

# WSHP Open v3 Integration Guide



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





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

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## Introduction

### What is the WSHP Open controller?

The Water Source Heat Pump (WSHP) controller is available as an integrated component of a Carrier packaged unit. Its internal application programming provides optimum performance and energy efficiency. WSHP 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:

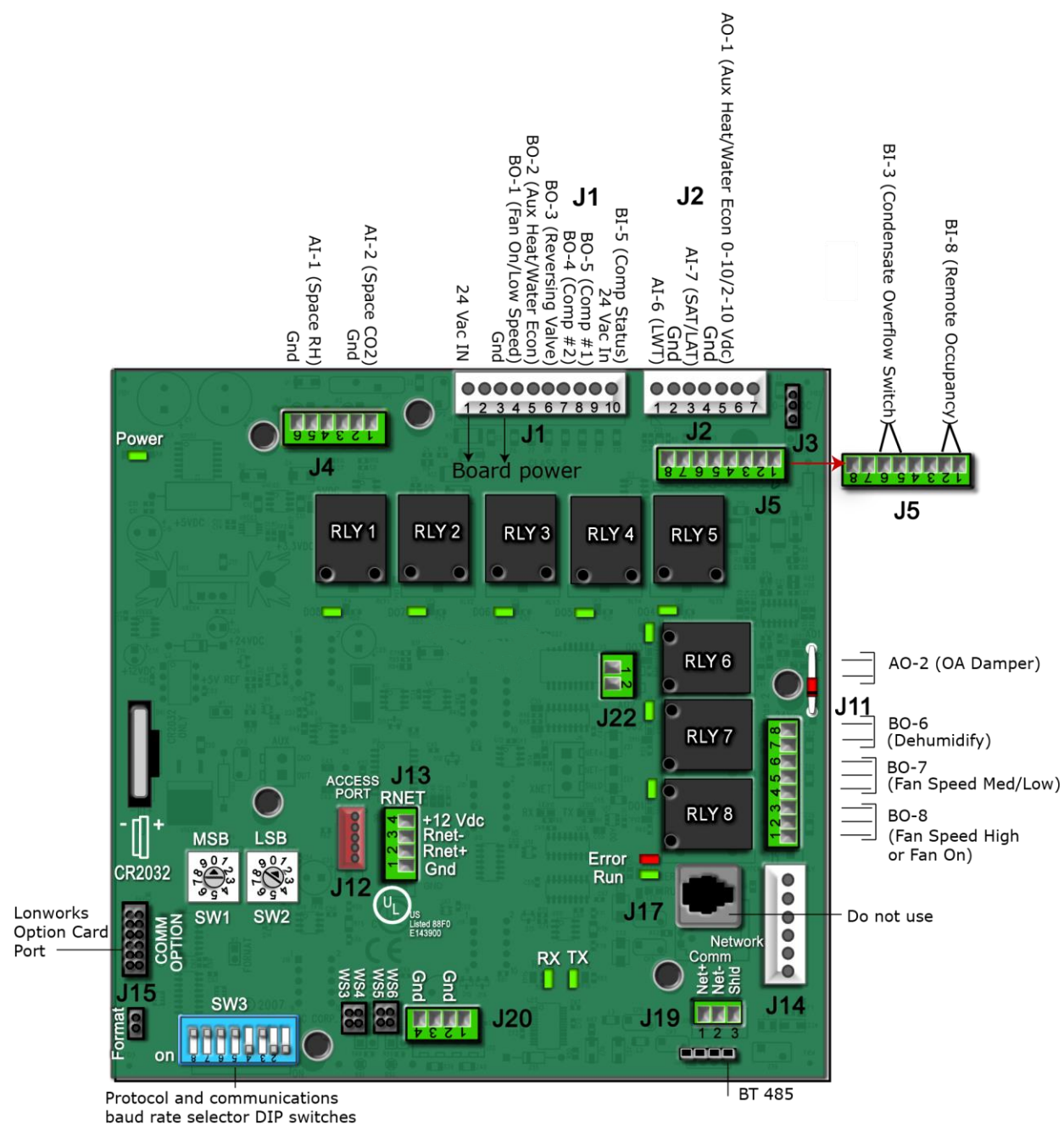
- BACnet MS/TP
- BACnet ARC156
- Modbus
- Johnson N2
- LonWorks

The Equipment Touch is a touchscreen device with a 4.3 in. color LCD display that you connect to the Rnet port of one of the following controllers to view or change its property values, schedule equipment, view trends and alarms, and more, without having to access the system's server.

