensor's circuit board and refer to the sensor installation instructions for addressing.

For Rnet wiring up to 500 ft (152 m), use 18 AWG 4 conductor unshielded plenum rated cable. The VAV-RTU Open's J13-RNET connection has a 4 pin Phoenix connector wired as described below; Fig. 11 shows sensor Rnet wiring.

- RNET - 1 = Signal ground (GND)
- RNET - 2 = Signal (Rnet+)
- RNET - 3 = Signal (Rnet-)
- RNET - 4 = Power (+12 v)

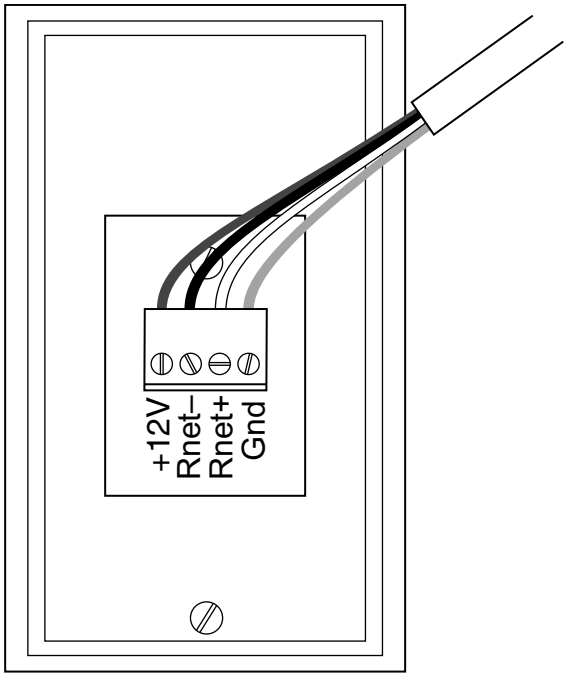

Fig. 11 — Typical Rnet Communication Sensor Wiring

CO_2 SENSOR(S) (IAQ AND OAQ)

The indoor air quality (IAQ) and outdoor air quality (OAQ) sensors monitor carbon dioxide (CO_2) levels. This information is used to monitor the quality of air in terms of parts per million (PPM). The same sensor is used for inside, outside, and duct monitoring, except an aspirator box is required for outside and duct mounting. The CO_2 sensor is preset for a range of 0 to 2000 ppm and a linear mA output of 4 to 20. The rooftop unit may have a factory installed CO_2 sensor on the side of the economizer assembly in the return air section of the unit and is pre-wired and pre-configured at the factory. For field installed sensors, a field supplied transformer must be used to power the sensor. Refer to the instructions supplied with the CO_2 sensor for electrical requirements and terminal locations. VAV-RTU Open configurations must be changed after adding a CO_2 sensor. See below and Fig. 5-10 for typical CO_2 sensor wiring.

- J4-2 or J4-5 = 4-20 mA signal input
- J4-3 or J4-6 = signal common

NOTE: The factory used J4-2 and 3 for CO_2 (IAQ) sensor inputs.

RELATIVE HUMIDITY SENSORS (SPACE OR DUCT MOUNTED)

The accessory space humidity sensor or duct humidity sensor is used to measure the relative humidity of the air within the space or return air duct. For wiring distances up to 500 ft (152 m), use a 3-conductor, 18 or 20 AWG shielded cable. The shield must be removed from the sensor end of the cable and grounded at the unit end. The current loop power for the sensor is provided by the VAV-RTU Open controller as 24 vdc. Refer to the instructions supplied with the RH sensor for electrical requirements and terminal locations. VAV-RTU Open configurations must be changed after adding a RH sensor. See below and Fig. 12 and 13 for typical non-communicating RH sensor wiring.

- J4-1 = 24 vdc loop power
- J4-2 = 4-20 mA signal input

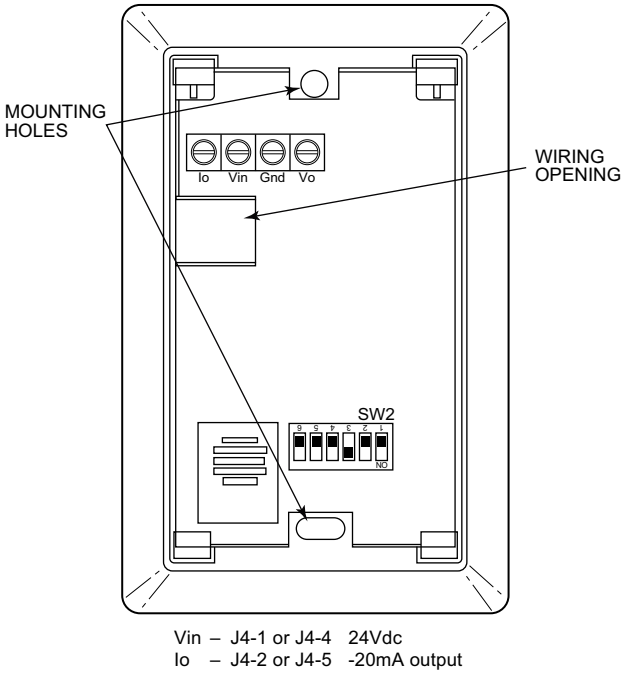

Fig. 12 — Space Relative Humidity Sensor Typical Wiring

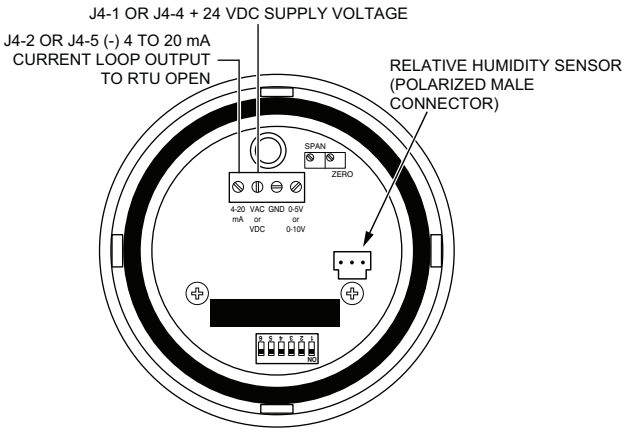

Fig. 13 — Duct Relative Humidity Sensor Typical Wiring

Installing Discrete Inputs

SINGLE ENTHALPY (OUTDOOR ENTHALPY)

The outdoor enthalpy switch/receiver (33CSENTHSW) senses temperature and humidity of the air surrounding the device and calculates the enthalpy when used without an enthalpy sensor. The relay is energized when enthalpy is high (above 28 BTU/lb OR dry bulb temperature is above 75°F) and de-energized when enthalpy is low (below 27 BTU/lb AND dry bulb temperature is below 74.5°F). The enthalpy input is dedicated to input 8 and tells the VAV-RTU Open when the outside air enthalpy is HIGH or LOW. The normal condition for the enthalpy input is HIGH. Enthalpy is configured on input 8 in the factory when it is added as an option.

NOTE: The enthalpy calculation is done using an average altitude of 1000 ft above sea level.

For field installation, refer to the enthalpy accessory instructions. For wiring see Fig. 2 and Fig. 5-10. The VAV-RTU Open board provides 24 vac on one of the two loose grey wires in the return air section of the rooftop near the 12-pin economizer plug. To determine the correct grey, measure the voltage on the wires with power applied to the unit. If 24 vac is sensed, then that is the grey wire that is connected to the VAV-RTU Open board at J2-7. The other is the signal for input 8, connect it to the LOW Enthalpy terminal on the enthalpy switch/receiver. Tie into the 12-pin economizer plug on pin 4 or the black wire connected to the actuator for the enthalpy's GND connection. Power can also be provided direct from the unit transformer and J5 terminal on the VAV-RTU Open.

- J2-7 or J5-2 = 24 VAC for enthalpy switch power
- J2-6 or J5-1 = input signal

DIFFERENTIAL ENTHALPY

Differential enthalpy control requires both an enthalpy switch/receiver (33CSENTHSW) and an enthalpy sensor (33CSENTSEN). The enthalpy sensor must be installed in the field as the factory can only provide single enthalpy. The enthalpy sensor must be mounted in the return airstream and calculates the enthalpy of the indoor air. The relay is energized when the enthalpy detected by the return air enthalpy sensor is less than the enthalpy at the enthalpy switch/receiver. The relay is de-energized when the enthalpy detected by the return air enthalpy sensor is greater than the enthalpy at the enthalpy switch/receiver (differential enthalpy control).

To wire return air enthalpy sensor:

Connect the 4-20 mA In terminal on the enthalpy switch/ receiver to the 4-20 mA Out terminal on the return air enthalpy sensor. Connect the 24-36 VDC Out terminal on the enthalpy switch/receiver to the 24-36 VDC In terminal on the return air enthalpy sensor. (See Fig. 14.)

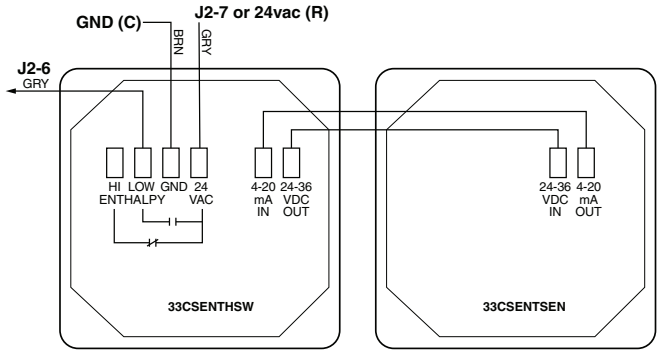

Fig. 14 — Enthalpy Switch and Sensor Wiring

FIRE SHUTDOWN

The fire shutdown input is provided for unit shutdown in response to a fire alarm or smoke detector. The fire shutdown input is dedicated to input 5 and tells the VAV-RTU Open when to shutdown due to smoke detection or fire alarm system. The normal condition for fire shutdown is there is no fire alarm. The unit may have factory installed smoke detector(s); refer to the base unit installation instructions for details on any adjustments required during unit installation. Fire shutdown is always factory configured for a normally open smoke detector.

For field installation of a smoke detector see instructions for that specific accessory. See below and the troubleshooting section for wiring at the unit's Integrated Staging Control (ISC) board.

- ISC - UNIT SHUTDOWN - 24v OUT = 24 VAC source
- ISC - UNIT SHUTDOWN - Smoke Alarm = Signal input to VAV-RTU Open

NOTE: Input 5 can also be wired into J5-3.

FILTER STATUS

The filter status accessory is a field-installed accessory. This accessory detects plugged air filters. When installing this accessory, the unit must have a free input (input 3, 5, 8, or 9). One of the dedicated functions (Fire shutdown, Enthalpy, or Compressor safety) must not be in use to configure Filter Status. Refer to the configuration section for details on configuring inputs for specific functions and state. Refer to Fig. 2 for wire terminations at J5.

FAN STATUS

The fan status accessory is a field-installed accessory. This accessory detects when the indoor fan is moving air. When installing this accessory, the unit must have a free input (input 3, 5, 8, or 9). One of the dedicated functions (Fire shutdown or Enthalpy) must not be in use to configure Fan Status. Refer to the configuration section for details on configuring inputs for specific functions and state. Refer to Fig. 2 for wire terminations at J5.

IGC OVERRIDE

The IGC Override input is factory-installed for 48LC gas heat units. This input provides an indication that the gas valve is stuck open and the heat is still operating after any call for heating has been dropped. This function requires the use of input 9. Any of the other dedicated functions (Fan Status, Filter Status, Remote Occupancy, or Door Contact) will not be in use if IGC Override is configured. Refer to the configuration section for details on configuring inputs for specific functions and state. Refer to Fig. 5 for wire terminations.

Communication Wiring

GENERAL

Protocols are the communication languages spoken by control devices. The main purpose of a protocol is to communicate information in the most efficient method possible. Different protocols exist to provide different kinds of information for different applications. In the BAS application, many different protocols are used, depending on manufacturer. Protocols do not change the function of a controller; just make the front end user different.

The VAV-RTU Open is set to communicate on BACnet MS/TP. Switch 3 (SW3) on the board is used to set protocol and baud rate. Switches 1 and 2 (SW1 and SW2) are used to set the board's network address. See Fig. 15 and 16 for protocol switch settings and address switches. For network wiring reference refer to MS/TP Networking and Wiring Installation Guide.

NOTE: Power must be cycled after changing the SW1-3 switch settings.

SW3 Protocol Selection

PROTOCOL	DS8	DS7	DS6	DS5	DS4	DS3	DS2	DS1
BACnet MS/TP (Master)	Unused	OFF	OFF	OFF	ON	OFF	Select Baud	Select Baud

NOTE:

DS = Dip Switch

BACnet MS/TP SW3 example shown

Baud Rate Selections

BAUD RATE	DS2	DS1
9,600	OFF	OFF
19,200	ON	OFF
38,400	OFF	ON
76,800	ON	ON

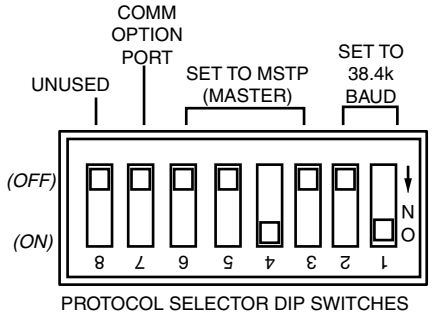

Fig. 15 — VAV-RTU Open SW3 Dip Switch Settings

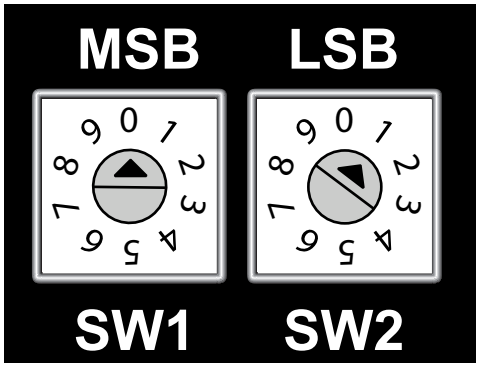

Fig. 16 — VAV-RTU Open Address Switches Shield

BACNET MS/TP

BACnet Master Slave/Token Passing (MS/TP) is used for communicating BACnet over a sub-network of BACnet-only controllers. This is the default Carrier communications protocol. Each VAV-RTU Open module acts as an MS/TP Master. The speed of an MS/TP network can range from 9600 to 76.8K baud. Physical Addresses can be set from 01 to 99.

Wiring BACnet MS/TP network for VAV System

The VAV Open Control System uses linkage to exchange data between the zone terminals and their air source to form a coordinated HVAC system. The system's air source controller and zone controllers are linked so that their data exchange can be managed by one zone controller configured as the VAV Master (see Fig. 17 and 18).

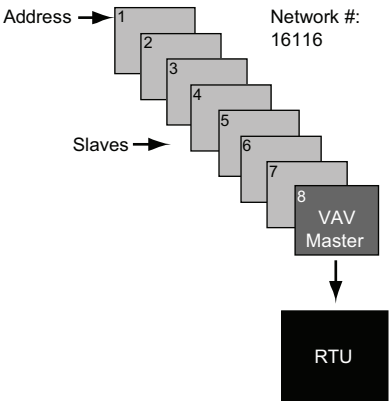

Fig. 17 — Example — Simple Network

A VAV Master can have a maximum of 63 slave zone controllers reporting to it. An MS/TP network is limited to a maximum of 60 controllers, but a VAV Master can have controllers from other networks as slaves.

A linked VAV system can be as simple as a single MS/TP network with a VAV Master and slaves, or it can be as complex as multiple MS/TP networks with VAV sub-masters and slaves on other networks. See the following example and Appendix B for configuring linkage in VAV zone controllers.

EXAMPLE: A simple network. The VAV Master exchanges data between the slave controllers and the AHU controller. The linked controllers on an MS/TP network must be sequentially addressed, and the VAV Master must have the highest address.

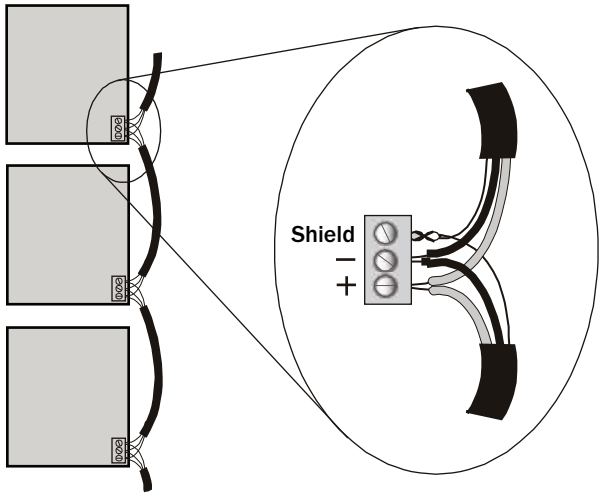

Fig. 18 — Network Wiring

I-VU BUILDING AUTOMATION SYSTEM

i-Vu is a Carrier front-end and Building Automation System (BAS). It is a web based network system that uses a native BACnet over MS/TP communication protocol. The speed of the network can range from 9600 to 76,800 baud. Refer to i-Vu literature for more information on i-Vu.

LOCAL ACCESS

Wall Mounted System Touch

The System Touch (SYT1-4-CAR) is a wall mounted interface used to connect to the VAV-RTU Open or VAV Zone to access the control information, read sensor values, and maintenance. This is an accessory interface that does not come with the VAV-RTU Open controller. You wire the System Touch to the VAV-RTU Open or VAV Zone BACnet MS/TP network wiring connection. There are 2 password protected levels in the display (User and Admin). See the Equipment Touch Installation and Setup Guide for more information. See Appendix A for navigation and screen content.

Field Assistant

Field Assistant is a computer program included with the purchase of the Tech Tool Kit (USB-TKIT). This is a field Tech Tool to set-up, service, or download application software to the VAV-RTU Open controller and includes a USB Link Cable. The link cable connects a USB port to the J12 local access port. The Field Assistant's menu structure is similar and functions the same as i-Vu. See Fig. 19.

START-UP

IMPORTANT: Follow the base unit's start-up sequence documented in its specific instructions. Use the base unit's start-up check list when performing the start-up. At the end of this manual there is an additional VAV-RTU Open Start-up Sheet to be completed and included with the base unit check list.

Besides the base unit start-up, there are a few steps to take to properly start-up the controls. The VAV-RTU Open Service Test function should be used to assist in the base unit start-up and also allows verification of output operation. Controller configuration is also part of start-up. This is especially important when field accessories have been added to the unit. The factory pre-configures options installed at the factory. There may also be additional installation steps or inspection required during the start-up process.

VAV-RTU Open System Start-Up

Before system test mode is activated the VAV Zone terminals and VAV-RTU Open are required to be programmed to meet the application. Reference the terminal controller installation and start-up guide for configuration for specific terminals. (OPN-VAVB3 / OPN-VAVB1) and this manual for VAV-RTU Open.

Proper addressing and programming for the units can be found in referenced manuals prior to setting up system. Please refer to the operation - standalone mode section for more details on accessing occupancy setpoints.

Step 1 —

Set up the terminals minimum and maximum airflow setpoints so that sufficient system minimum airflow is maintained in both heating and cooling modes. Refer to the Product Data for the specific rooftop equipment to determine those minimum values.

Step 2 —

Refer to product data for the VAV-RTU, verify the sum of the minimum heat airflow setpoints for all the air terminal are 80 to 100% of the minimum heating airflow requirement for the unit.

Step 3 —

Refer to product data for the VAV-RTU, verify the sum of the maximum cool cfm setpoints are equal to or greater than the units max airflow.

Step 4 —

Now the unit can be put in service test mode and the fan test used to set minimum VFD speed. The fan will start when the fan test is set to enable. The test runs the fan at minimum speed (default 25%) as configured in the VAV-RTU controller. During this time all terminals will be open 70%.

The minimum VFD output is set to a factory default of 25% which may be increased or decreased as required so that measured value of static pressure read will be approximately 0.07 to 0.1 in. wg.

Step 5 —

Final Test and Balance can be performed with Test and Balance software for system available from your local Carrier office. The USB adapter and cable (USB-L) will also be required.

Additional Installation/Inspection

Inspect the field installed accessories for proper installation, making note of which ones do or do not require configuration changes. Inspect the VAV-RTU Open Alarms for initial insight to any potential issues. See troubleshooting section for alarms. Inspect the SAT sensor for relocation as intended during installation. Inspect special wiring as directed below.

POWER EXHAUST RELAY POWER

The relay used by the VAV-RTU Open board to control power exhaust is a dry contact which means it does not have 24 vac. This 24 vac must be connected to the relay to allow it operate the power exhaust relay in the PE accessory. A 24 vac source should be provided to the J11-2 pin on the VAV-RTU Open. This can be provided by the unit's transformer from various sources. The "R" terminal on the unit's Integrated Staging Control (ISC) board is a logical source.

NOTE: Factory installed power exhaust comes pre-configured and does not require routing 24 vac as described above. This factory installed option is only available on the following vertical air flow units: 48/50LC*B 14-26.

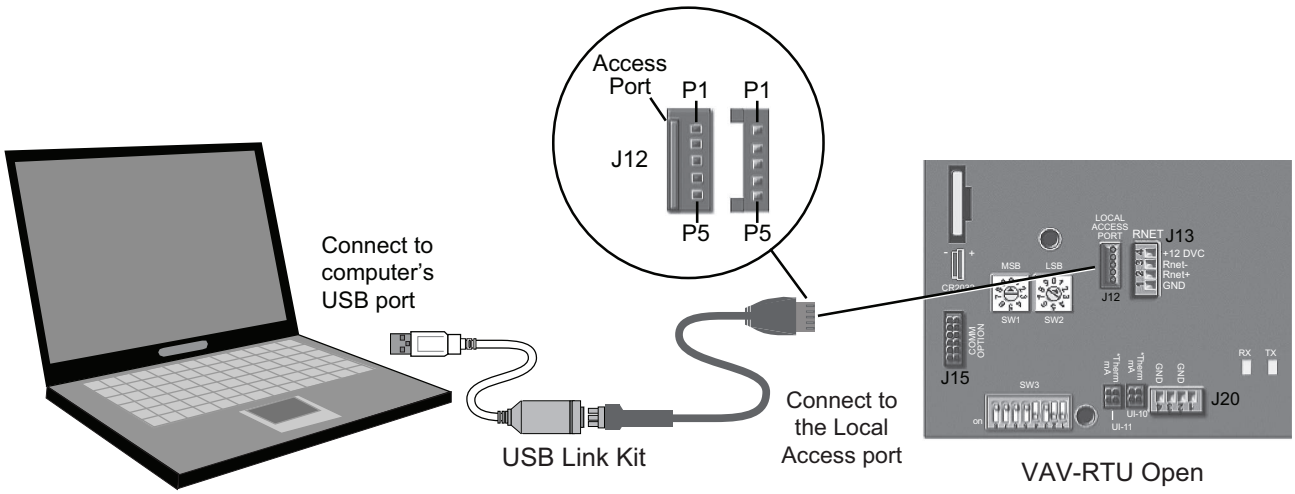

Fig. 19 — PC Running Field Assistant

Service Test

The Service Test function can be used to verify proper operation of compressors, heating stages, indoor fan, power exhaust fans and economizer. Use of Service Test is recommended at initial system start up and during troubleshooting. See Appendix A for Service Test Mode table.

