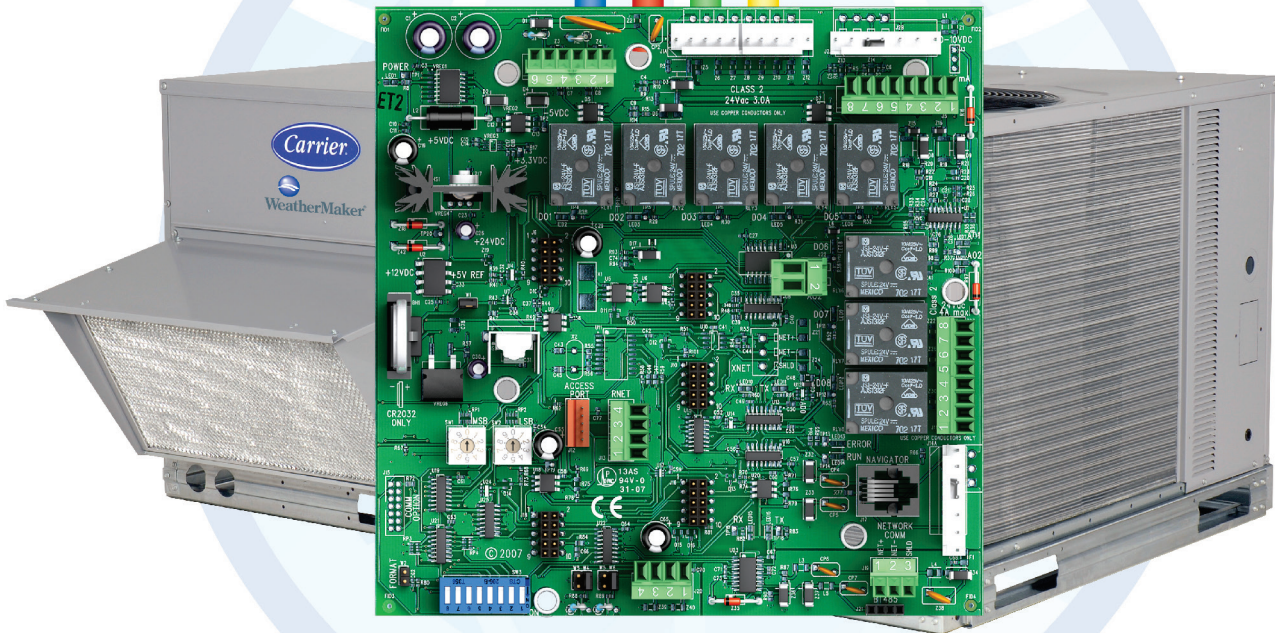




United Technologies
turn to the experts

RTU Open v2 Integration Guide

Modbus **N2**
BACnet **LonWorks**





Verify that you have the most current version of this document from www.hvacpartners.com or your local Carrier office.

Important changes are listed in **Document revision history** at the end of this document.

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Introduction

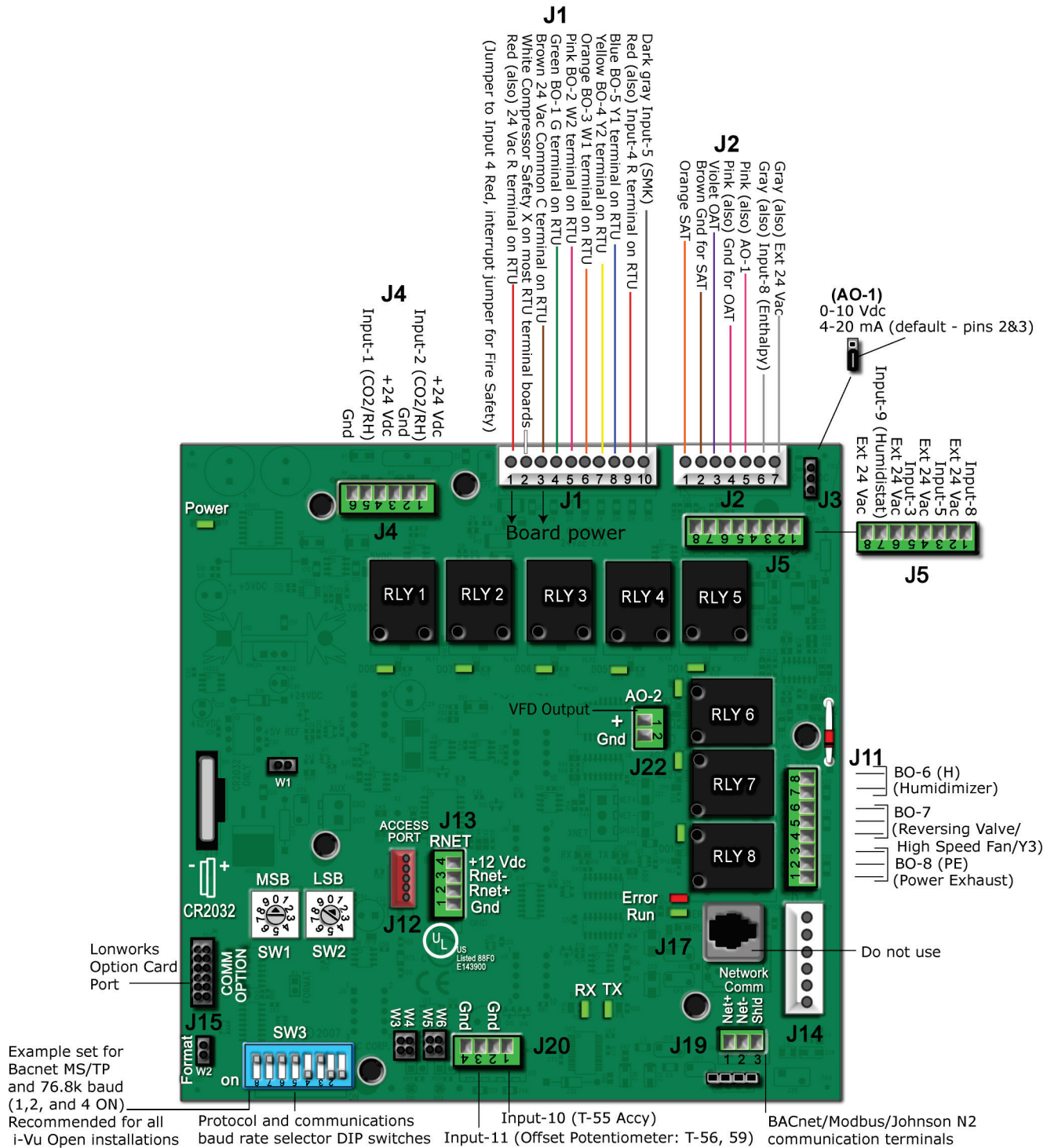
What is the RTU Open controller?

The RTU Open controller is available as an integrated component of a Carrier rooftop unit, or as a field-installed retrofit product. Its internal application programming provides optimum rooftop performance and energy efficiency. RTU Open enables the unit to run in 100% stand-alone control mode or it can communicate to the Building Automation System (BAS).

On board DIP switches allow you to select the baud rate and choose one of the following protocols:

- BACnet
- Modbus
- Johnson N2
- LonWorks

Carrier's diagnostic display tools such as the BACview[®] Handheld device or the Virtual BACview application can be used with the RTU Open controller via the **J12** Access Port. See illustration on the following page.



CAUTION If there is a jumper on the Format pins and power is cycled to the controller, all Modbus, N2, and LonWorks points will be lost.

Safety considerations & handling warning

 **WARNING**

When you handle the RTU Open:

- Do not contaminate the printed circuit board with fingerprints, moisture, or any foreign material.
- Do not touch components or leads.
- Handle the board by its edges.
- Isolate from high voltage or electrostatic discharge.
- Ensure that you are properly grounded.

Wiring inputs and outputs

RTU Open Inputs and Outputs Table

| Channel Number | Type | Signal | Function | Part Number | Wire/Terminal Numbers | Alternate Terminals |
|----------------|------|-------------------------|--|---|-------------------------|--------------------------|
| Input 1 | AI | 4-20 mA | CO2 OAQ Space Relative Humidity | 33ZCT55C02 33ZCT56C02 33ZCSPTC02-01 33ZCSPTC02LCD-01 w/ 33ZCASPC02 33ZCENSRH-02 | J4 - 5 & 6 | N/A |
| Input 2 | AI | 4-20 mA | CO2 OAQ Space Relative Humidity | 33ZCT55C02 33ZCT56C02 33ZCSPTC02-01 33ZCSPTC02LCD-01 w/ 33ZCASPC02 33ZCENSRH-02 | J4 - 2 & 3 | N/A |
| Input 3 | BI | 24 Vac | Compressor Safety **2 Fan Status Filter Status Remote Occupancy Door Contact | N/A CRSTATUS005A00 CRSTATUS005A00 Field-supplied Field-supplied | J1 - 2 | J5 - 5 & 6 *** |
| Input 4 | BI | 24 Vac | Safety Chain * | N/A | J1 - 9 | N/A |
| Input 5 | BI | 24 Vac | Fire Shutdown **1, 2 Fan Status Filter Status Remote Occupancy Door Contact | Field-supplied CRSTATUS005A00 CRSTATUS005A00 Field-supplied Field-supplied | J1 - 10 | J5 - 3 & 4 *** |
| Input 6 | AI | 10K Thermistor | Supply Air Temperature | 33ZCENSAT 33ZCSENDAT | J2 - 1 & 2 | N/A |
| Input 7 | AI | 10K Thermistor | Outside Air Temperature | 33ZCSENOAT | J2 - 3 & 2 | N/A |
| Input 8 | BI | 24 Vac | Enthalpy ** Fan Status Filter Status Remote Occupancy Door Contact | 33SENTHSW CRSTATUS005A00 CRSTATUS005A00 Field-supplied Field-supplied | J2 - 6 & 7 | J5 - 1 & 2 *** |
| Input 9 | BI | 24 Vac | Humidistat ** Fan Status Filter Status Remote Occupancy Door Contact | -HL-38MG-029 CRSTATUS005A00 CRSTATUS005A00 Field-supplied Field-supplied | J5 - 7 & 8 | N/A |
| Input 10 | AI | 10K Thermistor | Space Temperature | 33ZCT55SPT 33ZCT56SPT 33ZCT59SPT | J20 - 1 & 2 | N/A |
| Input 11 | AI | 100K Thermistor | Space Temperature Setpoint Adjust | 33ZCT56SPT 33ZCT59SPT | J20 - 3 & 4 | N/A |
| Rnet | AI | | Zone Temperature | SPS / SPPL / SPP | J13 - 1, 2, 3, 4 | N/A |
| AO - 1 | AO | Economizer | Economizer | Actuator-Field-supplied | J2 - 5 & 4 | N/A |
| AO - 2 | AO | 0-10 Vdc or 2-10 Vdc | Variable Frequency Drive | Field-supplied | J22 - 1 & 2 | N/A |
| BO - 1 | BO | N/A - Relay | Fan (G) | N/A | J1 - 4 | N/A |
| BO - 2 | BO | N/A - Relay | Heat 2 (W2) Output | N/A | J1 - 5 | N/A |
| BO - 3 | BO | N/A - Relay | Heat 1 (W1) Output | N/A | J1 - 6 | N/A |
| BO - 4 | BO | N/A - Relay | Cool 2 (Y2) Output | N/A | J1 - 7 | N/A |

| Channel Number | Type | Signal | Function | Part Number | Wire/Terminal Numbers | Alternate Terminals |
|----------------|------|-------------|----------------------------------|-------------|-----------------------|---------------------|
| BO - 5 | BO | N/A - Relay | Cool 1 (Y1) Output | N/A | J1 - 8 | N/A |
| BO - 6 | BO | N/A - Relay | Humidi-MiZer™ | N/A | J11 - 7 & 8 | N/A |
| BO - 7 | BO | N/A - Relay | Reversing Valve / High Speed Fan | N/A | J11 - 5 & 6 | N/A |
| BO - 8 | BO | N/A - Relay | Power Exhaust | N/A | J11 - 2 & 3 | N/A |

Legend

AI - Analog Input **AO** - Analog Output**BI** - Digital Input **BO** - Digital Output

* **Safety Chain Feedback** - 24 Vac required at this wire to provide **Run Enabled** status. Provide a jumper from **J1** - 1 to **J1** - 9 if no safeties are used. See "To wire inputs and outputs" in the *RTU Open Installation Guide* for additional information on the RTU Open wiring harness assembly terminations.

** Default input function

*** Parallel screw terminal at **J5** (**J5** - 1 = **J2** - 6, **J5** - 3 = **J1** - 10, **J5** - 5 = **J1** - 2) may be used in place of the associated flying leads at the harness (Part# OPN-RTUHRN). See "To wire inputs and outputs" in the *RTU Open Installation Guide* for additional information.

1 N.C. contact must be used as a primary safety device for approved fire shutdown operation. N.O. contact for monitoring only.

2 If a function other the default is used, do NOT connect wires from J1-x.

Communications wiring

Protocol overview

Protocols are the communication languages spoken by the control devices. The main purpose of a protocol is to communicate information in the most efficient method possible. Different protocols exist to provide specific information for different applications.

In the BAS application, many different protocols are used, depending on manufacturer. Different protocols do not change the function of the controller, but they typically require the owner to change systems or components in order to change from one protocol to another. The RTU Open is an effective solution to minimize the amount of controllers that you may need to change in order to communicate with different types of protocols.