You can use Carrier's Equipment Touch user interface with the WSHP Open controller using the 5-pin J12 Access Port. See illustration below.

The WSHP Open's application supports detailed color graphics, status, properties, alarms, trends, performance, configuration, and Help on the Equipment Touch. In addition, the WSHP Open Startup Wizard has screens to facilitate the installation technician to initially configure the WSHP Open.

For more details about the Equipment Touch, see the *Equipment Touch Installation and Setup Guide*.



## Safety considerations & handling warning

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### **WARNING**

When you handle the WSHP 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

**WSHP Open Inputs and Outputs Table**

Input/Output Type	Part Numbers	Type of I/O		Connection Pin Numbers	I/O Channel
<b>Inputs</b>					
SPT Sensors	For detailed information, see: Carrier Sensor Installation Guide	Communicating		<b>J13</b> , 1 - 4	Rnet Port
ZS sensors	ZS Sensors Installation or Application Guide				
Wireless Adapter for wireless sensors	Wireless Sensors Installation or Application Guide				
Equipment Touch	Equipment Touch Installation and Setup Guide				
Space Relative Humidity	33ZSENSRH-02	<b>AI</b> (4-20 mA)		<b>J4</b> - 5 & 6	AI - 1
Indoor Air Quality	33ZCSPTCO2	<b>AI</b> (4-20 mA)		<b>J4</b> - 2 & 3	AI - 2
Condensate Switch	N/A	<b>BI</b> (Dry Contacts)		<b>J5</b> - 5 & 6	BI - 3
Stage 1 Compressor Status	N/A	<b>BI</b> (Dry Contacts)		<b>J1</b> - 10	BI - 5
Leaving Source Water Temp	10K Type II	<b>AI</b> (10K Thermistor)		<b>J2</b> - 1 & 2	AI - 6
Supply Air Temperature	33ZCSSENSAT	<b>AI</b> (10K Thermistor)		<b>J2</b> - 3 & 4	AI - 7
Supply Fan Status	N/A	<b>BI</b> (Dry Contacts)		<b>J5</b> - 1 & 2	BI - 8
Occupancy Contact	N/A	<b>BI</b> (Dry Contacts)		<b>J5</b> - 1 & 2	BI - 8
Smoke Detector Input**	N/A	24 Vac		<b>J1</b> - 9	24 Vac IN
<b>Outputs</b>					
Aux Heat - Modulating (HW Valve/Water Econ)	N/A	<b>AO</b> (0-10 Vdc/ 2-10 mA)	*	<b>J2</b> - 4 & 5	AO - 1
Outside Air Damper	N/A	<b>AO</b> (0-10 Vdc/ 2-10 mA)	*	<b>J22</b> - 1 & 2	AO - 2
Supply Fan On/ Low speed (3-speed only)	N/A	<b>BO</b> Relay (24 Vac, 3A)	*	<b>J1</b> - 4	BO - 1 (G)
W2-Aux Heat or 2-pos. Water Economizer	N/A	<b>BO</b> Relay (24 Vac, 3A)	*	<b>J1</b> - 5	BO - 2
Reversing Valve (B or O)	N/A	<b>BO</b> Relay (24 Vac, 3A)	*	<b>J1</b> - 6	BO - 3 (RV)
Y2-Compressor 2nd stage	N/A	<b>BO</b> Relay (24 Vac, 3A)		<b>J1</b> - 7	BO - 4 (Y2)
Y1-Compressor 1st stage	N/A	<b>BO</b> Relay (24 Vac, 3A)		<b>J1</b> - 8	BO - 5 (Y1)
Dehumidification Relay	N/A	<b>BO</b> Relay (24 Vac, 3A)	*	<b>J11</b> - 7 & 8 (N.O.)	BO - 6
Fan Speed Medium/Low (3-speed Only)	N/A	<b>BO</b> Relay (24 Vac, 3A)	*	<b>J11</b> - 5 & 6 (N.O.)	BO - 7
Fan Speed High/Low (3-speed Only)	N/A	<b>BO</b> Relay (24 Vac, 3A)	*	<b>J11</b> - 2 & 3 (N.O.)	BO - 8