Service Test mode has the following changes from normal operation:

- Outdoor air temperature limits for cooling circuits, economizer, and heating are ignored.
- Normal compressor time guards and other staging delays are ignored.
- The status of Alarms (except Fire and Safety chain) is ignored, but all alerts and alarms are still broadcasted on the network.

Service Test can be turned ON/OFF from Field Assistant, from the network, or from the Equipment or System Touch. Once turned ON, other entries may be made with the display or through the network. To turn Service Test on, change the value of Test Mode to ON, to turn Service Test off, change the value of Test Mode to OFF. Service Test allows testing of each controller output.

Binary Service Test functions are on when the Default Value is set to Enable and off when set to Disable.

The output of the Analog Service Test is controlled by percentage (0-100%) entered into the Default Value.

It is recommended to return every Service Test variable to Disable or 0.00 after testing each function (unless that test variable must be active to test a subsequent function. As in Compressor 2 Test).

All outputs return to normal when Service Test is set to Disable. In addition, Service Test also returns to Disable after 1 hour.

FAN TEST

This point allows the board's fan output to be manually turned On (Enable) and Off (Disable). Other test points that require the fan for operation will automatically turn the fan on and this point will still show "Disable." Fan test can operate simultaneously with other Service Test Points. The fan test will operate the unit's fan at minimum VFD output speed.

COMPRESSOR 1 AND COMPRESSOR 2 TEST

The compressor test points are used to change output status for the individual compressors. Compressor starts are not staggered. The fan and heating service test outputs are reset to "Disable" for the compressor service tests. Compressor Tests can be enabled separately for Stage 1 or 2 or enabled in combination for Stage 3. The Indoor fan and outdoor fans are controlled normally to maintain proper unit operation. All normal cooling alarms and alerts are functional.

HEAT 1 AND HEAT 2 TEST

The heat test points are used to change output status for the individual heat stages, gas or electric. The fans and cooling service test outputs are reset to "Disable" for the heat service tests. Indoor and outdoor fans are controlled normally to maintain proper unit operation. All normal heating alarms and alerts are functional.

POWER EXHAUST TEST

This point allows the board's power exhaust (PE) output to be manually turned On (Enable) and Off (Disable). Power Exhaust test can operate simultaneously with other Service Test Points.

ECONOMIZER TEST

This point allows the board's economizer output to be manually controlled from 0 to 100 % Open. Economizer test can operate simultaneously with other Service Test Points.

VFD SPEED TEST

This point activates the board's 0-10 vdc analog output that controls the unit's supply fan VFD speed.

NOTE: Service Test Mode does not timeout. Be sure to turn off test mode or cycle power to the RTU to return to normal operation.

Configuration

The VAV-RTU Open controller's configuration points effect the unit's inputs and operation. Review and understand the meaning and purpose of each configuration point before changing it from the factory default value. Use the VAV-RTU Open Start-up Sheet during configuration; fill in changed values if changed from factory default. There are three main configurations menus: SETPOINT, UNIT CONFIGURATION, SERVICE and LINKAGE.

Each configuration point is described below under its according menu. See Appendix A for menu structure.

SETPOINT

Supply Air Setpoint

The user-defined base setpoint for Supply Air while in the Cooling mode.

Range = 45 to 75°F
Default = 53°F

Static Pressure Setpoint

The base setpoint for supply duct static pressure to be maintained at the static pressure sensor, which is located approximately 2/3 of the way down the supply duct.

Range = 0.25 to 2.25 in. wg
Default = 0.5 in. wg

Supply Air Tempering Setpoint

The temperature defined to control supply air when Outside Air Temp is below Supply Air Temp Low limit and unit is operating in Fan Only or IAQ Override mode.

Range = 40 to 75°F
Default = 48°F

Occ Relative Humidity Setpoint

The setpoint used to determine when any supply air reset, if previously calculated, should not be used. This will cause the supply air to be controlled at a temperature closer to the configured SAT setpoint when a high humidity condition exists.

Range = 0 to the Unocc RH control setpoint
Default = 60% RH

DCV Max Ctrl Setpoint

The difference between indoor and outdoor CO_2 level which results in maximum ventilation damper position. This value is transmitted through linkage from the VAV zones.

Range = 0 to 9999ppm
Default = 110ppm

Power Exhaust Setpoint

The outside air damper position at which the controller energizes the Power Exhaust relay.

Range = Open
Default = Open

NOTE: This setpoint is automatically adjusted in order to maintain proper building pressure. The actual calculated value, Calculated PE Setpoint, is shown in ***MAINTENANCE→USER***.

NOTE: This point is only used when Continuous Occupied Exhaust = NO

UNIT CONFIGURATION

Fan Mode

Sets the operation of the indoor fan when not in cooling or heating mode. Refer to fan operation for details on each operation.

Range = Auto, Continuous, or Always On
Default = Continuous

Power Fail Restart Delay

Sets how long the controller delays normal operation after the power is restored. Typically used to prevent excessive demand when recovering from a power failure

Range = 0 to 30 sec
Default = 5 sec

Fan Off Delay

The number of seconds that the fan continues to run after heating or cooling has ended.

Range = 5 to 120 sec
Default = 90 sec

Occupied Heating

Once a morning warm-up cycle is complete, Occupied Heating allows the unit to return to heating, if needed. If Disable is selected, the unit will not return to heating until the next occupancy cycle.

Range = Disable/Enable
Default = Disable

Supply Air Temp Reset

Allows the Supply Air Temperature Setpoint to be reset upward based on the amount the controlling zone temperature has fallen below the cooling setpoint.

Range = Disable/Enable
Default = Disable

Reset Ratio

The amount of reset calculated per degree as the controlling zone temperature falls below the cooling setpoint.

Range = 0 to 10
Default = 3

Reset Maximum Limit

The highest value in degrees of reset allowed when calculating the Supply Air Temp Reset.

Range = 0 to 25°F
Default = 10°F

SA Reset Humidity Override

Allows a reduction of the calculated Supply Air Temp Reset as the Space Relative Humidity approaches the Occ Relative Humidity Setpoint.

Range = Disable/Enable
Default = Disable

Minimum Cooling SAT

In cooling mode, the cooling outputs are controlled so that the supply air temperature does not drop below this value. The Minimum Cooling SAT is upper-limited by the calculated Supply Air Temp Clg. Setpoint minus 5°F.

Range = 45 to 75°F
Default = 45°F

Maximum Heating SAT

In heating mode, the heating outputs are controlled so the supply air temperature does not rise above this value. The Maximum Heating SAT is upper-limited by the calculated Automatic Max SAT Limit Learning algorithm.

Range = 90 to150°F
Default = 120°F

Vent Dmpr Pos / DCV Min Pos

The minimum outdoor air damper position maintained during occupied periods.

Range = 0 to 100% open
Default = 20% open

Economizer Purge Min Pos

The maximum outdoor air damper position allowed while DCV is active.

Range = 0 to 100% open
Default = 40% open

Low Fan Econ Min Pos

The minimum outdoor air damper position maintained during occupied periods when the fan is running at the minimum VFD speed.

Range = 0 to 100%
Default = 33%

DCV Max Vent Damper Pos

The maximum outdoor air damper position allowed while DCV is active.

Range = 0 to 75% open
Default = 50% open

Static Pressure Reset Enable

Enables Static Pressure setpoint reset, based on air terminal damper position received via Linkage. When the air terminal maximum damper is less than Minimum Damper Position, the unit initiates static pressure reset by lowering the calculated static pressure setpoint.

Range = Disable/Enable
Default = Enable

Maximum Damper Position

The trip point for the maximum air terminal damper position, received via Linkage, that calculates a reduction in any previously calculated static pressure reset value. When any air terminal has a damper above the Maximum Damper Position, the static pressure setpoint begins to increase toward the configured Static Pressure Setpoint.

Range = 0 to 100% Open
Default = 80% Open

Minimum Damper Position

The trip point for the minimum air terminal damper position, received via Linkage, that calculates static pressure setpoint reset. When all air terminals have their damper below the Minimum Damper Position, the Current Static Pressure Setpoint Reset value will increase, reducing the static pressure setpoint.

Range = 0 to 100% Open
Default = 50% Open

Maximum Reset

The maximum static pressure reset allowed.

Range = 0.05 to 2.50 in.wg
Default = 0.25 in. wg

SP Reset Demand Level

Enables the System Demand Level specified to lower the static pressure by the maximum reset value, when active. Enabling is cumulative for that level and higher levels with Cool Dmd Lvl 3 being the highest load shedding demand level.

Range = Not Active, Cool Dmd Lvl 1, Cool Dmd Lvl 2, Cool Dmd Lvl 3
Default = Not Active

Supply Fan Service Alarm Timer

A Supply Fan Runtime alarm is generated when the supply fan run hours exceed this value. Set to 0 to disable.

Range = 0 to 9999 hr
Default = 600 hr

Compressor 1 Service Alarm Timer

Compressor 1 Runtime alarm is generated when the compressor 1 run hours exceed this value. Set to 0 to disable.

Range = 0 to 9999 hr
Default = 0 hr

Compressor 2 Service Alarm Timer

A Compressor 2 Runtime alarm is generated when the compressor 2 run hours exceed this value. Set to 0 to disable.

Range = 0 to 9999 hr
Default = 0 hr

Filter Service Alarm Timer

The amount of time the fan will run before generating a Filter Alarm. Set to 0 to disable the alarm and reset accumulated fan hours.

Range = 0 to 9999 hr
Default = 600 hr

Heat 1 Service Alarm Timer

A Heat 1 Runtime alarm is generated when the Heat Stage 1 run hours exceed this value. Set to 0 to disable.

Range = 0 to 9999 hr
Default = 0 hr

Heat 2 Service Alarm Timer

A Heat 2 Runtime alarm is generated when the Heat Stage 2 run hours exceed this value. Set to 0 to disable.

Range = 0 to 9999 hr
Default = 0 hr

Door Alarm Delay

Determines the amount of delay before a door alarm is generated.

Range = 0 to 3600 seconds
Default = 60 seconds

Cooling Lockout Temperature

Cooling is inhibited below this outdoor air temperature.

Range = –65 to 80°F
Default = 45°F

Economizer High OAT Lockout Temp

The outdoor air temperature above which economizer cooling is inhibited.

Range = 55 to 80°F
Default = 75°F

Heating Lockout Temperature

Heating is inhibited above this outdoor air temperature.

Range = 35 to 150°F
Default = 65°F

Unocc Free Cool

Enables or disables the use of the economizer to provide unoccupied free cooling (NTFC).

Range = Disable/Enable
Default = Disable

Minimum Setpoint Separation

The minimum amount of temperature separation between the heating and cooling setpoints.

Range = 2 to 10Δ°F Default = 5Δ°F

INPUTS

Input 2 Function

This input is an analog (4-20 mA) input and can be configured to be one of four different inputs: No Sensor, IAQ Sensor, OAQ Sensor, or Space RH Se sor. Input 2 is wired to pin J4-1,2,3.

Software Default = No Sensor
Factory Default = IAQ Sensor with factory installed CO_2 sensor

NOTE: For Input 2, if using Carrier air quality sensors do not use 24Vdc from VAV-RTU Open board. External 24Vdc power supply required.

Input 3

This input is a discrete input and can be configured to be one of four different functions: No Function, Compressor Safety, Fan Status, and Filter Status. This input can also be configured to be either a Normally Open (N/O) or a Normally Closed (N/C) switch. Input 3 is factory wired to pin J1-2. Field accessories can be wired to its parallel pin J5-5. You must also set Input 3 Switch Configuration.

Software Default = No Function

Input 5

This input is a discrete input and can be configured to be one of four different functions: No Function, Fire Shutdown, Fan Status, and Filter Status. This input can also be configured to be either a Normally Open (N/O) or a Normally Closed (N/C) switch. Input 5 is factory wired to pin J1-10. Field accessories can be wired to its parallel pin J5-3. You must also set Input 3 Switch Configuration.

Software Default = Fire Shutdown and N/C
Factory Default = Fire Shutdown and N/O

Input 5 Switch Configuration

The normal (de-energized) state for the set of contacts terminated at Input 5.

Range = NO/NC (normally open/normally closed)
Default = NO

Input 8

This input is a discrete input and can be configured to be one of six different functions: No Function, Enthalpy Switch, Fan Status, and Filter Status. This input can also be configured to be either a Normally Open (N/O) or a Normally Closed (N/C) switch. Input 8 is factory wired to pin J2-6. Field accessories can be wired to its parallel pin J5-1.

Software Default= Enthalpy Switch and N/O
Factory Default = No Function and N/O without factory installed enthalpy sensor

Input 8 Switch Configuration

The normal (de-energized) state for the set of contacts terminated at Input 8.

Range = NO/NC (normally open/normally closed)
Default = NO

Input 9

This input is a discrete input and can be configured to be one of seven different functions: No Function, Fan Status, and Filter Status, or IGC Override. This input can also be configured to be either a Normally Open (N/O) or a Normally Closed (N/C) switch. Input 9 is factory and field wired to pin J5-7.

Factory Default = N/O

NOTE: For 48LC*B 07-26 Units (gas heat units) this decision is automatically set to IGC Override and is factory wired.

Input 9 Switch Configuration

The normal (de-energized) state for the set of contacts terminated at Input 9.

Range = NO/NC (normally open/normally closed)
Default = NO

ZS Sensor Type

The type of local space temperature sensor.

Range =ZS Base, ZS Plus, ZS Pro
Default =None

Rnet Port

Input for communicating sensor or Equipment Touch Terminal J13 - 1, 2, 3, 4

Range = SPT Sensor, ZS Sensor, or Equipment Touch
Default = None

SERVICE CONFIGURATION

Compressor Stages

The number of mechanical cooling stages. This decision is not configurable.

Default = Three stages

Economizer Exists

Set to Yes at factory. This decision is not configurable.

Default = Yes

VFD Input

Defines the electrical control signal used by the Variable Frequency Drive's (VFD) input.

Range = 0-10 Vdc, 2-10 Vdc
Default = 2-10 Vdc

Max VFD Output

The maximum output signal the control supplies to the VFD as a percentage of its range. The balancer can set this to adjust the unit's maximum airflow.

Range = 15% to 100%
Default = 100%

Min VFD Output

The minimum output signal the control supplies to the VFD as a percentage of its range. This must be set to ensure the unit's minimum airflow.

Range = 15% to 100%
Default = 25%

Heat Type

The type of heating used by the unit.

Range = Electric/Gas
Default = Gas

Number of Heat Stages

The number heat stages.

Range = 1 / 2 / 0 (no heating)
Default = 2

SA Tempering

Supply Air Tempering permits using heating, if installed to temper OA while unit is in Fan Only or IAQ Override mode.

Range = Disable/Enable
Default = Disable

Continuous Occupied Exhaust

This point tells the controller when to run the power exhaust if equipped on the unit.

If set to YES, the power exhaust will be on all the time when in occupied mode and will be off when in unoccupied mode. If set to NO the power exhaust will be controlled by the Power Exhaust Setpoint.

Range = YES/NO
Default = NO

DCV Control

Enables demand controlled ventilation (DCV) if valid CO_2 sensor value is available and the unit has an economizer installed.

Range = Disable/Enable
Default = Disable

Indoor CO_2 Sensor Value @min (ma)

The CO_2 value that corresponds to a 4 mA input at the appropriate input channel.

Range = 0 to 9999 ppm
Default = 0 ppm

Indoor CO_2 Sensor Value @max (ma)

The CO_2 value that corresponds to a 20 mA input at the appropriate input channel.

Range = 0 to 9999 ppm
Default = 2000 ppm

Outdoor CO_2 Sensor Value @min (ma)

The CO_2 value that corresponds to a 4 mA input at the appropriate input channel.

Range = 0 to 9999 ppm
Default = 0 ppm

Outdoor CO_2 Sensor Value @max (ma)

The CO_2 value that corresponds to a 20 mA input at the appropriate input channel.

Range = 0 to 9999 ppm
Default = 2000 ppm

NOTE: The indoor and outdoor min and max mA setting are used to set the linear curve of mA vs. PPM.

System Space Temperature

The network space temperature value that the controller is using for control (if applicable).

Range = N/A
Default = -999.0°F

System Space RH

The network relative humidity value that the controller is using for control (if applicable)

Range = N/A
Default = -999.0%

System Space AQ

The network indoor air quality (CO_2) value that the controller is using for control (if applicable)

Range = N/A
Default = -999.0 PPM

System Cool Demand Level

The system cool demand level being received over the network

Range = N/A
Default = 0-3

System Heat Demand Level

The system heat demand level being received over the network

Range = N/A
Default = 0-3

System Outdoor Air Temperature

Allows the outdoor air temperature value to be network readable when enabled.

Range = N/A
Default = -999.0°F

System Outdoor AQ

Allows network readable value of OAQ for calculation during differential OAQ CO_2 levels and IAQ CO_2 levels to drive the IAQ control

Range = N/A
Default = -999.0 PPM

System Fire / Smoke

Allows network readable fire/smoke signal to invoke shutdown action in the RTU

Range = N/A
Default = OFF

LINKAGE BASED OPERATION

The VAV-RTU Open will control the compressors, economizer and heating outputs based on the space temperature inputs and setpoints received from the zoning master through Linkage. The VAV-RTU Open supports Carrier Open air terminals with Airside Linkage or (VAV-RTU Open with version 2) can operate as a standalone VAV rooftop serving third party BACnet air terminals. An optional CO_2 IAQ sensor mounted in the space can influence the economizer minimum position. The following sections describe the operation for the functions of the VAV-RTU Open through Linkage.

Occupancy

Occupancy is the fundamental overall control of equipment. The unit can be in one of two states: Occupied or Unoccupied. These are usually referred to as periods because they represent periods of any given day. Before VAV-RTU Open can operate specific functions of the equipment it is installed on, occupancy must be determined. Occupancy only comes from the Linked zoning system.

Indoor (Supply) Fan

The indoor fan can be configured to operate in three different manners. The configuration point Fan Mode determines how the fan will run. The fan will always be disabled if a fire shutdown or safety chain alarm is active. A valid space temperature and supply air temperature must be available for the fan to operate. There is a unit start delay in effect when the unit is transitioning from unoccupied to occupied. The following describes specific fan operation based on the Fan Mode configuration value.

AUTO

When Fan Mode is set to Auto, VAV-RTU Open will cycle the fan on and off based on the demand for heating, and cooling. There is a configurable fan off delay that is upheld before shutting the fan off after conditioning has ended.

CONTINUOUS

When Fan Mode is set to Continuous, VAV-RTU Open will cycle the fan based on occupancy. The fan will run continuously whenever the unit is occupied and operate in the auto mode during the unoccupied period.

ALWAYS ON

When Fan Mode is set to Always On, VAV-RTU Open will run the fan all the time regardless of occupancy or demand.

FAN OFF DELAY

A Fan Off Delay allows the supply fan to continue operating after heating or cooling stops. If the following alarms are active, the fan turns off immediately, regardless of the occupancy state or demand:

- Fire Shutdown
- Safety Chain
- Supply Air Temp Sensor alarm

The VAV-RTU Open does not include smoke-control functions such as smoke-purge, zone-pressurization, or smoke-ventilation.

INDOOR (SUPPLY) FAN STATUS

The VAV-RTU Open has an optional Supply Fan Status input to provide proof of airflow. If this is enabled, the point will look for a contact change whenever the Supply Fan Relay is on. If it is not enabled then it will always be the same state as the Supply Fan Relay. The cooling, economizer, heating, CO_2 and power exhaust routines will use this input point for fan status.

Cooling

The VAV-RTU Open application and configuration determines the specific cooling sequence. The VAV-RTU Open controls 3 stages of mechanical cooling. The number of stages is not configurable.

The following conditions must be true for the cooling algorithm to operate:

- Cooling is required. (If occupied, the space temperature is > occupied cooling setpoint if reset is disabled or space temperature > occupied heating setpoint + 1Δ°F (0.5Δ°C)] if reset is enabled. If unoccupied, space temperature is > unoccupied cooling setpoint).
- Outdoor Air Temperature, if valid, is greater than the Cooling Lockout Temperature setpoint
- The Supply Fan is on
- The unit has a valid Supply Air Temperature input
- The unit has a valid Space Temperature input
- Heat mode is not active and the 5-minute time guard between modes has expired
- Economizer cooling is unavailable, or if Economizer cooling is active, the economizer is open > 90% for at least 5 minutes, the OAT > [Supply Air Setpoint + 5Δ°F (2.7Δ°C)], SAT > Supply Air Setpoint, and cooling mode is active (SPT > CSP if reset is disabled or SPT > HSP +1 if reset is enabled).

The cooling relays are controlled by the Cooling Control PID Loop and Cooling Capacity algorithm. They calculate the desired number of stages needed to satisfy the supply air temperature setpoint.

When the cooling algorithm preconditions have been met, the compressors are energized in stages, as applicable. Anti-recycle timers are employed to protect the equipment from short-cycling. There are fixed 3 minute minimum on-times, and 1 minute off-times for each compressor output.

During compressor operation, the VAV-RTU Open will reduce the number of active stages to only one if the rooftop supply air temperature falls below the Supply Air Setpoint. During mechanical cooling, should the SAT fall below the configured Minimum Cooling SAT value of 45°F (7.2°C), the economizer will modulate more open to maintain the minimum SAT. During integrated cooling, should the SAT fall below the configured Minimum Cooling SAT value of 45°F (7.2°C), the economizer will modulate more closed to maintain the minimum SAT. The Minimum Cooling SAT is user configurable between 45°F (7.2°C) and 75°F (23.9°C)

Compressor Service Alarm Timer functions are available (1 for each compressor). This function tracks the number of compressor run hours and generates an alarm when the accumulated runtime exceeds the threshold set by the adjustable compressor service alarm timers.

Supply Fan

The VAV-RTU Open supply fan is configured for Variable Speed operation:

- Fan speed is controlled to maintain the configured duct static pressure setpoint.

The VAV-RTU Open supply fan may be configured for 1 of 3 Fan Modes:

- Auto - The fan cycles on/off in conjunction with heating or cooling.
- Continuous - The fan runs continuously during occupancy and intermittently during unoccupied periods with heating and cooling.
- Always On - The fan runs continuously regardless of occupancy or calls for heating and cooling.

Occupancy is determined by Linkage.

A Fan Off Delay allows the supply fan to continue operating after heating or cooling stops.

If the following alarms are active, the fan turns off immediately, regardless of the occupancy state or demand:

- Fire Shutdown
- Safety chain
- SAT sensor alarm
- SPT sensor alarms

The VAV-RTU Open does not include smoke-control functions such as a smoke-purge, zone-pressurization, or smoke-ventilation. Each of these modes require a field-designed circuit to operate the following by local fire codes:

- RTU supply fan
- RTU economizer
- RTU power exhaust

The VAV-RTU Open many be configured to accept a Supply Fan Status input to provide proof the supply fan is operating. When enabled, a loss or lack of fan status will stop heating and cooling operation.

A supply Fan Alarm Service Timer function is available to track the number of supply fan run hours and generate an alarm when the accumulated runtime exceeds the set threshold.

Economizer

The Economizer dampers are used to provide free cooling when the outside conditions are suitable and Indoor Air Quality, if optional CO_2 sensor is installed.

