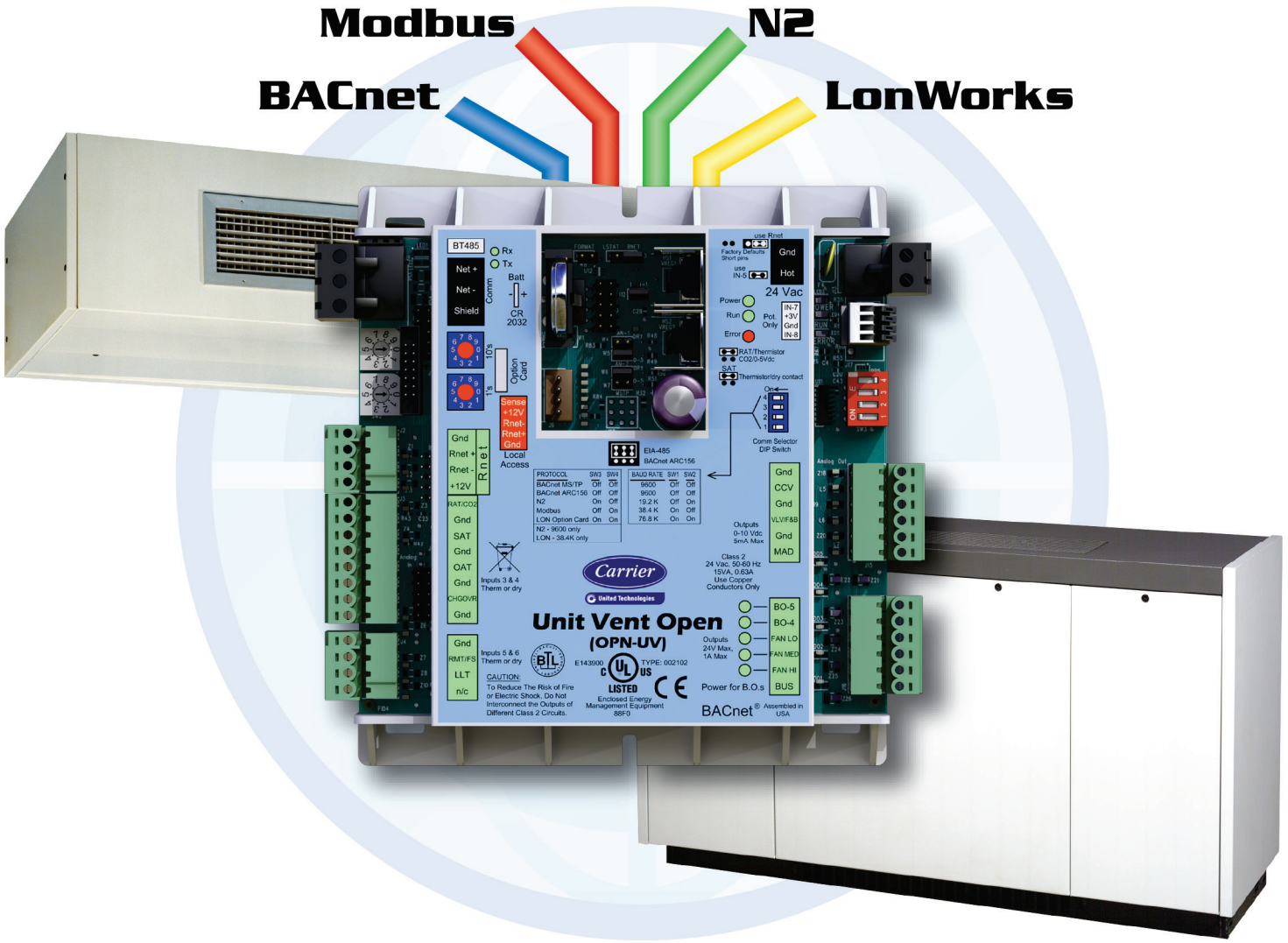
Unit Ventilator Integration Guide



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

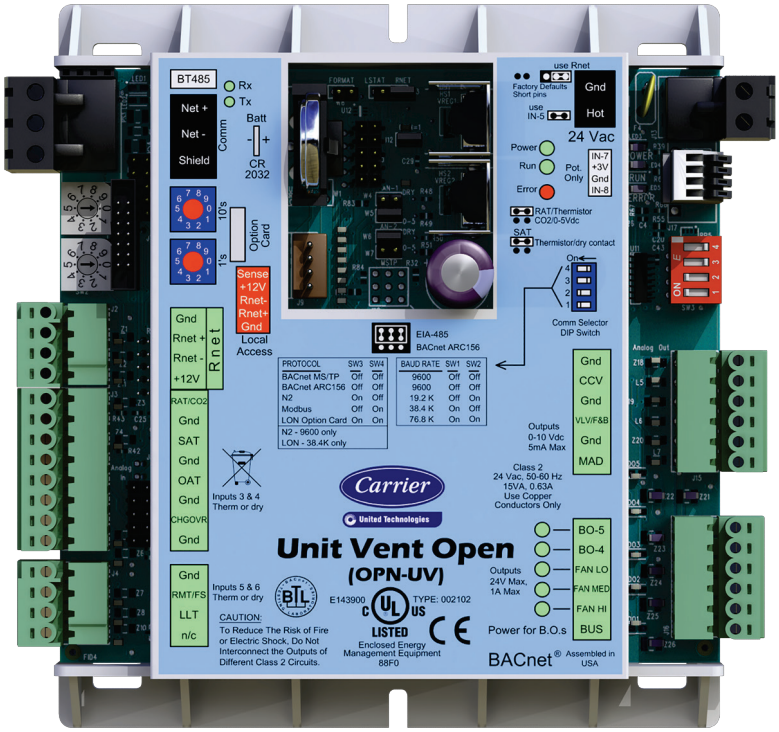
Important changes are listed in **Document revision history** at the end of this document.

Contents

Introduction

What is the Unit Vent controller?

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



Safety considerations

WARNING Disconnect electrical power to the Unit Vent before wiring it. Failure to follow this warning could cause electrical shock, personal injury, or damage to the controller.

Wiring inputs and outputs

I/O	Type	I/O Terminal	Gnd Terminal	Point Name/ Function	Hardware/ Signal	Jumper Position of Pins
Zone Temp/ Zone Temp*	AI	Rnet	Gnd	Space Temperature - Prime Variable	Communicating	N/A
RAT or CO_2 Sensor	AI	IN-1	2 - Gnd	Return Air Temperature Optional IAQ sensor	10K Thermistor 0-5 Vdc	IN-1 Top IN-1 Bottom
SAT Sensor	AI	IN-2	4 - Gnd	Supply Air Temperature	10K Thermistor	IN-2 Top
OAT Sensor	AI	IN-3	6 - Gnd	Outdoor Air Temperature	10K Thermistor	N/A
Changeover Temp	AI	IN-4	8 - Gnd	Changeover switch Changeover sensor	Dry Contact Thermistor	N/A
Input Channel #5	BI	IN-5	1 - Gnd	Remote Occ Contact Fan Status	Dry Contact	N/A
Freezestat	BI	IN-6	1 - Gnd	Low Limit Thermostat	Dry Contact	N/A
OA Damper	AO	AO-1	2 - Gnd	Mixed Air Damper	0-10 Vdc 2-10 Vdc	N/A
Valve / F&B	AO	AO-2	4 - Gnd	Face & Bypass Damper Heating Valve 2-Pipe H/C Valve	0-10 Vdc	N/A
Cooling Valve	AO	AO-3	6 - Gnd	Cooling Valve	0-10 Vdc	N/A
Fan High Spd	BO	BO-1*	1 - Pwr	High Speed Fan Stage 2 EH	Relay	N/A
Fan Med Spd	BO	BO-2*	1 - Pwr	Medium Speed Fan Stage 3 EH)	Relay	N/A
Fan G / Low Spd	BO	BO-3	1 - Pwr	Low Speed Fan	Relay	N/A
BO-4	BO	BO-4*	1 - Pwr	2-Pipe/2-Pos Valve (for equip w/F&B) 2-Pos Heating Valve (for equip w/F&B) EH stage 1	Relay	N/A
BO-5	BO	BO-5*	1 - Pwr	2-Pos Cooling Valve (for equip w/F&B) DX stage 1 EH stage 1 (w/2-Pipe/Electric Heat)	Relay	N/A

Legend

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

NOTE Connect ZS or SPT sensor to the Rnet port.

* These outputs are configurable.

Communications wiring

Protocol Overview

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

- *BACnet MS/TP* (page 4)
- *BACnet ARC156* (page 8)
- *N2* (page 9)
- *Modbus* (page 11)
- *LonWorks* (page 13)

The default setting is BACnet MS/TP. You set the protocol and baud rate on the Comm Selector DIP switches on the controller. See table below for specific switch settings.

The third party connects to the controller through the Comm port for BACnet MS/TP, N2, Modbus, and through the Option Card port 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 Comm Selector DIP switches or connecting the LonWorks Option Card.