You can set the controller to communicate 1 of 4 different protocols:

- *BACnet MS/TP* (page 7)
- *Modbus* (page 10)
- *N2* (page 12)
- *LonWorks* (page 14)

The default setting is BACnet MS/TP. Switch 3 (**SW3**) on the board sets protocol and baud rate. Switches **MSB (SW1)** and **LSB (SW2)** set the board's network address. See table below for specific switch settings. The third party connects to the controller through port **J19** for BACnet MS/TP, Modbus, and N2, and through **J15** for the LonWorks Option Card.

NOTES

- Changing protocol requires no programming or point assignment by the installer or operator.
- Power must be cycled after changing the **MSB (SW1) - LSB (SW2)** settings or connecting the LonWorks Option Card to **J15**.

SW3 Switch Settings Table

| | | Protocol Selection | | | | | | Baud Rate | |
|----------------------------------|--------|--------------------|-----|-----|-----|-----|-----|-------------|-------------|
| Protocol | | DS8 | DS7 | DS6 | DS5 | DS4 | DS3 | DS2 | DS1 |
| BACnet MS/TP (Default) | Master | Unused | Off | Off | Off | On | Off | Select Baud | Select Baud |
| Modbus | Slave | Unused | Off | Off | On | On | Off | Select Baud | Select Baud |
| N2 | Slave | Unused | Off | Off | Off | On | On | Off | Off |
| Lonworks | | Unused | On | On | Off | On | Off | Off | On |

Baud Selection Table

| Baud Rate | SW3/DS2 | SW3/DS1 |
|-------------------------|---------|---------|
| 9,600 | Off | Off |
| 19,200 | On | Off |
| 38,400 | Off | On |
| 76,800 (Default) | On | On |

BACnet MS/TP

To set up the RTU Open for BACnet MS/TP

Refer to *Appendix B* (page 46) for the Protocol Implementation Conformance Statement, or download the latest from *BACnet International* <http://www.bacnetinternational.net/catalog/index.php?m=28>.

NOTE This controller counts as a full load on the MS/TP bus.

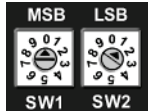
- 1 Turn **off** the RTU Open's power.

NOTE Changes made to the switches when the controller is on will not take effect until the power is cycled!

- 2 Using the rotary switches **MSB (SW1)** and **LSB (SW2)**, set a unique MS/TP MAC address for the RTU Open. Set the **MSB (SW1)** switch to the tens digit of the address, and set the **LSB (SW2)** switch to the ones digit. Valid addresses are 01-99.

NOTE The rotary switches also determine the BACnet device instance of the controller on the BACnet network. The BACnet device instance is automatically generated based on the scheme 16101xx, where “16” is the BACnet vendor ID for Carrier Corporation, and xx equals the rotary switch address.

EXAMPLE To set the controller’s MS/TP MAC address to 01, point the arrow on the **MSB (SW1)** switch to 0 and the arrow on the **LSB (SW2)** switch to 1. Internally, the BACnet device instance is automatically generated as 1610101.



- 3 Set the **SW3** Comm Selector DIP switches **DS1** and **DS2** for the appropriate communications speed (9600, 19.2k, 38.4k, or 76.8k bps).

NOTE Use the same baud rate and communication settings for all controllers on the network segment. The RTU Open is fixed at 8 data bits, No Parity, and 1 Stop bit for this protocol's communications.

Baud Selection Table

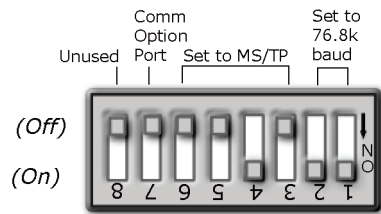
| Baud Rate | SW3/DS2 | SW3/DS1 |
|---------------|---------|---------|
| 9,600 | Off | Off |
| 19,200 | On | Off |
| 38,400 | Off | On |
| 76,800 | On | On |

- 4 Set **SW3** Comm Selector DIP switches **DS3** through **DS6** for BACnet MS/TP. See table and example below.
- 5 Leave **DS7** and **DS8** in the OFF position. These switches are not applicable to MS/TP.

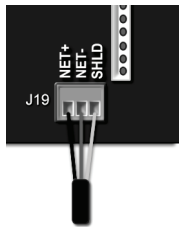
SW3 Protocol Switch Settings for MS/TP

| DS8 | DS7 | DS6 | DS5 | DS4 | DS3 |
|-----|-----|-----|-----|-----|-----|
| Off | Off | Off | Off | On | Off |

The following example shows the DIP switches set for 76.8k (Carrier default), and MS/TP.



- 6 Connect the MS/TP network to the controller's **J19** port. Connect to **Net+**, **Net-**, and **SHLD**.



Wire specifications

- o A dedicated 22 AWG shielded twisted pair wire (EIA 485)
- o Maximum wire length 2000 feet (610 meters) or 32 nodes
- o Devices should be daisy-chained and not star-wired
- o Attach the drain/shield wire to both ends of the network segment and through every controller

NOTE Use the same polarity throughout the network segment.

- 7 Turn **on** the RTU Open's power.

Troubleshooting BACnet MS/TP

Check the following to troubleshoot your RTU Open:

- 1 Verify that the BAS and controller are both set to speak the BACnet MS/TP protocol on the Comm Selector DIP switches **DS3 - DS6**.
- 2 Verify that the BAS and the controller are both set for the same baud rate:
 - o Baud rate DIP switches DS2 and DS1
 - o Obtain a Modstat of the controller. Scroll to the bottom of the page to **Network Communications** to view the active protocol and baud rate.
- 3 Verify that the BAS is configured to speak 2-wire EIA-485 to the controller. The BAS may have to configure jumper or DIP switches on their end.
- 4 Verify that the BAS and the controller have the same communication settings (8 data bits, No Parity, and 1 stop bit).
- 5 Verify proper connection wiring between the BAS and the controller.
- 6 Verify that the controller has a unique MAC address on the MS/TP bus. The controller's MS/TP MAC address is set by its rotary address switches.

- 7 Verify that the BAS is reading or writing to the proper BACnet objects in the controller. Refer to Appendix A for the points list for the controller.
- 8 Verify that the BAS is sending his requests to the proper MS/TP MAC address of our controller.
- 9 Present the BAS company with a copy of the controller's BACnet PICS so that they know which BACnet commands are supported. Refer to Appendix B for the BACnet PICS. In certain situations, it may be necessary to adjust the MS/TP Protocol timing settings through the BACview⁶ device.

It may be necessary to adjust the following two MS/TP Protocol timing settings through the BACview device:

Max Masters - defines the highest MS/TP Master MAC address on the MS/TP network.

For example, if there are 3 master nodes on an MS/TP network, and their MAC addresses are 1, 8, and 16, then Max Masters would be set to 16 (since this is the highest MS/TP MAC address on the network).

This property optimizes MS/TP network communications by preventing token passes and "poll for master" requests to non-existent Master nodes.

In the above example, MAC address 16 knows to pass the token back to MAC address 1, instead of counting up to MAC address 127. Each MS/TP master node on the network must have their Max Masters set to this same value. The default is 127.

Max Info Frames - defines the maximum number of responses that will be sent when the RTU Open receives the token. Any positive integer is a valid number. The default is 10 and should be ideal for the majority of applications. In cases where the RTU Open is the target of many requests, this number could be increased as high as 100 or 200.

NOTES

- MS/TP networks can be comprised of both master and slave nodes. Valid MAC addresses for master nodes are 0 – 127 and valid addresses for Slave nodes are 0 - 254.
- If the third party attempts to communicate to the controller but does not get a response, make sure the controller is set as a BACnet MS/TP (m) master. The BACnet software asks the controllers, "Who Is?" This is to auto-locate devices on the network. Only controllers set as masters will answer this request.
- See *Appendix A* (page 37) for Points Mapping tables.
- See *Appendix B* (page 46) for the BACnet Protocol Implementation Conformance Statement (PICS).

Editing MS/TP Properties:

- 1 From the default screen, press any key to continue.
- 2 Click the **LOGIN** button and enter a password of 1111.
- 3 Click **OK**.
- 4 Click the **MENU** button.
- 5 Click the right arrow (➤) to scroll over and down to the **Network** menu and press the **ENTER** button. The BACnet Settings are now shown, **Max Masters** and **Max Info Frames**.

If you want to edit **Max Masters**:

- 1 Click the **ENTER** button to enter edit mode.
- 2 Use arrow keys and keypad to either type in a new value (1-127), or click the **DECR/INCR** buttons to decrease/increase the value, respectively.
- 3 Click **OK** to accept the change.

If you want to edit **Max Info Frames**:

- 1 Click the down arrow and then press the **ENTER** button to enter edit mode.
- 2 Use arrow keys and keypad to either type in a new value (1-999), or hit the **DECR/INCR** buttons to decrease/increase the value, respectively.
- 3 Click **OK** button to accept the change.

Modbus

To set up the RTU Open for Modbus

Refer to *Appendix C* (page 47) for the Modbus Protocol Implementation Conformance Statement (PICS).

- 1 Turn **off** the RTU Open's power.
NOTE Changes made to the switches when the controller is on will not take effect until the power is cycled!
- 2 Using the rotary switches, set a unique Modbus slave address for the RTU Open. Set the **MSB (SW1)** switch to the tens digit of the address, and set the **LSB (SW2)** switch to the ones digit. Valid Modbus slave addresses are 01-99.

EXAMPLE To set the controller's Modbus slave address to 01, point the arrow on the **MSB (SW1)** switch to 0 and the arrow on the **LSB (SW2)** switch to 1.



- 3 Set the **SW3** Comm Selector DIP switches **DS1** and **DS2** for the appropriate communications speed (9600, 19.2k, 38.4k, or 76.8k bps).

NOTE Use the same baud rate and communication settings for all controllers on the network segment. The RTU Open is fixed at 8 data bits, No Parity, and 1 Stop bit for this protocol's communications.

Baud Selection Table

| Baud Rate | SW3/DS2 | SW3/DS1 |
|---------------|---------|---------|
| 9,600 | Off | Off |
| 19,200 | On | Off |
| 38,400 | Off | On |
| 76,800 | On | On |

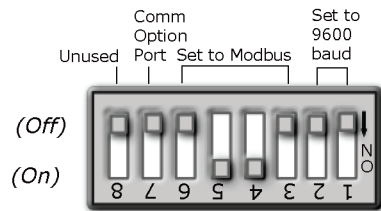
- 4 Set **SW3** Comm Selector DIP switches **DS3** through **DS6** for Modbus. See example below.

- 5 Leave **DS7** and **DS8** in the OFF position. These switches are not applicable to Modbus.

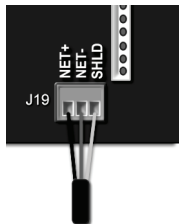
SW3 Protocol Switch Settings for Modbus

| DS8 | DS7 | DS6 | DS5 | DS4 | DS3 |
|-----|-----|-----|-----|-----|-----|
| Off | Off | Off | On | On | Off |

The following example shows the DIP switches set for 9600 baud and Modbus.



- 6 Connect the Modbus EIA-485 network to the RTU Open's **J19** port. Connect to **Net+**, **Net-**, and **SHLD**.



Wire specifications

- o A dedicated 22 AWG shielded twisted pair wire (EIA 485)
- o Maximum wire length 2000 feet (610 meters) or 32 nodes
- o Devices should be daisy-chained and not star-wired
- o Attach the drain/shield wire to both ends of the network segment and through every controller

NOTE Use the same polarity throughout the network segment.

- 7 Turn **on** the RTU Open's power.

Troubleshooting Modbus

Check the following to troubleshoot your RTU Open:

- 1 Verify that the BAS and controller are both set to speak the Modbus RTU protocol on the Comm Selector DIP switches **DS3 - DS6**.
- 2 Verify that the BAS and the controller are both set for the same baud rate:
 - o Baud rate DIP switches DS2 and DS1
 - o Obtain a Modstat of the controller. Scroll to the bottom of the page to **Network Communications** to view the active protocol and baud rate.

- 3 Verify that the BAS is configured to speak 2-wire EIA-485 to the controller. The BAS may have to configure jumper or DIP switches on their end.
- 4 Verify that the BAS and the controller have the same communication settings (8 data bits, No Parity, and 1 stop bit).
- 5 Verify proper connection wiring between the BAS and the controller.
- 6 Verify that the rotary address switches are set for the controller's unique slave address.
- 7 BAS must be reading or writing to the proper point addresses on the controller.
- 8 BAS is sending requests to the proper slave address of the controller.

NOTES

- Refer to *Appendix A* (page 37) for the Network Points list.
- Refer to *Appendix C* (page 47) for the Protocol Implementation Conformance Statement.

Modbus Exception Codes that might be returned from this controller

| Codes | Name | Description |
|-------|----------------------|--|
| 01 | Illegal Function | The Modbus function code used in the query is not supported by the controller. |
| 02 | Illegal Data Address | The register address used in the query is not supported by the controller. |
| 04 | Slave Device Failure | The Modbus Master has attempted to write to a non-existent register or a read-only register in the controller. |

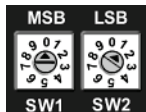
Johnson N2

To set up the RTU Open for N2

Refer to *Appendix D* (page 49) for the N2 Protocol Implementation Conformance Statement (PICS).