The following conditions must be true for economizer operation:

- Indoor Fan is on.
- Enthalpy is Low if the Enthalpy input is enabled.
- SAT reading is available.
- OAT reading is available.
- SPT reading is available.
- OAT <= High OAT economizer lockout configuration (default = 75).
- OAT <= SPT

For LC VAV rooftop the VAV-RTU Open will determine the required minimum economizer position (Calculated Min Econ Pos) based on the fan's actual operation speed. The minimum damper position can be overridden by the IAQ routine described later in this section.

Since the VAV-RTU Open provides variable supply airflow to the VAV system, as the supply airflow changes, the economizer minimum position is adjusted to provide a constant amount of outdoor air. If the fan operates at maximum speed, the economizer minimum position will be set to the Vent Dmpr Pos / DCV Min Pos setpoint. When the fan operates at its lowest speed, the economizer minimum position will be set to the Low Fan Econ Min Pos. For any fan speed between the minimum and maximum speeds, the VAV-RTU control calculates a minimum economizer position by a linear interpolation between these two values. When cooling is required, if all preceding conditions are true and the outdoor Enthalpy Status is Low, the economizer PID loop modulates the damper between the minimum position and 100% open to maintain the Supply Air Setpoint.

During economizer operation, the economizer position is reduced as the SAT falls below the Supply Air setpoint – 3Δ°F (1.7Δ°C), but never closes below the applicable minimum ventilation position. The Calculated Min Econ Pos used for control is displayed in the Maintenance section.

VAV-RTU Open provides Fault Diagnostic and Detection (FDD) for economizer operation in compliance with California Title 24. The FDD logic will detect an economizer that fails to close, fails to open, stuck fully open, and fails to fully open. Each condition will cause an Economizer Operation alarm to occur and the specific condition will be displayed.

Enthalpy Control

You may use an enthalpy switch to indicate the suitability of outdoor air for economizer cooling. You can use either an outdoor air or differential enthalpy switch. A differential enthalpy switch has a sensing device in both the outdoor and return air streams. A differential enthalpy switch indicates when outside air is more suitable to be used than the return air and is available for economizer cooling. If no enthalpy switch is configured, a network point (Object Name: oae) is available. This point is displayed in the i-Vu application and Equipment Touch as Enthalpy (BACnet).

The sequence of operation for economizer cooling is the same with or without an enthalpy switch, except that an enthalpy switch imposes one more validation on the suitability of outside air for economizer cooling. An Enthalpy Status that is High disables the economizer and the outside air damper goes to its minimum position. An Enthalpy Status that is Low enables the economizer if a call for cooling exists and the remaining preconditions are met.

Space Air Quality

Space Air Quality (AQ) is controlled on rooftop equipment using the economizer. The Space AQ sequence utilizes an air quality (CO_2) sensor to monitor conditions within the occupied space. A CO_2 sensor may be terminated at the VAV-RTU Open, or a subordinate zone controller, when part of a zoned system.

When an outdoor air quality sensor is not installed, the algorithm uses 400ppm as the fixed outdoor air CO_2 level. The following conditions must be true for the Space AQ algorithm to operate:

- The system is occupied
- The supply fan has been operating for at least 30 seconds
- The Space AQ sensor has a valid reading

As the air quality in the space decreases (Space AQ CO_2 value increases), the minimum position of the economizer increases, allowing more outdoor air to enter the space. The amount of increase depends on the relationship between the Space AQ level and the DCV Max Ctrl Setpoint.

The Space AQ algorithm calculates a minimum position value using a PID loop. The CO_2 minimum damper position is then compared against the Vent Dmpr Pos / DCV Min Pos setpoint and the greatest value becomes the minimum damper position utilized for the economizer. When the minimum economizer position is being reset by the Space AQ algorithm, the System Mode displays IAQ Override. The maximum amount the economizer may be opened to outdoor air by the Space AQ algorithm is limited by the DCV Max Vent Damper Pos, which is adjustable between 10 and 75%.

Power Exhaust

VAV-RTU Open may enable and disable an exhaust fan based on either the controller's occupancy or its economizer damper position. If configured for continuous occupied operation, it will be energized whenever the controller is in the occupied mode and disabled when in the unoccupied mode. If configured for damper position control, it will be energized whenever the economizer exceeds the power exhaust setpoint and disabled when the economizer drops below the setpoint by a fixed hysteresis of 10%. The Power Exhaust Setpoint is automatically adjusted based on the fan's air delivery. The Calculated PE Setpoint used for control is displayed in ***MAINTENANCE→USER***.

Heating

The heat outputs are controlled by the Heating Control PID Loop and Heating Stages Capacity algorithm.

MORNING WARM-UP

The specific heating sequence is determined by the controller's application and configuration. The VAV-RTU Open controls up to two stages of gas or electric heating. Morning Warm-Up occurs after the first transition from unoccupied operation to occupied operation if heat is required.

The following conditions must be true for the morning warm-up algorithm to operate:

- The Outdoor Air Temperature is less than the Heating Lockout Temperature setpoint
- Heating is required (Space temperature is < occupied heating setpoint – 1Δ°F (.5Δ°C). The unit has a valid Supply Air Temperature input
- The unit has a valid Space Temperature input
- Neither Cool nor Economizer modes have been active previously

The heating relays are controlled by the Heating Control PID Loop and Heating Stages Capacity algorithm, which calculate the required Supply Air Temperature to satisfy the space by comparing the Space Temperature to the:

- Effective Occupied Heating Setpoint when occupied

When the heating algorithm preconditions have been met, the Heating Stages Capacity algorithm calculates the Heating Control Setpoint during any heating mode. Anti-recycle timers are employed to protect the equipment from short-cycling. There are fixed application specific minimum on and off times for each heating output (gas = 120 seconds on and 60 seconds off / electric = 15 seconds on and 10 seconds off).

During heating operation, the VAV-RTU Open may reduce the number of active stages as the rooftop's Supply Air Temperature approaches the Maximum Heating SAT setpoint. A heat stage turned off in this fashion may be started again after the normal time-guard period has expired, if the Supply Air Temperature has decreased below the Maximum Heating SAT setpoint.

Heating Service Alarm Timer functions are available (1 for each stage of heat). This function tracks the number of heat run hours and generates an alarm when the accumulated runtime exceeds the threshold set by the adjustable heat service alarm timers.

OCCUPIED HEATING

Occupied Heating operates exactly the same as Morning Warm-up except that heating can occur any time during the occupied period. All the same conditions that apply to Morning warm-up apply to occupied heating except: the restriction - Neither Cool nor Economizer modes have been active. In its place is:

- Neither Cool or Economizer modes are currently active and the 5 minute time guard between modes has expired.

UNOCCUPIED HEATING

The following conditions must be true for the unoccupied heating algorithm to operate:

- The Outdoor Air Temperature is less than the Heating Lockout Temperature setpoint
- Heating is required (Space temperature is < unoccupied heating setpoint – 1Δ°F (.5Δ°C).
- The unit has a valid Supply Air Temperature input
- The unit has a valid Space Temperature input
- Neither Cool nor Economizer modes are active and the 5 minute time guard between modes has expired.

When the heating algorithm preconditions have been met, the Heating Stages Capacity algorithm calculates the Heating Control Setpoint during the heating mode and the heat operate the same as Morning Warm-up.

Supply Air Tempering

The VAV-RTU Open provides the option to operate the heat, if so equipped, to maintain a minimum supply air temperature during conditions where very cold outdoor air causes the supply air temperature to fall below the configured SA Tempering Setpoint. This occurs during periods where DCV is active and increasing the amount of outdoor air or in cases where the system is operating at very low airflow and the calculated economizer position has increased to maintain a constant ventilation rate. The following conditions must be true for the supply air tempering algorithm to operate:

- The SA Tempering is set to Enable
- The indoor fan is on
- The System Mode is Fan Only or IAQ Override
- The Outdoor Air Temperature < Minimum Cooling SAT
- Heat type is gas or electric and Number Of Heat Stages > 0

If the above are true, the VAV-RTU Open will monitor the SAT sensor value and operate the first stage of heat to temper the supply air as required in order to maintain the configured SA Tempering Setpoint. Heat operation is subject to anti-recycle timers to protect the equipment from short-cycling. There are fixed application specific minimum on and off times for each heating output (gas = 120 seconds on and 60 seconds off / electric = 15 seconds on and 10 seconds off).

Demand Controlled Ventilation

The VAV-RTU Open provides the option to control the economizer's minimum ventilation position based on a Demand Controlled Ventilation (DCV) algorithm. The algorithm monitors the CO_2 sensor value and compares that value to the user defined setpoint. A PID control calculates the required minimum economizer position required to satisfy the ventilation requirements of the space. A user adjustable DCV Max Vent Damper Pos is provided to limit the maximum amount of outdoor air that can be brought into the unit due to the DCV algorithm.

The following conditions must be true for DCV operation:

- The DCV Control is set to Enable
- The unit has a valid IAQ sensor input
- The unit is in an occupied mode
- If the above are true, the VAV-RTU Open will monitor the IAQ sensor value and the OAQ sensor value if the option is provided. It will compare those values to the IAQ setpoint and then calculate the required minimum economizer position as required. If that calculated value is greater than the configured DCV Max Vent Damper Pos, the value is clamped to that maximum limit. If the DCV damper position is less than the calculated economizer minimum position for ventilation, the economizer will maintain that calculated economizer minimum position.

Demand Limit

The VAV-RTU Open may employ a demand limit strategy. Demand limiting in the VAV-RTU Open works by resetting the Supply Air Static Pressure Setpoint. The demand level at which static pressure reset begins is defined by the parameter SP Reset Demand Level which is selected by the user. The selected SP Reset Demand Level determines at which demand level the SP Reset becomes active. The amount of reset is determined by Maximum Reset.

Unoccupied Free Cooling

The control can run a night time free cooling (NTFC) mode called Unocc Free Cooling. In this mode the damper is utilized to bring in outdoor air for free cooling during unoccupied periods. The following conditions must be true for unoccupied free cooling to operate:

- Unocc Free Cool Enable set to Enable
- The system is unoccupied
- The outside air temperature is below the Economizer High OAT Lockout Temp
- The outside air temperature is less than the space temperature
- Enthalpy (if enabled) is Low

When the VAV-RTU Open schedule is unoccupied and the space temperature rises at least 1 degree above the Occupied Cooling Setpoint, the supply fan starts. The economizer damper opens as necessary to cool the space. The VAV-RTU Open continues to operate in this mode until the space is satisfied or the outside air conditions are no longer suitable for free cooling.

Fire Shutdown

Fire Shutdown may be configured on Binary Input 5. A typical application involves a smoke detector or fire shutdown contact, which, when active, immediately shuts down equipment operation.

Compressor Safety

Compressor Safety may be configured on Binary Input 3. This feedback can be provided by a Compressor Lock-Out (CLO) device or current switch when field installed. A Compressor Safety Alarm indicates that the equipment requires attention. Cooling, heating, and supply fan outputs are not interrupted. Normal operation resumes when the compressor safety circuit is de-energized.

Fan Status

Fan Status may be configured on any unused binary input channel. A typical application would be an airflow switch, current sensing relay, or other device that provides a supply fan running verification. Enabling this function displays the supply fan's status on the equipment graphic. If the controller loses fan status during operation, heating and cooling are disabled, the economizer damper (if available) is closed, and an alarm for loss of status is indicated. If the fan status is on when the controller is commanding the fan off, the unit remains in the off state. An alarm is generated indicating that the fan is running when it should be off.

Filter Status

Filter status may be configured on any unused binary input channel. A typical application is a differential pressure switch that senses the pressure drop across a filter bank. When the pressure across the filter bank exceeds the setpoint of the differential pressure switch, the Filter status is displayed as Dirty on the controller graphic. An alarm indicates a dirty filter.

Linkage

The VAV-RTU Open may also serve as an air source to an Open Variable Volume and Temperature (VVTR) system. When the VAV-RTU Open is part of a VVT system and the controllers are wired together to form a network, the controllers may use a method of communication known as Linkage. Linkage is a method by which an air source and its subordinate zone terminals exchange data to form a coordinated HVAC system. The system's air source controller, zone controllers, and bypass controller are linked so that their data exchange can be managed by one zone controller configured as the VVT Master. The VVT Master gathers the following information from the slave zone controllers:

- occupancy status
- setpoints
- zone temperature
- relative humidity
- CO_2 level
- damper position
- optimal start data

The VVT Master performs mathematical calculations and algorithms on the data and then sends the composite information to the air source. The VVT Master receives information from the air source such as mode, supply air temperature, and outside air temperature, and passes that information to all linked controllers.

LINKAGE AIR SOURCE MODES

In a linked system, the air source determines its operating mode and qualifies that mode based on its own Supply Air Temperature (SAT). The following modes can be sent by the air source depending on its configuration:

- Off – Air source fan is off
- Ventilation – Air source fan is on and providing ventilation (neutral SAT) without heating or cooling
- Cooling – Air source fan is on and cooling is provided by economizer and mechanical cooling
- Heating – Air source fan is on and heating is provided (gas or electric)
- Unocc Free Cooling – Air source fan is on, with the economizer providing cooling while unoccupied

OPERATION — STANDALONE MODE

Occupied and Unoccupied Setpoints (Standalone Mode)

In standalone applications with third party BACnet enabled air terminals, it is recommended that the occupied and unoccupied heating and cooling setpoints be computed by and written to the RTU by the third party control system. See Appendix D - BACnet Points list for the addresses of the unit setpoints. In standalone applications with non-communicating air terminals, the occupied and unoccupied heating and cooling setpoints are programmed at the RTU via the setpoint bar on the VAV RTU Open graphic using Field Assistant or i-Vu Server.

Occupancy (Using Standalone Configuration)

In stand alone mode with third party air terminals occupancy is controlled by the following:

- **Always Occupied —** (default) Controller operates continuously, regardless of any configured schedule.

The unit's operation depends upon its occupancy state (Occupied/Unoccupied). The VAV-RTU Open operates continuously in the Occupied mode until you configure an occupancy schedule.

- **BACnet Schedule —** A separate occupancy schedule to determine when the unit is occupied and to determine which setpoints (occupied or unoccupied) should be used.

An occupancy schedule may be:

- A local schedule configured in the controller using an Equipment Touch or Field Assistant
- A BACnet schedule configured in the i-Vu application, networked through an i-Vu® Open Router

To set up occupancy schedules, see the documentation for your user interface.

NOTE: A BACnet schedule, downloaded from the i-Vu application will overwrite a local schedule that was set up with an Equipment Touch or Field Assistant.

BAS On/Off — Additionally, a network input multistate point (BAS ON/OFF) is provided for third party BAS systems to interface to the control and manually set its occupancy state. The network input has three states. State 1 (default) is inactive. State 2 sets the unit to occupied mode. This will cause the RAT to be compared to the configured occupied heating and cooling setpoints. State 3 will set the unit to go unoccupied and the RAT (or optional space temperature sensor) will be compared to the user configured unoccupied setpoints.

Remote Occ Input — is an optional remote occupancy digital input may also be used to determine the operation of the unit is occupied or unoccupied.

Indoor (Supply) Fan (Standalone Mode)

The indoor fan can be configured to operate in three different manners. The configuration point Fan Mode determines how the fan will run. The fan will always be disabled if a fire shutdown or safety chain alarm is active. A valid space temperature and supply air temperature must be available for the fan to operate. There is a unit start delay in effect when the unit is transitioning from unoccupied to occupied. The following describes specific fan operation based on the Fan Mode configuration value.

AUTO

When Fan Mode is set to Auto, VAV-RTU Open will cycle the fan on and off based on the demand for heating, and cooling. There is a configurable fan off delay that is upheld before shutting the fan off after conditioning has ended.

CONTINUOUS

When Fan Mode is set to Continuous, VAV-RTU Open will cycle the fan based on occupancy. The fan will run continuously whenever the unit is occupied and operate in the auto mode during the unoccupied period.

ALWAYS ON

When Fan Mode is set to Always On, VAV-RTU Open will run the fan all the time regardless of occupancy or demand.

FAN OFF DELAY

A Fan Off Delay allows the supply fan to continue operating after heating or cooling stops. If the following alarms are active, the fan turns off immediately, regardless of the occupancy state or demand:

- Fire Shutdown
- Safety Chain
- Supply Air Temp Sensor alarm

The VAV-RTU Open does not include smoke-control functions such as smoke-purge, zone-pressurization, or smoke-ventilation.

INDOOR (SUPPLY) FAN STATUS

The VAV-RTU Open has an optional Supply Fan Status input to provide proof of airflow. If this is enabled, the point will look for a contact change whenever the Supply Fan Relay is on. If it is not enabled then it will always be the same state as the Supply Fan Relay. The cooling, economizer, heating, CO_2 and power exhaust routines will use this input point for fan status.

Cooling (Standalone Mode)

The VAV-RTU Open application and configuration determines the specific cooling sequence. The VAV-RTU Open controls 3 stages of mechanical cooling. The number of stages is not configurable.

The following conditions must be true for the cooling algorithm to operate:

- Cooling is required. (If occupied, the RAT is > occupied cooling setpoint if reset is disabled or RAT > occupied heating setpoint + 1Δ°F (.5Δ°C), if reset is enabled. If unoccupied, RAT or space temperature (if configured) is > unoccupied cooling setpoint).
- Outdoor Air Temperature, if valid, is greater than the Cooling Lockout Temperature setpoint
- The Supply Fan is on
- The unit has a valid Supply Air Temperature input
- The unit has a valid RAT input
- Heat mode is not active and the 5-minute time guard between modes has expired
- Economizer is unavailable, or if Economizer cooling is active, the economizer is open > 90% for at least 5 minutes, the OAT > [Supply Air Setpoint + 5Δ°F (2.7Δ°C)], SAT > Supply Air Setpoint, and cooling mode is active (SPT > CSP if reset is disabled or SPT > HSP + 1 if reset is enabled).

The cooling relays are controlled by the Cooling Control PID Loop and Cooling Capacity algorithm. They calculate the desired number of stages needed to satisfy the supply air temperature setpoint.

When the cooling algorithm preconditions have been met, the compressors are energized in stages, as applicable. Anti-recycle timers are employed to protect the equipment from short-cycling. There are fixed 3 minute minimum on-times, and 1 minute off-times for each compressor output.

During compressor operation, the VAV-RTU Open will reduce the number of active stages to only one if the rooftop supply air temperature falls below the Supply Air Setpoint. During mechanical cooling, if the SAT falls below the configured Minimum Cooling SAT value of 45°F (7.2°C), the economizer will modulate more open to maintain the minimum SAT. During integrated cooling, if the SAT falls below the configured Minimum Cooling SAT value of 45°F (7.2°C), the economizer will modulate more closed to maintain the minimum SAT. The Minimum Cooling SAT is user-configurable between 45°F (7.2°C) and 75°F (23.9°C).

Compressor Service Alarm Timer functions are available (1 for each stage of compression). This function tracks the number of compressor run hours and generates an alarm when the accumulated runtime exceeds the threshold set by the adjustable compressor service alarm timers.

Supply Fan (Standalone Mode)

The VAV-RTU Open supply fan is configured for Variable Speed operation:

- Fan speed is controlled to maintain the configured duct static pressure setpoint.

The VAV-RTU Open supply fan may be configured for 1 of 3 Fan Modes:

- **Auto** — The fan cycles on/off in conjunction with heating or cooling.
- **Continuous** — The fan runs continuously during occupancy and intermittently during unoccupied periods with heating and cooling.
- **Always On** — The fan runs continuously regardless of occupancy or calls for heating and cooling.

A Fan Off Delay allows the supply fan to continue operating after heating or cooling stops.

If the following alarms are active, the fan turns off immediately, regardless of the occupancy state or demand:

- Fire Shutdown
- Safety chain
- SAT sensor alarm
- SPT sensor alarms

The VAV-RTU Open does not include smoke-control functions such as a smoke-purge, zone-pressurization, or smoke-ventilation. Each of these modes require a field-designed circuit to operate the following by local fire codes:

- RTU supply fan
- RTU economizer
- RTU power exhaust

The VAV-RTU Open many be configured to accept a Supply Fan Status input to provide proof the supply fan is operating. When enabled, a loss or lack of fan status will stop heating and cooling operation.

A supply Fan Alarm Service Timer function is available to track the number of supply fan run hours and generate an alarm when the accumulated runtime exceeds the set threshold.

Economizer (Standalone Mode)

The economizer dampers are used to provide free cooling when the outside conditions are suitable and Indoor Air Quality, if optional CO_2 sensor is installed.

The following conditions must be true for economizer operation:

- The Outdoor Air Temperature is < RAT and OAT is < the Economizer High OAT Lockout Temp setpoint
- The indoor fan is on
- The unit has a valid Supply Air Temperature input
- The unit has a valid RAT sensor input
- The unit has a valid Outdoor Air Temperature input

If the VAV-RTU Open provides variable supply airflow to the VAV system and maintains a constant minimum ventilation. As the supply airflow changes, the economizer minimum position is adjusted to provide a constant amount of outdoor air.

When the fan operates at maximum speed, the economizer minimum position will be set to the Vent Dmpr Pos / DCV Min Pos setpoint. For any fan speed between the minimum and maximum speeds, the VAV-RTU Open control calculates a minimum economizer position by a linear interpolation between these two values. When cooling is required, if all preceding conditions are true and the outdoor Enthalpy Status is Low, the economizer PID loop modulates the damper between the minimum position and 100% open to maintain the Supply Air Setpoint.

During economizer operation, the economizer position is reduced as the SAT falls below the Supply Air setpoint – 3Δ°F (1.7Δ°C), but never closes below the applicable minimum ventilation position.

The VAV-RTU Open provides FDD (Fault Detection and Diagnostics) for economizer operation in compliance with California Title 24. The FDD logic will detect an economizer that fails to close, fails to open, is stuck fully open, and fails to fully open. Each condition will cause an Economizer Operation alarm to occur and the specific fault condition will be displayed.

ENTHALPY CONTROL

An enthalpy switch can be used to indicate the suitability of outdoor air for economizer cooling. You can use either an outdoor air or differential enthalpy switch.

A differential enthalpy switch has a sensing device in both the outdoor and return air streams. A differential enthalpy switch indicates when outside air is more suitable to be used than the return air and is available for economizer cooling.

If no physical enthalpy switch is configured, a network point (Object Name: oae) is available. This point is displayed in the i-Vu application and an Equipment Touch as Enthalpy (BACnet). If no enthalpy input is used, then only a dry bulb OAT comparison can be used to determine the suitability of the outdoor air.

The sequence of operation for economizer cooling is the same with or without an enthalpy switch, except that an enthalpy switch imposes one more validation on the suitability of outside air for economizer cooling. An Enthalpy Status that is High disables the economizer and the outside air damper maintains only a position that provides minimum ventilation during occupied periods. An Enthalpy Status that is Low enables the economizer, if a need for cooling exists and the remaining preconditions are met.

SPACE AIR QUALITY

Space Air Quality (AQ) is controlled on rooftop equipment using the economizer. The Space AQ sequence utilizes an air quality (CO_2) sensor to monitor conditions within the occupied space. A CO_2 sensor may be terminated at the VAV-RTU Open, or a subordinate zone controller, when part of a zoned system.

When an outdoor air quality sensor is not installed, the algorithm uses 400ppm as the fixed outdoor air CO_2 level.

The following conditions must be true for the Space AQ algorithm to operate:

- The system is occupied
- The supply fan has been operating for at least 30 seconds
- The Space AQ sensor has a valid reading

As the air quality in the space decreases (Space AQ CO_2 value increases), the minimum position of the economizer increases, allowing more outdoor air to enter the space. The amount of increase depends on the relationship between the Space AQ level and the DCV Max Ctrl Setpoint.