Comm Selector DIP switch settings for protocols and baud

Protocol			**Baud Rate**	
	3	**4**	**1**	**2**
BACnet MS/TP (Default)	Off	Off	Select Baud	Select Baud
BACnet ARC156	Off	Off	N/A	N/A
N2 [1]	On	Off	Off	Off
Modbus	Off	On	Select Baud	Select Baud
LonWorks [2]	On	On	On	Off

[1] **N2** must have 9600 bps baud
[2] **LonWorks** must have 38.4 kbps baud

Baud Rate	**1**	**2**
9,600 bps	Off	Off
19.2 kbps	Off	On
38.4 kbps	On	Off
76.8 kbps (Default)	On	On

BACnet MS/TP

To set up the Unit Vent for BACnet MS/TP

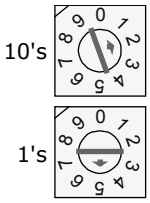
The Unit Vent's latest supported function codes and capabilities are listed on the associated Protocol Implementation Conformance Statement (PICS), *Carrier BACnet PICS website http://www.bacnetinternational.net/catalog/index.php?m=28*.

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

1 Turn off the power for the Unit Vent by disconnecting power terminals.

2 Using the rotary switches, set a unique address. Set the **Tens** (**10's**) switch to the tens digit of the address, and set the **Ones** (**1's**) switch to the ones digit.

EXAMPLE If the controller's address is 25, point the arrow on the **Tens** (**10**'s) switch to 2 and the arrow on the **Ones** (**1**'s) switch to 5.



NOTE The Unit Vent recognizes its address only after power has been cycled.

3 Set communications selector for **EIA-485**.

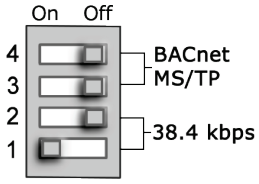
4 Set DIP switches **1** and **2** for the appropriate communications speed. See table below.

NOTE Use the same baud rate for all devices on the network segment.

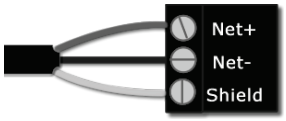
Baud Rate	**1**	**2**
9,600 bps	Off	Off
19.2 kbps	Off	On
38.4 kbps	On	Off
76.8 kbps	On	On

5 Set the both DIP switches 3 and 4 OFF for BACnet MS/TP.

The following example is set for 38.4 kbps and BACnet MS/TP.



6 Connect the communications wiring to the **Comm** port in the screw terminals labeled **Net +**, **Net -**, and **Shield**.



Wire specifications

- A dedicated 22 AWG shielded twisted pair wire (EIA 485)
- Maximum wire length 2000 feet (610 meters) or 32 nodes
- Devices should be daisy-chained and not star-wired
- 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 power for the Unit Vent by connecting power terminals.

Adjusting BACnet MS/TP properties using an Equipment Touch

You may need to adjust the following BACnet MS/TP protocol timing settings using the Equipment Touch.

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 Unit Vent 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 Unit Vent is the target of many requests, this number could be increased as high as 100 or 200.

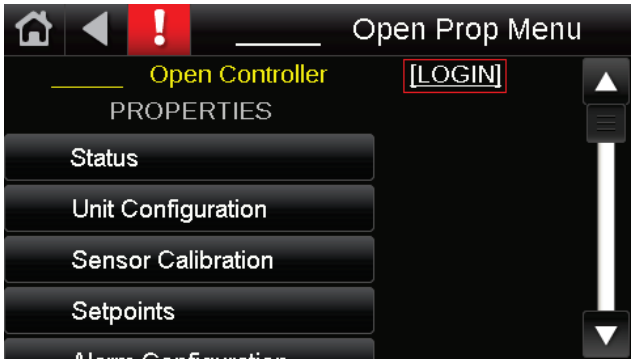
NOTES

- BACnet 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 26) for Network Points List.
- See *Appendix B* (page 33) for the BACnet Protocol Implementation Conformance Statement (PICS).

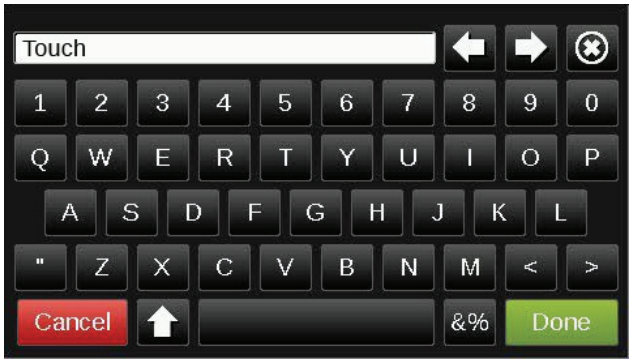
To set the Device Instance number or adjust the Max Masters or Max Info Frames using an Equipment Touch

1 In the Equipment Touch interface, navigate to the **Properties Menu** screen and click **Login**.

NOTE The following graphic is generic and not specific to your system.



2 Type **Touch** for the password and click **Done**.



3 On the **Properties Menu** screen, scroll to the bottom of the list and click **ET System**.

4 On the **ET System** screen, click **Setup**.

5 On the **Setup** screen, click **Module Setup**.

6 On the **Module Setup** screen, click **Communication**.

On the **Communication** screen, edit the fields as needed:

7 Click the property box next to **BACnet Device Instance**, type the new number, and click **Done**.

8 Click the property box next to **Max Masters** and/or **Max Info Frames**, type a new value (1-127), and click **Done**.

9 Click **Save**.

Troubleshooting BACnet MS/TP communication

For detailed troubleshooting and a list of supported objects, get the controller's BACnet PICS from the *Carrier BACnet PICS website http://www.bacnetinternational.net/catalog/index.php?m=28*. You must get your BACnet Object list from the manufacturer.

The most common communication problems are the result of not properly following the configuration steps outlined in this manual. Review all of the steps and use the following list to check your settings.

Verify accuracy of the following:

Hardware settings for BACnet MS/TP (8 Data bits, No Parity, and 1 Stop bit):

- Baud rate DIP switches 1 and 2
- BACnet MS/TP protocol DIP switches 3 and 4
- Jumper set to EIA-485
- Proper connection wiring
- Unique rotary address switches 1 – 99. If controllers have duplicate addresses, network communication can be lost.
- Unique BACnet Device Instance numbers. Default is 16101XX, with the rotary address switches defining XX. If controllers have duplicate device instance numbers, network communication can be lost.

NOTES

- The controller recognizes physical changes (DIP switches, rotary switches, and jumpers) upon power up.
- If RX LED is solid, then the terminations are incorrect.
- If the network has greater than 32 devices or exceeds 2,000 feet, a Repeater should be installed.
- If a controller begins or ends a network segment, a terminating resistor may be needed.

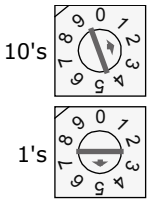
BACnet ARC156

To set up the Unit Vent for BACnet ARC156

1 Turn off the power for the Unit Vent by disconnecting power terminals.

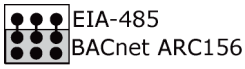
2 Using the rotary switches, set a unique address. Set the **Tens** (**10's**) switch to the tens digit of the address, and set the **Ones** (**1's**) switch to the ones digit.

EXAMPLE If the controller's address is 25, point the arrow on the **Tens** (**10**'s) switch to 2 and the arrow on the **Ones** (**1**'s) switch to 5.



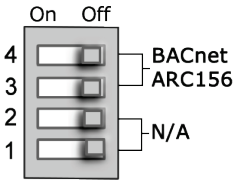
NOTE The Unit Vent recognizes its address only after power has been cycled.

3 Set communications selector for **BACnet ARC156**.

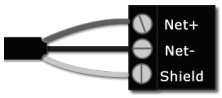


4 Set the both DIP switches **3** and **4** OFF for BACnet ARC156.

NOTE The baud rate for BACnet ARC156 is automatically 156 kbps, so DIP switches **1** and **2** are overridden.



5 Connect the communications wiring to the **Comm** port in the screw terminals labeled **Net +**, **Net -**, and **Shield**.



Wire specifications

- A dedicated 22 AWG shielded twisted pair wire (EIA 485)
- Maximum wire length 2000 feet (610 meters) or 32 nodes
- Devices should be daisy-chained and not star-wired
- 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.

6 Turn on the power for the Unit Vent by connecting power terminals.

Troubleshooting ARC156 communication

The most common communication problems result from not properly following the configuration steps outlined above in this manual. Review all of the steps and use the following list to check your settings.

Verify accuracy of the following:

- Protocol DIP switches 3 and 4
- Proper connection wiring
- Unique rotary address switches 1 – 99. If controllers have duplicate addresses, network communication can be lost.
- Unique BACnet Device Instance numbers. Default is 16101XX, with the rotary address switches defining XX. If controllers have duplicate device instance numbers, network communication can be lost.

NOTES

- The controller recognizes physical changes (DIP switches, rotary switches, and jumpers) upon power up.
- If RX LED is solid, then the terminations are incorrect.
- If the network has greater than 32 devices or exceeds 2,000 feet, a Repeater should be installed.
- If a controller begins or ends a network segment, a terminating resistor may be needed.