Input/Output Type	Part Numbers	Type of I/O		Connection Pin Numbers	I/O Channel
<p>Legend:</p> <p><b>AI</b> - Analog Input    <b>AO</b> - Analog Output</p> <p><b>BI</b> - Digital Input    <b>BO</b> - Digital Output</p> <p>* These outputs are configurable.</p> <p>** 24 Vac required at this terminal to provide unit operation. Connect an isolated N.C. smoke detector contact (or jumper) between 24 Vac and <b>J1</b> - 9.</p>					

## 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, many different protocols might be 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. communicates different types of protocols.

The WSHP Open can communicate 1 of 5 different protocols:

- *BACnet MS/TP* (page 7)
- *BACnet ARC156* (page 11)
- *Modbus* (page 13)
- *Johnson N2* (page 16)
- *LonWorks* (page 18)

The default setting is BACnet MS/TP. You set the protocol and baud rate using the **SW3** DIP switches. The rotary 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, BACnet ARC156, Modbus, and N2, and through **J15** for the LonWorks Option Card.

**NOTE** You must cycle power after changing the rotary switches or after connecting the LonWorks Option Card to **J15**.

#### SW3 DIP switch settings

		Unused	Comm Option port	Protocol				Baud rate	
		8	7	6	5	4	3	2	1
<b>BACnet MS/TP</b> (Default)	Master	N/A	Off	Off	Off	On	Off	Select Baud	Select Baud
<b>BACnet ARC156</b>		N/A	Off	Off	Off	Off	Off	N/A	N/A
<b>Modbus</b>	Slave	N/A	Off	Off	On	On	Off	Select Baud	Select Baud
<b>N2</b>	Slave	N/A	Off	Off	Off	On	On	Off	Off
<b>Lonworks</b>		N/A	On	On	Off	On	Off	Off	On

**Baud DIP switch settings**

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

## BACnet MS/TP

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### To set up the WSHP Open for BACnet MS/TP

Refer to *Appendix B* (page 45) 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.

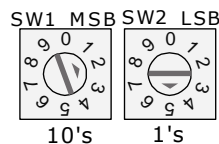
- 1 Turn **off** the WSHP Open's power.

**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 BACnet MS/TP MAC address for the WSHP 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** DIP switches **1** and **2** 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 WSHP Open is fixed at 8 data bits, No Parity, and 1 Stop bit for this protocol's communications.

#### Baud DIP switch settings

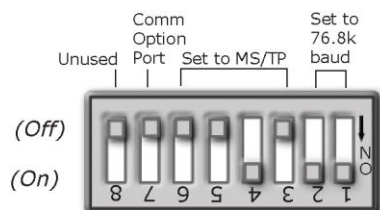
Baud rate	2	1
9,600 bps	Off	Off
19.2 kbps	On	Off
38.4 kbps	Off	On
76.8 kbps	On	On

- 4 Set the remaining DIP switches as follows:

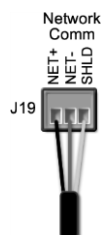
#### BACnet MS/TP DIP switch settings

8	7	6	5	4	3
Off	Off	Off	Off	On	Off

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



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



#### 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 WSHP Open's power.

## 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 WSHP Open receives the token. The default is 10 and should be ideal for the majority of applications. In cases where the WSHP Open is the target of many requests, this number could be increased as high as 100 or 200.