The Space AQ algorithm calculates a minimum position value using a PID loop. The CO_2 minimum damper position is then compared against the Vent Dmpr Pos / DCV Min Pos setpoint and the greatest value becomes the minimum damper position utilized for the economizer. When the minimum economizer position is being reset by the Space AQ algorithm, the System Mode displays IAQ Override.

The maximum amount the economizer may be opened to outdoor air by the Space AQ algorithm is limited by the DCV Max Vent Damper Pos, which is adjustable between 10 and 75%.

POWER EXHAUST

The VAV-RTU Open may enable and disable an exhaust fan, based on either the controller's occupancy or a calculated economizer damper position. The Power Exhaust Setpoint is automatically adjusted based on the fan's air delivery in order to maintain a constant building pressure. The Calculated PE Setpoint used for control is displayed in ***MAINTENANCE→USER***.

If Continuous Occupied Exhaust is Yes, the Power Exhaust binary output (BO-8) is energized while the VAV-RTU Open is occupied and de-energized when unoccupied.

If Continuous Occupied Exhaust is No, the Power Exhaust binary output (BO-8) is energized when the economizer damper output exceeds the Calculated Power Exhaust (PE) Setpoint value. The output remains energized until the economizer output falls below the Power Exhaust Setpoint value by a fixed hysteresis of 10%.

Heating (Standalone Mode)

The heat outputs are controlled by the Heating Control PID Loop and Heating Stages Capacity algorithm.

MORNING WARM-UP

The specific heating sequence is determined by the controller's application and configuration. The VAV-RTU Open controls up to two stages of gas or electric heating. Morning Warm-Up occurs after the first transition from unoccupied operation to occupied operation if heat is required.

The following conditions must be true for the morning warm-up algorithm to operate:

- The Outdoor Air Temperature is less than the Heating Lockout Temperature setpoint
- Heating is required (Space temperature is < occupied heating setpoint – 1Δ°F (.5Δ°C) The unit has a valid Supply Air Temperature input
- The unit has a valid Space Temperature input
- The unit has a valid Return Air Temperature (RAT) sensor input
- Neither Cool nor Economizer modes have been active previously

The heating relays are controlled by the Heating Control PID Loop and Heating Stages Capacity algorithm, which calculate the required Supply Air Temperature to satisfy the space by comparing the RAT to the:

- Effective Occupied Heating Setpoint when occupied

When the heating algorithm preconditions have been met, the Heating Stages Capacity algorithm calculates the Heating Control Setpoint during any heating mode. Anti-recycle timers are employed to protect the equipment from short-cycling. There are fixed application specific minimum on and off times for each heating output (gas = 120 seconds on and 60 seconds off / electric = 15 seconds on and 10 seconds off).

During heating operation, the VAV-RTU Open may reduce the number of active stages as the rooftop's Supply Air Temperature approaches the Maximum Heating SAT setpoint. A heat stage turned off in this fashion may be started again after the normal time-guard period has expired, if the Supply Air Temperature has decreased below the Maximum Heating SAT setpoint.

Heating Service Alarm Timer functions are available (1 for each stage of heat). This function tracks the number of heat run hours and generates an alarm when the accumulated runtime exceeds the threshold set by the adjustable heat service alarm timers.

OCCUPIED HEATING

Occupied Heating operates exactly the same as Morning Warm-up except that heating can occur any time during the occupied period. All the same conditions that apply to Morning warm-up apply to occupied heating except: the restriction - Neither Cool nor Economizer modes have been active. In its place is:

- Neither Cool or Economizer modes are currently active and the 5 minute time guard between modes has expired

UNOCCUPIED HEATING

The following conditions must be true for the unoccupied heating algorithm to operate:

- The Outdoor Air Temperature is less than the Heating Lockout Temperature setpoint
- Heating is required RAT (space temperature if configured) is < unoccupied heating setpoint – 1Δ°F (.5Δ°C)
- The unit has a valid Supply Air Temperature input
- The unit has a valid RAT (space temperature if configured) input
- Neither Cool nor Economizer modes are active and the 5 minute time guard between modes has expired

When the heating algorithm preconditions have been met, the Heating Stages Capacity algorithm calculates the Heating Control Setpoint during the heating mode and the heat operates the same as Morning Warm-up.

SUPPLY AIR TEMPERING

The VAV-RTU Open provides the option to operate the heat, if so equipped, to maintain a minimum supply air temperature during conditions where very cold outdoor air causes the supply air temperature to fall below the configured SA Tempering Setpoint. This occurs during periods where DCV is active and increasing the amount of outdoor air or in cases where the system is operating at very low airflow and the calculated economizer position has increased to maintain a constant ventilation rate.

The following conditions must be true for the supply air tempering algorithm to operate:

- The SA Tempering is set to Enable
- The indoor fan is on
- The System Mode is Fan Only or IAQ Override
- The Outdoor Air Temperature < Minimum Cooling SAT
- Heat type is gas or electric and Number Of Heat Stages > 0

If the above are true, the VAV-RTU Open will monitor the SAT sensor value and operate the first stage of heat to temper the supply air as required in order to maintain the configured SA Tempering Setpoint. Heat operation is subject to anti-recycle timers to protect the equipment from short-cycling. There are fixed application specific minimum on and off times for each heating output (gas = 120 seconds on and 60 seconds off / electric = 15 seconds on and 10 seconds off).

Demand Controlled Ventilation (Standalone Mode)

The VAV-RTU Open provides the option to control the economizer's minimum ventilation position based on a Demand Controlled Ventilation (DCV) algorithm. The algorithm monitors the CO_2 sensor value and compares that value to the user defined setpoint. A PID control calculates the required minimum economizer position required to satisfy the ventilation requirements of the space. A user adjustable DCV Max Vent Damper Pos is provided to limit the maximum amount of outdoor air that can be brought into the unit due to the DCV algorithm.

The following conditions must be true for DCV operation:

- The DCV Control is set to Enable
- The unit has a valid IAQ sensor input
- The unit is in an occupied mode

If the above are true, the VAV-RTU Open will monitor the IAQ sensor value and the OAQ sensor value if the option is provided. It will compare those values to the IAQ setpoint and then calculate the required minimum economizer position as required. If that calculated value is greater than the configured DCV Max Vent Damper Pos, the value is clamped to that maximum limit. If the DCV damper position is less than the calculated economizer minimum position for ventilation, the economizer will maintain that calculated economizer minimum position.

Demand Limit (Standalone Mode)

The VAV-RTU Open may employ a demand limit strategy. Demand limiting in the VAV-RTU Open works by resetting the Supply Air Static Pressure Setpoint. The demand level at which static pressure reset begins is defined by the parameter SP Reset Demand Level which is selected by the user. The selected SP Reset Demand Level determines at which demand level the SP Reset becomes active. The amount of reset is determined by Maximum Reset.

Unoccupied Free Cooling (Standalone Mode)

The control can run a night time free cooling (NTFC) mode called Unocc Free Cooling. In this mode the damper is utilized to bring in outdoor air for free cooling during unoccupied periods. The following conditions must be true for unoccupied free cooling to operate:

- Unocc Free Cool Enable set to Enable
- The system is unoccupied
- The outside air temperature is below the Economizer High OAT Lockout Temp
- The outside air temperature is less than the space temperature or RAT
- Enthalpy (if enabled) is Low

When the VAV RTU Open is unoccupied and the RAT (space temperature if configured) rises at least 2Δ°F (1.1Δ°C) above the Occupied Cooling Setpoint, the supply fan starts. The economizer damper opens as necessary to maintain the Supply Air Setpoint and cool the space. The VAV RTU Open continues to operate in this mode until the RAT drops to 1Δ°F (.5Δ°C) below the Occupied Cooling Setpoint or the outside air conditions are no longer suitable for free cooling.

Unoccupied Fan Cycling (Standalone Mode)

Unoccupied Fan Cycling Enable - enables the indoor fan to run and permits RAT sampling during unoccupied modes. The VAV-RTU provides fan cycling during the unoccupied periods to determine if there is a valid demand for heating or cooling before initiating an unoccupied heating or cooling mode. This will allow the RAT to be used to sample the actual space temperature conditions more accurately during unoccupied periods when the fan is off and without have to remotely mount the RAT sensor inside the return air duct inside the building. If enabled, the feature will start the supply fan once every hour (default), allow it to operate for 5 minutes (default), and then use the measured RAT sensor value to determine the unit's required operating mode for the last 1 minute (default). The feature is disabled if a network RAT value is used, a valid space temperature sensor is installed and functional, or if Open Linkage is active.

The following conditions must be true for Unoccupied Fan Cycling to operate:

- Unoccupied Fan Cycling set to Enable
- The system is unoccupied
- No space temperature sensor or network RAT temperature is configured

Fire Shutdown (Standalone Mode)

Fire Shutdown may be configured on Binary Input 5. A typical application involves a smoke detector or fire shutdown contact, which, when active, immediately shuts down equipment operation.

Compressor Safety (Standalone Mode)

Compressor Safety may be configured on Binary Input 3. This feedback can be provided by a compressor.

Lock-Out (CLO) device or current switch when field installed. A Compressor Safety Alarm indicates that the equipment requires attention. Cooling, heating, and supply fan outputs are not interrupted. Normal operation resumes when the compressor safety circuit is de-energized.

Fan Status (Standalone Mode)

Fan Status may be configured on any unused binary input channel. A typical application would be an airflow switch, current sensing relay, or other device that provides a supply fan running verification. Enabling this function displays the supply fan's status on the equipment graphic. If the controller loses fan status during operation, heating and cooling are disabled, the economizer damper (if available) is closed, and an alarm for loss of status is indicated. If the fan status is on when the controller is commanding the fan off, the unit remains in the off state. An alarm is generated indicating that the fan is running when it should be off.

Filter Status (Standalone Mode)

Filter status may be configured on any unused binary input channel. A typical application is a differential pressure switch that senses the pressure drop across a filter bank. When the pressure across the filter bank exceeds the setpoint of the differential pressure switch, the Filter status is displayed as Dirty on the controller graphic. An alarm indicates a dirty filter.

TROUBLESHOOTING

General

The VAV-RTU Open controller acts as an intelligent imbedded thermostat to the rooftop unit, but can be monitored and controlled from i-Vu Open (Linkage) or a third party network. This causes the system as a whole to be troubleshot from three points of view. The three parts to the system are the rooftop unit, the Open controller, and the network connected. Determining which part needs to be troubleshot is the first step.

The Open controller can be used to troubleshoot the rooftop unit and/or itself with service test, communicating LED's, and built in alarms. Disconnecting the VAV-RTU Open from the network may also help troubleshooting the controller and rooftop unit. Third Party Network troubleshooting may also be required. For base unit troubleshooting, refer to specific base unit Service Maintenance manual.

There is an on-board battery that is used for RAM and clock back-up (see Fig. 2). It is a 3-volt lithium battery (CR2032). The average life is 7 years with a minimum of 10,000 hours of back-up. When the VAV-RTU Open board is powered up, the battery is not being used. If power is lost, the battery backs up the time clock.

REPLACING THE VAV-RTU OPEN BATTERY

To determine when to replace the battery, remove and measure the voltage. If the voltage is below 2.9 volts, replace the battery.

⚠ CAUTION

UNIT OPERATION HAZARD

Power must be ON to the VAV-RTU Open when replacing the battery or date, time, and trend data will be lost.

1. Remove the battery from the controller, making note of the battery's polarity.
2. Insert the new battery, matching the battery's polarity with the polarity indicated on the VAV-RTU Open.

Thermistor Troubleshooting

VAV-RTU Open uses thermistors to sense temperatures for control operation of the unit. Resistances at various temperatures are listed in Table 2. Thermistor pin connections are shown in Table 1 on page 6. Thermistors are used for supply air temperature (SAT), return air temperature (RAT) and outdoor air temperature (OAT).

To check accuracy, use a high quality digital volt-ohmmeter. Connect the meter to the thermistor leads to obtain a resistance value. Use Table 2 to convert that resistance to a temperature. The next step is to measure temperature at probe location with an accurate thermocouple-type temperature-measuring instrument. Temperature measured by thermocouple and temperature determined from thermistor voltage reading should be close, within 5°F if care was taken in applying thermocouple and taking readings. If a sensor must be corrected, use the VAV-RTU Open's calibration function to offset the temperature reading.

Table 2 — Thermistor Resistance vs Temperature Values for Space Temperature Sensor, Supply Air Temperature Sensor, and Outdoor Air Temperature Sensor

TEMP (C)	TEMP (F)	RESISTANCE (Ohms)
–40	–40	335,651
–35	–31	242,195
–30	–22	176,683
–25	–13	130,243
–20	–4	96,974
–15	5	72,895
–10	14	55,298
–5	23	42,315
0	32	32,651
5	41	25,395
10	50	19,903
15	59	15,714
20	68	12,494
25	77	10,000
30	86	8,056
35	95	6,530
40	104	5,325
45	113	4,367
50	122	3,601
55	131	2,985
60	140	2,487
65	149	2,082
70	158	1,752

Software Version

During start-up and throughout the life of the equipment, it may be necessary to obtain the VAV-RTU Open's software version. To do this a module status (Modstat) must be run on the controller. This can be done from Field Assistant or from Equipment or System Touch. An example of the beginning lines of a Modstat is shown in Fig. 20. The application software version shows the current running software of the board. In this case the vav_rtu_open_20180828 refers to VAV-RTU Open software version 20180828. The last 8 digits of the number refer to a date (YYYYMMDD). The first 4 digits are the year (2018) and the month and day (0828), so this version is August 28, 2018.

```
12/10/2019  12:12:53            CM: 1

Device Instance: 1610101

Downloaded by: AppLoader AppLoader 12/10/19 05:53 AI654321

Application Software Version: PRG:vav_rtu_open_20180828

Flash Archive Status: Valid on 12/10/19 07:03:07

1 PRGs initialized.  1 PRGs running.

Module status:
Firmware sections validated in flash memory
============================================
  Boot16-H_IAR     - v2.10:001   Apr 18 2013
  RTU-OPEH DRIVER  - v6.02:028   Jan  4 2017
```

Fig. 20 — Example Modstat

Communication LEDs

The LEDs indicate if the controller is speaking to the devices on the network. The LEDs should reflect communication traffic based on the baud rate set. The higher the baud rate the more solid the LEDs will appear. See Table 3.

Table 3 — LEDs

The LEDs on the RTU Open controller show the status of certain functions

Power	The VAV-RTU Open has power
Rx	The VAV-RTU Open is receiving data from the network segment
Tx	The VAV-RTU Open is transmitting data over the network segment
BO#	The binary output is active

The Run and Error LED indicate control module and network status

IF RUN LED SHOWS...	AND ERROR LED SHOWS...	STATUS IS...
2 flashes per second	Off	Normal
2 flashes per second	2 flashes, alternating with Run LED	Five minute auto-restart delay after system error
2 flashes per second	3 flashes, then off	Control module has just been formatted
2 flashes per second	4 flashes, then pause	Two or more devices on this network have the same MSTP network address
2 flashes per second	On	Exec halted after frequent system errors or control programs halted
5 flashes per second	On	Exec start-up aborted, boot is running
5 flashes per second	Off	Firmware transfer in progress, boot is running
7 flashes per second	7 flashes per second, alternating with Run LED	Ten second recovery period after brownout
14 flashes per second	14 flashes per second, alternating with Run LED	Brownout
On	On	Failure. Try the following solutions: - Turn the VAV-RTU Open off, then on - Format the VAV-RTU Open - Download memory to the VAV-RTU Open - Replace the VAV-RTU Open

Table 4 — VAV-RTU Open Alarms

POINT NAME	ACTION TAKEN BY CONTROL	RESET METHOD	PROBABLE CAUSE
Safety Chain	Immediate shutdown	Automatic	Over load Indoor fan or electric heater overheat
Fire Shutdown	Immediate shutdown	Automatic	Smoke detected by smoke detector or configuration incorrect
Gas Valve	Immediately operate fan at highest speed	Automatic	Gas valve stuck open after heating cycle, causing heat to continue to operate
Supply Fan	Immediately disable operations	Automatic	Tripped circuit breaker, broken belt, bad indoor fan motor, configuration incorrect, bad fan status switch
Supply Fan in Hand	Ramp down operations	Automatic	Bad fan status switch, configuration incorrect
Compressor Status	Alert generated	Automatic	Compressor would not start
Space Temp Sensor	Ramp down operations	Automatic	Bad sensor, bad wiring, failure to receive network or linkage space temp value, or sensor configured incorrectly
ZS Sensor	Alert generated	Automatic	Indicates a communication failure of a connected ZS sensor that previously had been actively communicating
ZS Configuration	Alert generated	Automatic	Indicates that at least one ZS sensor is configured in the sensor binder properties and is not actually communicating
Supply Air Temp Sensor	Ramp down operations	Automatic	Faulty, shorted, or open thermistor caused by wiring error or loose connection
Local OAT Sensor	May cause economizer and low ambient DX cooling lockout to be disabled	Automatic	Faulty, shorted, or open thermistor caused by wiring error or loose connection
Outdoor Air Temp Sensor	Economizer and low ambient DX cooling lockout disabled	Automatic	Failure to receive valid local or network value for outdoor air temperature
Space Relative Humidity Sensor	Dehumidification disabled	Automatic	Sensor reading is out of range. Bad sensor, bad wiring, failure to receive network or linkage RH value, or sensor configured incorrectly
Indoor Air Quality Sensor	No IAQ operation	Automatic	Sensor reading is out of range. Bad sensor, bad wiring, failure to receive network or linkage RH value, or sensor configured incorrectly
Outdoor Air Quality Sensor	Control uses default OAQ value of 400 ppm	Automatic	Sensor reading is out of range. Bad sensor, bad wiring, failure to receive network value, or sensor configured incorrectly
Economizer Operation	Alert generated	Automatic	Active whenever an economizer fault is detected as required by the California Title 24 Economizer FDD logic.Economizer fault conditions include: Failed to Fully Open, Failed to Open, Failed to Close, and Stuck Open
Space Temperature	Alert generated	Automatic	Space temperature value is less than the low limit value or greater than the high limit value

Table 4 — VAV-RTU Open Alarms (cont)

POINT NAME	ACTION TAKEN BY CONTROL	RESET METHOD	PROBABLE CAUSE
Supply Air Temperature	Alert generated	Automatic	SAT is greater than the high limit value or less than the low limit value for more than 5 minutes
Switch Configuration	Disable only wrong switch functions	Configure correctly	More than one discrete input is configured to provide the same function
Analog Input Configuration	Disable 4 selectable analog inputs	Configure correctly	More than one analog input is configured to provide the same function
Space Relative Humidity	Alert generated	Automatic	Indoor RH is greater than the high limit value or less than the low limit value for more then 15 minutes
Indoor Air Quality	Alert generated	Automatic	CO_2 ppm reading is above the configuration for 1 minute
Supply Fan Runtime	Alert generated	Zero the timer	Supply fan run time exceeded user defined limit
Compressor 1 Runtime	Alert generated	Zero the timer	Compressor #1 run time limit is exceeded
Compressor 2 Runtime	Alert generated	Zero the timer	Compressor #2 run time limit is exceeded
Heat 1 Runtime	Alert generated	Zero the timer	Heat Stage 1 run time limit is exceeded
Heat 2 Runtime	Alert generated	Zero the timer	Heat Stage 2 run time limit is exceeded
Filter	Alert generated	Automatic / reset timer	Dirty filter, supply fan run time exceeded, filter switch configuration wrong.
Airside Linkage Alarm	Alert generated	Automatic	Airside linkage communication from VVT® or VAV master terminal has stopped or failed
Return Air Temperature	Alert generated	Automatic	RAT is less than the low limit value or greater than the high limit value

Alarms

Alarms are provided to indicate a possible problem with the controller or unit. Alarms can be checked through a network and/or the local access device. All alarms are listed in Table 4 with name, object name, action taken by control, reset method, and possible cause. Some alarms can occur based on specific configurations.

SAFETY CHAIN ALARM

This alarm occurs immediately if a field installed, normally closed, safety contact opens and interrupts 24 vac signal input #4 (J1-9). The Unit Status will be Shutdown and the System Mode will be Disable. All unit operations stop immediately and will not restart until the alarm automatically clears. There are no configurations for this alarm; it is all based on field installed wiring. This alarm will not occur if Fire Shutdown Alarm is active. Normal operation resumes when the safety chain circuit is complete.

FIRE/SMOKE SHUTDOWN ALARM

This alarm occurs immediately when the smoke detector senses smoke. The Unit Status will be Shutdown and the System Mode will be Disable. All unit operations stop immediately and will not restart until the alarm automatically clears. If there is not a smoke detector installed or the smoke detector did not trip, check input configurations.

NOTE: The default function for input 5 is a normally open Fire Shutdown input.

GAS VALVE ALARM

This alarm occurs 60 second after gas heat has been de-energized but the Integrated Gas Control (IGC) board is still indicating a need for fan operation. Upon alarm detection, the fan will start immediately and run at its highest speed.

NOTE: The default function for input 9 is a normally open IGC input for LC WeatherExpert units.

SUPPLY FAN FAILURE

This alarm occurs when the indoor fan is being command on and the fan status switch feedback is showing the fan off. This will end current operating mode and disable unit operation. This alarm requires a fan status switch to be configured on one of the inputs.

SUPPLY FAN IN HAND

This alarm occurs when the indoor fan is being commanded off and the fan status switch feedback is showing the fan is on. This will prevent any operating mode and disable unit operation. This alarm requires a fan status switch to be configured on one of the inputs.

COMPRESSOR STATUS

This alarm indicates the base unit's compressor safety circuit is energized. Cooling, heating, and supply fan outputs are not interrupted. Normal operation resumes when the compressor safety circuit is de-energized. This alarm requires field use of this described compressor safety circuit.

SPACE TEMP SENSOR

The SPT value from the Network or Airside Linkage is no longer being received. When this occurs the Unit Status will be Shutdown and the System Mode will be Run. Sensor, sensor connections, wiring, board connection, and configurations should be checked for faults or errors. Alarm will reset automatically when cause is fixed.

ZS SENSOR

This alarm occurs if the ZS sensor wired to the VAV-RTU Open stops communicating with the controller.

ZS Sensor

This alarm indicates a communication failure of a connected ZS sensor that previously had been actively communicating. The alarm is reset when normal ZS sensor communications resume, if power is cycled to the controller, or if the Shutdown point is set to Active.

ZS Configuration

This alarm indicates that at least one ZS sensor is configured in the Sensor Binder properties and is not actually communicating. The alarm is reset when the configured ZS sensor is communicating or the configuration is changed to reflect the sensor is no longer connected to the Rnet.

SUPPLY AIR TEMP SENSOR

This alarm occurs immediately when the supply air temperature sensor wired to the VAV-RTU Open is disconnected or shorted. When this occurs the Unit Status will be Shutdown and the System Mode will be Run. Sensor, sensor connections, wiring, board connection, and configurations should be checked for faults or errors. Alarm will reset automatically when cause is fixed.

LOCAL OAT SENSOR

This alarm occurs when the outdoor air sensor indicates a short or open circuit or the Network OAT value is no longer being received. Economizer cooling and optimal start functions are disabled. Normal operation resumes when the controller detects a valid sensor.