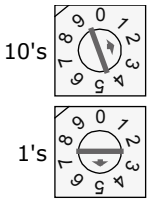
Software settings defined through the Equipment Touch device. To confirm settings, obtain a Modstat of the device. On the Equipment Touch, click the link to the Modstat.

Johnson N2

To set up the Unit Vent for N2

1. Turn off the power for the Unit Vent by disconnecting power terminals.
2. Using the rotary switches, set a unique address. Set the **Tens** (**10's**) switch to the tens digit of the address, and set the **Ones** (**1's**) switch to the ones digit.

   EXAMPLE If the controller's address is 25, point the arrow on the **Tens** (**10**'s) switch to 2 and the arrow on the **Ones** (**1**'s) switch to 5.



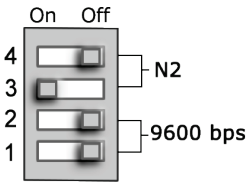
3 Set communications selector for **EIA-485**.

4 Set both DIP switches **1** and **2** OFF for 9600 bps.

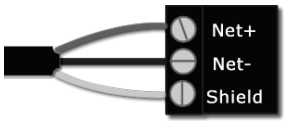
NOTE Use the same baud rate for all devices on the network segment.

5 Set the DIP switches **3** ON and **4** OFF for N2.

The following example is set for 9600 bps and N2.



6 Connect the communications wiring to the **Comm** port in the screw terminals labeled **Net +**, **Net -**, and **Shield**.



Wire specifications

- A dedicated 22 AWG shielded twisted pair wire (EIA 485)
- Maximum wire length 2000 feet (610 meters) or 32 nodes
- Devices should be daisy-chained and not star-wired
- 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 power for the Unit Vent by connecting power terminals.

Troubleshooting N2 communication

The most common communication problems result from not properly following the configuration steps outlined above in this manual. Review all of the steps and use the following list to check your settings.

Verify accuracy of the following:

Hardware settings for N2 (8 Data bits, No Parity, and 1 Stop bit):

- Baud rate DIP switches 1 and 2 set to 9600 bps
- Protocol DIP switches 3 and 4
- Jumper set to EIA-485
- Proper connection wiring

- Unique rotary address switches 1 – 99. If controllers have duplicate addresses, network communication can be lost.
- Unique BACnet Device Instance numbers. Default is 16101XX, with the rotary address switches defining XX. If controllers have duplicate device instance numbers, network communication can be lost.

NOTES

- If RX LED is solid, then the terminations are incorrect.
- If the network has greater than 32 devices or exceeds 2,000 feet, a Repeater should be installed.
- If a controller begins or ends a network segment, a terminating resistor may be needed.
- The controller recognizes physical changes (DIP switches, rotary switches, and jumpers) upon power up.
- Refer to Appendix A for the Network Points list.
- Refer to Appendix D for the Protocol Implementation Conformance Statement.

Software settings defined through the Equipment Touch device. To confirm settings, obtain a Modstat of the device. On the Equipment Touch, click the link to the Modstat.

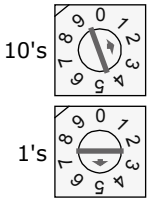
Modbus

To set up the Unit Vent for Modbus RTU

1 Turn off the power for the Unit Vent by disconnecting power terminals.

2 Using the rotary switches, set a unique address. Set the **Tens** (**10's**) switch to the tens digit of the address, and set the **Ones** (**1's**) switch to the ones digit.

EXAMPLE If the controller's address is 25, point the arrow on the **Tens** (**10**'s) switch to 2 and the arrow on the **Ones** (**1**'s) switch to 5.



NOTE The Unit Vent recognizes its address only after power has been cycled.

3 Set communications selector for **EIA-485**.

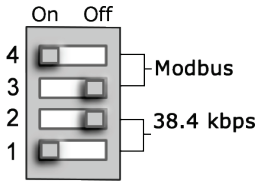
4 Set DIP switches **1** and **2** for the appropriate communications speed. See table below.

NOTE Use the same baud rate for all devices on the network segment.

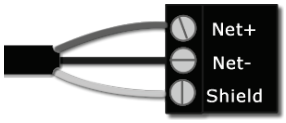
Baud Rate	1	2
9,600 bps	Off	Off
19.2 kbps	Off	On
38.4 kbps	On	Off
76.8 kbps	On	On

5 Set DIP switch **3** OFF and **4** ON for Modbus.

The following example is set for 38.4 kbps and Modbus.



6 Connect the communications wiring to the **Comm** port in the screw terminals labeled **Net +**, **Net -**, and **Shield**.



Wire specifications

- A dedicated 22 AWG shielded twisted pair wire (EIA 485)
- Maximum wire length 2000 feet (610 meters) or 32 nodes
- Devices should be daisy-chained and not star-wired
- 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 power for the Unit Vent by connecting power terminals.

Troubleshooting Modbus communication

The most common communication problems result from not properly following the configuration steps outlined above in this manual. Review all of the steps and use the following list to check your settings.

Verify accuracy of the following:

Hardware settings for Modbus (8 Data bits, No Parity, and 1 Stop bit):

- Baud rate DIP switches 1 and 2
- Protocol DIP switches 3 and 4
- Jumper set to EIA-485
- Proper connection wiring
- Unique rotary address switches 1 – 99. If controllers have duplicate addresses, network communication can be lost.

NOTES

- If RX LED is solid, then the terminations are incorrect.
- If the network has greater than 32 devices or exceeds 2,000 feet, a Repeater should be installed.
- If a controller begins or ends a network segment, a terminating resistor may be needed.
- The controller recognizes physical changes (DIP switches, rotary switches, and jumpers) upon power up.

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.

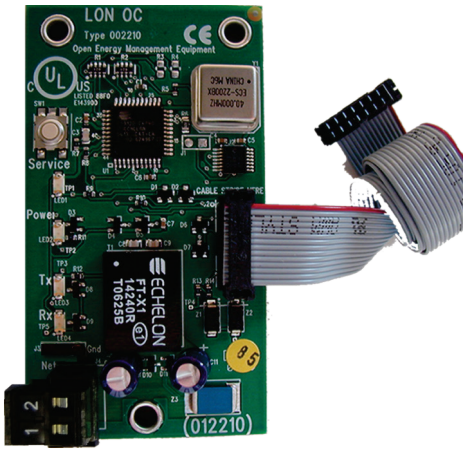
LonWorks

WARNING

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 for the LonWorks Protocol Implementation Conformance Statement (PICS).

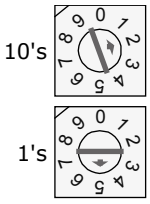


To set up the Unit Vent for the LonWorks Option Card (#LON-OC)

1 Turn off the power for the Unit Vent by disconnecting power terminals.

2 Using the rotary switches, set a unique address. Set the **Tens** (**10's**) switch to the tens digit of the address, and set the **Ones** (**1's**) switch to the ones digit.

EXAMPLE If the controller's address is 25, point the arrow on the **Tens** (**10**'s) switch to 2 and the arrow on the **Ones** (**1**'s) switch to 5.



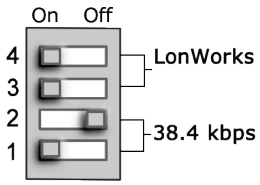
3 Set communications selector for **EIA-485**.

4 Set both DIP switches **1** ON and **2** OFF for 38.4 kbps baud.

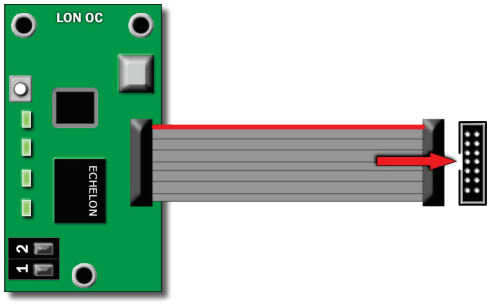
NOTE Use the same baud rate for all devices on the network segment.

5 Set both DIP switches **3** and **4** ON for LON.

The following example is set for 38.4 kbps and LonWorks.



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



6 Connect LON network to pins **1** and **2** on the Option Card.

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.

7 Turn on the power for the Unit Vent by connecting power terminals.

8 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 Unit Vent 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 Unit Vent. The Network Management Tool allows you to test integration prior to binding the controller's network variables to other LonWorks nodes.

Troubleshooting LonWorks communication

The most common communication problems result from not properly following the configuration steps outlined above in this manual. Review all of the steps and use the following list to check your settings.

Verify accuracy of the following:

Hardware settings for LonWorks (8 Data bits, No Parity, and 1 Stop bit):

- Baud rate DIP switches 1 and 2 set to 38.4 kbps
- LonWorks protocol DIP switches 3 and 4
- Jumper set to EIA-485 when using the LonWorks Option Card
- LON network terminated on LonWorks Option Card pins 1 and 2

NOTES

- If RX LED is solid, then the terminations are incorrect.
- If the network has greater than 32 devices or exceeds 2,000 feet, a Repeater should be installed.
- If a controller begins or ends a network segment, a terminating resistor may be needed.

Start-up

Use one of the following interfaces to start up, access information, read sensor values, and test the controller.