- 1 Turn **off** the RTU Open's power.
NOTE Changes made to the switches when the controller is on will not take effect until the power is cycled!
- 2 Using the rotary switches, set a unique N2 slave address for the RTU Open. Set the **MSB (SW1)** switch to the tens digit of the address, and set the **LSB (SW2)** switch to the ones digit. Valid N2 slave addresses are 01-99.

EXAMPLE To set the N2 slave address to 01, point the arrow on the **MSB (SW1)** switch to 0 and the arrow on the **LSB (SW1)** switch to 1.



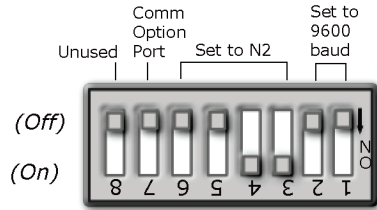
- 3 Set the Comm Selector DIP switches **DS1** and **DS2** for the 9600 baud.
NOTE Use the same baud rate and communication settings for all controllers on the network segment. The RTU Open is fixed at 9600 baud, 8 data bits, No Parity, and 1 Stop bit.

- 4 Set **SW3** Comm Selector DIP switches **DS3** through **DS6** for N2. See example below.
- 5 Leave **DS7** and **DS8** in the OFF position. These switches are not applicable to N2.

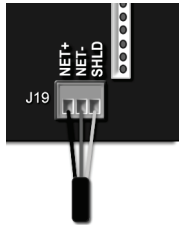
SW3 Protocol Switch Settings for N2

| DS8 | DS7 | DS6 | DS5 | DS4 | DS3 |
|-----|-----|-----|-----|-----|-----|
| Off | Off | Off | Off | On | On |

The following example shows the DIP switches set for 9600 baud and N2.



- 6 Connect the N2 EIA-485 network to the controller's **J19** port. Connect to **Net+**, **Net-**, and **SHLD**.



Wire specifications

- o A dedicated 22 AWG shielded twisted pair wire (EIA 485)
- o Maximum wire length 2000 feet (610 meters) or 32 nodes
- o Devices should be daisy-chained and not star-wired
- o Attach the drain/shield wire to both ends of the network segment and through every controller

NOTE Use the same polarity throughout the network segment.

- 7 Turn **on** the RTU Open's power.

Troubleshooting N2

Check the following to troubleshoot your RTU Open:

- 1 Verify that the BAS and controller are both set to speak N2 protocol on the Comm Selector DIP switches **DS3 - DS6**.
- 2 Verify that the BAS and the controller are both set for the same baud rate:
 - o 9600 for N2
 - o Baud rate DIP switches DS2 and DS1
 - o Obtain a Modstat of the controller. Scroll to the bottom of the page to **Network Communications** to view the active protocol and baud rate.
- 3 Verify that the BAS is configured to speak 2-wire EIA-485 to the controller. The BAS may have to configure jumper or DIP switches on their end.
- 4 Verify that the BAS and the controller have the same communication settings (8 data bits, No Parity, and 1 stop bit).
- 5 Verify proper connection wiring between the BAS and the controller.
- 6 Verify that the rotary address switches are set for the controller's unique slave address.
- 7 BAS must be reading or writing to the proper point addresses on the controller.
- 8 BAS is sending requests to the proper slave address of the controller.

NOTES

- Refer to *Appendix A* (page 37) for the Network Points list.
- Refer to *Appendix D* (page 49) for the Protocol Implementation Conformance Statement.

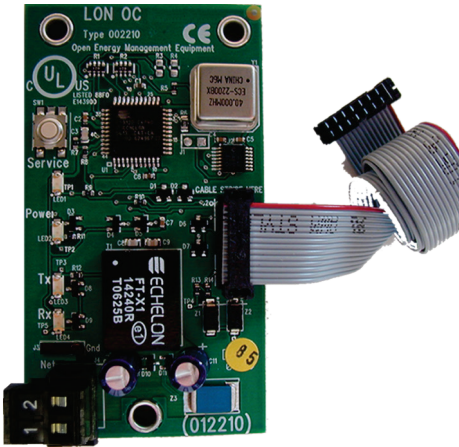
LonWorks



When you handle the LonWorks Option Card:

- Do not contaminate the printed circuit board with fingerprints, moisture, or any foreign material.
- Do not touch components or leads.
- Handle the board by its edges.
- Isolate from high voltage or electrostatic discharge.
- Ensure that you are properly grounded.

Refer to *Appendix E* (page 51) for the LonWorks Protocol Implementation Conformance Statement (PICS).



To set up the RTU Open for the LonWorks Option Card (Part #LON-OC)

- 1 Turn **off** the RTU Open's power.

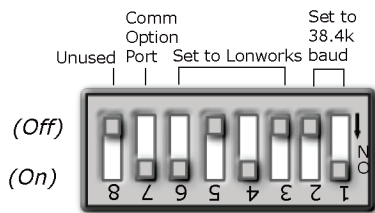
NOTES

- Changes made to the switches when the controller is on will not take effect until the power has been cycled!
 - The controller's rotary address switches are not used when the LON-OC is installed. That's because each LON-OC has a 48-bit Neuron ID that makes it unique on the LonWorks network.
- 2 Set the Comm Selector DIP switches **DS1** and **DS2** on **SW3** for 38.4k Communications speed. This is the speed at which the LON-OC speaks to the RTU Open. It is fixed at 38.4k.
 - 3 Set the Comm Selector DIP switches **DS3** through **DS6** on **SW3** for LonWorks. See example below.
 - 4 Set the Comm Selector DIP switch **DS7** on **SW3** to the ON position to enable the LON-OC.
 - 5 Leave Comm Selector DIP switch **DS8** on **SW3** in the OFF position since it is not used.


SW3 Protocol Switch Settings for LonWorks

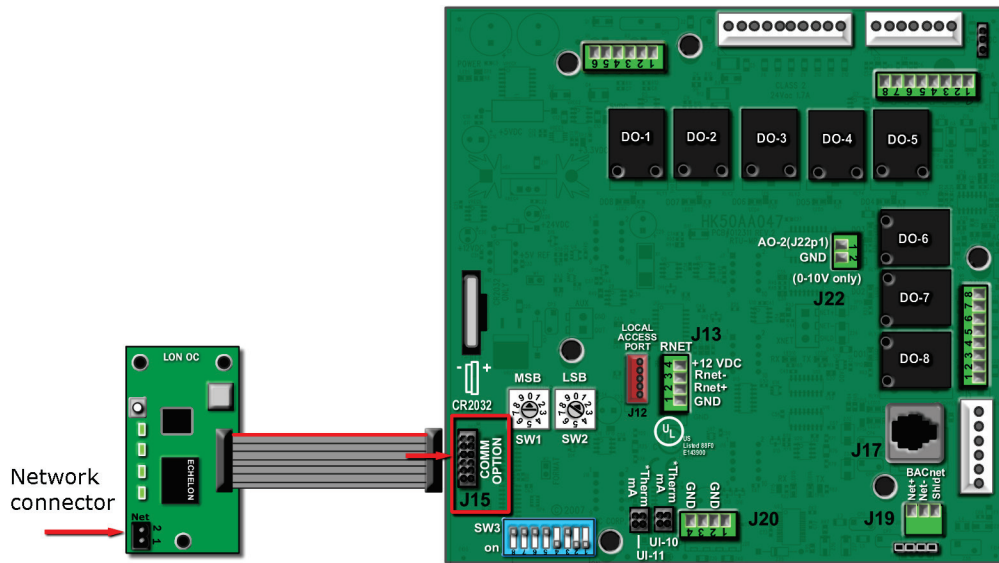
| DS8 | DS7 | DS6 | DS5 | DS4 | DS3 |
|-----|-----|-----|-----|-----|-----|
| Off | On | On | Off | On | Off |

The following example shows the DIP switches set for 38.4k baud and the LON-OC enabled.



- 6 Plug the LON-OC's ribbon cable into Comm Option Port **J15** on the controller. See illustration below.

 **CAUTION!** The controller must be **OFF** before being connected.



- 7 Connect the LonWorks network to the LON-OC via the 2-pin **Net** port.
NOTE The 2-pin **Net** port provides TP/FT-10 channel compatibility. The TP/FT-10 or "Free Topology" network type is **polarity insensitive**. Use 24 to 16 AWG twisted pair wire.
- 8 Turn **on** the RTU Open's power.
- 9 Commission the controller for LonWorks communication. See instructions below.

Commissioning the controller for LonWorks communication

Before a device can communicate on a LonWorks network, it must be commissioned. Commissioning allows the system integrator to associate the device hardware with the LonWorks system's network layout diagram. This is done using the device's unique Neuron ID.

A network management tool such as Echelon's LonMaker is used to commission each device, as well as, to assign addressing. Specific instructions regarding the commissioning of LonWorks devices should be obtained from documentation supplied with the LonWorks Network Management Tool.

When a new device is first commissioned onto the LonWorks network, the system integrator must upload the device's External Interface File (XIF) information. LonWorks uses the XIF to determine the points (network variables) that are available from a device. The RTU Open has a set of predefined network variables. These variables can be bound or accessed by the Network Management Tool.

The **Browse** feature of the Network Management Tool allows you to read real-time values from the RTU Open. The Network Management Tool allows you to test integration prior to binding the controller's network variables to other LonWorks nodes.

Troubleshooting LonWorks

Check the following to troubleshoot your RTU Open:

- 1 Verify that the BAS and controller are both set to speak the LonWorks protocol by the Comm Selector DIP switches **DS3 - DS6**.
- 2 Verify that the BAS and the controller are both set for the same baud rate:
 - o 38.4k for LonWorks
 - o Baud rate DIP switches DS2 and DS1
 - o Obtain a Modstat of the controller. Scroll to the bottom of the page to **Network Communications** to view the active protocol and baud rate.
- 3 BAS must be reading or writing to the proper point addresses on the controller.
- 4 Verify that the Comm Option Port is enabled on the controller. The Comm Option Port setting must be set via **SW3** (switch **DS7**). It should be in the ON position to enable LonWorks communication.
- 5 Verify that controller has been properly commissioned onto the LonWorks network. See *Commissioning the controller for LonWorks communication* (page 16).
- 6 Use the **Browse** feature of the network management tool to verify that you can communicate and get real-time values from the controller before connecting the BAS.
- 7 Once you have confirmed communications with the controller using the network management tool, connect the BAS.
- 8 Verify that the BAS is connected properly to the LonWorks Option Card's 2-wire TP/FT-10 Net port, which is polarity insensitive. The BAS may have to configure jumper or DIP switches on their end to support TP/FT-10.

Local Access

BACview6 Handheld device

The BACview⁶ Handheld device (BV6H) is a keypad/display interface used to connect to the RTU Open to access the control information, read sensor values, and test the RTU Open. This is an accessory interface that does not come with the RTU Open and can only be used at the unit.

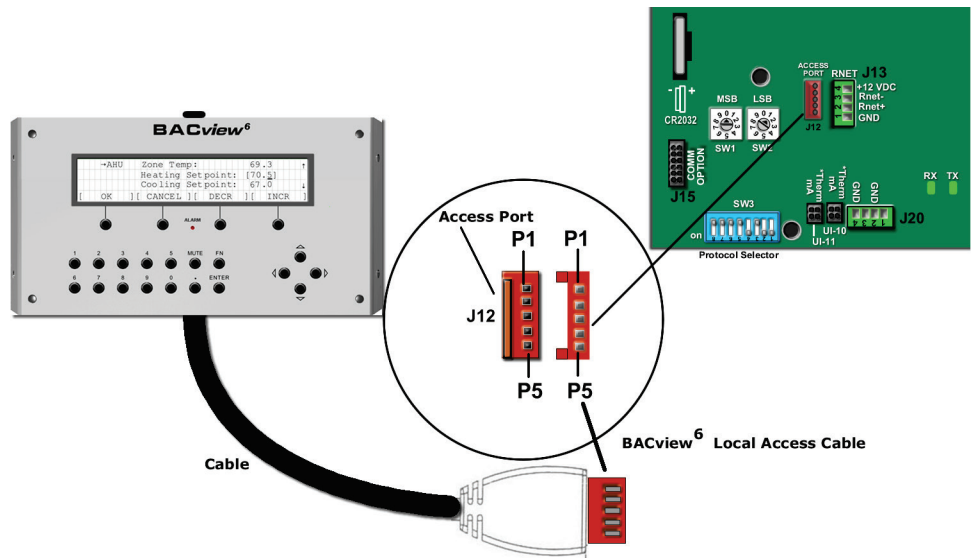
Connect the BACview⁶ device to the RTU Open's **J12** local access port.

There are 2 password-protected levels in the display (User and Admin).

- The User password is defaulted to 0000 but can be changed.
- The Admin password is 1111 and cannot be changed.

NOTES

- To adjust the contrast of the display, turn the contrast screw on top of the BACview⁶ device clockwise to lighten the display or counterclockwise to darken it.
- There is a 10 minute auto logout if a screen is left idle.



Virtual BACview® application

The Virtual BACview® application is software that mimics the BACview®⁶ Handheld device. The USB Link cable (USB-L) is required to connect a computer to the RTU Open board. The USB Link cable connects a PC's USB port to the **J12** local access port on the RTU Open. This program functions and operates identical to the BACview® Handheld device.

Sequence of Operation

The RTU Open supports various types of constant volume air source configurations:

- Standard heat/cool unit types with up to 2-stages of mechanical cooling and gas or electric heating
- Heat pump units utilizing a reversing valve output for heating and cooling control
- Heat pump unit (Carrier) with an OEM control board
- Economizer, CO2, Demand Limiting, and RH control strategies are available for appropriately equipped units

The RTU Open may operate as part of a linked VVT system or as a stand-alone controller.