OUTDOOR AIR TEMP SENSOR

This alarm indicates that a valid OAT sensor value is no longer available to the controller after having been available previously.

Economizer Operation

This alarm is active whenever an economizer fault is detected as required by California Title 24 Economizer FDD logic. Once detected, this alarm will stay active until the Shutdown input is set to Active or the fan is stopped.

Economizer

This point indicates the specific fault detected and annunciated by the Economizer Operation alarm above. Detected fault conditions include: Failed to Fully Open, Failed to Open, Failed to Close, and Stuck Open.

SPACE RELATIVE HUMIDITY SENSOR

This alarm indicates the mA input at the associated channel falls below 35 mA or rises above 21 mA, or the Network value for space RH is no longer being received. Cooling, heating, and supply fan operation continues, however, the controller's Humidi-MiZer binary output is disabled until the fault condition is corrected.

IAQ SENSOR

This alarm indicates the mA input at the associated channel falls below 3.5 mA or rises above 21 mA, or the Network value for space RH is no longer being received. Cooling, heating, and supply fan operation continues. However, the controller's IAQ control function is disabled until the fault condition is corrected.

OAQ SENSOR

This alarm indicates the mA input at the associated channel falls below 3.5 mA or rises above 21 mA, or the Network value for space RH is no longer being received. Cooling, heating, and supply fan operation continues. However, the controller's IAQ control function uses 400ppm as the fixed outdoor air CO_2 level until the fault condition is corrected.

SPACE TEMPERATURE

When Occupied, a Space Temperature alarm is generated if the space temperature falls below the lower limit or rises above the upper limit.

When Unoccupied, an unoccupied space temperature alarm is generated when the space temperature falls below the alarm configuration Unoccupied Low SPT Alarm Limit or when the space temperature rises above the alarm configuration Unoccupied High SPT Alarm Limit. The following values are related to the Space Temperature alarm:

Alarming Temperature

This variable displays the value of the space temperature that caused the alarm and is only visible when the space temperature is in an alarm state.

Alarm Limit Exceeded

This variable displays the value of the alarm setpoint that was exceeded by the alarming space temperature and is only visible when the space temperature is in an alarm state.

SUPPLY AIR TEMPERATURE

This alarm indicates the supply air temperature fell below the alarm configuration Low SAT Alarm Limit or exceeded the alarm configuration High SAT Alarm Limit for 5 minutes. This alarm is inhibited until the RTU has been running for 30 minutes to allow for system stabilization after startup.

RETURN AIR TEMPERATURE

This alarm indicates the return air temperature fell below the alarm configuration Low RAT Alarm Limit or exceeded the alarm configuration High RAT Alarm Limit for 5 minutes. This alarm is inhibited until the RTU has been running for 30 minutes to allow for system stabilization after startup.

SWITCH CONFIGURATION

This occurs if more than one binary input (inputs 3, 5, and 8) is configured for the same function. When this happens the two inputs (or more) configured wrong will be disabled as an inputs. This alarm will automatically be cleared when configuration is corrected.

An example of this would be: Input 3 = Compressor Safety, input 5 = Fan Status, and input 8 = Fan Status; the alarm would be active, unit would run, compressor safety, and Fan Status (inputs 5 and 8) will be interpreted as "No Function."

ANALOG INPUT CONFIGURATION

This occurs if more than one analog input (inputs 1 and 2) is configured for the same sensor. When this happens the two inputs will be disabled as inputs. This alarm will automatically be cleared when configuration is corrected. An example of this would be: Input 1 = IAQ Sensor, input 2 = IAQ Sensor; the alarm would be active, unit would run, but the IAQ Sensor (inputs 1 and 2) will be interpreted as "No Function."

SPACE RELATIVE HUMIDITY

This alarm indicates the space humidity fell below the alarm configuration Low Space Humidity Alarm Limit or exceeded the alarm configuration High Space Humidity Alarm Limit for 10 minutes. This alarm is inhibited until the RTU runs for 15 minutes to allow for system stabilization after startup.

INDOOR AIR QUALITY

This alarm indicates the space CO_2 level exceeds the alarm configuration Occupied High CO_2 Alarm Limit for 1-minute. This alarm will be inhibited until the RTU has been running for 2-minutes to allow for system stabilization after startup.

SUPPLY FAN RUNTIME

This alarm indicates the accumulated runtime exceeds the unit configuration Supply Fan Service Alarm Timer value (when not set to 0). This alarm is most commonly used to indicate an equipment maintenance interval is due. The supply fan runtime accumulator may be reset by setting the maintenance point Reset Supply Fan Runtime Alarm to Clear, and then back to Run – acknowledging each selection by clicking the OK button when it appears. Setting unit configuration Supply Fan Service Timer value to 0 disables the supply fan runtime alarm function.

COMPRESSOR 1 RUNTIME

This alarm indicates the accumulated runtime exceeds the unit configuration Compressor 1 Service Alarm Timer value (when not set to 0). This alarm is most commonly used to indicate an equipment maintenance interval is due. The Compressor 1 Runtime accumulator may be reset by setting the maintenance point Reset Comp 1 Runtime Alarm to Clear, and then back to Run – acknowledging each selection by clicking the OK button when it appears. Setting unit configuration Compressor 1 Service Timer value to 0 disables the Compressor 1 Runtime alarm function.

COMPRESSOR 2 RUNTIME

This alarm indicates the accumulated runtime exceeds the unit configuration Compressor 2 Service Alarm Timer value (when not set to 0). This alarm is most commonly used to indicate an equipment maintenance interval is due. The Compressor 2 runtime accumulator may be reset by setting the maintenance point Reset Comp 2 Runtime Alarm to Clear, and then back to Run – acknowledging each selection by clicking the OK button when it appears. Setting unit configuration Compressor 2 Service Timer value to 0 disables the Compressor 2 runtime alarm function. Note that this function is unavailable if the service configuration Compressor Stages value is not set to Two Stages.

HEAT 1 RUNTIME

The VAV-RTU Open generates this alarm when the accumulated runtime exceeds the Unit Configuration > Heat 1 Service Alarm Timer value (when not set to 0). This alarm is most commonly used to indicate an equipment maintenance interval is due. The Heat 1 Runtime accumulator may be reset by setting the Maintenance > Reset Heat 1 Runtime Alarm to Clear, and then back to Run – acknowledging each selection by clicking the OK button when it appears. Setting Unit Configuration > Heat 1 Service Timer value to 0 disables the Heat 1 Runtime alarm function.

HEAT 2 RUNTIME

The VAV-RTU Open generates this alarm when the accumulated runtime exceeds the Unit Configuration > Heat 2 Service Alarm Timer value (when not set to 0). This alarm is most commonly used to indicate an equipment maintenance interval is due. The Heat 2 Runtime accumulator may be reset by setting the Maintenance > Reset Heat 2 Runtime Alarm to Clear, and then back to Run – acknowledging each selection by clicking the OK button when it appears. Setting Unit Configuration > Heat 2 Service Timer value to 0 disables the Heat 2 Runtime alarm function. Note that this function is unavailable if the Service Configuration > Heat Stages value is not set to Two Stages.

FILTER

This alarm indicates the accumulated runtime exceeds the unit configuration Filter Service Alarm Timer value (when not set to 0). This alarm is most commonly used to indicate a filter replacement is due. Reset the filter service runtime accumulator by setting the maintenance point Reset Filter Runtime Alarm to On, back to Off, and clicking the OK button after each setting. Setting unit configuration Filter Service Alarm Timer value to 0 disables the filter service alarm function.

AIRSIDE LINKAGE ALARM

This alarm indicates that VAV-RTU Open was connected to a zoned system using Airside Linkage and it lost communications with its linkage master or it is receiving data from multiple masters.

Performance

CURRENT PERFORMANCE DATA

The VAV-RTU Open collects performance data during operation. The data can be used to monitor the operation of the unit over time.

EQUIPMENT RUNTIME

The RTU monitors the supply fan and records the amount of time the unit has been operating. This value will continue to accumulate runtime until Performance Data has been changed to Reset or will also automatically reset every 24 hours at midnight if Save Performance Data Daily is set to Enable.

ECONOMIZER UTILIZATION

The amount of time the equipment has operated in the economizer mode as a percentage of the equipment runtime above. This value will continue to accumulate runtime until Performance Data has been changed to Reset or will automatically reset every 24 hours at midnight if Save Performance Data Daily is set to Enable.

DCV UTILIZATION

The amount of time the equipment has provided Demand Controlled Ventilation as a percentage of the equipment runtime above. This value will continue to accumulate runtime until Performance Data has been changed to Reset or will automatically reset every 24 hours at midnight if Save Performance Data Daily is set to Enable.

UNOCC FREE COOL UTILIZATION

The amount of time the equipment has provided Free Cooling while unoccupied as a percentage of the equipment runtime above. This value will continue to accumulate runtime until Performance Data has been changed to Reset or will automatically reset every 24 hours at midnight if Save Performance Data Daily is set to Enable.

PART LOAD COOLING UTILIZATION

The amount of time the equipment has operated in the cooling mode but at less than 100% full cooling capacity as a percentage of the equipment runtime above. This value will continue to accumulate runtime until Performance Data has been changed to Reset or will automatically reset every 24 hours at midnight if Save Performance Data Daily is set to Enable.

FULL LOAD COOLING UTILIZATION

The amount of time the equipment has operated in the cooling mode at 100% full cooling capacity as a percentage of the equipment runtime above. This value will continue to accumulate runtime until Performance Data has been changed to Reset or will automatically reset every 24 hours at midnight if Save Performance Data Daily is set to Enable.

HEATING UTILIZATION

The amount of time the equipment has operated in the heating mode as a percentage of the equipment runtime above. This value will continue to accumulate runtime until Performance Data has been changed to Reset or will automatically reset every 24 hours at midnight if Save Performance Data Daily is set to Enable.

RECORDED HIGH OAT

The highest value of OAT noted since the last reset occurred. This value will continue to update until Performance Data has been changed to Reset or will automatically reset every 24 hours at midnight if Save Performance Data Daily is set to Enable.

RECORDED LOW OAT

The lowest value of OAT noted since the last reset occurred. This value will continue to update until Performance Data has been changed to Reset or will automatically reset every 24 hours at midnight if Save Performance Data Daily is set to Enable.

PERFORMANCE DATA

Indicates the mode that is currently in effect. This point is used to reset all of the above performance data manually at any time.

Range = Collect/Reset
Default = Collect

HISTORICAL PERFORMANCE DATA

The VAV-RTU Open collects historical performance every time the performance data above has been reset.

SAVE PERFORMANCE DATA DAILY

If set to Enable, the control will automatically transfer the Current Performance Data directly to the Historical Performance Data values for each entry once every 24 hours at midnight. All Historical data will only be available for viewing for the next 24 hours. Also, all current performance data will be reset after the data has been transferred.

Range = Disable/Enable
Default = Enable

EQUIPMENT RUNTIME

The value of the equipment runtime when the current performance data was last reset.

ECONOMIZER UTILIZATION

The value of the Economizer Utilization when the current perfo mance data was last reset.

DCV UTILIZATION

The value of the DCV Utilization when the current performance data was last reset.

UNOCC FREE COOL UTILIZATION

The value of the Unocc Free Cool Utilization when the current performance data was last reset.

PART LOAD COOLING UTILIZATION

The value of the Part Load Cooling Utilization when the current performance data was last reset.

FULL LOAD COOLING UTILIZATION

The value of the Full Load Cooling Utilization when the current performance data was last reset.

HEATING UTILIZATION

The value of the Heating Utilization when the current performance data was last reset.

PREVIOUS HIGH OAT

The value of the Recorded High OAT when the current performance data was last reset.

PREVIOUS LOW OAT

The value of the Recorded Low OAT when the current performance data was last reset.

Third Party Networking

Third party communication and networking troubleshooting should be done by or with assistance from the front end third party technician. A Module Status Report (Modstat) can be run from Field Assistance or Equipment Touch (see Table 5 to perform). This lists information about the board status and networking state. For basic protocol troubleshooting see Table 6.

Table 5 — Manufacture Date

When troubleshooting, you may need to know a control module's manufacture date.

OBTAIN THE MANUFACTURE DATE FROM A...	NOTES
Module status report (modstat)	To obtain a modstat with Field Assistant: 1. Press Function (FN) key and hold. 2. Then press period (.) 3. Release both buttons. The report shows the date under Main board hardware.
Sticker on the control board "Serial No: OR2YMCxxxP" (Bar Coded and Typed Number)	The serial numbers are unique and contain embedded information, for example OR2420042P: "VRT" — These first three digits are unique to VAV-RTU Open and are used as an identifier. "YM" — These two digits identify the last digit of the year and month (in hex, A=10/Oct) of manufacture. "42" would represent a date of manufacture of "Feb 2014". "C" — Thousands counter 0- 9 and A- Z; A = 10; Z = 35 "xxx" — These three digits represent the sequential number of units produced for a given product for the mentioned manufacturing time period. "P" — This final digit represents the decade and toggles between "N" and "M" every ten years.

Table 6 — Basic Protocol Troubleshooting

PROBLEM	POSSIBLE CAUSE	CORRECTIVE ACTION
No communication with third party vendor	Incorrect settings on SW1, SW2 and SW3	Verify and correct switch settings. Cycle power to VAV-RTU Open after changing switch settings.
	RS485 Port has no voltage output (check with VAV-RTU Open disconnected from RS485 communication bus): • BACnet @ 9600/19.2K - 01 to 045vdc • BACnet @ 38.4K - 06 to 09vdc • BACnet @ 76.8K - 1vdc	Verify VAV-RTU Open has correct power supply.
		Possible bad driver on board.
		Check RS485 bus for external voltage before reconnecting to the bus.
	Verify devices are daisy chained and repeaters and bias terminators are correctly installed.	Check third party vendor RS485 communication wiring guidelines and troubleshooting procedures.

APPENDIX A — USER INTERFACE MENUS

Field Assistant Navigation

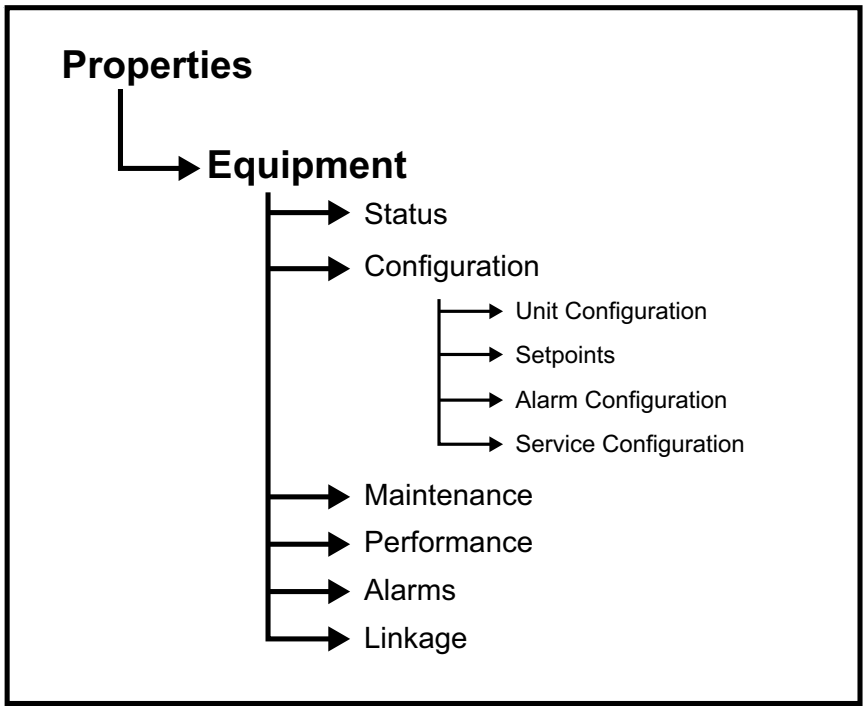

Fig. A — Field Assistant Navigation Chart

Table A — User Interface Menus

EQUIPMENT TOUCH OR SYSTEM TOUCH MENU	ACCESS LEVEL 3 = ADMIN 2 = USER 1 = NONE	POINT NAME	RANGE	DEFAULT	FIELD ASSISTANT MENU
			STATUS		
Properties Pages>Status	3, 2, 1	Equipment Status	1 = Disabled 2 = Test 3 = Run		**Properties>Control Program> Status**
	3, 2, 1	System Mode	1 = Off 2 = Fan Only 3 = Economizer Cooling 4 = Cooling 5 = Heating 6 = Dehumidification 7 = Test 8 = Shutdown 9 = Unocc Free Cooling 10 = Fire Shutdown 11 = IAQ Override 12 = Pre-occ Purge 13 = IGC Override		
	3, 2, 1	Supply Fan Status[1]	Off / Running		
	3, 2, 1	Static Pressure	0-2.5"wc		
	3, 2, 1	Supply Fan VFD	0-100%		
	3, 2, 1	Supply Air Temperature - Prime Variable	–56 to 245°F		
	3, 2, 1	Return Air Temperature	–56 to 245°F		
	3, 2, 1	Space Temperature[2]	–56 to 245°F		
	3, 2, 1	Controlling Temperature	–56 to 245°F		
	3, 2, 1	Outdoor Air Temperature	–56 to 245°F		
	3, 2, 1	Enthalpy Status	High/Low		
	3, 2, 1	Space Relative Humidity[3]	0-100%		
	3, 2, 1	Indoor Air Quality CO_2[4]	0-5000 ppm		
	3, 2, 1	Outdoor Air Quality CO_2[5]	0-5000 ppm		
	3, 2, 1	Economizer Output	0-100% Open		
	3, 2, 1	Shutdown	Inactive/Active	Inactive	

APPENDIX A — USER INTERFACE MENUS (cont)

Table A — User Interface Menus (cont)

EQUIPMENT TOUCH OR SYSTEM TOUCH MENU	ACCESS LEVEL 3 = ADMIN 2 = USER 1 = NONE	POINT NAME	RANGE	DEFAULT	FIELD ASSISTANT MENU
UNIT CONFIGURATION					
Property Pages> Configuration> Unit Configuration	3	Fan Mode	1 = Auto 2 = Continuous 3 = Always On	Continuous	**Properties> Control Program> Configuration>Unit Configuration**
	3	Power Fail Restart Delay	0-30 sec	5	
	3	Fan Off Delay	5-120 sec	90	
	3	Occupied Heating	Disable/Enable	Disable	
	3	Supply Air Temp Reset	Disable/Enable	Disable	
	3	Reset Ratio	0-10	3	
	3	Reset Maximum Limit	0 - 25°F	10	
		SA Reset Humidity Override	Disable/Enable	Disable	
	3	Humidity Override Disable/Enable	Disable		
	3	Minimum Cooling SAT[6]	45 - 75°F	45	
	3	Maximum Heating SAT	90 - 150°F	120	
	3	Vent Dmpr Pos / DCV Min Pos	0-100% Open	20	
	3	Low Fan Econ Min Pos	0-100% Open	33	
		Economizer Purge Min Pos	0-100% Open	40	
	3	DCV Max Vent Damper Pos	0-75% Open	50	
	3	Static Pressure Reset Enable	Disabled/Enabled	Enabled	
	3	Maximum Damper Position	0-100 % Open	80	
	3	Minimum Damper Position	0-100 % Open	50	
	3	Maximum Reset	0.00 to 2.00 "wc	0.25	
	3	SP Reset Demand Level	1 = Not Active 2 = Cool Dmd Lvl 1 3 = Cool Dmd Lvl 2 4 = Cool Dmd Lvl 3	Not Active	
	3	Supply Fan Service Alarm Timer	0-9999 hr	600	
	3	Comp 1 Service Alarm Timer	0-9999 hr	0	
	3	Comp 2 Service Alarm Timer	0-9999 hr	0	
	3	Filter Service Alarm Timer	0-9999 hr	600	
	3	Heat 1 Service Alarm Timer	0-9999 hr	0	
	3	Heat 2 Service Alarm Timer	0-9999 hr	0	
	3	Cooling Lockout Temperature	-65 - 80°F	45	
	3	Economizer High OAT Lockout Temp	55 - 80°F	75	
	3	Heating Lockout Temperature	35 - 150°F	65	
	3	Unocc Free Cool	Disable/Enable	Disable	
	3	Min Setpoint Separation	2-10Δ°F	5Δ	

APPENDIX A — USER INTERFACE MENUS (cont)

Table A — User Interface Menus (cont)

EQUIPMENT TOUCH OR SYSTEM TOUCH MENU	ACCESS LEVEL 3 = ADMIN 2 = USER 1 = NONE	POINT NAME	RANGE	DEFAULT	FIELD ASSISTANT MENU
INPUT CONFIGURATION					
Property Pages> Configuration> Unit Configuration> Input Configuration	3	Input 2 Function	1 = No Sensor 2 = IAQ Sensor 3 = Space RH Sensor 4 = OAQ Sensor	No Sensor	**Properties> Control Program> Configuration> Unit Configuration> Input Configuration**
	3	Input 3 Function	1 = No Function 2 = Compressor Safety 3 = Fan Status 4 = Filter Status 5 = Remote Occupancy[7] 6 = Door Contact[7]	No Function	
	3	Input 3 Switch Configuration[8]	1 = NO (Normally Open) 2 = NC (Normally Closed)	NO	
	3	Input 5 Function	1 = No Function 2 = Fire Shutdown 3 = Fan Status 4 = Filter Status 5 = Remote Occupancy[7] 6 = Door Contact7	Fire Shutdown	
	3	Input 5 Switch Configuration	1 = NO (Normally Open) 2 = NC (Normally Closed)	NO	
	3	Input 8 Function[8]	1 = No Function 2 = Enthalpy Switch 3 = Fan Status 4 = Filter Status 5 = Remote Occupancy[7] 6 = Door Contact[7]	No Function	
	3	Input 8 Switch Configuration[8]	1 = NO (Normally Open) 2 = NC (Normally Closed)	NO	
	3	Input 9 Function[9]	1 = No Function 2 = Humidistat[7] 3 = Fan Status 4 = Filter Status 5 = Remote Occupancy[7] 6 = Door Contact[7] 7 = IGC Override	No Function	
	3	Input 9 Switch Configuration[8, 9]	NO (Normally Open) NC (Normally Closed)	NO	
	3	ZS Sensor Binder Alarm	ALARM/Normal		
	3	ZS Space Temp	°F		
	3	ZS Space Humidity	%rh		
	3	ZS Space CO2	ppm		
SENSOR CALIBRATION					
Property Pages> Configuration> Unit Configuration> Sensor Calibration	3	Space Temp	°F		**Properties> Control Program> Configuration> Unit Configuration> Sensor Calibration**
	3	Space RH[3]	%rh		
	3	Space AQ[4]	ppm		
	3	Outdoor AQ[5]	ppm		
	3	Static Pressure	0.00 - 2.50 "wc		
	3	Static Pressure Calibration	-0.2 - 0.20 "wc	0	
	3	Supply Air Temperature	-56 - 245°F		
	3	Supply Air Temp Calibration	-9.9 - 10Δ°F	0Δ	
	3	Return Air Temperature	-56 - 245°F		
	3	Return Air Temp Calibration	-9.9 - 10Δ°F	0Δ	
	3	Outdoor Air Temperature	-56 - 245°F		
	3	Outdoor Air Temp Calibration	-9.9 - 10Δ°F	0Δ	

APPENDIX A — USER INTERFACE MENUS (cont)

Table A — User Interface Menus (cont)