This interface...	Provides a...
Field Assistant application - Runs on a laptop that connects to controller's Local Access port [1]	Temporary interface
Equipment Touch device - Connects to controller's Rnet port [2]	Temporary or permanent interface
i-Vu® application Available for BACnet systems only	Permanent interface
System Touch device Available only for BACnet MS/TP systems. Wire to a BACnet MS/TP network connector and a 24 Vac power supply [3]	Temporary or permanent interface

[1] Requires a USB Link (Part #USB-L).
[2] See the *Equipment Touch Installation and Setup Guide* for detailed instructions.
[3] See the *System Touch Installation and Setup Guide* for detailed instructions.

CAUTION If multiple controllers share power but polarity was not maintained when they were wired, the difference between the controller's ground and the computer's AC power ground could damage the USB Link and the controller. If you are not sure of the wiring polarity, use a USB isolator between the computer and the USB Link. Purchase a USB isolator online from a third-party manufacturer.

Sequence of Operation

The Unit Vent controls mechanical cooling and heating based on its own space temperature input and setpoints. An optional CO_2 (Indoor Air Quality) sensor mounted in the space maximizes occupant comfort when used with the **Modulating Mixed Air Damper** option.

See *Scheduling* (page 17) for occupancy types.

The following sections describe the functionality of the Unit Vent. All points in this sequence of operation refer to the Equipment Touch, i-Vu®, or Field Assistant interface.

Scheduling

Scheduling

You must configure time periods to schedule the transitions from occupied to unoccupied operation. The time periods control the space temperature to occupied heating and cooling setpoints. The Unit Vent operates continuously in the **Occupied** mode until you either configure a **Time Schedule** or a third party control system **Enables/Disables** the **BAS On/Off** point. You must set the local time and date for these functions to operate properly.

The controller is defaulted to control to the occupied setpoints all the time, until either a **Time Schedule** is configured or a third party control system **Enables/Disables** the **BAS On/Off** point. The local time and date must be set for these functions to operate properly.

The occupancy source can be changed to one of the following:

- **Occupancy Schedules**

  The controller is occupied 24/7 until you configure a time schedule using the Equipment Touch, Field Assistant, or the i-Vu® application, or until a third party control system **Enables/Disables** the **BAS On/Off** point. You can disable this by going to **Configuration** > **Unit Configuration** > **Occupancy Schedules** and changing the point from **Enable** to **Disable** and clicking **OK**.

  NOTE You must **Enable** this point in order for the Equipment Touch, Field Assistant, or the i-Vu® application to assign a time schedule to the controller.

- **Schedule**

  The unit operates according to the schedule configured and stored in the unit. The schedule is accessible in the Equipment Touch, Field Assistant, or the i-Vu® application. The daily schedule consists of a start and stop time (standard or 24 hour mode) and seven days of the week, starting with Monday and ending on Sunday.

- **Occupancy Input Contact** (optional)

  If configured for remote occupancy control, the controller uses an external dry contact closure to determine the occupancy status of the unit. Disable the **Occupancy Schedules** in order to use the occupancy contact input.

  NOTE Scheduling can only be controlled from one source.

- **BAS (Building Automation System) On/Off**

  For use with a Building Automation System that supports network scheduling, you must disable the **Occupancy Schedules** so the BAS can control the unit through a network communication and the BAS scheduling function.

  NOTE Scheduling can either be controlled from the unit or the BAS, but not both.

- **System Occupancy**

  Uses the network to obtain an occupancy status value from another controller, which is read over the network and used by this controller. **Occupancy Schedules** MUST be set to **Disable** to use this function.

  NOTE Scheduling can only be controlled from one source.

Supply fan

You can configure the indoor fan to operate in any 1 of 3 **Fan Modes**:

- **Auto** - runs intermittently during both occupied and unoccupied periods
- **Continuous** (default) - runs continuously during occupied periods and intermittently during unoccupied periods
- **Always on** - runs continuously regardless of occupancy

In the **Continuous** mode, the fan is turned on when one of the following is true:

- It is in occupied mode, as determined by its occupancy status
- There is a demand for cooling or heating in the unoccupied mode
- There is a call for ventilation (IAQ override - optional)

When power is reapplied after a power outage, or when transitioning from unoccupied to occupied, you can configure a delay of 5 - 600 (default 60) seconds before starting the fan. Configure as follows:

- **Fan On Delay** defines the delay time (0 - 30 seconds, default 30) before the fan begins to operate after heating or cooling is started and is automatically overridden if electric heat or DX cooling are active.
- **Fan Off Delay** defines the delay time (0 - 180 seconds, default 120) the fan continues to operate after heating or cooling stops.

The fan runs as long as cooling, heating, economizer operation, or DCV is active. If the space temperature failure alarm, condensate overflow alarm, or the test mode is active, the fan shuts down immediately, regardless of occupancy state or demand.

Automatic Fan Speed Control - The Unit Vent controls up to 3 fan speeds using a Fan Interface board or field-installed relays. The fan motor operates at the lowest speed possible to provide quiet and efficient fan operation with the best latent capability during cooling. The motor increases speed if additional cooling or heating (except for electric heating) is required to reach the desired space temperature setpoint. The motor's speed increases as the space temperature rises above the cooling setpoint or falls below the heating setpoint. The amount of space temperature increase above or below the setpoint that is required to increase the fan speed is configurable. Also, the fan speed increases as the **Supply Air Temperature** approaches the configured minimum or maximum SAT limits if DX cooling or electric heat is active.

Configuring Automatic Fan Speed setpoints – When configured for more than 1 speed, the fan speed selection is based on Space Temperature compared to the Effective Setpoints. For example, if configured for a 3-speed fan, the fan will go to Medium speed when the Space Temp exceeds the Cool 1/ Heat 1 level. The setpoint graph represents this as the yellow and light blue areas. The fan increases to High speed when the Space Temp exceeds Cool 2/ Heat 2 level. These are represented by the orange and dark blue areas. Speed is reduced when the Space Temp passes the same threshold, but includes a non-adjustable Hysteresis (differential) of 0.5Δ°F (.27Δ°C) for both heating and cooling modes. All color bands (yellow, orange, light blue and dark blue) MUST be set to more than 0.5Δ°F (.27Δ°C).

Manual Fan Speed Control - When you use the controller with the optional SPT sensor, the automatic fan speed operation may be overridden from the SPT sensor (if applicable). You can select any available motor speed or automatic operation.

Unoccupied Fan Cycling - When **Unoccupied Fan Cycling** is set to **Enable** (default), the controller operates the equipment's fan for 1 minute every hour during the unoccupied period. The fan operates at the lowest speed

Fan Speed Control - Electric Heat Override - When electric heat is required and active, the control continuously monitors the supply air temperature to verify it does not rise above the configured **Maximum Heating SAT Limit** [90°F (32.2°C) default]. As the SAT approaches the limit minus 10Δ°F (5.5Δ°C), the fan speed increases to ensure the SAT remains below the limit. This provides the most quiet and efficient operation by running the fan at the lowest speed possible.

Fan Speed Control - DX Cooling override - When DX (direct expansion) mechanical cooling is required and active, the control continuously monitors the supply air temperature to maintain the SAT at or above the configured **Minimum Cooling SAT Limit** [50°F (10°C) default] plus 5Δ°F (2.7Δ°C). When the SAT drops below this value, the fan speed increases to prevent the SAT from dropping further. The fan operates at the lowest speed to maximize latent capacity during cooling.

Fan Status (Option) - The optional input can be configured as either an occupancy input or a fan status input. If configured as fan status, the controller compares the status of the fan to the desired commanded state. When the fan is commanded to run (ON), the fan status is checked and verified to match the commanded state. If the fan status is not on, then a fan status alarm is generated after 1 minute and the equipment's MAD is disabled. If the equipment has hydronic heat configured, the heating algorithm maintains the desired fan off setpoint.

Cooling

The Unit Vent operates mechanical cooling (one stage of DX, a modulating chilled water valve or a F&B damper plus a 2-position water valve) to maintain the desired cooling setpoint. The cooling is controlled by the PI (Proportional-integral) cooling algorithm and integrated with the modulating mixed-air damper control. The required **Cooling Control Setpoint** is calculated by the controller and the cooling device is controlled to maintain the **Supply Air Temperature** at this setpoint. This setpoint is compared to the actual supply air temperature and determines valve or damper operation and staging control for DX.

The following conditions must be true in order for the cooling algorithm to run:

- **Cool Enable** is set to **Enable**
- Space temperature reading is valid
- Supply fan must not be in alarm
- For 2-pipe systems, the water temperature is suitable for cooling
- Heat mode is not active
- For DX, the 5 minute compressor time-guard timer has expired
- **Fire/Smoke Detector** (FSD) is **Normal**
- OAT > damper setpoint plus 3Δ°F (1.6Δ°C)/hr and damper output > 95% for 1 minute, or, OAT is NOT suitable for cooling, or, **Damper Type** is not **Modulating**.