Occupancy

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

An occupancy schedule may be:

- A local schedule configured in the controller using a BACview device or Field Assistant
- A BACnet schedule configured in the i-Vu® application, networked through an i-Vu Open Router
- A BACnet or local schedule configured for subordinate VVT Zones, networked through an i-Vu Open Router(s) and employing Linkage

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 a BACview device or Field Assistant.

Occupancy Source - the following settings determine occupancy. See Unit Configuration.

Options:

- **Always Occupied** – (default) Controller operates continuously, regardless of any configured schedule
- **BACnet Schedule** – Uses a local BACnet occupancy schedule configured within the controller
- **BAS On/Off** – Occupancy is set over the network by another device or a third party BAS. Refer to the *RTU Open Integration Guide* for additional instructions in communication protocols.
- **Remote Occ Input** – Controller monitors an input contact connected to one of the available binary inputs configured to receive it. You must set **Unit Configuration > Occupancy Source** to **Remote Occ Input** and one **Input Switch Configuration** to **Remote Occupancy**.

Supply fan

The RTU Open supply fan may be configured for 1 of 3 **Fan Control modes**:

- **Single** - The fan operates at one speed only and provides on/off operation
- **Two Speed** - The fan operates at 1 of 2 speeds depending on the mode of operation and load conditions. During fan only or single stage cooling, the fan operates at low speed. During heating, second stage cooling, dehumidification, or if maximum economizer operation is required, the fan operates at high speed.
- **Variable Speed** - The fan operates at a variable speed to meet the load conditions and SAT safety requirements to provide maximum energy savings by minimizing fan horsepower consumption. Fan speed is NOT controlled by static pressure.

The 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 or cooling
- **Always On** - The fan runs continuously regardless of occupancy or calls for heating and cooling

Occupancy can be determined by Linkage, BACnet schedules, BAS schedules, or in response to a remote occupancy switch.

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** alarm
- **SPT** alarms

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

- RTU supply fan
- RTU economizer
- RTU power exhaust

The RTU Open may 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.

Cooling

The RTU Open's application and configuration determines the specific cooling sequence. The RTU Open can control up to 2 stages of cooling with an additional output for a reversing valve (heat pump applications).

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

- **Outdoor Air Temperature** is greater than the **Cooling Lockout Temperature** setpoint
- The indoor fan has been on for at least 30 seconds

- The unit has a valid **Supply Air Temperature** input
- The unit has a valid **Space Temperature** input
- Heat mode is not active and the time guard between modes has expired
- Economizer is unavailable, or if the Economizer is active, mechanical cooling is available if the economizer is open > 85% for at least 5 minutes, the SAT > [**Minimum Cooling SAT** + 5Δ °F (2.7Δ °)] and SPT > [**Effective Cooling Setpoint** + 0.5Δ °F (.27Δ °C)].

The cooling relays are controlled by the Cooling Control PID Loop and Cooling Stages Capacity algorithm. They calculate the desired number of stages needed to satisfy the space by comparing the **Space Temperature** to the:

- **Effective Occupied Cooling Setpoint** when occupied
- **Effective Unoccupied Cooling Setpoint** when unoccupied

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 5 minute off-times for each compressor output.

During compressor operation, the RTU Open may reduce the number of active stages if the rooftop supply air temperature falls below the **Minimum Cooling SAT Setpoint**. A compressor staged off in this fashion may be started again after the normal time-guard period has expired, if the **Supply Air Temperature** has increased above the **Minimum Cooling SAT Setpoint**.

Compressor 2 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.

Economizer

The RTU Open provides an analog economizer output for rooftop units with economizer dampers. Economizer dampers may be used to provide indoor air quality control and free cooling when outside air conditions are suitable.

The following conditions must be true for economizer operation:

- The **Outdoor Air Temperature** is less than the **Space Temperature** and less than the **Economizer High OAT Lockout Temp** setpoint
- The indoor fan has been on for at least 30 seconds
- The unit has a valid **Supply Air Temperature** input
- The unit has a valid **Space Temperature** input

If the RTU Open is configured for VFD or 2-speed fan, and the fan is on high speed or is configured for single-speed fan, and any of the preceding conditions are not true, the economizer will be set to the **Vent Dmpr Pos / DCV Min Pos** setpoint. If it is configured for VFD or 2-speed fan, and the fan is on low speed and any of the preceding conditions are not true, the economizer will be set to the **Low Fan Econ Min Pos**.

If all preceding conditions are true, the economizer PID loop modulates the damper.

The economizer position is reduced as the SAT falls below the **Minimum Cooling SAT** + 5Δ °F (2.8Δ °C), but never closes below the configured **Vent Dmpr Pos / DCV Min Pos**.

Power Exhaust

The RTU Open may enable and disable an exhaust fan, based on either the controller's occupancy or its economizer damper position. If the **Fan Control** is set to **Two Speed** or **Variable Speed**, the **Power Exhaust Setpoint** is automatically adjusted based on the fan's air delivery. The **Calculated PE Setpoint** used for control is displayed in the **Maintenance** section.

If **Continuous Occupied Exhaust** is **Yes**, the **Power Exhaust** binary output (BO-8) is energized while the 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 **Power Exhaust Setpoint** value (default = 50%). The output remains energized until the economizer output falls below the **Power Exhaust Setpoint** value by a fixed hysteresis of 10%.

Pre-Occupancy Purge

Pre Occupancy Purge allows the rooftop equipment with an economizer damper to use outdoor air to purge the space of contaminants just prior to the beginning of the occupied period.

The following conditions must be true for pre-occupancy purge to operate:

- **Pre-Occupancy Purge** set to **Enable**
- **Economizer Exists** set to **Yes**
- A local time schedule is configured
- The local time schedule is currently unoccupied and the remaining time is less than the configured **Purge Time**

When the RTU Open schedule is unoccupied and the remaining unoccupied time is less than the purge time, the supply fan starts. The economizer damper opens to the configured **Economizer Purge Min Pos**. The RTU Open continues to operate in this mode until the occupied start time is reached. The **Pre-Occ Purge** state is displayed in the **Maintenance** section.

Unoccupied Free Cooling

Unocc Free Cool Enable allows rooftop equipment with an economizer damper to use 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** setpoint
- The outside air temperature is less than the space temperature
- **Enthalpy** (if enabled) is **Low**

When the RTU Open schedule is unoccupied and the space temperature rises at least $1\Delta^{\circ}\text{F}$ ($.5\Delta^{\circ}\text{C}$) above the **Occupied Cooling Setpoint**, the supply fan starts. The economizer damper opens as necessary to cool the space. The 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.

Optimal Start

The RTU Open may use **Optimal Start**. **Optimal Start** adjusts the effective setpoints to achieve the occupied setpoints by the time scheduled occupancy begins. The Optimal Start recovery period may begin as early as 4 hours prior to occupancy. The algorithm works by moving the unoccupied setpoints toward the occupied setpoints. The rate at which the setpoints move is based on the outside air temperature, design temperatures, and capacities.

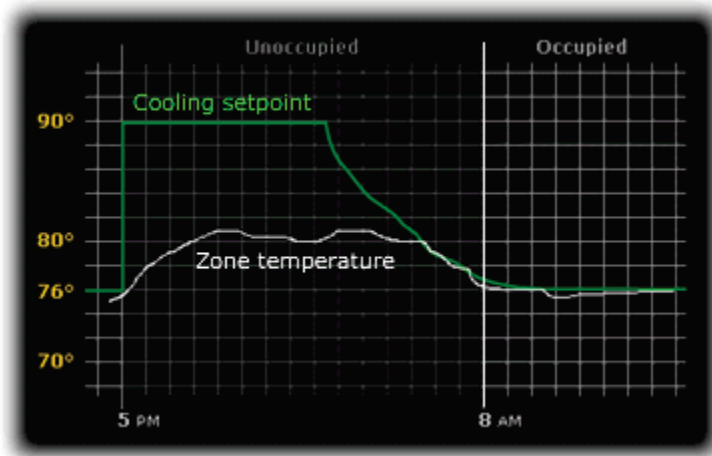
The following conditions must be true for optimal start to operate:

- On the **Properties** page > **Equipment** tab > **Configuration** > **Setpoints** > **Optimal Start**, the **Default Value** must be set greater than **0** and less than or equal to **4** (**0.00** disables **Optimal Start**).
- The system is unoccupied

NOTE If the Open controller does not have a valid outside air temperature, then a constant of 65° F (18.3° C) is used. This value is not adjustable.

The actual equation that the controller uses to calculate **Optimal Start** is nonlinear. An approximation of the result is shown below.

NOTE The values in the graph below are Fahrenheit.



To change **Optimal Start** settings:

- 1 In the navigation tree, select the equipment that you want to change.
- 2 Click **Properties** page > **Equipment** tab > **Configuration** > **Setpoints**.

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 a BACview device 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 uses an air quality (CO₂) sensor to monitor conditions within the occupied space. A CO₂ sensor may be terminated at the RTU Open, or a subordinate zone controller, when part of a zoned system.

An outdoor air quality sensor may also be installed and terminated at the RTU Open, but is not required. When an outdoor air quality sensor is not installed, the algorithm uses 400ppm as the fixed outdoor air CO₂ 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 CO₂ 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 CO₂ minimum damper position is then compared against the **Vent Dmpr Pos / DCV Min Pos** setpoint and the greatest value becomes the minimum damper position used 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%.

Indoor Air CO₂

Indoor Air CO₂ is controlled on rooftop equipment with an economizer. **Indoor Air CO₂** sequence is enabled by installing an air quality (CO₂) sensor. A CO₂ sensor may be terminated at the RTU Open, or a subordinate zone controller, when part of a zoned system.

An outdoor air quality sensor may also be installed and terminated at the RTU Open, but it is not required. When an outdoor air quality sensor is not installed, the algorithm uses 400ppm as the fixed outdoor air CO₂ level.

The following conditions must be true for the **Indoor Air CO₂** algorithm to operate:

- The system is occupied
- The supply fan has been started for at least 30 seconds
- The CO₂ sensor has a valid reading

As the air quality within the space changes, the minimum position of the economizer damper changes, which allows more or less outdoor air into the space, depending on the relationship of the indoor air CO2 level to the differential setpoint.

The **Indoor Air CO2** algorithm calculates a minimum position value using a PID loop. The CO2 minimum damper position is then compared against the **Vent Dmpr Pos / DCV Min Pos** setpoint and the greatest value becomes the final minimum damper position of the economizer output.

The degree to which the outside air damper may be opened by the **Indoor Air CO2** algorithm is limited by the **DCV Max Vent Damper Pos** setpoint, which is adjustable between ten and sixty percent (10 – 60%).

Heating

The specific heating sequence is determined by the controller's application and configuration. The RTU Open controls up to two stages of gas or electric heating with an additional output for a **Reversing Valve** (Heat Pump applications).

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

- The **Outdoor Air Temperature** is less than the **Heating Lockout Temperature** setpoint
- The indoor fan has been ON for at least 30 seconds
- The unit has a valid **Supply Air Temperature** input
- The unit has a valid **Space Temperature** input
- Neither Cool mode nor economizer are active and the time guard between modes has expired

The heating relays are controlled by the Heating Control PID Loop and Heating Stages Capacity algorithm, which calculate the desired number of stages to satisfy the space by comparing the **Space Temperature** to the:

- **Effective Occupied Heating Setpoint** when occupied
- **Effective Unoccupied Heating Setpoint** when unoccupied

When the heating algorithm preconditions have been met, the heating is energized in stages. Anti-recycle timers are employed to protect the equipment from short-cycling. There are fixed one minute minimum on and off times for each heating output.

During heating operation, the RTU Open may reduce the number of active stages if the rooftop **Supply Air Temperature** exceeds 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.

Heat Pump operation

The RTU Open can control heat pumps **HP O/B** and **Y1/W1**.

HP O/B provides a separate output (BO-7) to control a reversing valve. The reversing valve control may be configured to be energized with a call for heating (**B**), or energized with a call for cooling (**O**).

The sequence of operations are as previously described for heating and cooling except that the **Y1** and **Y2** outputs are compressor outputs, energizing mechanical heating or cooling, depending on the state of the reversing valve. **W1** and **W2** are used for auxiliary heat. Up to two stages are available.

Selection **Y1/W1** is for heat pumps that do not require a **O** terminal to energize the reversing valve. The sequences of operations are as described for *Heating* (page 26) and *Cooling* (page 21). The reversing valve output is not used in this application. **W1** and **W2** are used for auxiliary heat. Up to two stages are available.

Dehumidification

The RTU Open provides occupied and unoccupied dehumidification on units that are equipped with the Carrier Humidi-MiZer™ option from the factory. This requires a space relative humidity sensor or a humidistat for control.

The following conditions must be true for the dehumidification control to operate:

- The **Outside Air Temperature** is greater than the **Cooling Lockout Temperature** setpoint
- The **Indoor Fan** has been ON for at least 30 seconds
- The unit has a valid **Supply Air Temperature** input
- The unit has a valid **Space Temperature** input
- The unit has a valid **Space Relative Humidity Sensor** or **Humidistat** input
- Heat mode is not active and the time guard between modes has expired

When using a relative humidity sensor to control dehumidification, occupied and unoccupied dehumidification setpoints are used.

When using a humidistat, the setpoints are not used. The humidistat indicates a high-humidity condition.