EQUIPMENT TOUCH OR SYSTEM TOUCH MENU	ACCESS LEVEL 3 = ADMIN 2 = USER 1 = NONE	POINT NAME	RANGE	DEFAULT	FIELD ASSISTANT MENU
SETPOINTS					
Property Pages> Configuration> Setpoints	3	Supply Air Setpoint	45 - 75°F	53	**Properties> Control Program> Configuration> Setpoints**
	3	Static Pressure Setpoint	0.25 - 2.25 "wc	0.5	
	3	SA Tempering Setpoint[11]	40 - 75°F	48	
	3	Optimal Start Type	Temp Compensated		
		Occ Relative Humidity Setpoint	0%RH to Unoccupied RH Control Setpoint	60	
		DCV Max Ctrl Setpoint	0 to 9999 ppm	1100	
	3	Power Exhaust Setpoint	20 to 90% Open	50	
HIGH STATIC PRESSURE ALARM					
Property Pages> Configuration> Alarm Configuration	3	SP High Limit Trip Setpoint	0 to 2.50 "wc	1.50	**Properties> Control Program> Configuration> Alarm Configuration>**
SUPPLY AIR TEMPERATURE ALARM					
Property Pages> Configuration> Alarm Configuration	3	Low SAT Alarm Limit	15-90°F	38	**Properties> Control Program> Configuration> Alarm Configuration**
	3	High SAT Alarm Limit	90-175°F	160	
RETURN AIR TEMPERATURE ALARM					
Property Pages> Configuration> Alarm Configuration	3	Low RAT Alarm Limit	15-90°F	55	**Properties> Control Program> Configuration> Alarm Configuration**
	3	High RAT Alarm Limit	90-175°F	120	
SPACE HUMIDITY ALARM					
Property Pages> Configuration> Alarm Configuration	3	Occupied High RH Alarm Limit	0-100%RH	70	**Properties> Control Program> Configuration> Alarm Configuration>**
	3	Alarm Delay (min/%RH)	0-30 min	5	
	3	Unoccupied High RH Alarm Limit	0-100%rh	100	
	3	Low RH Alarm Limit	0-100%rh	0	
IAQ / VENTILATION ALARM					
Property Pages> Configuration> Alarm Configuration	3	Occ High CO_2 Alarm Limit	0-9999 ppm	1200	**Properties> Control Program> Configuration> Alarm Configuration>**
SERVICE CONFIGURATION					
Property Pages> Configuration> Service Configuration	3	Compressor Stages[12]	N/A	Three Stages	**Properties> Control Program> Configuration> Service Configuration**
	3	Economizer Exists[13]	N/A	Yes (FIOP)	
	3	VFD Input	0-10Vdc/2-10Vdc	2-10Vdc	
	3	Max VFD Output	15-100%	100	
	3	Min VFD Output	15-100%	25	
	3	Heat Type	0 = Electric (50 series units) 1 = Gas (48 series units)	Gas	
	3	Number of Heat Stages	1 = 1 stage (All 50LC*B07-09 units, 50LC*B12-14 lo heat) 2 = 2 stages (All 48LC*B07-26 units, 50LC*B12 hi heat, 50LC*B14 med/hi heat, All 50LC*B17-26 units)	2	
	3	SA Tempering	Disabled/Enabled	Disable	
	3	Continuous Occupied Exhaust	No/Yes	No	
	3	DCV Control	Disable/Enable	Disable	

APPENDIX A — USER INTERFACE MENUS (cont)

Table A — User Interface Menus (cont)

EQUIPMENT TOUCH OR SYSTEM TOUCH MENU	ACCESS LEVEL 3 = ADMIN 2 = USER 1 = NONE	POINT NAME	RANGE	DEFAULT	FIELD ASSISTANT MENU
SERVICE CONFIGURATION (cont)					
Property Pages> Configuration> Service Configuration *(cont)*	3	Indoor CO_2 Sensor Value @ Min mA[14]	0-9999ppm	0	**Properties> Control Program> Configuration> Service Configuration *(cont)***
	3	Indoor CO_2 Sensor Value @ Max mA[14]	0-9999ppm	2000	
	3	Outdoor CO_2 Sensor Value @ Min mA[15]	0-9999ppm	0	
	3	Outdoor CO_2 Sensor Value @ Max mA[15]	0-9999ppm	2000	
	3	Static Pressure Sensor Value @ Min mA		0	
	3	Static Pressure Sensor Value @ Max mA		2.5	
	3	System Space RH	N/A	-999.0	
	3	System Space AQ	N/A	-999.0	
	3	System Cool Demand Level	0-3	0	
	3	System Heat Demand Level	0-3	0	
	3	System Outdoor Air Temperature	N/A	-999.0	
	3	System Outdoor AQ	N/A	-999.0	
	3	System Fire / Smoke	Off/On	Off	
	3	Network Heat Interlock	Off/On	Off	
SERVICE TEST					
Property Pages> Configuration> Service Configuration	3	Service Test Mode	Disable/Enable		**Properties> Control Program> Configuration> Service Configuration> Service Test**
	3	Service Test	Disable/Enable	Disable	
	3	Fan Test	Disable/Enable	Disable	
	3	Compressor 1 Test	Disable/Enable	Disable	
	3	Compressor 2 Test	Disable/Enable	Disable	
	3	Heat 1 Test	Disable/Enable	Disable	
	3	Heat 2 Test	Disable/Enable	Disable	
	3	Heat Interlock Relay Test	Disable/Enable	Disable	
	3	Power Exhaust Test	Disable/Enable	Disable	
	3	Economizer Test	0-100 %Open	0	
	3	VFD Speed Test	0-100%	0	
MAINTENANCE (UNIT)					
Property Pages> Maintenance> Unit	3	Occupancy Status	Occupied/Unoccupied		**Properties> Control Program> Maintenance> Unit**
	3	Current Static Pressure Setpoint	"wc		
	3	Calculated Static Pressure Reset	"wc		
	3	HPCO Status	Normal/Shutdown		
	3	Reset Tripped HPCO[16]	Run / Reset		
	3	Static Pressure Proof	Not Active Valid SP Proof Wait SP Proof SP Proof Timeout		
	3	Supply Air Setpoint	°F		
	3	Supply Air Temp Clg. Setpoint	°F		
	3	SAT Reset Source	No Reset SAT Rst by SPT SAT Rst ovr RH		
	3	SAT Reset Value	°F		
	3	RH Reset Override	°F		
	3	Heating Control Setpoint	°F		
	3	Calculated Max Heat SAT Limit	°F		

APPENDIX A — USER INTERFACE MENUS (cont)

Table A — User Interface Menus (cont)

EQUIPMENT TOUCH OR SYSTEM TOUCH MENU	ACCESS LEVEL 3 = ADMIN 2 = USER 1 = NONE	POINT NAME	RANGE	DEFAULT	FIELD ASSISTANT MENU
MAINTENANCE (UNIT) (cont)					
Property Pages> Maintenance> Unit *(cont)*	3	Reset Calculated Max Heat Limit	Off/On	Off	**Properties> Control Program> Maintenance> Unit *(cont)***
	3	Pre-Occ Purge	Inactive/Active		
		RAT Source	Sensor Failure Local RAT Net/Sys RAT Locked Value		
	3	Space Temp Source	1 = N/A 2 = Local 3 = Network 4 = Linkage 5 = Locked Value		
	3	Ctrl Temp Source	Sensor Failure Space Temp Return Air Linkage Zone Locked value		
	3	Occupancy Source	Override TLO BACnet Schedule BAS On / Off Remote Occ Input Linkage		
	3	Effective Heat Setpoint	°F		
	3	Effective Clg Setpoint	°F		
	3	Relative Humidity Source	1 = N/A 2 = Local 3 = Network 4 = Linkage 5 = Locked Value 6 = Linkage & Local 7 = ZS Sensor 8 = Linkage & ZS Sensor		
	3	IAQ Source	1 = N/A 2 = Local 3 = Network 4 = Linkage 5 = Locked Value 6 = Linkage & Local 7 = ZS Sensor 8 = Linkage & ZS Sensor		
	3	Outdoor Air Temperature Source	1 = N/A 2 = Local 3 = Network 4 = Linkage 5 = Locked Value 6 = Linkage & Local 7 = ZS Sensor 8 = Linkage & ZS Sensor		
	3	OAQ Source	1 = N/A 2 = Local 3 = Network 4 = Linkage 5 = Locked Value 6 = Linkage & Local 7 = ZS Sensor 8 = Linkage & ZS Sensor		
	3	System Cooling Demand Level	0 -3		
	3	System Heating Demand Level	0 - 3		
	3	System Status	1 = OA Econ unsuitable 2 = Free Cooling Avail 3 = Economizer Enabled 4 = Compressor Enabled 5 = Heating Enabled 6 = MA Low Limit Active		
	3	Safety Chain Feedback	Off/Run Enabled		
	3	Fire Shutdown Status	Run Enabled/Shutdown		
	3	Compressor Safety Status	Normal/Trouble		

APPENDIX A — USER INTERFACE MENUS (cont)

Table A — User Interface Menus (cont)

EQUIPMENT TOUCH OR SYSTEM TOUCH MENU	ACCESS LEVEL 3 = ADMIN 2 = USER 1 = NONE	POINT NAME	RANGE	DEFAULT	FIELD ASSISTANT MENU
MAINTENANCE (UNIT) (cont)					
Property Pages> Maintenance> Unit *(cont)*	3	Calculated Min Econ Pos	0-100%		**Properties> Control Program> Maintenance> Unit *(cont)***
	3	Calculated Min PE Setpoint	0-100%		
	3	Active Cooling Stages	0-2		
	3	Active Heat Stages	0-2		
	3	Enthalpy (BACnet)	High/Low		
	N/A	Humidistat Input Status	High/Low		
	3	Filter Status	Clean/Dirty		
	3	Door Contact Status	On/Off		
	3	IGC Override	off/active		
	3	Static Pressure Source	1 = N/A 2 = Local 3 = Network 4 = Linkage 5 = Locked Value		
	3	Reset Supply Fan Runtime Alarm	Run/Clear	Run	
	3	Reset Comp 1 Runtime Alarm	Run/Clear	Run	
	3	Reset Comp 2 Runtime Alarm	Run/Clear	Run	
	3	Heat 1 Runtime Alarm	Run/Clear	Run	
	3	Heat 2 Runtime Alarm	Run/Clear	Run	
	3	Reset Filter Runtime Alarm	Off/On	Off	
OCCUPANCY					
RTU Properties Menu> Occupancy	3	BAS On / Off	Inactive Occupied Unoccupied	Inactive	**Properties> Control Program> Occupancy**
	3	Occupancy Contact	Off/On		
MAINTENANCE (RUNTIME)					
RTU Properties Menu> Maintenance (Runtime)	3	Supply Fan Runtime	xxxxx hr		**Properties> Control Program> Maintenance> Runtime**
		Compressor 1 Runtime	xxxxx hr		
		Compressor 2 Runtime	xxxxx hr		
		Heat 1 Runtime	xxxxx hr		
		Heat 2 Runtime	xxxxx hr		
		Filter Runtime	xxxxx hr		
CURRENT PERFORMANCE DATA					
Property Pages> Performance	3, 2, 1	Equipment Runtime	xxxxx hr		**Properties> Control Program> Performance> Current Performance Data**
	3, 2, 1	Economizer Utilization	0-100%		
	3, 2, 1	DCV Utilization	0-100%		
	3, 2, 1	Unocc Free Cool Utilization	0-100%		
	3, 2, 1	Part Load Cooling Utilization	0-100%		
	3, 2, 1	Full Load Cooling Utilization	0-100%		
	3, 2, 1	Heating Utilization	0-100%		
	3, 2, 1	Recorded High OAT	-xxx - xxx°F		
	3, 2, 1	Recorded Low OAT	-xxx - xxx°F		
	N/A	Performance Data	Collect/Reset	Collect	

APPENDIX A — USER INTERFACE MENUS (cont)

Table A — User Interface Menus (cont)

EQUIPMENT TOUCH OR SYSTEM TOUCH MENU	ACCESS LEVEL 3 = ADMIN 2 = USER 1 = NONE	POINT NAME	RANGE	DEFAULT	FIELD ASSISTANT MENU
HISTORICAL PERFORMANCE DATA					
Field Assistant Only		Save Performance Data Daily	Disable/Enable	Enable	**Properties> Control Program> Performance> Historical Performance Data**
		Equipment Runtime	xxxxx.x hr		
		Economizer Utilization	0-100%		
		DCV Utilization	0-100%		
		Unocc Free Cool Utilization	0-100%		
		Part Load Cooling Utilization	0-100%		
		Full Load Cooling Utilization	0-100%		
		Heating Utilization	0-100%		
		Previous High OAT	-xxx - xxx°F		
		Previous Low OAT	-xxx - xxx°F		
ALARMS					
Property Pages> Alarms	3, 2, 1	Safety Chain	Normal/Alarm		**Properties> Control Program> Alarms**
	3, 2, 1	Fire / Smoke Shutdown	Normal/Alarm		
	3, 2, 1	Gas Valve	Normal/Alarm		
	3, 2, 1	HPCO Shutdown	Normal/Alarm		
	3, 2, 1	SP Proof (status)	Not Active Valid SP Proof Wait SP Proof SP Proof Timeout		
	3, 2, 1	Compressor Status	Normal/Alarm		
	3, 2, 1	ZS Sensor Configuration	Normal/Alarm		
	3, 2, 1	Space Temp Sensor	Normal/Alarm		
	3, 2, 1	Supply Air Temperature	Normal/Alarm		
	3, 2, 1	Supply Air Temp Sensor	Normal/Alarm		
	3, 2, 1	Return Air Temperature	Normal/Alarm		
	3, 2, 1	Return Air Temp Sensor	Normal/Alarm		
	3, 2, 1	Supply Fan Failure	Normal/Alarm		
	3, 2, 1	Supply Fan in Hand	Normal/Alarm		
	3, 2, 1	Indoor Air Quality	Normal/Alarm		
	3, 2, 1	Indoor Air Quality Sensor	Normal/Alarm		
	3, 2, 1	Space Relative Humidity	Normal/Alarm		
	3, 2, 1	Space Relative Humidity Sensor	Normal/Alarm		
	3, 2, 1	Filter	Clean/Dirty		
	3, 2, 1	Local OAT Sensor	Normal/Alarm		
	3, 2, 1	Outdoor Air Temp Sensor	Normal/Alarm		
	3, 2, 1	Economizer Operation	Normal/Alarm		
	3, 2, 1	Economizer	1 = Normal 2 = Failed to Fully Open 3 = Failed to Open 4 = Failed to Close 5 = Stuck Open		
	3, 2, 1	Switch Configuration	Normal/Alarm		
	3, 2, 1	Analog Input Configuration	Normal/Alarm		
	3, 2, 1	Supply Fan Runtime	Normal/Alarm		
	3, 2, 1	Compressor 1 Runtime	Normal/Alarm		
	3, 2, 1	Compressor 2 Runtime	Normal/Alarm		
	3, 2, 1	Heat 1 Runtime	Normal/Alarm		
	3, 2, 1	Heat 2 Runtime	Normal/Alarm		
	3, 2, 1	Airside Linkage	Normal/Alarm		
	3, 2, 1	Static Pressure Sensor	Normal/Alarm		

APPENDIX A — USER INTERFACE MENUS (cont)

Table A — User Interface Menus (cont)

EQUIPMENT TOUCH OR SYSTEM TOUCH MENU	ACCESS LEVEL 3 = ADMIN 2 = USER 1 = NONE	POINT NAME	RANGE	DEFAULT	FIELD ASSISTANT MENU
ALARMS (cont)					
Property Pages> Alarms (cont)	3, 2, 1	Outdoor Air Quality Sensor	Normal/Alarm		**Properties> Control Program> Alarms (cont)**
LINKAGE					
Property Pages> Linkage	N/A	Linkage Collector[17]			**Properties> Control Program> Linkage> Airside Linkage**
	3	Airside Linkage Status	Active/Not Active		
	When Airside Linkage Status is Active the following information is received from the Zoning System Master Zone as applicable:				
	3	Occupancy Status	Unoccupied/Occupied		
	3	Space Temperature	xxx °F		
	3	Occupied Cooling Setpoint	xxx °F		
	3	Occupied Heating Setpoint	xxx °F		
	3	Unoccupied Cooling Setpoint	xxx °F		
	3	Unoccupied Heating Setpoint	xxx °F		
	3	Indoor Air CO_2	xxxx ppm		
	3	Space Relative Humidity	xxx %		
	3	Linkage Optimal Start	Inactive/Active		
	The following information is sent back to the Zoning System Master Zone:				
	3	Air Source Mode			
	3	Air Source Supply Air Temp	xxx °F		
	3	Air Source Static Pressure	"wc		
	3	Air Source Outdoor Air Temp	xxx °F		

1 This input will only be shown if Input Configuration>Input 5, 8 or 9 Function is set to 3 = Fan Status
2 Displayed value that the VAV-RTU Open controller is controlling to
3 This input will only be shown if Input Configuration>Input 2 Function is set to 3 = Space RH Sensor and there is a valid Space Relative Humidity value on J4 -2&3
4 This input will only be shown if Input Configuration>Input 2 Function is set to 2 = IAQ Sensor and there is a valid Indoor Air Quality CO_2 Sensor value on J4 -2&3
5 This input will only be shown if Input Configuration>Input 2 Function is set to 2 = OAQ Sensor, there is a valid Indoor Air Quality CO_2 Sensor value on J4 -2&3, and Service Configuration>DCV Control is set to Enable at one of the VAV Zone controllers which has Service Configuration>Hardwired Sensor set to CO_2 Sensor with a valid value on J4 - RH&Gnd
6 Default to meet California Title 24 requirements is 45°F
7 Do Not Use
8 Input Switch Configuration must be set for each Input Function
9 This input will only be shown if Service Configuration>Heat Type is set to Electric. For gas units (Service Configuration> Heat Type set to 1 = Gas) (48 series units) this input is automatically set to 7 = IGC Override
10 This input will only be shown when a ZS sensor is connected to J13
11 This setpoint will only be shown if Service Configuration>SA Tempering is set to Enable
12 Compressor Stages default is Three Stages and cannot be changed
13 Economizer Exist default is Yes and cannot be changed
14 This configuration will only be shown if Input Configuration>Input 2 Function is set to 2 = IAQ Sensor
15 This configuration will only be shown if Input Configuration>Input 2 Function is set to 4 = OAQ Sensor
16 This input will only be shown if HPCO Shutdown is in alarm. This is the reset point for the alarm.
17 If using a Carrier Comfort Network® (CCN) and BACnet System (i.e., Carrier CCN Air Terminal to BACnet Air Source), the Application Instance can be 1, 2, 3, or 4, depending on the number of air sources used in the system.

APPENDIX B — VAV ZONE AIRSIDE LINKAGE CONFIGURATION

Table B — VAV Zone Airside Linkage Configuration

EQUIPMENT TOUCH OR SYSTEM TOUCH MENU	ACCESS LEVEL 3 = ADMIN 2 = USER 1 = NONE	POINT NAME	RANGE	DEFAULT	FIELD ASSISTANT MENU
AIRSIDE LINKAGE					
Air Terminal Properties>Startup Wizard> Airside Linkage Configuration	N/A	Linkage Collector If Master zone, set Number of Providers to the total # of controllers that will report to the Master, including the master For a slave zone the # of providers is 1	1 to 64	1	**Properties> Control Program> Linkage> Airside Linkage**
	N/A	Linkage Provider If Master zone, set MS/TP network number and MAC address of the RTU (air source) with the VAV-RTU Open controller For a slave zone leave at zero	Network Number: 0 to 65,535 MAC Address: 0 to 127	0 0	
	N/A	Airside Linkage Status	Active/Not Active		
	3	Linkage Zone Type	Slave VVT Master VAV Master	Slave	
	3	Inhibit Heating Call from this zone?	No/Yes	No	
	N/A	Active Heating Caller?	No/Yes		
	3	Inhibit Cooling Call from this zone?	No/Yes	No	
	N/A	Active Cooling Caller?	No/Yes		
	3	Linkage RH Type	Avg/Max	Avg	
	3	Linkage IAQ Type	Avg/Max	Avg	
	N/A	Air Source Mode	Off Warmup Heat Cool Freecool Pressure Evac Vent		
	N/A	Air Source Supply Air Temp	°F		
	N/A	Air Source Static Pressure	in wc		
	3	Air Source Outdoor Air Temp	°F		
	3	Number of ProvidersIf Master zone, set Number of Providers to the total # of controllers that will report to the Master, including the master For a slave zone the # of providers is 1	1 to 64	1	
Air Terminal Properties> Startup Wizard> Airside Linkage Configuration> Air Source Configuration	3	Air Source (RTU) (Collector) Network #	0 to 65,535	0	**Properties> Control Program> Linkage> Airside Linkage**
	3	Air Source Address Type	MSTP or IP	MSTP	
	3	MS/TP Address	0 to 137	0	

BACnet VARIABLE AIR VOLUME COOLING WITH ON/OFF HOT WATER HEAT CONTROL PACKAGE NO. 4243

Application:

Single duct units are designed to provide accurate variable air volume (VAV) temperature control with a minimum amount of energy consumption. A typical application is shown in Fig. 1. A wall-mounted space temperature (SPT) sensor located in each zone will sense load requirements and activate the control sequence to accommodate cooling or heating. Load requirements and sound level acceptability govern terminal sizing. When reheat is required, the controller can increase airflow to a user-defined reheat airflow set point to ensure sufficient air quantity through the heating coil. It is important that the correct reheat airflow be selected to ensure that sufficient Btu's can be delivered to meet load requirements. The airflow will be reduced to the minimum cooling airflow set point after reheat is no longer required. This control package provides the following sequences of operation:

A. Cooling: (refer to numbers on flow diagram [Fig. 2])
   1. 1-2 indicates that maximum flow is established by the user-defined maximum cooling airflow set point until the zone comes under control at 2.
   2. Beginning at 2, the flow is regulated over a throttling range by the damper until the minimum cooling airflow set point is reached at 3.
   3. 3-4 indicates that, should the zone temperature continue to fall the damper will hold the user-defined minimum cooling airflow set point.
   4. It must be noted that the minimum cooling airflow set point could be set to zero by the user. In this case, the damper will hold a fully closed position if the zone temperature continues to fall.

B. Hot water reheat: (when the primary air source is cooling, refer to numbers on flow diagram)
   1. Should the zone temperature fall below the occupied heating set point, the Occupied Heating mode is in effect at 4.
   2. At 5, the flow is increased to the user-defined reheat airflow set point. The on/off hot water valve will open to provide heating and satisfy the load requirements. The valve is controlled so as not to exceed the maximum discharge temperature limit.
   3. When the zone temperature rises above the occupied heating set point, the on/off hot water valve will close, the Ventilation mode is reactivated at 4, and the airflow is reduced to the minimum cooling airflow set point.

C. Heating: (when the primary air source is providing heated air, refer to numbers on flow diagram)
   1. Should the zone temperature fall below the occupied heating set point, the Occupied Heating mode is in effect at 4'.
   2. The damper is throttled between the user-defined minimum heating airflow set point at 4' and the user-defined maximum heating airflow set point at 6. The hot water valve will operate as required to supplement the primary air temperature and controlled so as not to exceed the maximum discharge temperature limit.
   3. The control may be configured to provide constant volume heating. In that case the damper will maintain the minimum heating airflow set point at 4' to supply a constant volume of heated air to the zone. If the temperature of the primary air is insufficient to meet the zone's heating requirements, the hot water valve will operate as required to supplement the primary air. The valve is controlled so as not to exceed the maximum discharge temperature limit.