- OAT is greater than the **Cooling Lockout Temperature**
- If occupied, the SPT is greater than the **Occupied Cooling** setpoint
- If unoccupied, the SPT is greater than the **Unoccupied Cooling** setpoint

If all the above conditions are met, cooling is energized as required, otherwise it is disabled. If cooling is active and the SAT approaches the minimum SAT limit, the cooling valve modulates closed. (For DX cooling, if the SAT drops below the configured minimum SAT value, the fan is indexed to a higher speed. If this is insufficient and if the SAT falls below the minimum limit minus 5Δ°F (2.7Δ°C), the DX cooling will be disabled.)

The configuration screens contain **Min Cooling SAT** and **Cooling Lockout** based on outdoor air temperature (OAT). Both can be adjusted to meet various specifications.

For DX cooling, after the compressor is staged off, it may be restarted again after the supply air temperature has increased above the minimum supply air temperature limit. There is a 5 minute minimum off-time for the compressor as well as a 2 minute minimum on-time to prevent oil migration.

Modulating Chilled Water - The control can operate a modulating (0-10 Vdc or 2-10 Vdc) type, NO or NC, chilled water valve connected to the cooling coil of the unit in order to maintain the desired cooling setpoint. The valve modulates to maintain the SAT at the calculated **Cooling Control Setpoint**. The control will also prevent the SAT from exceeding the **Minimum Cooling SAT** limit.

Face & Bypass Chilled Water - The control can operate a modulating (0-10 Vdc or 2-10 Vdc) type F&B damper and an optional 2-position NO or NC chilled water valve to maintain the desired cooling setpoint. The damper modulates to maintain the SAT at the calculated **Cooling Control Setpoint**. The valve opens when cooling is required (and the water is suitable if 2-pipe changeover). The control will prevent the SAT from exceeding the **Minimum Cooling SAT** limit.

Single Stage Direct Expansion (DX) - The control can operate a single stage of DX cooling in order to maintain the desired cooling setpoint. The DX stage is controlled to prevent the SAT from exceeding the **Minimum Cooling SAT** minus 5Δ°F (2.7Δ°C) and also subject to a 2 minute minimum on-time. The compressor output is not energized unless SAT > **Minimum Cooling SAT** limit plus 10Δ°F (5.5Δ°C). Once disabled, the compressor cannot be restarted for at least 5 minutes.

Heating

The Unit Vent operates mechanical heating (staged electric heat, a modulating hot water/steal valve, or a F&B damper plus a 2-position heating valve, or a combination) to maintain the desired heating setpoint. The heating is controlled by the PI (Proportional-integral) heating algorithm and the heating stage capacity algorithm for electric heat. The desired **Heating Control Setpoint** is calculated by the controller. This setpoint is compared to the actual supply air temperature and determines valve or damper operation and staging control for electric heat.

The following conditions must be true in order for the heating algorithm to run:

- **Heat Enable** is set to **Enable**
- Space temperature reading is valid
- **Supply Fan** must not be in alarm
- For 2-pipe systems, the water temperature is suitable for heating
- Cool mode is not active
- For electric heat, the minimum off timers have expired

- **Fire/Smoke Detector** (FSD) is **Normal**
- OAT is less than the heating lockout temperature
- If occupied, the SPT is less than the occupied heating setpoint
- If unoccupied, the SPT is less than the unoccupied heating setpoint

If all the above conditions are met, the heating outputs are energized as required, otherwise they are de-energized. If the heating is active and the SAT approaches the maximum SAT limit, the heating valve modulates closed, or the F&B damper moves to the coil bypass position. For electric heating, if the SAT rises above the configured Maximum SAT value minus 10Δ°F (5.5Δ°C), the fan is indexed to a higher speed. If this is insufficient and the SAT continues to approach the maximum limit, the EH heating stages are proportionally disabled. After the electric heater stage is turned off, it may be restarted again until after the supply air temperature falls below the maximum supply air temperature limit. There is a minimum off-time for the electric heater stage to protect against excessive cycling.

The configuration screens contain the **Max SAT** parameter as well as **Heating Lockout** based on outdoor air temperature (OAT). Both can be adjusted to meet various specifications.

Modulating Hot Water/Steam Heating - The control can operate a modulating (0-10 Vdc or 2-10 Vdc) type, NO or NC, hot water or steam valve, connected to the heating coil of the unit and supplied by a boiler in order to maintain the desired heating setpoint. The valve is controlled to maintain the **Heating Control Setpoint** during heating and will not exceed the **Maximum Heating SAT** limit. If the fan is off or a fan failure alarm occurs, the valve modulates to maintain the **Supply Air Temperature** at the configured **Fan Off Value**.

Face & Bypass Hot Water/Steam - The control can operate a modulating (0-10 Vdc or 2-10 Vdc) type F&B damper and an optional 2-position NO or NC heating valve in order to maintain the desired heating setpoint. The damper modulates to maintain the SAT at the calculated **Heating Control Setpoint**. The valve opens when heating is required (and the water is suitable if 2-pipe changeover). The control will prevent the SAT from exceeding the **Maximum Heating SAT** limit.

Electric Heat - The control can operate up to 3 stages (1 stage default) of electric heat in order to maintain the desired heating setpoint. The heat stages are controlled to maintain the **Heating Control Setpoint** during heating and will not exceed the **Maximum Heating SAT**. **Stage** cycling is subject to a 2 minute minimum off-time to prevent excessive cycling (30 seconds for stage #1). The number of electric heat stages is limited so that the total number of combined fan speeds and electric heat stages equal 4.

Combination Heating - The control can operate the modulating hot water heat or the Face & Bypass Hot Water heat (with a suitable 2-position valve plus electric heat) in order to maintain the desired heating setpoint. The non-electric heat is used to meet the heating requirements in the space when the changeover mode is heat. The electric heater is used when the changeover mode is cool. If the fan is off and the changeover mode is heat, the non-electric heat is controlled to maintain the **Supply Air Temperature** at the configured **Fan Off Value**.

Mixed air damper (Modulating)

The Unit Vent operates a mixed air damper to maintain the desired cooling setpoint without mechanical cooling, while also providing the required ventilation. The modulating mixed air damper is controlled by the PI (Proportional-integral) cooling algorithm and integrated with mechanical cooling while also maintaining a minimum OA intake if the optional CO_2 sensor is available. See *Indoor Air Quality* (page 23) for additional information.

The desired **Damper Setpoint** is calculated by the controller when cooling is required. The **Damper Setpoint Override Value** provides the capability to maintain a user-defined fixed supply air temperature when cooling is required and available. It will override the PI temperature control algorithm when the **Damper Setpoint Override Value** is not equal to 0 (and must be greater than 45°F (7.2°C). The **Damper Setpoint** is compared to the actual supply air temperature and used to determine the **Mixed Air Damper** position.

The following conditions must be true in order for the modulating damper (economizer) algorithm to run:

- **Damper Type** is Modulating
- Space temperature reading is valid
- **Supply Fan** must be on and not in Alarm
- OAT is valid
- Heat mode is not active
- **Fire/Smoke Detector** (FSD) is **Normal**
- OAT is less than **Damper Lockout Temperature** limit
- OAT is less than RAT/SPT sensor
- If occupied, the SPT is greater than the **Occupied Cooling** setpoint
- If unoccupied, the SPT is greater than the **Unoccupied Cooling** setpoint

If all the above conditions are met, the mixed air damper will operate as an economizer as required, otherwise it will be disabled and maintain either a closed or minimum damper position.

The configuration screens contain the **Min Cooling SAT** and **Damper Lockout** parameter based on outdoor air temperature (OAT). Both can be adjusted to meet various specifications.

Mixed air damper (2-position)

The control can operate a 2-position (0-10 Vdc or 2-10 Vdc) type minimum outdoor air damper to maintain the desired ventilation during occupied periods. The damper output provides a 10 Vdc signal when the control is occupied or in an occupancy override mode. When the control is unoccupied or the fan is off, the damper output will go to 0 Vdc. To control the maximum amount of outdoor air entering the unit, a mechanical actuator stop must be set.

The following conditions must be true in order for the 2-position damper algorithm to run:

- **Damper Type** is **2-Pos**
- **Supply Fan** must be on and not in alarm
- The unit is in an occupied mode

Changeover mode detection

The Unit Vent determines the changeover mode for 2-pipe heating/cooling systems. The controller monitors a local changeover thermistor sensor or switch, dependent upon the configuration. For thermistor applications, the heat or cool mode is determined by user-configurable temperature setpoints. When the sensed temperature exceeds the **Changeover Heat Limit**, the system changeover mode is set to heat. When the sensed temperature falls below the **Changeover Cool Limit**, the system changeover mode is set to cool. For applications using a switch, the heat mode is determined when the input is open, while a closed switch indicates cool mode.

Additionally, an Analog Network Input point and a BACnet Analog Value input variable are also provided to allow a network-supplied analog value of the system water temperature to be used to determine the changeover mode. The Analog Network Input point has the highest priority, followed by the BACnet AV point, then the local input if multiple inputs are supplied simultaneously.

Indoor Air Quality

If used with a modulating-type mixed air damper, the controller can provide **Demand Controlled Ventilation** (DCV) to properly ventilate an occupied space. To meet ventilation requirement, the fan must be configured for the **Continuous** or **Always On** mode of operation.