When a high indoor relative humidity condition is indicated and the above conditions are satisfied, the RTU Open enters the dehumidification mode, energizing the Humidi-MiZer™ output.

The mode continues until the space relative humidity falls below the active setpoint by a 5% fixed Hysteresis when a humidity sensor is used, or when there is no longer a call for dehumidification where a humidistat is used.

See the base unit / Humidi-MiZer™ operations manual for additional information.

Demand Limiting

The RTU Open may employ a demand limit strategy. Demand limiting in the RTU Open works through setpoint expansion. The controller's heating and cooling setpoints are expanded in steps or levels. The degree to which the setpoints are expanded is defined by the **Demand Level Setpoints**.

Each **Demand Level** (1 through 3) adjusts the heating and cooling setpoints outwards. By default, **Demand 1** yields a 1Δ°F (.5Δ°C) expansion, **Demand 2** yields a 2Δ°F (1.1Δ°C) expansion, and **Demand 3** yields a 4Δ°F (2.2Δ°C) expansion.

The BACnet **Demand Limit** variable sets the desired level of setpoint expansion in the receiving controller. **Level 0** leaves the standard occupied and unoccupied heating and cooling setpoints in effect. Levels 1 through 3 expands occupied heating and cooling setpoints.

Door switch

A **Door Contact** may be configured on any unused binary input. A typical application is an occupancy sensor mounted within the space served by a single zone rooftop. **Door Contact** disables mechanical cooling and electric or gas heating, when active. Economizer cooling, if available, continues to operate.

Remote Occupancy

Remote occupancy may be configured on any unused binary input channel. A typical application is a remote contact, controlled by a third party, to set the controller's occupied mode. The **Remote Occupancy** function requires both an input configured for **Remote Occupancy**, and **Occupancy Source** set to **Remote Occ Input** to operate.

Once configured, the controller will operate in the occupied or unoccupied mode, as determined by the state of the **Remote Occupancy** input.

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. A compressor safety tripped indicator circuit is available on most Carrier rooftop equipment.

A **Compressor Safety Alarm** is shown on **Properties** page > **Equipment** tab > **Alarms** and indicates that the equipment requires attention.

Cooling, heating, and supply fan outputs are not interrupted except where the RTU Open is configured for Heat Pump operation. When configured for Heat Pump, and in the heating mode, a compressor safety fault will cause the available stages of electric heating to be enabled in place of mechanical heating.

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.

Alarms

NOTE Some of the **Alarms** functions described in this section will only be visible on the **Properties** page > **Equipment** tab > **Alarms** when the appropriate inputs are configured. Alarms are not initiated when the input is not configured.

Safety Chain - You may use the RTU Open's safety chain circuit to shut down the unit for a safety condition. Examples: Low or High Temperature Cutouts (Freezestat / Firestat). See To wire inputs and outputs for additional wiring instructions. This alarm indicates the safety chain circuit (Input 4) is open. Cooling, heating, and supply fan operation stop after appropriate time guards. Normal operation resumes when the safety chain circuit is complete.

Fire/Smoke Shutdown may configure the RTU Open to accept a **Fire Shutdown** contact on Input 5. Examples: Smoke detectors or fire shutdown relays. This alarm indicates this device (Input 5) has tripped. Cooling, heating, and supply fan operation immediately stop. Reset fire shutdown contact to resume normal operation.

Compressor Safety - You may configure the RTU Open to monitor the base unit's compressor safety circuit. This alarm indicates the base unit's compressor safety circuit is energized. Cooling, heating, and supply fan outputs are not interrupted except when the RTU Open is configured for Heat Pump. Normal operation resumes when the compressor safety circuit is de-energized.

If the Heat Pump is in the heating mode, it will automatically replace the compressor stage(s) with the equivalent number of auxiliary heat stages, as available.

- If it's a Carrier Heat Pump, there is only one auxiliary heat stage output and the staging is done by the machine itself, if it's two-stage gas or electric.
- For a non-Carrier Heat Pump, when configured for two stages of aux heat and two compressors, Compressor 1 is replaced by Aux Heat Stage 1 and Compressor 2 is replaced by Aux Heat Stage 2.

The compressor output stays on when the safety alarm is present. For cooling, the alarm indicates the compressors are down. See *Heat Pump operation* (page 26) for further information.

Space Temperature - This alarm indicates if the space temperature is outside the configured alarm limits. If active (Alarm), displays additional values for the space temperature when the alarm condition occurred and the alarm limit exceeded.

The following values are related to the **Space Temperature** alarm:

- **Alarming Temperature** - Displays the value of the space temperature that caused the alarm condition to occur and is only visible when the **Space Temperature** is in an alarm state.
- **Alarm Limit Exceeded** - Displays the value of the alarm setpoint that was exceeded by the alarming temperature and is only visible when the **Space Temperature** is in an alarm state.

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

Space Temp Sensor - This alarm indicates an invalid sensor condition in a physically connected space temperature sensor (SPT Sensor/T5*). Cooling, heating, and supply fan operation stop after the appropriate time guards. Normal operation resumes when the controller detects a valid sensor.

Supply Air Temperature – This alarm indicates that the supply air temperature is outside the configured alarm limits. The alarm is reset to normal when the supply air temperature returns within the configured alarm limits plus a $5\Delta^{\circ}\text{F}$ ($2.7\Delta^{\circ}\text{C}$) hysteresis. This alarm is inhibited until the fan has been running for 15 minutes to allow for system stabilization after startup.

Supply Air Temp Sensor – This alarm indicates a shorted or open circuit in the SAT input. Cooling, heating, and supply fan operation stops after the appropriate time guards. Normal operation resumes when the controller detects a valid sensor.

Indoor Air Quality – The RTU Open generates an **Indoor Air Quality** alarm if the CO₂ level exceeds the configured alarm limits. (This alarm is only shown when a valid indoor air quality sensor value is available).

Indoor Air Quality Sensor – The RTU Open generates an **Indoor Air Quality Sensor** alarm if a valid sensor value is no longer available. For locally connected sensors, the mA input at the associated channel falls below 3.5 mA or rises above 21 mA. For network sensors, the controller is no longer receiving a value from the network. Cooling, heating, and supply fan continue to operate. However, the controller's IAQ control function is disabled until the fault condition is corrected.

Space Relative Humidity – The RTU Open generates a **Space Relative Humidity** alarm if the space humidity level exceeds the configured low or high alarm limits. (This alarm is only shown when a valid relative humidity sensor value is available).

Space Relative Humidity Sensor – The RTU Open generates a **Space Relative Humidity Sensor** alarm if a valid sensor value is no longer available. For locally connected sensors, the mA input at the associated channel falls below 3.5 mA or rises above 21 mA. For network sensors, the controller is no longer receiving a value from the network. Cooling, heating, and supply fan operation continues, however, the controller's Humidi-MiZer™ binary output is disabled until the fault condition is corrected.

Filter – If the RTU Open is configured to monitor the filter through a hardware input switch contact, it generates a **Filter** alarm if the associated input channel detects a dirty filter condition (opposite state of the **Input "x" Switch Configuration**). Otherwise, if no hardware switch monitoring is used, the RTU Open generates a filter alarm when 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 > Reset Filter Runtime Alarm** to **On**, back to **Off**, and clicking **OK** after each setting. Set **Unit Configuration > Filter Service Alarm Timer** value to **0** to disable the filter service alarm function.

Local OAT Sensor – This alarm indicates a shorted or open circuit in the locally connected OAT input.

Outdoor Air Temp Sensor – This alarm indicates a valid OAT sensor value is no longer available. An alarm condition can occur from a failed locally connected sensor or if a network OAT value is no longer being received by the controller. Cooling, heating, and supply fan operation continues. OAT lockouts will not operate while the sensor is in alarm. Normal operation resumes when the controller detects a valid sensor.

Outdoor Air Quality Sensor – The RTU Open generates an **Outdoor Air Quality Sensor** alarm if the mA input at the associated channel falls below 3.5 mA or rises above 21 mA. For network sensors, the controller is no longer receiving a value from the network. Cooling, heating, and supply fan operation continues. However, the controller's IAQ control function uses 400ppm as the fixed outdoor air CO₂ level until the fault condition is corrected.

Setpoint Slider – The RTU Open generates this alarm when an open circuit is detected at Input 11 and the RTU Open **Configuration > Unit Configuration > Input Configuration > Space Sensor Type** is set to T56. Note that only an open circuit results in an alarm. A short across this input offsets the setpoints negatively by the amount configured in the **Unit Configuration > Setpoint Adjustment Range**.

Switch Configuration - The RTU Open generates this alarm when any two of the **Unit Configuration > Input Functions 3, 5, 8, or 9** are configured identically. Neither input may work reliably and downstream control may be affected, depending on the function duplicated. The alarm clears and normal control is restored when the input function duplication is corrected.

Analog Input Configuration - The RTU Open generates this alarm when the **Unit Configuration > Input Functions 1 and 2** are configured identically. Neither input may work reliably and downstream control may be affected, depending on the function duplicated. The alarm clears and normal control is restored when the input function duplication is corrected.

Supply Fan Runtime - The RTU Open generates a this alarm when 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 > 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 - The RTU Open generates this alarm when 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 > 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 - The RTU Open generates this alarm when 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 > 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 States** value is not set to **Two Stages**.

Airside Linkage Alarm - An RTU Open may act as an air source in a zoned system. Carrier systems use a function called Linkage™ to pass data between a master zone and its air source over an MS/TP network connection. When the RTU Open is part of a linked system, it will indicate an airside linkage alarm if it loses communications with its linkage master or if it receives data from more than 1 master zone.

Linkage

The RTU Open may serve as an air source to an Open Variable Volume Terminal (VVT) system. When the 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
- CO₂ 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 System Mode, Supply Air Temperature, and Outside Air Temperature (if available), and passes that information to all linked controllers.

NOTE The following paragraphs describe the interaction between the air source (RTU Open) and its subordinate zones. Additional information regarding Open Zoned Systems may be found in the *VVT Zone and VVT Bypass Controller Installation Guides*.

The VVT Master determines system operation by prioritizing heating and cooling requirements from all the zones based on their occupancy and demand. The VVT Master scans the system continuously to determine if any zones are occupied. Occupied zones are a higher priority than unoccupied zones. The VVT Master evaluates all the occupied zones' heating or cooling demands and sends a request to the air source (RTU Open) for:

- Cooling, if the number of occupied zones with cooling demands exceeds the number of occupied zones with heating demands, and the demand is greater than or equal to the number of configured **Linkage Callers**.
- Heating, if the number of occupied zones with a heating demand exceeds or is equal to the number of **Linkage Callers**.

If no zones are occupied or no occupied zones require heating or cooling, the VVT Master performs the evaluation described above for the unoccupied zones.

The VVT Master then gathers the following information and sends it to the air source (RTU Open):

- The system mode
- The setpoints and zone temperature from the zone with the greatest demand for the requested air source mode (heating or cooling). (This zone is called the reference zone.)
- The system occupancy status
- Most open damper position from any zone
- RH and CO2 values (if applicable)

The air source responds by sending the air source mode, supply air temperature, and outside air temperature. The air source verifies the mode by comparing its supply air temperature to the space temperature received through Linkage. See the air source documentation for operation and parameters used to verify its mode. This verification allows the VVT system to determine if the desired air source mode is actually being provided. For example, if the VVT Master sends a request for heating and the air source does not have heat or it's heat has failed, the air source's actual mode indicates that and it's current mode is sent to the zones so that they can control accordingly.

The system remains in that mode until all zones of that demand are satisfied or until the system mode reselect timer (default 30 minutes) causes a forced re-evaluation of the system. If there is no demand for the opposite mode, the reselect timer starts again and the current mode continues until all zones are satisfied or until the reselect timer expires, repeating the process. If there is a demand for the opposite mode, the VVT Master sends the reference zone's space temperature and setpoints to the air source and restarts the reselect timer. The air source re-evaluates its demand based on the new information and goes to the Vent mode until the new mode can be verified as described above. The amount of time this takes is determined by the air source's operating parameters.

The VVT Master continuously evaluates the system and updates the air source with the most current system demand. Based on the evaluation, the reference zone can change from one zone to another. The evaluation process continues until there is no demand from any zone or the system mode reselect timer causes a re-evaluation of the system conditions.

If no heating or cooling is required or the current air source mode is satisfied, the VVT Master calculates the weighted average of the occupied and unoccupied heating and cooling setpoints. It also calculates a zone temperature that is midway between the setpoints (occupied or unoccupied based on the system's current occupancy status). This information, plus the occupancy status, is sent to the air source so that its current mode is disabled and the unit ceases heating or cooling operation. If the system is occupied, the air source fan and OA damper, if applicable, operate to maintain proper ventilation.

Air source mode determination

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

- **OFF** – Air source fan is off.
- **WARMUP** – Air source fan is on and providing first cycle of heat when changing from unoccupied to occupied.
- **HEAT** – Air source fan is on and providing heat.
- **FREECOOL** – Air source fan is on and providing cooling using economizer only.
- **COOL** – Air source fan is on, and cooling is provided by economizer and mechanical cooling.
- **PRESSURIZATION** – Fire-Life safety override input is active. Air source fan is on providing 100 percent outside air. Mechanical heating and cooling may be disabled.
- **EVACUATION/SHUTDOWN** – Fire-Life safety override input is active. Air source fan is off.
- **VENT** – Air source fan is on, economizer providing ventilation without heating or cooling, providing neutral supply air temperature.