D. Unoccupied time period: (cooling)
   When the unoccupied period is reached, the user-defined occupied cooling set point is reset upward to a user-defined unoccupied cooling set point. The damper will operate in the same manner (as per A) during the unoccupied period, using the unoccupied cooling set point.

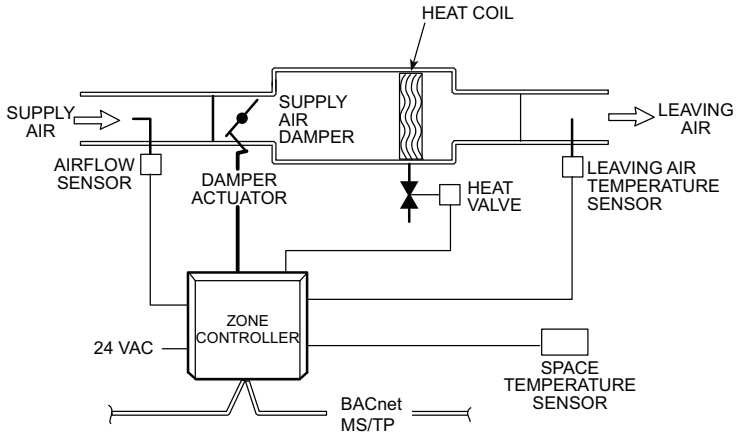

Figure 1 - Single Duct Air Terminal with Hot Water or Steam Heat

E. Unoccupied time period: (reheat)
When the unoccupied period is reached, the user-defined occupied heating set point is reset downward to a user-defined unoccupied heating set point. The damper will operate in the same manner (as per B) during the unoccupied period. The hot water valve will operate as required to satisfy the heating load.

F. Unoccupied time period: (heating)
When the unoccupied period is reached, the user-defined occupied heating set point is reset downward to a user-defined unoccupied heating set point. The damper will operate in the same manner (as per C) during the unoccupied period, if the air source provides heat. The hot water valve will operate to supplement the primary air heat (if required).

G. Morning warm-up: (if not configured to provide constant volume heating)
Upon receiving a morning warm-up signal generated by the air source equipped with BACnet controls, the damper will go to the maximum heating airflow set point if the zone temperature is below the occupied heating set point at 6. This allows the warm primary air to be delivered to the zone. As the zone temperature rises above the occupied heating set point, the damper will move toward the minimum heating airflow set point at 4'. The hot water valve will operate to supplement the primary air heat (if required) and controlled so as not to exceed the maximum discharge temperature limit.

H. Demand controlled ventilation (option):
Whenever the zone is occupied and the air source is not heating (determined by receiving a cooling signal from the air source equipped with BACnet controls or a primary air temperature sensor is installed to detect the air source is operating in the Cooling mode), the control will monitor a CO_2 sensor (optional) and determine if ventilation is adequate. The zone CO_2 level is compared to the ventilation set point. If the CO_2 level is above the set point (insufficient ventilation), the airflow set point is increased appropriately to maintain proper ventilation. Should the zone's temperature fall, reheat will operate to maintain the zone's temperature midway between the heating and cooling set points. Should the zone's temperature fall below the heating set point, the control will suspend ventilation override until the zone's temperature recovers (reheat will operate as per B).

J. Humidity control (option):
Whenever the zone is occupied and the air source is cooling (determined by receiving a cooling signal from the air source equipped with BACnet controls or a primary air temperature sensor is installed to detect the air source is operating in the Cooling mode), the control will monitor a relative humidity (rh) sensor (optional) and determine if the zone's rh is above the humidity set point. If the rh level is above the rh set point, the airflow control point is increased to displace the humid air in the space with air from the primary air source (which has a lower dew point). To ensure non-simultaneous operation of both heating and cooling, should the increased airflow cause the zone's temperature to fall below the heating set point, the control will suspend the airflow override. Reheat will be enabled to maintain the zone's heating set point (reheat will operate as per B). The airflow override will resume when the zone's temperature recovers and be disabled once the zone's rh level falls below the zone's rh set point.

K. Damper override:
The damper override function is energized through the use of a field-supplied smoke control panel connected to the air source equipped with BACnet controls. The smoke control panel and installation must be in accordance with UL864 and local codes. The damper override function overrides the airflow setting used by the logic. It will cause the terminal to provide the configured maximum cooling airflow when the air source is in the Pressurization mode, and to fully close the damper when the air source is in the Evacuation mode.

M. Nighttime free cooling:
The logic calculates nighttime free cooling (NTFC) temperature set point halfway between the occupied heating and occupied cooling temperature set points. Upon receiving a NTFC signal generated by the air source equipped with BACnet controls (or a primary air temperature sensor is installed to detect the air source is operating in the NTFC mode), the damper will throttle between the maximum and minimum cooling airflow set points as required to maintain the zone's NTFC temperature set point.

N. Primary air source shuts off:
1. The damper will fully close and the control will recalibrate the airflow transducer.
2. If the primary air source remains off (no primary air), the damper will be repositioned to at least 50% open to allow the air source to restart properly.

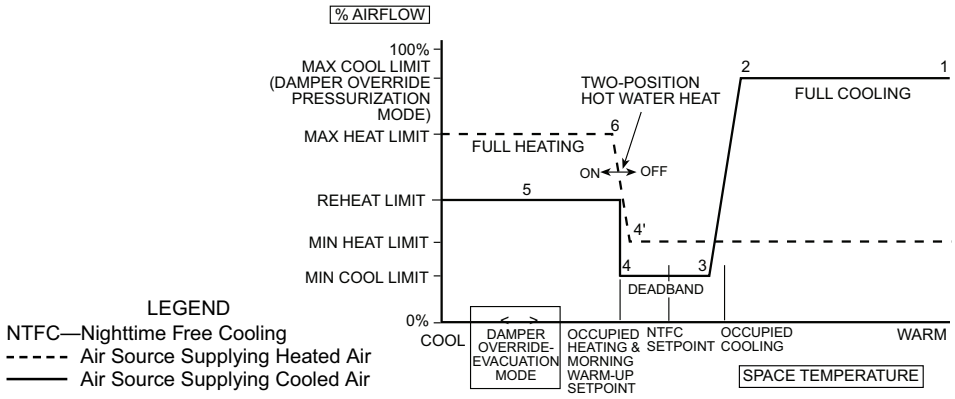

Figure 2 - Sequence of Operation for Single Duct Air Terminal with Two-Position Hot Water or Steam Heat

JOB NAME	JOB NUMBER	LOCATION	PAGE NUMBER	DRAWING NUMBER
BUYER	BUYER #	SHEET	2 OF 3	35ED-4243

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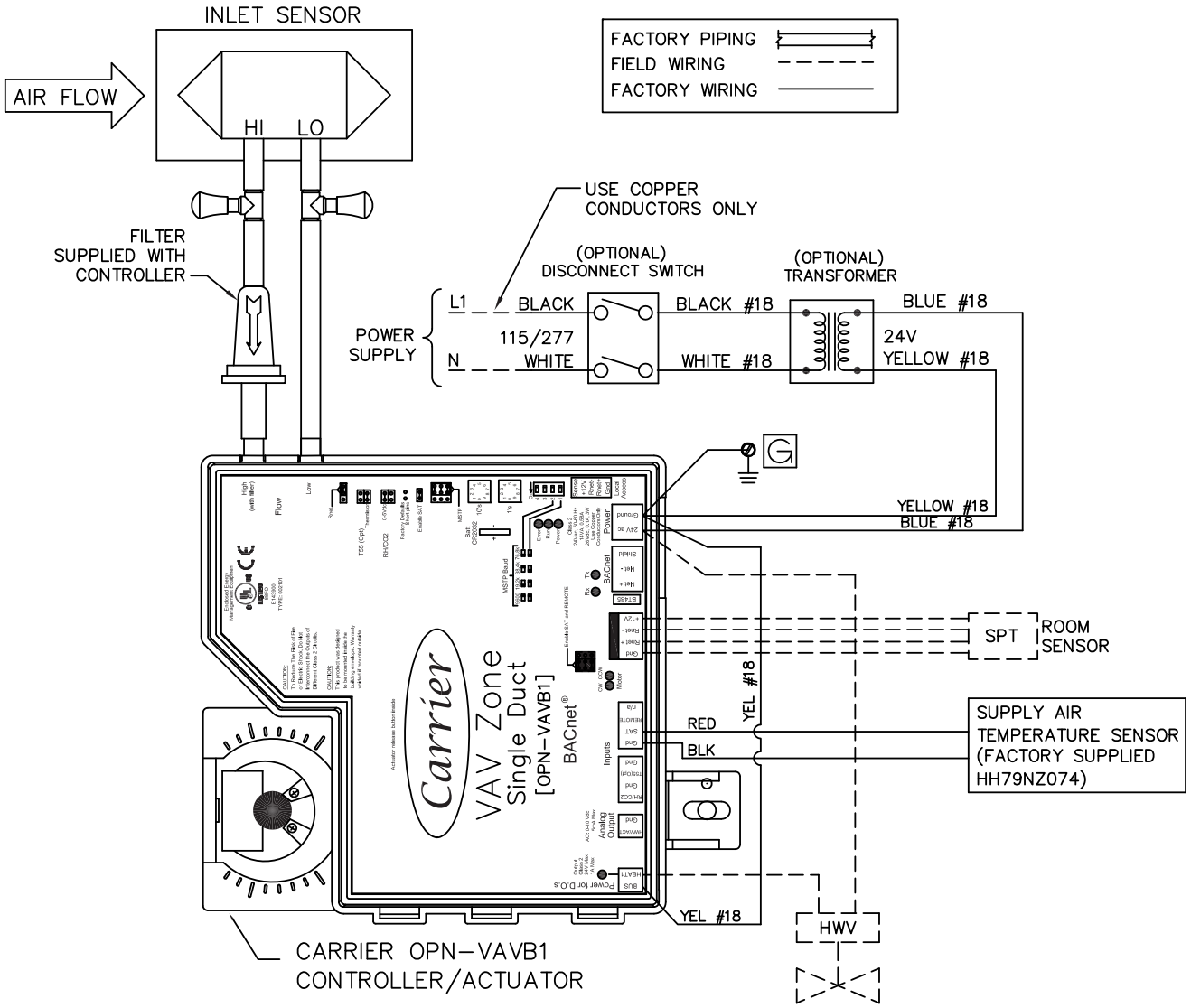

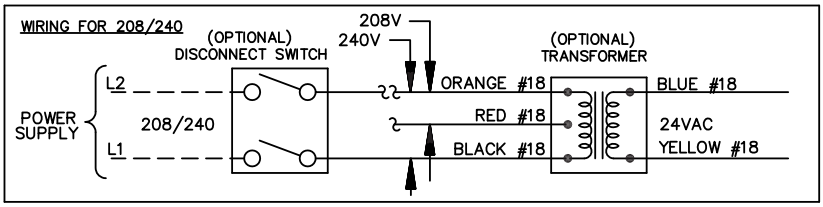

Notes:

1. Verify actuator bushing is in the full CCW position. Rotate damper CCW to the fully closed position. Mount actuator over damper shaft and secure to shaft enclosure. Engage clutch and rotate damper CW to the fully open position.
2. CAUTION:
   Electric shock may result. Disconnect unit prior to servicing unit.
3. These controls have been wired to comply with UL-1995.

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JOB NAME	JOB NUMBER	LOCATION	PAGE NUMBER	DRAWING NUMBER
BUYER	BUYER #	SHEET	3 OF 3	35ED-4243

APPENDIX D — BACnet POINTS LIST

Table C — VAV-RTU Open Protocol Maps

POINT NAME	POINT ACCESS	UNITS	DEFAULT VALUE	BACnet POINT NAME	BACnet OBJECT ID
Active Cooling Stages	R	no units		et_comp_run	AV:2020
Active Heat Stages	R	no units		heat_run	AV:2003
Air Source Mode	R	1=Off 2=Warmup 3=Heating 4=Cooling 5=Freecool 6=Pressure 7=Evac 8=Vent		link_ahu_mode	MSV:2005
Air Source Outdoor Air Temp	R	°F		link_ahu_oat	AV:2609
Air Source Static Pressure	R	in H2O		link_sp	AV:2610
Air Source Supply Air Temp	R	°F		link_sat	AV:2608
Airside Linkage	R			air_linkage_fail	BV:7030
Analog Input Configuration	R			ai_cfg_alarm	BV:7026
BAS On / Off	R/W	1=Inactive 2=Occupied 3=Unoccupied	1	keypad_ovrde	MSV:1001
Compressor 1 Relay State	R			comp_1	BV:2005
Compressor 1 Runtime	R			comp1_rntm_alarm	BV:7014
Compressor 1 Runtime	R	hr		comp1_rntm	AV:2017
Compressor 1 Service Alarm Timer	R/W	hr	0	comp1_service_hrs	AV:83006
Compressor 1 Test	R/W		Inactive (0)	comp1_test	BV:81005
Compressor 2 Relay State	R			comp_2	BV:2004
Compressor 2 Runtime	R			comp2_rntm_alarm	BV:7015
Compressor 2 Runtime	R	hr		comp2_rntm	AV:2018
Compressor 2 Service Alarm Timer	R/W	hr	0	comp2_service_hrs	AV:83007
Compressor 2 Test	R/W		Inactive (0)	comp2_test	BV:81004
Compressor 3 Relay State	R			comp_3	BV:2007
Compressor Safety Status	R			comp_status	BV:1008
Compressor Status	R			comp_alarm	BV:7013
Continuous Occupied Exhaust	R/W		Inactive (0)	occ_exh	BV:9002
Controlling Temperature	R	°F		ctrl_temp	AV:2035
Cooling Lockout Temperature	R/W	°F	45	oat_cl_lockout	AV:9002
Ctrl Temp Sensor Failure	R			ctrl_temp_fail	BV:7067
Ctrl Temp Source	R	1=Sensor Failure 2=Space 3=Return Air 4=Linkage Zone 5=Locked Value		ctrl_temp_src	MSV:2013
Current Static Pressure Setpoint	R	in H2O		sa_static_stpt_value	AV:3031
DCV Control	R/W		Inactive (0)	dcv_enable	BV:1027
DCV Max Ctrl Setpoint	R/W	ppm	1100	iaq_stpt_max	AV:3013
DCV Max Vent Damper Pos	R/W	%Open	50	iaq_dpr_max	AV:9011
Door Contact Status	R			door_contact_status	BV:1010
Economizer	R	1=Normal 2=Failed to Fully Open 3=Failed to Open 4=Failed to Close 5=Stuck Open		econ_fdd_result	MSV:2011
Economizer Exists (required)	R/W		Active (1)	econ_exist	BV:99001
Economizer High OAT Lockout Temp	R/W	°F	75	oat_ec_lockout	AV:9008
Economizer Operation	R			econ_opr	BV:7054
Economizer Output	R	%Open		econ_output	AV:2022
Economizer Test	R/W	%Open	0	econ_test	AV:81001
Effective Cool Setpoint	R	°F		eff_cl_stpt	AV:3005
Effective Heat Setpoint	R	°F		eff_ht_stpt	AV:3006
Enthalpy (BACnet)	R/W		Active (1)	oae	BV:1901
Enthalpy Status	R			enthalpy_status	BV:1002
Equipment Status	R	1=Disabled 2=Test 3=Run		mode_status	MSV:2001
Factory Test Analog 1 Control	R/W	%	0	ao1_fac_test	AV:91001
Factory Test Analog 2 Control	R/W	%	0	ao2_fac_test	AV:91002
Factory Test Relay 1 Control	R/W		Inactive (0)	relay1_fac_test	BV:91001
Factory Test Relay 2 Control	R/W		Inactive (0)	relay2_fac_test	BV:91002

APPENDIX D — BACnet POINTS LIST (cont)

Table C — VAV-RTU Open Protocol Maps (cont)

POINT NAME	POINT ACCESS	UNITS	DEFAULT VALUE	BACnet POINT NAME	BACnet OBJECT ID
Factory Test Relay 3 Control	R/W		Inactive (0)	relay3_fac_test	BV:91003
Factory Test Relay 4 Control	R/W		Inactive (0)	relay4_fac_test	BV:91004
Factory Test Relay 5 Control	R/W		Inactive (0)	relay5_fac_test	BV:91005
Factory Test Relay 6 Control	R/W		Inactive (0)	relay6_fac_test	BV:91006
Factory Test Relay 7 Control	R/W		Inactive (0)	relay7_fac_test	BV:91007
Factory Test Relay 8 Control	R/W		Inactive (0)	relay8_fac_test	BV:91008
Fan Off Delay	R/W	seconds	90	fan_delay_off	AV:9024
Filter	R			filter_alarm	BV:7017
Filter Runtime	R	hr		filter_rntm	AV:2015
Filter Service Alarm Timer	R/W	hr	600	filter_service_hrs	AV:2019
Filter Status	R			filter_status	BV:1004
Fire / Smoke Shutdown	R			fire_alarm	BV:7007
Fire Shutdown Status	R			firedown_status	BV:1005
Gas Valve	R			igc_alarm	BV:7050
Heat 1 Runtime	R	hr		heat1_rntm	AV:2029
Heat 1 Runtime	R			heat1_rntm_alarm	BV:7062
Heat 1 Service Alarm Timer	R/W	hr	0	heat1_service_hrs	AV:83008
Heat 1Test	R/W		Inactive (0)	heat1_test	BV:81003
Heat 2 Runtime	R	hr		heat2_rntm	AV:2030
Heat 2 Runtime	R			heat2_rntm_alarm	BV:7063
Heat 2 Service Alarm Timer	R/W	hr	0	heat2_service_hrs	AV:83009
Heat 2Test	R/W		Inactive (0)	heat2_test	BV:81002
Heat Interlock Relay State	R			ht_interlock	BV:2012
Heat Interlock Relay Test	R/W		Inactive (0)	hir_test	BV:81006
Heat Stage 1 Relay State	R			heat_1	BV:2003
Heat Stage 2 Relay State	R			heat_2	BV:2002
Heat Type	R/W		Active (1)	heat_type	BV:99002
Heating Control Setpoint	R	°F		htg_cntl_pt	AV:2034
Heating Lockout Temperature	R/W	°F	65	oat_ht_lockout	AV:9003
HPCO Shutdown	R			sp_alarm	BV:7060
Humidistat Input Status	R			humstat_status	BV:1006
IGC Override	R			igcovr_status	BV:1022
Indoor Air Quality	R			iaq_alarm	BV:7005
Indoor Air Quality CO2 (ppm)	R	ppm		iaq	AV:1009
Indoor Air Quality Sensor	R			iaq_sensor_fail	BV:7039
Input 2 Function	R/W		1	ai2_function	MSV:81002
Input 3 Function	R/W		1	di3_function	MSV:81003
Input 3 Switch Configuration	R/W		1	di3_type	MSV:81013
Input 5 Function	R/W		2	di5_function	MSV:81005
Input 5 Switch Configuration	R/W		1	di5_type	MSV:81015
Input 8 Function	R/W		2	di8_function	MSV:81008
Input 8 Switch Configuration	R/W		1	di8_type	MSV:81018
Input 9 Function	R/W		1	di9_function	MSV:81009
Input 9 Switch Configuration	R/W		1	di9_type	MSV:81019
input_2	R	mA		ai_2	AI:1002
input_3	R			di_3	BI:1003
input_4	R			di_4	BI:1004
input_5	R			di_5	BI:1005
input_8	R			di_8	BI:1008
input_9	R			di_9	BI:1009
Local OAT Sensor	R			loc_oat_sensor_fail	BV:7003
Low Fan Econ Min Pos	R/W	%Open	33	econ_min_2	AV:9030
Max VFD Output	R/W	%	100	max_vfd_spd	AV:3026
Maximum Heating SAT	R/W	°F	120	sat_ht_max	AV:83004
Min VFD Output	R/W	%	25	min_vfd_spd	AV:3027
Minimum Cooling SAT	R/W	°F	45	sat_cl_min	AV:83003
Number Of Heat Stages	R/W		2	heat_stages	MSV:91004
OAT sensor	R	°F		ai_7	AI:1007
Occ Relative Humidity Setpoint	R/W	%rh	60	occ_dehum_stpt	AV:3011
Occupancy Contact	R			occ_contact_status	BV:1007
Occupancy Source	R			occ_source	MSV:1002

APPENDIX D — BACnet POINTS LIST (cont)

Table C — VAV-RTU Open Protocol Maps (cont)

POINT NAME	POINT ACCESS	UNITS	DEFAULT VALUE	BACnet POINT NAME	BACnet OBJECT ID
Occupancy Status	R			occ_status	BV:2008
Occupied Heating	R/W		Inactive (0)	occ_heat	BV:2031
Outdoor Air Quality CO2 (ppm)	R	ppm		oaq	AV:1012
Outdoor Air Quality Sensor	R			oaq_fail	BV:7006
Outdoor Air Temp Sensor	R			oat_fail	BV:7029
Outdoor Air Temperature	R	°F		oa_temp	AV:1003
Override Time Remaining	R	min		ovrde_time	AV:2016
Password Protected Output Variable	R/W	no units	0	ppo	AV:90000
Power Exhaust Relay State	R			pexh	BV:2010
Power Exhaust Setpoint	R/W	%Open	50	pexh_stpt	AV:3010
Power Exhaust Test	R/W		Inactive (0)	pexh_test	BV:81008
Power Fail Restart Delay	R/W	seconds	5	start_delay	AV:9007
RAT Sensor	R	°F		ai_11	AI:1011
RAT Source	R			rat_src	MSV:2015
Reset Calculated Max Heat Limit	R/W		Inactive (0)	calc_limit_reset	BV:9003
Reset Comp 1 Runtime Alarm	R/W		Inactive (0)	comp1_rntm_clr	BV:7514
Reset Comp 2 Runtime Alarm	R/W		Inactive (0)	comp2_rntm_clr	BV:7515
Reset Filter Alarm	R/W		Inactive (0)	filter_rntm_clr	BV:7517
Reset Heat 1 Runtime Alarm	R/W		Inactive (0)	heat1_rntm_clr	BV:7518
Reset Heat 2 Runtime Alarm	R/W		Inactive (0)	heat2_rntm_clr	BV:7519
Reset High Static Trip	R/W		Inactive (0)	hsl_reset	BV:1908
Reset Maximum Limit	R/W	°^F	10	sat_cl_stpt_reset_max	AV:9040
Reset Ratio	R/W	no units	3	sat_cl_stpt_reset	AV:9041
Reset Supply Fan Runtime Alarm	R/W		Inactive (0)	sfan_rntm_clr	BV:7510
Return Air Temp Sensor	R			rat_fail	BV:7052
Return Air Temperature	R	°F		ra_temp	AV:1010
Return Air Temperature	R			rat_alarm	BV:7035
SA Reset Humidity Override	R/W		Inactive (0)	rh_enable	BV:1025
SA Tempering	R/W		Inactive (0)	sa_tempering_en	BV:83016
SA Tempering Setpoint	R/W	°F	55	tempering_stpt	AV:3032
Safety Chain	R			safety_alarm	BV:7024
Safety Chain Feedback	R			safety_status	BV:1009
SAT Reset Source	R			sat_reset_source	MSV:2016
SAT Sensor	R	°F		ai_6	AI:1006
Service Test	R/W		Inactive (0)	test_enable	BV:81000
Setpoint	R/W	°F		occ_cl_stpt	AV:3001
Setpoint	R/W	°F		occ_ht_stpt	AV:3002
Setpoint	R/W	°F		unocc_cl_stpt	AV:3003
Setpoint	R/W	°F		unocc_ht_stpt	AV:3004
Shutdown	R/W		Inactive (0)	shutdown	BV:9001
SP Proof	R			sp_proof_alm	MSV:7068
SP Reset Demand Level	R/W		1	sp_reset_dmd_lvl	MSV:9033
Space Relative Humidity	R	%rh		space_rh	AV:1011
Space Relative Humidity	R			sprh_hi_alarm	BV:7018
Space Relative Humidity Sensor	R			sprh_sensor_fail	BV:7022
Space Temp Sensor	R	°F		ai_10	AI:1010
Space Temp Sensor	R			spt_fail	BV:7001
Space Temp Source	R			spt_source	MSV:2014
Space Temperature	R	°F		spt_temp	AV:1032
Static Pressure	R	in H2O		static_press	AV:2028
Static Pressure Sensor	R	mA		ai_1	AI:1001
Static Pressure Sensor	R			sp_fail	BV:7061
Static Pressure Setpoint	R/W	in H2O	0.5	sa_static_stpt	AV:3030
Supply Air Setpoint	R/W	°F	53	sat_cl_stpt	AV:3029
Supply Air Setpoint	R	°F		sasp	AV:2031
Supply Air Temp Reset	R/W		Inactive (0)	sa_reset_en	BV:9004
Supply Air Temp Sensor	R			loc_sat_sensor_fail	BV:7020
Supply Air Temperature	R			sat_alarm	BV:7004
Supply Air Temperature - Prime Variable	R	°F		sa_temp	AV:1008
Supply Fan Failure	R			sfan_fail_alarm	BV:7008
Supply Fan in Hand	R			sfan_hand_alarm	BV:7009