Demand Control Ventilation (DCV) - If the optional CO_2 sensor (or a CO_2 sensor value) is available and a modulating mixed air damper is installed, the controller will increase the minimum damper opening to outdoor air as required by the CO_2 levels within the occupied space. The control provides DCV during occupied periods. The control monitors the CO_2 level and compares it to the configured setpoints and adjusts the minimum damper position as required. The control provides proportional ventilation to meet the requirements of ASHRAE specifications by providing a base ventilation rate and then increasing the rate as the CO_2 level increases. The control begins to proportionally increase ventilation when the CO_2 level rises above the start ventilation setpoint and reaches the full ventilation rate when the CO_2 level is at or above the maximum setpoint.

The configurable **Minimum Damper Pos** insures that proper base ventilation is delivered when occupants are not present. The **DCV Max Vent Damper Pos** (default 60%) limits the maximum amount of outdoor air. An automatic minimum mixed air temperature override control prevents unacceptable mixed air temperatures when the outdoor air is extremely cold. It proportionally resets the maximum amount of outdoor air used for DCV from the configured **DCV Max Vent Damper Pos** as the OA drops below the **Minimum Cooling SAT** limit and ends at the **Minimum Damper Pos** when the OAT reaches 10°F (-12.2°C).

If this additional outdoor air being introduced for ventilation causes an unacceptable drop in the supply air temperature or could cause a potential coil freeze-up condition, then the control can be set to temper the supply air during DCV control. The control uses heating to prevent the supply air from falling below the configurable **Min DCV Override** SAT setpoint, when the DCV control is active. The IAQ configurations are accessed on the **Properties** page > **Equipment** tab > **Configuration**.

The following conditions must be true for this algorithm to run:

- **Damper Control** is configured for **Modulating**
- Valid space temperature must be available
- The unit is in an occupied mode
- **Supply Fan** must be on and not in alarm
- IAQ sensor value reading is greater than the **DCV Start Control Setpoint**
- The DCV calculated damper position must be > the economizer position

The configuration screens contain the 5 adjustable setpoints:

- **DCV Start Control** setpoint
- **DCV Maximum Control** setpoint
- **Minimum Damper Position**
- **DCV Maximum Vent Damper Position**
- **Min SAT in DCV Override**

These can be adjusted to meet various specifications.

Demand Limiting

The Unit Vent accepts 3 levels of demand limit from the network. In response to a demand limit, the unit decreases its heating setpoint and increases its cooling setpoint to widen the range in order to immediately lower the electrical demand. You can change the responding temperature adjustment for both heating and cooling and each demand level. The response to a particular demand level may also be set to 0.

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

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: Unit Vent Network Points List

Network points list for BACnet and Modbus

				BACnet		Modbus	
Point Name	Point Access	Units	Default Value	BACnet Point Name	BACnet Object ID	Modbus Register Type	Modbus Register #
Return Air Temperature	R	°F		ra_temp	AV:1010	Input Register (Float)	65
Setpoint	R/W	°F		occ_cl_stpt	AV:3001	Holding Register (Float)	9
Setpoint	R/W	°F		occ_ht_stpt	AV:3002	Holding Register (Float)	19
Setpoint	R/W	°F		unocc_cl_stpt	AV:3003	Holding Register (Float)	15
Setpoint	R/W	°F		unocc_ht_stpt	AV:3004	Holding Register (Float)	17
Supply Fan Status	R	Off On		sfan_status	BV:1003	Discrete Input	24
Supply Air Temperature	R	°F		sa_temp	AV:1008	Input Register (Float)	109
Cooling Lockout Temperature	R/W	°F	45	oat_cl_lockout	AV:9002	Holding Register (Float)	43
Cooling Output	R	%		clg_output	AV:2025	Input Register (Float)	21
Damper Lockout Temp	R/W	°F	63	oatlecon	AV:4004	Holding Register (Float)	23
Damper Output	R	%		oa_dpr_pos	AV:2022	Input Register (Float)	169
Damper Setpoint Override Value	R/W	°F	0	dmpr_ovrde_val	AV:4006	Holding Register (Float)	25
Economizer Purge Min Pos	R/W	%Open	40	econ_purge_min	AV:9029	Holding Register (Float)	75
Effective Cool Setpoint	R	°F		eff_cl_stpt	AV:3005	Input Register (Float)	55
Effective Heat Setpoint	R	°F		eff_ht_stpt	AV:3006	Input Register (Float)	57
Filter Service	R/W	hr	600	filter_service_hrs	AV:2019	Holding	67

				BACnet		Modbus	
Point Name	Point Access	Units	Default Value	BACnet Point Name	BACnet Object ID	Modbus Register Type	Modbus Register #
Alarm Timer						Register (Float)	
Heating Lockout Temperature	R/W	°F	65	oat_ht_lockout	AV:9003	Holding Register (Float)	69
Heating Output	R	%		htg_output	AV:2026	Input Register (Float)	37
Occ Override Delay	R/W	min	15	occ_ovr_delay	AV:9028	Holding Register (Float)	63
Outdoor Air Temperature	R	°F		oa_temp	AV:1003	Input Register (Float)	87
Override Time Remaining	R	min		ovrde_time	AV:2016	Input Register (Float)	93
Power Fail Restart Delay	R/W	seconds	5	start_delay	AV:9007	Holding Register (Float)	127
Setpoint Adjustment	R	°F		stpt_adj	AV:1006	Input Register (Float)	99
Setpoint Adjustment Range	R/W	°F	5	stpt_adj_range	AV:9015	Holding Register (Float)	101
Space Temperature - Prime Variable	R	°F		space_temp	AV:2007	Input Register (Float)	107
System Outdoor Air Temperature	R/W	°F	-999	system_oat	AV:1901	Holding Register (Float)	119
System Setpoint Adjustment	R/W	°F	-999	system_stpt_adj	AV:1913	Holding Register (Float)	53
System Space AQ	R/W	no units	-999	system_iaq	AV:1903	Holding Register (Float)	149
System Space Temperature	R/W	°F	-999	system_spt	AV:1902	Holding Register (Float)	123
System Water Temperature	R/W	°F	-999	system_water_temp	AV:1905	Holding Register (Float)	105
Changeover Mode	R	Cool Heat		chgovr_mode	BV:1014	Discrete Input	2
Cool Enable	R/W	Disable Enable	Active (1)	cl_enable	BV:1011	Coil	36
Filter	R	Clean Dirty		filter_alarm	BV:7017	Discrete Input	31
Fire / Smoke Shutdown	R	Normal Alarm		fire_alarm	BV:7007	Discrete Input	32
Freezestat	R	Normal Alarm		llt_alarm	BV:7037	Discrete Input	13
Heat Enable	R/W	Disable	Active (1)	ht_enable	BV:1012	Coil	37

				BACnet		Modbus	
Point Name	Point Access	Units	Default Value	BACnet Point Name	BACnet Object ID	Modbus Register Type	Modbus Register #
		Enable					
High Space Temperature	R	Normal Alarm		spt_hi_alarm	BV:7011	Discrete Input	35
Indoor Air Quality	R	Normal Alarm		iaq_alarm	BV:7005	Discrete Input	33
Indoor Air Quality Sensor	R	Normal Alarm		iaq_sensor_fail	BV:7039	Discrete Input	37
Low Space Temperature	R	Normal Alarm		spt_lo_alarm	BV:7012	Discrete Input	39
Occupancy Status	R	Unoccupied Occupied		occ_status	BV:2008	Discrete Input	18
Outdoor Air Temperature	R	Normal Alarm		oat_alarm	BV:7036	Discrete Input	19
Reset Filter Alarm	R/W	Off On	Inactive (0)	filter_rntm_clr	BV:7517	Coil	22
Return Air Temperature	R	Normal Alarm		rat_alarm	BV:7035	Discrete Input	21
Setpoint Adjustment	R/W	Disable Enable	Active (1)	stpt_adj_enable	BV:1013	Coil	26
Shutdown	R/W	Inactive Active	Inactive (0)	shutdown	BV:9001	Coil	27
Space Temp Sensor	R	Normal Alarm		spt_fail	BV:7001	Discrete Input	46
SPT Sensor	R	Normal Alarm		spt_sensor_fail	BV:7032	Discrete Input	38
Supply Air Temperature	R	Normal Alarm		sat_alarm	BV:7004	Discrete Input	47
Supply Fan Failure	R	Normal Alarm		sfan_fail_alarm	BV:7008	Discrete Input	48
Unoccupied Fan Cycling	R/W	Disable Enable	Active (1)	fan_cycle	BV:1016	Coil	9
BAS On / Off	R/W	(1) Inactive (2) Occupie (3) Unoccupied	1	keypad_ovrde	MSV:1001	Holding Register (Signed)	133
Fan / Speed	R	(1) Off (2) Low (3) Med (4) High (5) On		fan_run	MSV:2004	Input Register (Signed)	175
Optimal Start Type	R/W	(1) None (2) Temp Compensated (3) Learning Adaptive	2	start_type	MSV:2009	Holding Register (Signed)	154
System Mode	R	(1) Off (2) Fan Only (3) Economize (4) Cooling (5) Heating (6) Cont Fan (7) Test (8) Start Delay (9) Temper SAT (10) Fire Shutdown		run_status	MSV:2002	Input Register (Signed)	1