See the air source's Installation manual for specific operation.

Troubleshooting

The RTU Open controller acts as an intelligent embedded thermostat to the rooftop unit, but can be monitored and controlled from a third party network. For this reason, there are 3 distinct components for troubleshooting.

The three parts to the system are:

- The mechanical systems of the rooftop unit
- The RTU Open controller
- The third party network connected

Determining which component needs troubleshooting is the first step.

The RTU Open controller can be used to troubleshoot itself with service test, communicating LED's, and built-in alarms, which are discussed in the unit Controls and Troubleshooting instructions. Disconnecting the RTU Open from the unit control inputs can be valuable in determining whether the problem is related to the unit/equipment, the controller/equipment, or the controller/network. Generally, this should be the first step in troubleshooting operational problems. When disconnected from the unit control inputs, simple 24V signals can be used to activate the units G, Y1, Y2, W1, W2, etc. and verify proper unit operation. If the problem occurs without the RTU Open connected, then the operator should begin troubleshooting the unit/equipment rather than the RTU Open or network.

Third party network may also help in troubleshooting the controller and rooftop unit. Third party network troubleshooting may also be required.

LED's

The LED's indicate if the controller is speaking to the other devices on the network. The LED's should reflect communication traffic based on the baud rate set. The higher the baud rate, the more solid the LED's will appear.

The LED's on the RTU Open show the status of certain functions.

| If this LED is on... | Status is... |
|----------------------|--|
| Power | The RTU Open has power |
| Rx | The RTU Open is receiving data from the network segment |
| Tx | The RTU Open is transmitting data over the network segment |
| BO# | The binary output is active |

NOTE If Tx is not lit, the MS/TP token is not being passed between controllers.

The **Run** and **Error** LED's indicate controller 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 |

| If Run LED shows... | And Error LED shows... | Status is.. |
|----------------------------|--|--|
| 2 flashes per second | 3 flashes, then off | Controller has just been formatted |
| 2 flashes per second | On | Two or more devices on this network have the same network address |
| 2 flashes per second | On | Firmware halted after frequent system errors or control programs halted |
| 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: <ul style="list-style-type: none"> • Turn the RTU Open off, then on. • Replace the RTU Open. |

Compliance

FCC Compliance

This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.



CAUTION Changes or modifications not expressly approved by the responsible party for compliance could void the user's authority to operate the equipment.

CE Compliance



WARNING This is a Class A product. In a domestic environment, this product may cause radio interference in which case the user may be required to take adequate measures.

BACnet Compliance

BACnet® is a registered trademark of ASHRAE. ASHRAE does not endorse, approve or test products for compliance with ASHRAE standards. Compliance of listed products to requirements of ASHRAE Standard 135 is the responsibility of BACnet International. BTL® is a registered trademark of BACnet International.

Appendix A: Network Points List for RTU Open

APPENDIX A – NETWORK POINTS LIST RTU OPEN Protocol Maps

| Point Name | Read Only | Enabled | Units | Default Value | BACnet Info | | Modbus Info | | N2 Info | | LonWorks Info | |
|--------------------------------------|-----------|---------|-------|---------------|-------------------|------------------|-------------------|----------------------|-----------------------|--------------------------|-----------------------|-----------------|
| | | | | | BACnet Point Name | BACnet Object ID | Modbus Register # | Modbus Register Type | N2 Network Point Type | N2 Network Point Address | SNVT Type | SNVT Name |
| input_1 | ✓ | | N/A | | ai_1 | AI:1001 | | | | | | |
| input_10 | ✓ | | *F/C | | ai_10 | AI:1010 | | | | | | |
| input_11 | ✓ | | N/A | | ai_11 | AI:1011 | | | | | | |
| input_2 | ✓ | | N/A | | ai_2 | AI:1002 | | | | | | |
| input_6 | ✓ | | *F/C | | ai_6 | AI:1006 | | | | | | |
| input_7 | ✓ | | *F/C | | ai_7 | AI:1007 | | | | | | |
| slidepot voltage reading | ✓ | | N/A | | slidepot_volts | AI:1012 | | | | | | |
| Space Temp / Zone Temp | ✓ | | *F/C | | zone_temp | AI:1 | | | | | | |
| Active Compressor Stages | ✓ | ✓ | N/A | | comp_run | AV:2020 | float value | 40031 | ADF | 10 | SNVT_count_inc (9) | nvcCompStages |
| Active Heat Stages | ✓ | ✓ | N | | heat_run | AV:2003 | float value | 40033 | ADF | 11 | SNVT_count_inc (9) | nvcHeatStages |
| Air Source Outdoor Air Temp | ✓ | | *F/C | | link_ahu_oat | AV:2609 | | | | | | |
| Air Source Supply Air Temp | ✓ | | *F/C | | link_sat | AV:2608 | | | | | | |
| Compressor 1 Runtime | ✓ | | hr | | comp1_rmtm | AV:2017 | | | | | | |
| Compressor 1 Service Alarm | ✓ | | hr | | comp1_service_hrs | AV:83006 | | | | | | |
| Compressor 2 Runtime | ✓ | | hr | | comp2_rmtm | AV:2018 | | | | | | |
| Compressor 2 Service Alarm | ✓ | | hr | | comp2_service_hrs | AV:83007 | | | | | | |
| Cooling Lockout Temperature | | | *F/C | 45°F (7.2°C) | oat_cl_lockout | AV:9002 | float value | 40043 | ADF | 16 | SNVT_temp_p (105) | nvcCoolLckTemp |
| DCV Max Ctrl Setpoint | | ✓ | ppm | 650 | iaq_stpt_max | AV:3013 | float value | 40045 | ADF | 17 | SNVT_ppm (29) | nviDCVMaxPPM |
| DCV Max Vent Damper Pos Lockout Temp | | ✓ | %Open | 50 | iaq_dpr_max | AV:9011 | float value | 40047 | ADF | 18 | SNVT_lev_percent (81) | nviDCVMaxPos |
| Economizer High OAT Lockout Temp | | | *F/C | | oat_ec_lockout | AV:9008 | | | | | | |
| Economizer Output | ✓ | ✓ | %Open | | econ_output | AV:2022 | float value | 40051 | ADF | 20 | SNVT_lev_percent (81) | nvcEconOutput |
| Economizer Purge Min Pos | | ✓ | %Open | | econ_purge_min | AV:9029 | float value | 40075 | ADF | 5 | SNVT_lev_percent (81) | nviEconPurgeMin |
| Economizer Test | | | %Open | | econ_test | AV:81001 | float value | 40053 | ADF | 21 | SNVT_temp_p (105) | |
| Effective Cool Setpoint | ✓ | ✓ | *F/C | | eff_cl_stpt | AV:3005 | float value | 40055 | ADF | 22 | SNVT_temp_p (105) | nvcEffCoolSP |
| Effective Heat Setpoint | ✓ | ✓ | *F/C | | eff_ht_stpt | AV:3006 | float value | 40057 | ADF | 23 | SNVT_temp_p (105) | nvcEffHeatSP |

**APPENDIX A – NETWORK POINTS LIST
RTU OPEN Protocol Maps**

| Point Name | Read Only | Enabled | Units | Default Value | BACnet Info | | Modbus Info | | N2 Info | | LonWorks Info | |
|--|-----------|---------|-------|----------------|----------------------|------------------|----------------------|-------------------|-----------------------|--------------------------|-----------------------|-------------------|
| | | | | | BACnet Point Name | BACnet Object ID | Modbus Register Type | Modbus Register # | N2 Network Point Type | N2 Network Point Address | SNVT Type | SNVT Name |
| Factory Test Analog 1 Control | | | % | | ao1_fac_test | AV:91001 | | | | | | |
| Factory Test Analog 2 Control | | | V | | ao2_fac_test | AV:91002 | | | | | | |
| Fan Off Delay | | | sec | | fan_delay_off | AV:9024 | | | | | | |
| Filter Runtime | ✓ | | hr | | filter_rntm | AV:2015 | | | | | | |
| Filter Service Alarm Timer | | ✓ | hr | 600 | filter_service_hrs | AV:2019 | float value | 40067 | ADF | 28 | SNVT_time_hour (124) | nvIFilterAlmTime |
| Heating Lockout Temperature | | ✓ | *F/C | 65°F (18.3°) | oat_ht_lockout | AV:9003 | float value | 40069 | ADF | 29 | SNVT_temp_p (105) | nvIHeatLockTemp |
| HP Rev Cycle Lockout Temp | | ✓ | *F/C | -3°F (-19.4°C) | hp_rev_cycle_lockout | AV:9004 | float value | 40071 | ADF | 30 | SNVT_temp_p (105) | nvIHPRevCkLckTemp |
| Indoor Air Quality CO2 (ppm) | ✓ | ✓ | ppm | | iaq | AV:1009 | float value | 40073 | ADF | 31 | SNVT_ppm (29) | nvIaIQ |
| Linkage Max Damper Position | ✓ | | % | | link_max_dmpr | AV:2611 | | | | | | |
| Low Fan Econ Min Pos | | ✓ | %Open | | econ_min_2 | AV:9030 | float value | 40089 | ADF | 32 | SNVT_lev_percent (81) | nvILowFanEconMin |
| Maximum Heating SAT | | | *F/C | | sat_ht_max | AV:83004 | | | | | | |
| Minimum Cooling SAT | | | *F/C | | sat_cl_min | AV:83003 | | | | | | |
| Occ Relative Humidity Setpoint | | ✓ | %rh | 60 | occ_dehum_stpt | AV:3011 | float value | 40083 | ADF | 36 | SNVT_lev_percent (81) | nvIOccRHSP |
| Optimal Start | | ✓ | hr | 4 | optm_start | AV:9026 | float value | 40147 | ADF | 61 | SNVT_time_hour (124) | nvIOptimalStart |
| Outdoor Air Quality CO2 (ppm) | ✓ | ✓ | ppm | | oaq | AV:1012 | float value | 40085 | ADF | 37 | SNVT_ppm (29) | nvOOAQ |
| Outdoor Air Temperature | ✓ | ✓ | *F/C | | oa_temp | AV:1003 | float value | 40087 | ADF | 38 | SNVT_temp_p (105) | nvOOAT |
| Override Time Remaining Variable | ✓ | ✓ | min | | ovrde_time | AV:2016 | float value | 40093 | ADF | 41 | SNVT_time_min (123) | nvOOvrTimeRemain |
| Password Protected Output Variable | | | N/A | | ppo | AV:90000 | | | | | | |
| Power Exhaust Setpoint | | ✓ | %Open | 50 | pehx_stpt | AV:3010 | float value | 40097 | ADF | 43 | SNVT_lev_percent (81) | nvIPwrExhSP |
| Power Fail Restart Delay | | ✓ | sec | 5 | start_delay | AV:9007 | float value | 40127 | ADF | 58 | SNVT_time_sec (107) | nvUnitStartDly |
| Setpoint / Cooling Occupied Setpoint | | ✓ | *F/C | 76°F (24.4°C) | occ_cl_stpt | AV:3001 | float value | 40009 | ADF | 4 | SNVT_temp_p (105) | nvIOccCoolSP |
| Setpoint / Cooling Unoccupied Setpoint | | ✓ | *F/C | 90°F (32.2°C) | unocc_cl_stpt | AV:3003 | float value | 40015 | ADF | 7 | SNVT_temp_p (105) | nvIUoccCoolSP |
| Setpoint / Heating Occupied Setpoint | | ✓ | *F/C | 70°F (21.1°) | occ_ht_stpt | AV:3002 | float value | 40019 | ADF | 9 | SNVT_temp_p (105) | nvIOccHeatSP |
| Setpoint / Heating Unoccupied Setpoint | | ✓ | *F/C | 55°F (12.7°C) | unocc_ht_stpt | AV:3004 | float value | 40017 | ADF | 8 | SNVT_temp_p (105) | nvIUoccHeatSP |
| Setpoint Adjustment | ✓ | ✓ | *F/C | | stpt_adj | AV:1006 | float value | 40099 | ADF | 44 | SNVT_temp_p (105) | nvOSPAdjst |