APPENDIX D — BACnet POINTS LIST (cont)

Table C — VAV-RTU Open Protocol Maps (cont)

POINT NAME	POINT ACCESS	UNITS	DEFAULT VALUE	BACnet POINT NAME	BACnet OBJECT ID
Supply Fan Relay State	R			sfan	BV:2001
Supply Fan Runtime	R	hr		sfan_rntm	AV:2014
Supply Fan Runtime	R			sfan_rntm_alarm	BV:7010
Supply Fan Service Alarm Timer	R/W	hr	0	sfan_service_hrs	AV:83005
Supply Fan Status	R			sfan_status	BV:1003
Supply Fan VFD	R	%		vfd_output	AV:2027
Switch Configuration	R			di_cfg_alarm	BV:7025
System Cooling Demand Level	R	no units		cool_demand_level	AV:9006
System Heating Demand Level	R	no units		heat_demand_level	AV:9036
System is shut down	R			shutdown_status	BV:2011
System Mode	R	1=Off 2=Fan Only 3=Economizer Cooling 4=Cooling 5=Heating 6=Dehumidification 7=Test 8=Shutdow 9=Unocc Free Cooling 10=Fire Shutdown 11=IAQ Override 12=Pre-Occ Purge 13=IGC Override		run_status	MSV:2002
System OAT Master	R	°F		mstr_oa_temp	AV:80001
System Outdoor Air Temperature	R/W	°F	-999	system_oat	AV:1901
System Outdoor AQ	R/W	ppm	-999	system_oaq	AV:1908
System Return Air Temperature	R/W	°F	-999	system_rat	AV:1920
System Space AQ	R/W	ppm	-999	system_iaq	AV:1903
System Space RH	R/W	%rh	-999	system_rh	AV:1904
System Space Temperature	R/W	°F	-999	system_spt	AV:1902
Unocc Free Cool	R/W		Inactive (0)	ntfc_ena	BV:80001
Vent Dmpr Pos / DCV Min Pos	R/W	%Open	20	econ_min	AV:9005
VFD Speed Test	R/W	%	0	vfd_spd_test	AV:81002
ZS Sensor Configuration	R			zs_config_fail	BV:7055

APPENDIX E — EQUIPMENT/SYSTEM TOUCH NAVIGATION SCREENS

The Equipment Touch™ interface is a touchscreen device with a 4.3 inch color LCD display that can be connected to the VAV-RTU Open controller to view or change its property values, schedule equipment, view trends and alarms, and more, without having to access the building automation system's server.

Fig. A — Equipment Touch Interface

This appendix provides a brief overview of the screens used to navigate the Equipment Touch interface. For full details on installation and setup refer to the Equipment Touch Installation and Setup Guide.

NOTE: The System Touch™ interface when connected to the VAV-RTU Open controller over the BACnet MS/TP network will provide the same screens and function as the Equipment Touch.

STANDBY

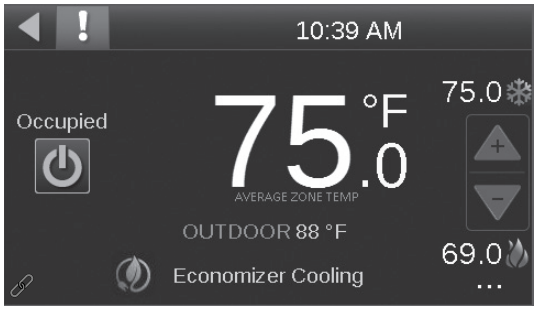

Fig. B — Standby Screen

The Standby screen displays after the Inactivity Timer expires (default is 5 minutes).

Displays:

- average space temperature (optional static pressure or SAT)
- current controlling setpoints
- Linkage Status

  The color of the Linkage Status icon changes with the current linkage condition:
  Gray – no linkage condition
  Green – linkage OK condition
  Red – linkage Alarm condition

NOTE: The Linkage Status icon is displayed on the Standby. Home, and Snapshot screens.

- mode
- occupancy
- OAT (outdoor air temperature), if available

The Standby screen is not interactive. Touch anywhere on the screen to advance to the Home screen.

HOME

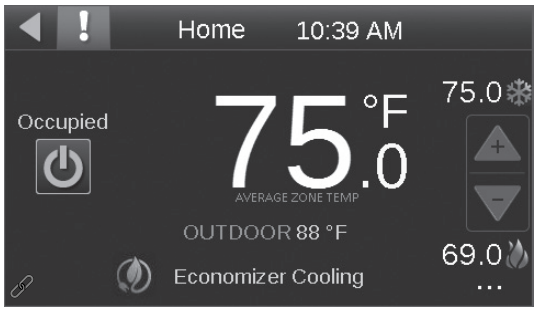

Fig. C — Home Screen

Displays:

- average space temperature (optional static pressure or SAT)
- current setpoints
- mode
- occupancy status
- OAT, if available
- Linkage Status

Tap … on the right to navigate to the Snapshot screen.

SNAPSHOT

Fig. D — Snapshot Screen

Displays:

- SAT (supply air temperature) actual and setpoint
- RAT (return air temperature) actual
- static pressure, actual and setpoint
- % open economizer
- OAT actual
- VFD % speed
- active cooling stages
- active heating stages
- Comp 1, Comp 2
- Heat 1, Heat 2
- VAV-RTU Open alarms, if present
- Filter Status
- Linkage Status

Navigates to:

- Alarm History 
- Trends 
- Linkage Status 
- Back to Home –  on the left
- Forward to the VAV RTU Properties Menu screen – click  on the right

VAV-RTU OPEN PROPERTIES

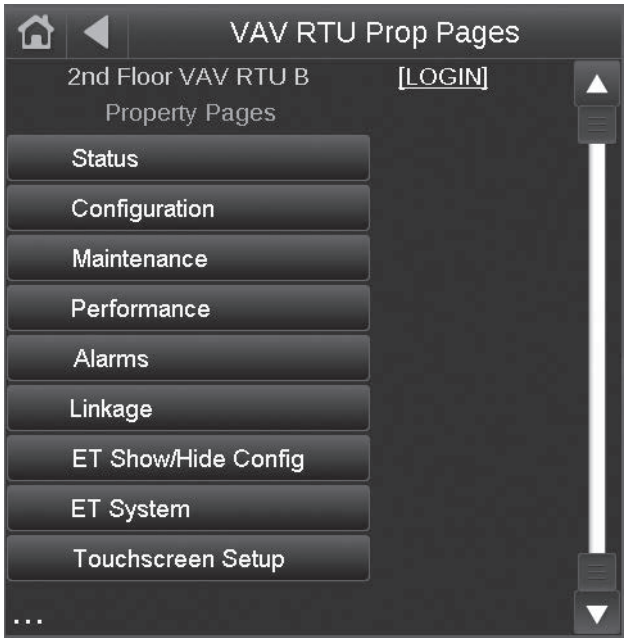

Fig. E — VAV-RTU Properties Menu Screen

Navigates to the Property pages.

Login with one of the following passwords:

- User level - type user
- Admin level - type admin
- Factory level - type Touch

NOTE: Only the buttons that are authorized for a specific password level are visible.

SHOW/HIDE CONFIGURATION

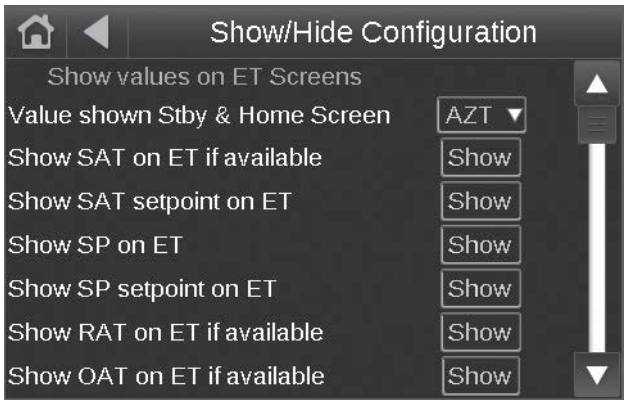

Fig. F — Show/Hide Configuration Screen

You can configure Show/Hide conditions for values on the following screens:

- Standby
- Home
- Snapshot

NOTE: Only shown when logged in with the Factory or Admin password.

ALARMS SCREEN

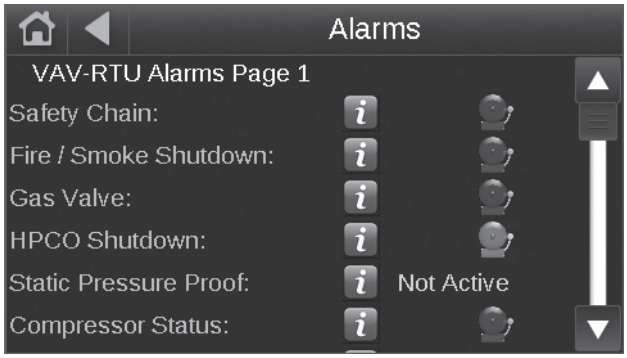

Fig. G — Alarms Screen

Displays the current status for each alarm.

Tap  on the right to navigate to the help screen for the alarm.

Tap  or  to navigate to the Alarm History screen.

ALARM HELP INFORMATION SCREEN

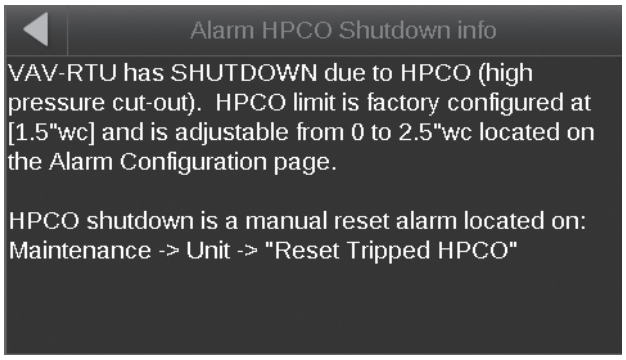

Fig. H — Alarm Help Information Screen

Displays the current status for each alarm.

Tap  on the Alarms to navigate to the above screen.

ALARM HISTORY SCREEN

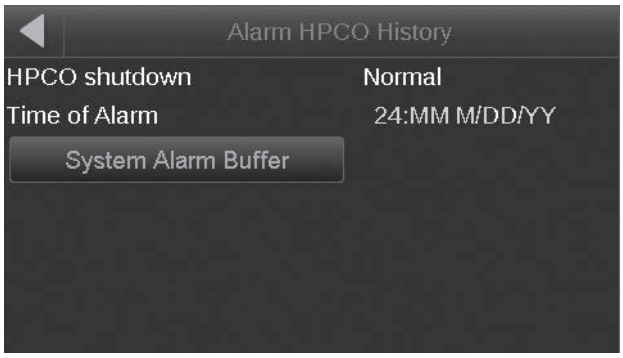

Fig. I — Alarms Screen

Tap  or  to navigate to the Alarms screen to navigate this screen.

RTU OPEN CONTROLLER START-UP SHEET

RTU Model Number:	Date:
RTU Serial Number:	Performed by:
RTU Open Software Version:	Company:
Protocol and Baud Rate:	Network Address:

POINT NAME	RANGE	DEFAULT	ENTRY
UNIT CONFIGURATION			
Fan Mode	1 = Auto 2 = Continuous 3 = Always On	Continuous	
Power Fail Restart Delay	0-30 sec	5	
Fan Off Delay	5-120 sec	90	
Occupied Heating	Disable/Enable	Disable	
Supply Air Temp Reset	Disable/Enable	Disable	
Reset Ratio	0-10	3	
Reset Maximum Limit	0 - 25°F	10	
SA Reset Humidity Override	Disable/Enable	Disable	
Humidity Override Disable/Enable	Disable		
Minimum Cooling SAT[1]	45 - 75°F	45	
Maximum Heating SAT	90 - 150°F	120	
Vent Dmpr Pos / DCV Min Pos	0-100% Open	20	
Low Fan Econ Min Pos	0-100% Open	33	
Economizer Purge Min Pos	0-100% Open	40	
DCV Max Vent Damper Pos	0-75% Open	50	
Static Pressure Reset Enable	Disabled/Enabled	Enabled	
Maximum Damper Position	0-100 % Open	80	
Minimum Damper Position	0-100 % Open	50	
Maximum Reset	0.00 to 2.00 "wc	0.25	
SP Reset Demand Level	1 = Not Active 2 = Cool Dmd Lvl 1 3 = Cool Dmd Lvl 2 4 = Cool Dmd Lvl 3	Not Active	
Supply Fan Service Alarm Timer	0-9999 hr	600	
Comp 1 Service Alarm Timer	0-9999 hr	0	
Comp 2 Service Alarm Timer	0-9999 hr	0	
Filter Service Alarm Timer	0-9999 hr	600	
Heat 1 Service Alarm Timer	0-9999 hr	0	
Heat 2 Service Alarm Timer	0-9999 hr	0	
Cooling Lockout Temperature	-65 - 80°F	45	
Economizer High OAT Lockout Temp	55 - 80°F	75	
Heating Lockout Temperature	35 - 150°F	65	
Unocc Free Cool	Disable/Enable	Disable	
Min Setpoint Separation	2-10Δ°F	5Δ	
INPUT CONFIGURATION			
Input 2 Function	1 = No Sensor 2 = IAQ Sensor 3 = Space RH Sensor 4 = OAQ Sensor	No Sensor	
Input 3 Function	1 = No Function 2 = Compressor Safety 3 = Fan Status 4 = Filter Status 5 = Remote Occupancy[2] 6 = Door Contact[7]	No Function	
Input 3 Switch Configuration[8]	1 = NO (Normally Open) 2 = NC (Normally Closed)	NO	

POINT NAME	RANGE	DEFAULT	ENTRY
INPUT CONFIGURATION (cont)			
Input 5 Function	1 = No Function 2 = Fire Shutdown 3 = Fan Status 4 = Filter Status 5 = Remote Occupancy[2] 6 = Door Contact[2]	Fire Shutdown	
Input 5 Switch Configuration	1 = NO (Normally Open) 2 = NC (Normally Closed)	NO	
Input 8 Function[3]	1 = No Function 2 = Enthalpy Switch 3 = Fan Status 4 = Filter Status 5 = Remote Occupancy[2] 6 = Door Contact[2]	No Function	
Input 8 Switch Configuration[3]	1 = NO (Normally Open) 2 = NC (Normally Closed)	NO	
Input 9 Function[4]	1 = No Function 2 = Humidistat[7] 3 = Fan Status 4 = Filter Status 5 = Remote Occupancy[2] 6 = Door Contact[2] 7 = IGC Override	No Function	
Input 9 Switch Configuration[3 4]	NO (Normally Open) NC (Normally Closed)	NO	
ZS Sensor Binder Alarm	ALARM/Normal		
ZS Space Temp	°F		
ZS Space Humidity	%rh		
ZS Space CO2	ppm		
SENSOR CALIBRATION			
Space Temp	°F		
Space RH[5]	%rh		
Space AQ[6]	ppm		
Outdoor AQ[7]	ppm		
Static Pressure	0.00 - 2.50 "wc		
Static Pressure Calibration	-0.2 - 0.20 "wc	0	
Supply Air Temperature	-56 - 245°F		
Supply Air Temp Calibration	-9.9 - 10Δ°F	0Δ	
Return Air Temperature	-56 - 245°F		
Return Air Temp Calibration	-9.9 - 10Δ°F	0Δ	
Outdoor Air Temperature	-56 - 245°F		
Outdoor Air Temp Calibration	-9.9 - 10Δ°F	0Δ	
SETPOINT			
Supply Air Setpoint	45 - 75°F	53	
Static Pressure Setpoint	0.25 - 2.25 "wc	0.5	
SA Tempering Setpoint[8]	40 - 75°F	48	
Optimal Start Type	Temp Compensated		
Occ Relative Humidity Setpoint	0%RH to Unoccupied RH Control Setpoint	60	
DCV Max Ctrl Setpoint	0 to 9999 ppm	1100	
Power Exhaust Setpoint	20 to 90% Open	50	
HIGH STATIC PRESSURE ALARM			
SP High Limit Trip Setpoint	0 to 2.50 "wc	1.50	
SUPPLY AIR TEMPERATURE ALARM			
Low SAT Alarm Limit	15-90°F	38	
High SAT Alarm Limit	90-175°F	160	
RETURN AIR TEMPERATURE ALARM			
Low RAT Alarm Limit	15-90°F	55	
High RAT Alarm Limit	90-175°F	120	
SPACE HUMIDITY ALARM			
Occupied High RH Alarm Limit	0-100%RH	70	
Alarm Delay (min/%RH)	0-30 min	5	
Unoccupied High RH Alarm Limit	0-100%rh	100	
Low RH Alarm Limit	0-100%rh	0	

POINT NAME	RANGE	DEFAULT	ENTRY
IAQ / VENTILATION ALARM			
Occ High CO_2 Alarm Limit	0-9999 ppm	1200	
SERVICE CONFIGURATION			
Compressor Stages[9]	N/A	Three Stages	
Economizer Exists[10]	N/A	Yes (FIOP)	
VFD Input	0-10Vdc/2-10Vdc	2-10Vdc	
Max VFD Output	15-100%	100	
Min VFD Output	15-100%	25	
Heat Type	0 = Electric (50 series units) 1 = Gas (48 series units)	Gas	
Number of Heat Stages	1 = 1 stage (All 50LC*B07-09 units, 50LC*B12-14 lo heat) 2 = 2 stages (All 48LC*B07-26 units, 50LC*B12 hi heat, 50LC*B14 med/ hi heat, All 50LC*B17-26 units)	2	
SA Tempering	Disabled/Enabled	Disable	
Continuous Occupied Exhaust	No/Yes	No	
DCV Control	Disable/Enable	Disable	
Indoor CO_2 Sensor Value @ Min mA[11]	0-9999ppm	0	
Indoor CO_2 Sensor Value @ Max mA[11]	0-9999ppm	2000	
Outdoor CO_2 Sensor Value @ Min mA[12]	0-9999ppm	0	
Outdoor CO_2 Sensor Value @ Max mA[12]	0-9999ppm	2000	
Static Pressure Sensor Value @ Min mA		0	
Static Pressure Sensor Value @ Max mA		2.5	
System Space RH	N/A	-999.0	
System Space AQ	N/A	-999.0	
System Cool Demand Level	0-3	0	
System Heat Demand Level	0-3	0	
System Outdoor Air Temperature	N/A	-999.0	
System Outdoor AQ	N/A	-999.0	
System Fire / Smoke	Off/On	Off	
Network Heat Interlock	Off/On	Off	
SERVICE TEST			
Service Test Mode	Disable/Enable		
Service Test	Disable/Enable	Disable	
Fan Test	Disable/Enable	Disable	
Compressor 1 Test	Disable/Enable	Disable	
Compressor 2 Test	Disable/Enable	Disable	
Heat 1 Test	Disable/Enable	Disable	
Heat 2 Test	Disable/Enable	Disable	
Heat Interlock Relay Test	Disable/Enable	Disable	
Power Exhaust Test	Disable/Enable	Disable	
Economizer Test	0-100 %Open	0	
VFD Speed Test	0-100%	0	
LINKAGE			
Linkage Collector[13]			
Airside Linkage Status	Active/Not Active		
Occupancy Status	Unoccupied/Occupied		
Space Temperature	xxx °F		
Occupied Cooling Setpoint	xxx °F		
Occupied Heating Setpoint	xxx °F		
Unoccupied Cooling Setpoint	xxx °F		
Unoccupied Heating Setpoint	xxx °F		
Indoor Air CO_2	xxxx ppm		
Space Relative Humidity	xxx %		
Linkage Optimal Start	Inactive/Active		
Air Source Mode			
Air Source Supply Air Temp	xxx °F		
Air Source Static Pressure	"wc		
Air Source Outdoor Air Temp	xxx °F		

1 Default to meet California Title 24 requirements is 45°F
2 Do Not Use
3 Input Switch Configuration must be set for each Input Function
4 This input will only be shown if Service Configuration>Heat Type is set to Electric. For gas units (Service Configuration> Heat Type set to 1 = Gas (48 series units) this input is automatically set to 7 = IGC Override
5 This input will only be shown if Input Configuration>Input 2 Function is set to 3 = Space RH Sensor and there is a valid Space Relative Humidity value on J4 -2&3
6 This input will only be shown if Input Configuration>Input 2 Function is set to 2 = IAQ Sensor and there is a valid Indoor Air Quality CO_2 Sensor value on J4 -2&3
7 This input will only be shown if Input Configuration>Input 2 Function is set to 2 = OAQ Sensor, there is a valid Indoor Air Quality CO_2 Sensor value on J4 -2&3, and Service Configuration>DCV Control is set to Enable at one of the VAV Zone controllers which has Service Configuration>Hardwired Sensor set to CO_2 Sensor with a valid value on J4 - RH&Gnd
8 This setpoint will only be shown if Service Configuration>SA Tempering is set to Enable
9 Compressor Stages default is Three Stages and cannot be changed
10 Economizer Exist default is Yes and cannot be changed
11 This configuration will only be shown if Input Configuration>Input 2 Function is set to 2 = IAQ Sensor
12 This configuration will only be shown if Input Configuration>Input 2 Function is set to 4 = OAQ Sensor
13 If using a Carrier Comfort Network® (CCN) and BACnet System (i.e., Carrier CCN Air Terminal to BACnet Air Source), the Application Instance can be 1, 2, 3, or 4, depending on the number of air sources used in the system.

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