				BACnet		**Modbus**	
Point Name	Point Access	Units	Default Value	BACnet Point Name	BACnet Object ID	Modbus Register Type	Modbus Register #
		(11) Shutdown (12) IAQ Override (12) Pre-occ Purge					
Vent Dmpr Pos / DCV Min Pos	R/W	%	20	econ_min	AV:4005	Holding Register (Float)	131
Indoor Air Quality CO2 (ppm)	R	ppm		iaq	AV:1009	Input Register (Float)	73
Optimal Start	R/W	hr	1	optm_start	AV:9026	Holding Register (Float)	147
Maximum Heating SAT	R/W	°F	105	sat_ht_max	AV:83004	Holding Register (Float)	41
Minimum Cooling SAT	R/W	°F	50	sat_cl_min	AV:83003	Holding Register (Float)	61
Space Temp Source	R	(1) Sensor Failure (2) SPT Sensor (3) RAT / T55 (4) Network (5) Airside Linkage (6) Locked Value (7) T-Stat Linkage (8) ZS Sensor		spt_status	MSV:2003		
System Cooling Demand Level	R	no units		cool_demand_level	AV:9006		
System Heating Demand Level	R	no units		heat_demand_level	AV:9036		
Fan Off Delay	R/W	seconds	90	fan_delay_off	AV:9024		
Changeover Sensor	R	Normal Alarm		chgovr_fail	BV:7034		
ZS Temp Sensor	R	Normal Alarm		zst_sensor_fail	BV:7051		
ZS Sensor Configuration	R	Normal Alarm		zs_config_fail	BV:7055		
Fan On Delay	R/W	seconds	10	fan_delay_on	AV:9025		
Filter Runtime	R	hr		filter_rntm	AV:2015		
Thermostat Linkage	R	Not Active Active		t_link_status	BV:2801		
Thermostat Linkage	R	Normal Alarm		link_therm_fail	BV:7033		

Network points list for N2 and LonWorks

				N2		LonWorks	
Point Name	Point Access	Units	Default Value	N2 Network Point Type	N2 Network Point Address	SNVT Type	SNVT Name
Return Air Temperature	R	°F	°F	ADF	50	nvoRtnAirTmp	Output (active) - default
Setpoint	R/W	°F	°F	ADF	4	nviOccCoolSP	Input (passive) - default
Setpoint	R/W	°F	°F	ADF	9	nviOccHeatSP	Input (passive) - default
Setpoint	R/W	°F	°F	ADF	7	nviUnoccClSP	Input (passive) - default
Setpoint	R/W	°F	°F	ADF	8	nviUnoccHtSP	Input (passive) - default
Supply Fan Status	R	Off On		BI	24	nvoFanStatus	Output (active) - default
Supply Air Temperature	R	°F	°F	ADF	49	nvoSAT	Output (active) - default
Cooling Lockout Temperature	R/W	°F	°F	ADF	16	nviClLckTemp	Input (passive) - default
Cooling Output	R	%	%	ADF	14	nvoCoolOut	Output (active) - default
Damper Lockout Temp	R/W	°F	°F	ADF	15	nviDmpLckTmp	Input (passive) - default
Damper Output	R	%	%	ADF	74	nvoOAVntDmpr	Output (active) - default
Damper Setpoint Override Value	R/W	°F	°F	ADF	19	nviDmpSetOvr	Input (passive) - default
Economizer Purge Min Pos	R/W	%Open	%Open	ADF	5	nviEcnPrgMin	Input (passive) - default
Effective Cool Setpoint	R	°F	°F	ADF	22	nvoEffCoolSP	Output (active) - default
Effective Heat Setpoint	R	°F	°F	ADF	23	nvoEffHeatSP	Output (active) - default
Filter Service Alarm Timer	R/W	hr	hr	ADF	28	nviFltAlmTm	Input (passive) - default
Heating Lockout Temperature	R/W	°F	°F	ADF	29	nviHtLckTmp	Input (passive) - default
Heating Output	R	%	%	ADF	26	nvoHeatOut	Output (active) - default
Occ Override Delay	R/W	min	min	ADF	47	nviOccOvrDly	Input (passive) - default
Outdoor Air Temperature	R	°F	°F	ADF	38	nvoOAT	Output (active) - default
Override Time Remaining	R	min	min	ADF	41	nvoOvrTmRem	Output (active) - default
Power Fail Restart Delay	R/W	seconds	seconds	ADF	58	nviUntStrDly	Input (passive) - default
Setpoint Adjustment	R	°F	°F	ADF	44	nvoSPAdjust	Output (active) - default
Setpoint Adjustment Range	R/W	°F	°F	ADF	45	nviSPAdjRng	Input (passive) - default
Space Temperature -	R	°F	°F	ADF	48	nvoSpaceTemp	Output (active) - default

				N2		LonWorks	
Point Name	Point Access	Units	Default Value	N2 Network Point Type	N2 Network Point Address	SNVT Type	SNVT Name
Prime Variable							
System Outdoor Air Temperature	R/W	°F	°F	ADF	54	nviSysOAT	Input (passive) - default
System Setpoint Adjustment	R/W	°F	°F	ADF	68	nviSysSptAdj	Input (passive) - default
System Space AQ	R/W	no units	no units	ADF	39	nviSysSpAQ	Input (passive) - default
System Space Temperature	R/W	°F	°F	ADF	56	nviSysSpTmp	Input (passive) - default
System Water Temperature	R/W	°F	°F	ADF	62	nviSysWtrTmp	Input (passive) - default
Changeover Mode	R	Cool Heat		BI	2	nvoChngovrMd	Output (active) - default
Cool Enable	R/W	Disable Enable		BO	36	nviClEnb	Input (passive) - default
Filter	R	Clean Dirty		BI	31	nvoFilter	Output (active) - default
Fire / Smoke Shutdown	R	Normal Alarm		BI	32	nvoFrShtdwn	Output (active) - default
Freezestat	R	Normal Alarm		BI	13	nvoFreezeAlm	Output (active) - default
Heat Enable	R/W	Disable Enable		BO	37	nviHtEnb	Input (passive) - default
High Space Temperature	R	Normal Alarm		BI	35	nvoHiSpTemp	Output (active) - default
Indoor Air Quality	R	Normal Alarm		BI	33	nvoIAQAlm	Output (active) - default
Indoor Air Quality Sensor	R	Normal Alarm		BI	37	nvoIAQSensor	Output (active) - default
Low Space Temperature	R	Normal Alarm		BI	39	nvoLoSpTmp	Output (active) - default
Occupancy Status	R	Unoccupied Occupied		BI	18	nvoOccStatus	Output (active) - default
Outdoor Air Temperature	R	Normal Alarm		BI	19	nvoOatAlm	Output (active) - default
Reset Filter Alarm	R/W	Off On		BO	22	nviRstFilAlm	Input (passive) - default
Return Air Temperature	R	Normal Alarm		BI	21	nvoRatAlm	Output (active) - default
Setpoint Adjustment	R/W	Disable Enable		BO	26	nviSPAdjEnbl	Input (passive) - default
Shutdown	R/W	Inactive Active		BO	1	nviShutdown	Input (passive) - default
Space Temp Sensor	R	Normal Alarm		BI	46	nvoSPTmpSen	Output (active) - default
SPT Sensor	R	Normal Alarm		BI	38	nvoSptSnsFl	Output (active) - default
Supply Air Temperature	R	Normal Alarm		BI	47	nvoSATSensor	Output (active) - default
Supply Fan Failure	R	Normal Alarm		BI	58	nvoSFAlarm	Output (active) - default
Unoccupied Fan Cycling	R/W	Disable Enable		BO	9	nviUnocFnCyc	Input (passive) - default
BAS On / Off	R/W	(1) Inactive (2) Occupied		ADI	1	nviBASOnOff	Input (passive) -

				N2		LonWorks	
Point Name	Point Access	Units	Default Value	N2 Network Point Type	N2 Network Point Address	SNVT Type	SNVT Name
		(3) Unoccupied					default
Fan / Speed	R	(1) Off (2) Low (3) Med (4) High (5) On		ADI	4	nvoFanSpeed	Output (active) - default
Optimal Start Type	R/W	(1) None (2) Temp Compensated (3) Learning Adaptive		ADI	20	nviOptStType	Input (passive) - default
System Mode	R	(1) Off (2) Fan Only (3) Economize (4) Cooling (5) Heating (6) Cont Fan (7) Test (8) Start Delay (9) Temper SAT (10) Fire Shutdown (11) Shutdown (12) IAQ Override (12) Pre-occ Purge		ADI	13	nvoOpMode	Output (active) - default
Vent Dmpr Pos / DCV Min Pos	R/W	%	%	ADF	60	nviDCVMinPos	Input (passive) - default
Indoor Air Quality CO2 (ppm)	R	ppm	ppm	ADF	31	nvoIAQ	Output (active) - default
Optimal Start	R/W	hr	hr	ADF	61	nviOptmStart	Input (passive) - default
Maximum Heating SAT	R/W	°F	°F	ADF	33	nviMaxHtSAT	Input (passive) - default
Minimum Cooling SAT	R/W	°F	°F	ADF	42	nviMinClSAT	Input (passive) - default

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.