**APPENDIX A – NETWORK POINTS LIST
RTU OPEN Protocol Maps**

| Point Name | Read Only | Enabled | Units | Default Value | BACnet Info | | Modbus Info | | N2 Info | | LonWorks Info | |
|---------------------------------------|-----------|---------|---------------|------------------|-------------------------|------------------|-------------------|----------------------|-----------------------|--------------------------|-----------------------|-----------------|
| | | | | | BACnet Point Name | BACnet Object ID | Modbus Register # | Modbus Register Type | N2 Network Point Type | N2 Network Point Address | SNVT Type | SNVT Name |
| Setpoint Adjustment Range | | ✓ | Δ°F/C | 5Δ°F (2.7Δ°C) | stp_adj_range | AV:9015 | float value | 40101 | ADF | 45 | SNVT_temp_p (105) | nvsPAdjRange |
| Space Relative Humidity | ✓ | ✓ | %rh | -999 | space_rh | AV:1011 | float value | 40103 | ADF | 46 | SNVT_lev_percent (81) | nvoSpaceRH |
| Space Temp / Override Time Remaining | | | min | | override_time_remaining | AV:1 | | | | | | |
| Space Temperature Offset Pot Variable | ✓ | ✓ | °F/C | | stp_adj_offset | AV:91006 | float value | | | | | |
| Space Temperature - Prime | ✓ | ✓ | °F/C | | space_temp | AV:2007 | float value | 40107 | ADF | 48 | SNVT_temp_p (105) | nvoSpaceTemp |
| Supply Air Temperature | ✓ | ✓ | °F/C | | sa_temp | AV:1008 | float value | 40109 | ADF | 49 | SNVT_temp_p (105) | nvoSAT |
| Supply Fan Runtime | ✓ | ✓ | hr | | sfan_rmtm | AV:2014 | | | | | | |
| Supply Fan Service Alarm Timer | | | hr | | sfan_service_hrs | AV:83005 | | | | | | |
| Supply Fan VFD | ✓ | ✓ | % | | vfd_output | AV:2027 | | | | | | |
| System Cooling Demand Level | ✓ | ✓ | N/A | | cool_demand_level | AV:9006 | | | | | | |
| System Heating Demand Level | ✓ | ✓ | N/A | | heat_demand_level | AV:9036 | | | | | | |
| System OAT Master | ✓ | ✓ | °F/C | | msfr_oa_temp | AV:80001 | | | | | | |
| System Outdoor Air Temperature | | ✓ | °F/C | -999 | system_oat | AV:1901 | float value | 40119 | ADF | 54 | SNVT_temp_p (105) | nvsSysOAT |
| System Space AQ | | ✓ | N/A | -999 | system_iq | AV:1903 | float value | 40148 | ADF | 39 | SNVT_ppm (29) | nviSysSpaceAQ |
| System Space RH | | ✓ | % | -999 | system_rh | AV:1904 | float value | 40150 | ADF | 40 | SNVT_lev_percent (81) | nviSysSpaceRH |
| System Space Temperature | | ✓ | °F/C | -999 | system_spt | AV:1902 | float value | 40123 | ADF | 56 | SNVT_temp_p (105) | nviSysSpaceTemp |
| T5x Override Duration | | | hr | | ovr_dur | AV:9023 | | | | | | |
| Unocc Relative Humidity Setpoint | | ✓ | %rh | 95 | unocc_dehum_stpt | AV:3012 | float value | 40129 | ADF | 59 | SNVT_lev_percent (81) | nviUnoccRHSP |
| Vent Dmpr Pos / DCV Min Pos | | ✓ | %Open | 20 | econ_min | AV:9005 | float value | 40131 | ADF | 60 | SNVT_lev_percent (81) | nviDCVMinPos |
| VFD Speed Test | | | % | | vfd_spd_test | AV:81002 | | | | | | |
| input_3 | ✓ | | 0=Off 1=On | | dl_3 | Bi:1003 | | | | | | |
| input_4 | ✓ | | 0=Off 1=On | | dl_4 | Bi:1004 | | | | | | |
| input_5 | ✓ | | 0=Off 1=On | | dl_5 | Bi:1005 | | | | | | |
| input_8 | ✓ | | 0=Off 1=On | | dl_8 | Bi:1008 | | | | | | |
| input_9 | ✓ | | 0=Off 1=On | | dl_9 | Bi:1009 | | | | | | |

**APPENDIX A – NETWORK POINTS LIST
RTU OPEN Protocol Maps**

| Point Name | Read Only | Enabled | Units | Default Value | BACnet Info | | Modbus Info | | N2 Info | | LonWorks Info | |
|------------------------------|-----------|---------|------------------------|---------------|---------------------|------------------|----------------------|-------------------|-----------------------|--------------------------|------------------|----------------|
| | | | | | BACnet Point Name | BACnet Object ID | Modbus Register Type | Modbus Register # | N2 Network Point Type | N2 Network Point Address | SNVT Type | SNVT Name |
| Airside Linkage | ✓ | | 0=Normal 1=Alarm | | air_linkage_fail | BV:7030 | | | | | | |
| Compressor 1 Relay State | ✓ | | 0=Off 1=On | | comp_1 | BV:2005 | | | | | | |
| Compressor 1 Runtime | ✓ | | 0=Normal 1=Alarm | | comp1_rtrtm_alarm | BV:7014 | | | | | | |
| Compressor 1 Test | | | 0=Disable 1=Enable | | comp1_test | BV:81005 | | | | | | |
| Compressor 2 Relay State | ✓ | | 0=Off 1=On | | comp_2 | BV:2004 | | | | | | |
| Compressor 2 Runtime | ✓ | | 0=Normal 1=Alarm | | comp2_rtrtm_alarm | BV:7015 | | | | | | |
| Compressor 2 Test | | | 0=Disable 1=Enable | | comp2_test | BV:81004 | | | | | | |
| Compressor Safety Status | ✓ | | 0=Normal 1=Trouble | | comp_status | BV:1008 | | | | | | |
| Compressor Status | ✓ | ✓ | 0=Normal 1=Alarm | | comp_alarm | BV:7013 | discrete in | 10030 | BI | 30 | SNVT_switch (95) | nvoCompSafety |
| Continuous Occupied Exhaust | | | 0=No 1=Yes | | occ_exh | BV:9002 | | | | | | |
| Dehumidification | ✓ | ✓ | 0=Inactive 1=Active | | dehum | BV:2006 | discrete in | 10009 | BI | 9 | SNVT_switch (95) | nvoDehumRelay |
| Dehumidification Test | | | 0=Disable 1=Enable | | dehum_test | BV:81006 | | | | | | |
| Door Contact Status | ✓ | | 0=Off 1=On | | door_contact_status | BV:1010 | | | | | | |
| Economizer Exists | | | 0=No 1=Yes | | econ_exist | BV:99001 | | | | | | |
| Enthalpy (BACnet) | | ✓ | 0=High 1=Low | | cae | BV:1901 | discrete out | 6 | BO | 6 | SNVT_switch (95) | nviSysEnthalpy |
| Enthalpy Status | ✓ | | 0=High 1=Low | | enthalpy_status | BV:1002 | | | | | | |
| Factory Test | | | 0=Off 1=On | | fac_test_enable | BV:91000 | | | | | | |
| Factory Test Relay 1 Control | | | 0=Off 1=On | | relay1_fac_test | BV:91001 | | | | | | |
| Factory Test Relay 2 Control | | | 0=Off 1=On | | relay2_fac_test | BV:91002 | | | | | | |
| Factory Test Relay 3 Control | | | 0=Off 1=On | | relay3_fac_test | BV:91003 | | | | | | |
| Factory Test Relay 4 Control | | | 0=Off 1=On | | relay4_fac_test | BV:91004 | | | | | | |
| Factory Test Relay 5 Control | | | 0=Off 1=On | | relay5_fac_test | BV:91005 | | | | | | |

**APPENDIX A – NETWORK POINTS LIST
RTU OPEN Protocol Maps**

| Point Name | Read Only | Enabled | Units | Default Value | BACnet Info | | Modbus Info | | N2 Info | | LonWorks Info | |
|------------------------------|-----------|---------|-----------------------------|---------------|--------------------|------------------|-------------------|----------------------|-----------------------|--------------------------|------------------|-----------------|
| | | | | | BACnet Point Name | BACnet Object ID | Modbus Register # | Modbus Register Type | N2 Network Point Type | N2 Network Point Address | SNVT Type | SNVT Name |
| Factory Test Relay 6 Control | | | 0=Off 1=On | | relay6_fac_test | BV:91006 | | | | | | |
| Factory Test Relay 7 Control | | | 0=Off 1=On | | relay7_fac_test | BV:91007 | | | | | | |
| Factory Test Relay 8 Control | | | 0=Off 1=On | | relay8_fac_test | BV:91008 | | | | | | |
| Filter | ✓ | ✓ | 0=Clean 1=Dirty | | filter_alarm | BV:7017 | discrete in | 10031 | BI | 31 | SNVT_switch (95) | nvoFilter |
| Filter Status | ✓ | ✓ | 0=Clean 1=Dirty | | filter_status | BV:1004 | | | | | | |
| Fire / Smoke Shutdown | ✓ | ✓ | 0=Normal 1=Alarm | | fire_alarm | BV:7007 | discrete in | 10032 | BI | 32 | SNVT_switch (95) | nvoFireShutdown |
| Fire Shutdown Status | ✓ | ✓ | 0=Run Enabled 1=Shutdown | | firedown_status | BV:1005 | | | | | | |
| Heat 1 Test | | | 0=Disable 1=Enable | | heat1_test | BV:81003 | | | | | | |
| Heat 2 Test | | | 0=Disable 1=Enable | | heat2_test | BV:81002 | | | | | | |
| Heat Stage 1 Relay State | ✓ | ✓ | 0=Off 1=On | | heat_1 | BV:2003 | | | | | | |
| Heat Stage 2 Relay State | ✓ | ✓ | 0=Off 1=On | | heat_2 | BV:2002 | | | | | | |
| High Space Temperature | ✓ | ✓ | 0=Normal 1=Alarm | | spt_hi_alarm | BV:7011 | discrete in | 10035 | BI | 35 | SNVT_switch (95) | nvoHSpaceTemp |
| High Speed Fan Test | | | 0=Disable 1=Enable | | hi_spd_test | BV:81010 | | | | | | |
| Humidistat Input Status | ✓ | ✓ | 0=High 1=Low | | humstat_status | BV:1006 | | | | | | |
| Indoor Air Quality | ✓ | ✓ | 0=Normal 1=Alarm | | iaq_alarm | BV:7005 | discrete in | 10033 | BI | 33 | SNVT_switch (95) | nvoIAQAlm |
| Indoor Air Quality Sensor | ✓ | ✓ | 0=Normal 1=Alarm | | iaq_sensor_fail | BV:7039 | discrete in | 10037 | BI | 37 | SNVT_switch (95) | nvoIAQSensor |
| Low Space Temperature | ✓ | ✓ | 0=Normal 1=Alarm | | spt_lo_alarm | BV:7012 | discrete in | 10039 | BI | 39 | SNVT_switch (95) | nvoLSpaceTemp |
| Occupancy Contact | ✓ | ✓ | 0=Off 1=On | | occ_contact_status | BV:1007 | | | | | | |
| Occupancy Status | ✓ | ✓ | 0=Unoccupied 1=Occupied | | occ_status | BV:2008 | discrete in | 10018 | BI | 18 | SNVT_switch (95) | nvoOccStatus |
| Outdoor Air Quality Sensor | ✓ | ✓ | 0=Normal 1=Alarm | | oatq_fail | BV:7006 | discrete in | 10041 | BI | 41 | SNVT_switch (95) | nvoOAQSensor |
| Outdoor Air Temp Sensor | ✓ | ✓ | 0=Normal 1=Alarm | | oat_fail | BV:7029 | discrete in | 10027 | BI | 27 | | |
| Power Exhaust Relay State | ✓ | ✓ | 0=Off 1=On | | pekh | BV:2010 | | | | | | |
| Power Exhaust Test | | | 0=Disable 1=Enable | | pekh_test | BV:81008 | | | | | | |

**APPENDIX A – NETWORK POINTS LIST
RTU OPEN Protocol Maps**

| Point Name | Read Only | Enabled | Units | Default Value | BACnet Info | | Modbus Info | | N2 Info | | LonWorks Info | |
|--------------------------------|-----------|---------|----------------------------|---------------|-------------------|------------------|-------------------|----------------------|-----------------------|--------------------------|---------------|--------------------------------------|
| | | | | | BACnet Point Name | BACnet Object ID | Modbus Register # | Modbus Register Type | N2 Network Point Type | N2 Network Point Address | SNVT Type | SNVT Name |
| Reset Comp 1 Runtime Alarm | | | O=Run 1=Clear | | | comp1_rntm_clr | BV:7514 | | | | | |
| Reset Comp 2 Runtime Alarm | | | O=Run 1=Clear | | | comp2_rntm_clr | BV:7515 | | | | | |
| Reset Filter Alarm | | ✓ | O=Off 1=On | Off | | filter_rntm_clr | BV:7517 | discrete out | 22 | BO | 22 | SNVT_switch (95) rvlResetFitAlm |
| Reset Supply Fan Runtime Alarm | | | O=Run 1=Clear | | | sfan_rntm_clr | BV:7510 | | | | | |
| Safety Chain | ✓ | ✓ | O=Normal 1=Alarm | | | safety_alarm | BV:7024 | discrete in | 10043 | BI | 43 | SNVT_switch (95) rvoSafetyChain |
| Safety Chain Feedback | ✓ | | O=Off 1=On | | | safety_status | BV:1009 | | | | | |
| Schedule | | | O=Unoccupied 1=Occupied | | | schedule | BV:8000 | | | | | |
| Service Test | | | O=Disable 1=Enable | | | test_enable | BV:81000 | | | | | |
| Setpoint Adjustment | | ✓ | O=Disable 1=Enable | Enable | | spt_adj_enable | BV:1013 | discrete out | 26 | BO | 26 | SNVT_switch (95) rvSPAdjEnable |
| Setpoint Slider | ✓ | | O=Normal 1=Alarm | | | slidepot_alarm | BV:7002 | | | | | |
| Shutdown | | | O=Inactive 1=Active | | | shutdown | BV:9001 | | | | | |
| Space Relative Humidity | ✓ | ✓ | O=Normal 1=Alarm | | | sprh_hi_alarm | BV:7018 | discrete in | 10034 | BI | 34 | SNVT_switch (95) rvoHSRPHAlm |
| Space Relative Humidity Sensor | ✓ | ✓ | O=Normal 1=Alarm | | | sprh_sensor_fail | BV:7022 | discrete in | 10045 | BI | 45 | SNVT_switch (95) rvoSpaceRHSensor |
| Space Temp Sensor | ✓ | ✓ | O=Normal 1=Alarm | | | spt_fail | BV:7001 | discrete in | 10046 | BI | 46 | SNVT_switch (95) rvoSPTempSensor |
| SPT Sensor | ✓ | ✓ | O=Normal 1=Alarm | | | spt_sensor_fail | BV:7032 | discrete in | 10038 | BI | 38 | |
| Supply Air Temperature | ✓ | ✓ | O=Normal 1=Alarm | | | set_alarm | BV:7004 | discrete in | 10047 | BI | 47 | SNVT_switch (95) rvoSATSensor |
| Supply Fan Failure | ✓ | | O=Normal 1=Alarm | | | sfan_fail_alarm | BV:7008 | | | | | |
| Supply Fan in Hand | ✓ | | O=Normal 1=Alarm | | | sfan_hand_alarm | BV:7009 | | | | | |
| Supply Fan Relay State | ✓ | ✓ | O=Off 1=On | | | sfan | BV:2001 | discrete in | 10023 | BI | 23 | SNVT_switch (95) rvoSFRelay |
| Supply Fan Runtime | ✓ | | O=Normal 1=Alarm | | | sfan_rntm_alarm | BV:7010 | discrete in | 10050 | BI | 50 | |
| Supply Fan Status | ✓ | ✓ | O=Off 1=On | | | sfan_status | BV:1003 | discrete in | 10024 | BI | 24 | SNVT_switch (95) rvoFanStatus |
| System is shut down | ✓ | | O=No 1=Yes | | | shutdown_status | BV:2011 | | | | | |