BACnet Data Link Layer Options

Data Link Layer Options

☐ BACnet IP, (Annex J)

☐ Able to register as a Foreign Device

☐ ISO 8802-3, Ethernet (Clause 7)

☐ ANSI/ATA 878.1, 2.5 Mb ARCNET (Clause 8)

XX ANSI/ATA 878.1, RS-485 ARCNET (Clause 8) baud rate(s) 156k baud

XX MS/TP master (Clause 9), baud rate(s): 9600, 19200, 38400, 76800

☐ MS/TP slave (Clause 9), baud rate(s): 9600, 19200, 38400, 76800

☐ Point-To-Point, EIA 232 (Clause 10), baud rate(s): 9600, 19200, 38400, 76800

☐ Point-To-Point, modem, (Clause 10), baud rate(s): 9600, 19200, 38400, 76800

☐ LonTalk, (Clause 11), medium: _____

☐☐ Other:

Device Address Binding Methods Supported

Is static device binding supported? (This is currently necessary for 2-way communication with MS/TP slaves and certain other devices. **XX** Yes

***Networking Options**

☐ Router, Clause 6 - List all routing configurations, e.g., ARCNET-Ethernet, Ethernet-MS/TP, etc.

ARCNET-MS/TP, ARCNET-MS/TP-UDP/IP

☐ Annex H.3, BACnet Tunneling Router over UDP/IP

☐ BACnet/IP Broadcast Messaging Device (BBMD)

Does the BBMD support registrations by Foreign Devices? ☐Yes ☐No

Character Sets Supported

Indicating support for multiple character sets does not imply that they can all be supported simultaneously.

XX ANSI X3.4

XX IBM™/Microsoft™ ☐DBCS

XX ISO 8859-1

XX ISO 10646 (UCS-2)

XX ISO 10646 (ICS-4)

XX JIS C 6226

If this product is a communication gateway, describe the types of non-BACnet equipment/networks what the gateway supports: Various protocols, depending on which firmware is loaded.

Appendix C: Johnson Controls N2 Protocol Implementation Conformance Statement

Serial Transmission Mode	Supported?
N2 Open	Slave (Slave is the Default Dipswitch setting)

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	Write Analog Input
Sync Time	Write Binary Input
Poll Without Acknowledge	Write Analog Output
Poll With Acknowledge	Write Binary Output
Read Analog Input	Write Internal Parameter
Read Binary Input	Override Analog Input
Read Analog Output	Override Binary Input
Read Binary Output	Override Internal Parameter
Read Internal Parameter	Override Release Request

Appendix D: Modbus Protocol Implementation Conformance Statement

Serial Transmission Mode:	Supported?
RTU	Slave (Slave is the Default Dipswitch setting)

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 - 09999
02 – Read Input Status	Read Discrete Inputs	10001 - 19999
03 – Read Holding Registers	Read Holding Registers	40001 - 49999
04 – Read Input Registers	Read Input Registers	30001 - 39999
05 – Force Single Coil	Write Discrete Outputs (single)	00001 - 09999
06 – Preset Single Register	Write Holding Registers (single)	40001 - 49999
15 – Force Multiple Coils	Write Discrete Outputs	00001 - 09999
16 – Preset Multiple Coils	Write Holding Registers	40001 - 49999

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
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 E: LonWorks Protocol Implementation Conformance Statement

Product Names: **Unit Vent**

LonWorks network points are spawned within the device as a result of downloading graphical control programs. The Unit Vent controller speaks the LonWorks Protocol as described by Echelon Protocol Specification. Since the controller is custom-programmable it does not conform to LonMark certification. Further details on the LonWorks supported implementation are described below.

The FT 3120 Free Topology Smart Transceiver is fully compatible with the TP/FT-10 channel and can communicate with devices using Echelon's FTT-10A Free Topology Transceiver. The free topology transceiver supports polarity insensitive cabling using a star bus, daisy-chain, loop, or combination topology.

Serial Transmission Mode	Supported?
LonWorks	Master or Slave (Slave is the Default Dipswitch setting)

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

The controller supports the following SNVT listing as noted by the Echelon Protocol Specification:

SNVT_abs_humid	SNVT_elec_whr	SNVT_mass_kilo	SNVT_speed
SNVT_address	SNVT_elec_whr_f	SNVT_mass_mega	SNVT_speed_f
SNVT_alarm	SNVT_enthalpy	SNVT_mass_mil	SNVT_speed_mil
SNVT_alarm_2	SNVT_evap_state	SNVT_motor_state	SNVT_state
SNVT_amp	SNVT_ex_control	SNVT_muldiv	SNVT_state_64
SNVT_amp_ac	SNVT_file_pos	SNVT_multiplier	SNVT_str_asc
SNVT_amp_f	SNVT_file_req	SNVT_obj_request	SNVT_str_int
SNVT_amp_mil	SNVT_file_status	SNVT_obj_status	SNVT_switch
SNVT_angle	SNVT_fire_indcte	SNVT_occupancy	SNVT_telcom
SNVT_angle_deg	SNVT_fire_init	SNVT_override	SNVT_temp
SNVT_angle_f	SNVT_fire_test	SNVT_ph	SNVT_temp_diff_p
SNVT_angle_vel	SNVT_flow	SNVT_ph_f	SNVT_temp_f
SNVT_angle_vel_f	SNVT_flow_f	SNVT_pos_ctrl	SNVT_temp_p
SNVT_area	SNVT_flow_mil	SNVT_power	SNVT_temp_ror
SNVT_btu_f	SNVT_flow_p	SNVT_power_f	SNVT_temp_setpt
SNVT_btu_kilo	SNVT_freq_f	SNVT_power_kilo	SNVT_therm_mode
SNVT_char_ascii	SNVT_freq_hz	SNVT_ppm	SNVT_time_f
SNVT_char_mega	SNVT_freq_kilohz	SNVT_ppm_f	SNVT_time_hour
SNVT_chlr_status	SNVT_freq_milhz	SNVT_preset	SNVT_time_min
SNVT_color	SNVT_gfci_status	SNVT_press	SNVT_time_passed
SNVT_config_src	SNVT_grammage	SNVT_press_f	SNVT_time_sec
SNVT_count	SNVT_grammage_f	SNVT_press_p	SNVT_time_stamp
SNVT_count_f	SNVT_hvac_emerg	SNVT_privacyzone	SNVT_time_zone
SNVT_count_inc	SNVT_hvac_mode	SNVT_ptz	SNVT_tod_event
SNVT_count_inc_f	SNVT_hvac_override	SNVT_pumpset_mn	SNVT_trans_table
SNVT_ctrl_req	SNVT_hvac_status	SNVT_pumpset_sn	SNVT_turbidity
SNVT_ctrl_resp	SNVT_hvac_type	SNVT_pump_sensor	SNVT_turbidity_f

SNVT_currency	SNVT_ISO_7811	SNVT_pwr_fact	SNVT_valve_mode
SNVT_date_cal	SNVT_length	SNVT_pwr_fact_f	SNVT_vol
SNVT_date_day	SNVT_length_f	SNVT_reg_val	SNVT_volt
SNVT_date_time	SNVT_length_kilo	SNVT_reg_val_ts	SNVT_volt_ac
SNVT_defr_mode	SNVT_length_micr	SNVT_res	SNVT_volt_dbmv
SNVT_defr_state	SNVT_length_mil	SNVT_res_f	SNVT_volt_f
SNVT_defr_term	SNVT_lev_cont	SNVT_res_kilo	SNVT_volt_kilo
SNVT_density	SNVT_lev_cont_f	SNVT_rpm	SNVT_volt_mil
SNVT_density_f	SNVT_lev_disc	SNVT_scene	SNVT_vol_f
SNVT_dev_c_mode	SNVT_lev_percent	SNVT_scene_cfg	SNVT_vol_kilo
SNVT_earth_pos	SNVT_lux	SNVT_setting	SNVT_vol_mil
SNVT_elapsed_tm	SNVT_magcard	SNVT_smo_obscur	SNVT_zerospan
SNVT_elec_kwh	SNVT_mass	SNVT_sound_db	
SNVT_elec_kwh_1	SNVT_mass_f	SNVT_sound_db_f	

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*
5/22/18	Troubleshooting BACnet MS/TP Troubleshooting N2 Troubleshooting ARC156	Corrected BACnet Device Instance number	C-TS-RD-F
1/11/18	Sequence of Operation > Supply Fan	Section added on Configuring Automatic Fan Speed setpoints	C-AE-AP-E-WB
2/8/17	Communications wiring - BACnet ARC156	New topics	C-D
	Cover What is the Unit Vent controller?	Updated controller graphic.	C-D
2/23/16	Start-up	Added USB Link wiring caution.	C-TS-RD-E-JH
1/8/16	Wiring inputs and outputs	Correction - AN-1 and AN-2 changed to IN-1 and IN-2	C-D

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