**APPENDIX A – NETWORK POINTS LIST
RTU OPEN Protocol Maps**

| Point Name | Read Only | Enabled | Units | Default Value | BACnet Info | | Modbus Info | | N2 Info | | LonWorks Info | |
|------------------------------|-----------|---------|---|---------------|-------------------|------------------|----------------------|-------------------|-----------------------|--------------------------|-------------------|------------|
| | | | | | BACnet Point Name | BACnet Object ID | Modbus Register Type | Modbus Register # | N2 Network Point Type | N2 Network Point Address | SNVT Type | SNVT Name |
| Unocc Free Cool | | | 0=Disable 1=Enable 2=Warmup 3=Heating 4=Cooling 5=Freecool 6=Pressure 7=Evac 8=Vent | | nfc_ena | BY:80001 | | | | | | |
| Air Source Mode | ✓ | | 1=Inactive 2=Occupied 3=Unoccupied | | link_ahu_mode | MSV:2005 | | | | | | |
| BAS On / Off | | ✓ | 1=Inactive 2=Occupied 3=Unoccupied | Inactive | keypad_override | MSV:1001 | unsigned int | 40133 | ADI | 1 | SNVT_count_inc(9) | mIBASOnOff |
| Equipment Status | ✓ | | 1=Disabled 2=Test 3=Run | | mode_status | MSV:2001 | | | | | | |
| Fan Mode | | | 1=Auto 2=Continuous 3=Always On | | fan_mode | MSV:9032 | | | | | | |
| Input 1 Function | | | 1=No Sensor 2=IAQ Sensor 3=OAQ Sensor 4=Space RH Sensor | | ai1_function | MSV:81001 | | | | | | |
| Input 2 Function | | | 1=No Sensor 2=IAQ Sensor 3=OAQ Sensor 4=Space RH Sensor | | ai2_function | MSV:81002 | | | | | | |
| Input 3 Function | | | 1=No Function 2=Compressor Safety 3=Fan Status 4=Filter Status 5=Remote Occupancy 6=Door Contact | | di3_function | MSV:81003 | | | | | | |
| Input 3 Switch Configuration | | | 1=NO 2=NC | | di3_type | MSV:81013 | | | | | | |
| Input 5 Function | | | 1=No Function 2=Fire Shutdown 3=Fan Status 4=Filter Status 5=Remote Occupancy 6=Door Contact | | di5_function | MSV:81005 | | | | | | |

**APPENDIX A – NETWORK POINTS LIST
RTU OPEN Protocol Maps**

| Point Name | Read Only | Enabled | Units | Default Value | BACnet Info | | Modbus Info | | N2 Info | | LonWorks Info | |
|------------------------------|-------------------------------------|---------|---|---------------|-------------------|------------------|----------------------|-------------------|-----------------------|--------------------------|---------------|-----------|
| | | | | | BACnet Point Name | BACnet Object ID | Modbus Register Type | Modbus Register # | N2 Network Point Type | N2 Network Point Address | SNVT Type | SNVT Name |
| Input 3 Function | <input checked="" type="checkbox"/> | | 1=No Function 2=Compressor Safety 3=Fan Status 4=Filter Status 5=Remote Occupancy 6=Door Contact | | di3_function | MSV:81003 | | | | | | |
| Input 5 Function | <input checked="" type="checkbox"/> | | 1=No Function 2=Fire Shutdown 3=Fan Status 4=Filter Status 5=Remote Occupancy 6=Door Contact | | di5_function | MSV:81005 | | | | | | |
| Input 8 Function | <input checked="" type="checkbox"/> | | 1=No Function 2=Entraply Switch 3=Fan Status 4=Filter Status 5=Remote Occupancy 6=Door Contact | | di8_function | MSV:81008 | | | | | | |
| Input 9 Function | <input checked="" type="checkbox"/> | | 1=No Function 2=HumidStat 3=Fan Status 4=Filter Status 5=Remote Occupancy 6=Door Contact | | | MSV:81009 | | | | | | |
| Input 3 Switch Configuration | <input checked="" type="checkbox"/> | | 1=NO 2=NC | | di3_type | MSV:81013 | | | | | | |
| Input 5 Switch Configuration | <input checked="" type="checkbox"/> | | 1=NO 2=NC | | di5_type | MSV:81015 | | | | | | |
| Input 8 Switch Configuration | <input checked="" type="checkbox"/> | | 1=NO 2=NC | | di8_type | MSV:81018 | | | | | | |
| Input 9 Switch Configuration | <input checked="" type="checkbox"/> | | 1=NO 2=NC | | di9_type | MSV:81019 | | | | | | |
| Space sensor type | <input checked="" type="checkbox"/> | | 1=155 2=156 3=SPT Sensor 4=None | | spt_type | MSV:9001 | | | | | | |
| Unit Type | <input checked="" type="checkbox"/> | | 1=Sensor Failure 2=SPT Sensor 3=155/156 4=Network 5=Airside Linkage 6=Locked Value | | unit_type | MSV:9018 | | | | | | |

**APPENDIX A – NETWORK POINTS LIST
RTU OPEN Protocol Maps**

| Point Name | Read Only | Enabled | Units | Default Value | BACnet Info | | Modbus Info | | N2 Info | | LonWorks Info | |
|-------------|-----------|---------|---|---------------|-------------------|------------------|-------------------|----------------------|-----------------------|--------------------------|--------------------|------------------|
| | | | | | BACnet Point Name | BACnet Object ID | Modbus Register # | Modbus Register Type | N2 Network Point Type | N2 Network Point Address | SNVT Type | SNVT Name |
| 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 Pre-occ Purge | | run_status | MSV2002 | unsigned int | 30001 | ADI | 13 | SNVT_count_inc (9) | invOperatingMode |

Appendix B: BACnet Protocol Implementation Conformance Statement

The PIC statements are updated regularly. Please refer to the *BACnet website*
<http://www.bacnetinternational.net/catalog/index.php?m=28> for the latest information.

Appendix C: Modbus Protocol Implementation Conformance Statement

Date: 11/12/2013

Vendor Name: **Carrier**

Product Names: **RTU Open**

Product Model Number: **RTU Open**

Protocol Description:

The RTU Open controller speaks the Modicon Modbus RTU/ASCII Protocol as described in the *Modicon Modbus Protocol Reference Guide, PI-MBUS-300 Rev.J.* Further details on the Modbus implementation are described below.

Product Description:

The RTU Open is a factory-installed rooftop controller that is capable of speaking multiple protocols.

| Serial Transmission Mode: | Supported? |
|---------------------------|---------------|
| RTU | Slave only |
| ASCII | Not supported |

| Communication Types: | Baud rates: | Data Bits: | Parity: | Stop Bits: |
|----------------------|------------------------------|------------|---------|------------|
| 2-wire EIA-485, | 9600, 19200, 38400, 76800 | 8 | None | 1 |

| Function Codes: | Purpose: | Used with Register Numbers: |
|-----------------------------|----------------------------------|-----------------------------|
| 01 – Read Coil Status | Read Discrete Outputs | 00001 - 65535 |
| 02 – Read Input Status | Read Discrete Inputs | 00001 - 65535 |
| 03 – Read Holding Registers | Read Holding Registers | 00001 - 65535 |
| 04 – Read Input Registers | Read Input Registers | 00001 - 65535 |
| 05 – Force Single Coil | Write Discrete Outputs (single) | 00001 - 65535 |
| 06 – Preset Single Register | Write Holding Registers (single) | 00001 - 65535 |
| 15 – Force Multiple Coils | Write Discrete Outputs | 00001 - 65535 |
| 16 – Preset Multiple Coils | Write Holding Registers | 00001 - 65535 |

| Register Type: | Range: | Function Codes Used with this Register Type: |
|---------------------|--|--|
| Float Value (FLOAT) | Single-Precision IEEE floating point value | 3 – Read Holding Register 6 – Preset Single Register 16 – Preset Multiple Register |

Appendix C: Modbus Protocol Implementation Conformance Statement

| | | |
|-------------------------|-----------------|--|
| Unsigned Integer (UINT) | 0 - 65535 | 3 - Read Holding Register 6 - Preset Single Register 16 - Preset Multiple Register |
| Signed Integer (SINT) | -32768 - 32767 | 3 - Read Holding Register 6 - Preset Single Register 16 - Preset Multiple Register |
| Discrete Input (DI) | 0 = Off, 1 = On | 2 - Read Input Status |
| Discrete Output (DO) | 0 = Off, 1 = On | 1 - Read Coil Status 5 - Force Single Coil 15 - Force Multiple Coils |

Appendix D: Johnson N2 Protocol Implementation Conformance Statement

Vendor Name: **Carrier**

Product Names: **RTU Open**

Product Model Number: **RTU Open**

Protocol Description:

N2 is not a standard protocol, but one that was created by Johnson Controls, Inc. that has been made open and available to the public. The speed of N2 network is limited to only 9600 baud. The N2 slave address can be set from 01 to 99.

Product Description:

The RTU Open is a factory-installed rooftop controller that is capable of speaking multiple protocols. The RTU Open controller speaks the Johnson N2 Open Protocol as described in the *Metasys N2 System Protocol Specification (for Vendors) document*, revision 6/13/96. Further details on the N2 supported implementation are described below.

| Communication Types: | Baud rates: | Data Bits: | Parity: | Stop Bits: |
|-----------------------------|--------------------|-------------------|----------------|-------------------|
| 2-wire EIA-485 | 9600 | 8 | None | 1 |

| Network Point Types: |
|-----------------------------|
| Analog Inputs (AI) |
| Binary Inputs (BI) |
| Analog Outputs (AO) |
| Binary Outputs (BO) |
| Internal Floats (ADF) |
| Internal Integers (ADI) |
| Internal Bytes (BD) |

| Protocol Commands: |
|---------------------------|
| Identify Device Type |
| Sync Time |
| Poll Without Acknowledge |
| Poll With Acknowledge |
| Read Analog Input |
| Read Binary Input |
| Read Analog Output |
| Read Binary Output |
| Read Internal Parameter |
| Write Analog Input |
| Write Binary Input |
| Write Analog Output |
| Write Binary Output |

| |
|-----------------------------|
| Write Internal Parameter |
| Override Analog Input |
| Override Binary Input |
| Override Internal Parameter |
| Override Release Request |

Appendix E: LonWorks Protocol Implementation Conformance Statement

Date: 11/12/2013

Vendor Name: **Carrier**

Product Names: **RTU Open**

Product Model Number: **RTU Open**

Product Description:

The RTU Open is a factory-installed rooftop controller that is capable of speaking multiple protocols. When the LonWorks Option Card (LON-OC), is installed in the field, it enables the RTU Open to communicate over a LonTalk network. The RTU Open does not conform to a standard LonWorks profile, but is self-documenting and any network management tool can manage and configure it over the network. An external interface file (.XIF), is also available so that any network management tool can design and configure the RTU Open prior to installation. Contact your Carrier representative for this .XIF file.

LonWorks is an open protocol that requires the use Echelon's Neuron microprocessor to encode and decode the LonWorks packets. In order to reduce the cost of adding the Echelon chip to every module, a separate LonWorks Option Card (LON-OC) was designed to connect to the RTU Open.

This accessory card must be ordered separately and is connected by attaching its ribbon cable into the **J15** connector on the RTU Open. The RTU Open's baud rate (**DS1** and **DS2** on **SW3**) must be set to 38.4k to communicate with the LON-OC. The address switches (**SW1** and **SW2**) are not used with LonWorks.

Transceiver Type: TP/FT 10

Document revision history

Important changes to this document are listed below. Minor changes such as typographical or formatting errors are not listed.

| Date | Topic | Change description | Code* |
|-------------|-----------------------|--|--------------|
| 2/24/16 | Sequence of Operation | Space Air Quality section deleted - information is contained in the Indoor Air CO2 section | C-TS-CB-E-WB |
| | Start-up | Added USB Link wiring caution. | C-TS-RD-E-JH |

* For internal use only

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