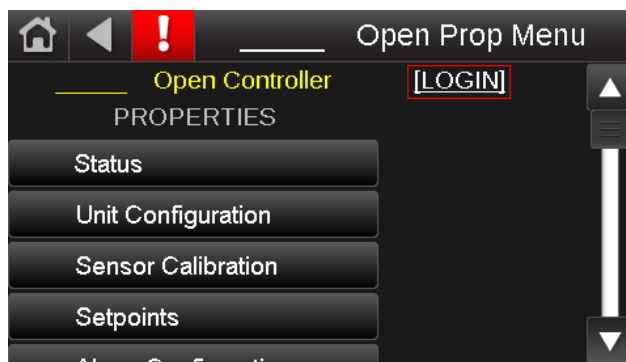
### NOTES

- 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 for Network Points List.
- See *Appendix B* (page 45) for the BACnet Protocol Implementation Conformance Statement (PICS).

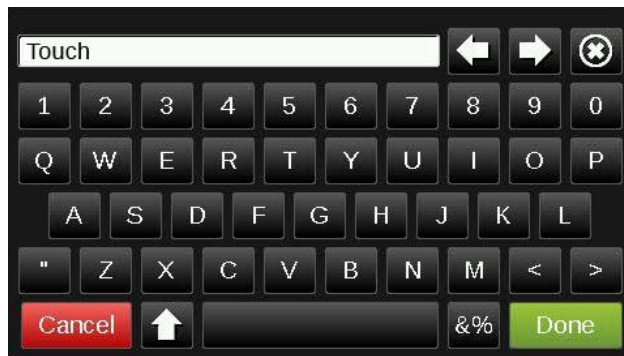
### To set the Device Instance number or adjust the Max Masters or Max Info Frames using an Equipment Touch

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

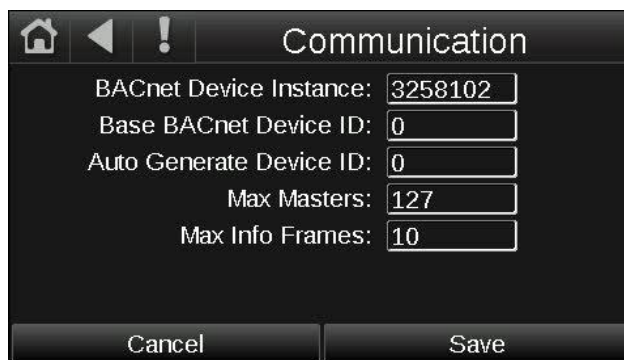
**NOTE** The following graphic is generic and not specific to your system.



- 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 DS2 and DS1
- BACnet MS/TP protocol DIP switches DS3 - DS6
- 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

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### To set up the WSHP Open for BACnet ARC156

The WSHP Open'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>.

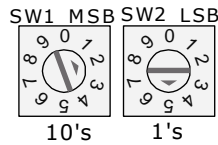
- 1 Turn **off** the WSHP Open's power.

**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 BACnet MS/TP MAC address for the WSHP 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 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.

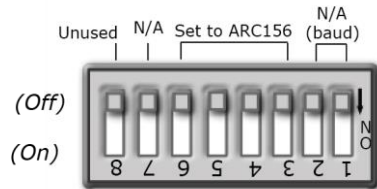


- 3 Set the remaining DIP switches as follows:

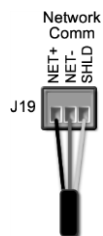
**BACnet ARC156 DIP switch settings**

8	7	6	5	4	3
Off	Off	Off	Off	N/A	N/A

The following example shows the DIP switches set for BACnet ARC156.



- 4 Connect the BACnet ARC156 network to the controller's **J19 Network Comm** port. Connect to **Net+**, **Net-**, and **SHLD**.



**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.

- 5 Turn **on** the WSHP Open's power.



## 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 DS3 - DS6
- 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.

## Modbus

### To set up the WSHP Open for Modbus

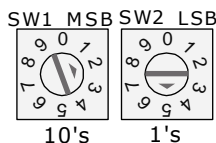
Refer to *Appendix C* (page 46) for the Modbus Protocol Implementation Conformance Statement (PICS).

- 1 Turn **off** the WSHP 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 WSHP 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** DIP switches **1** and **2** 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 WSHP Open is fixed at 8 data bits, No Parity, and 1 Stop bit for this protocol's communications.

**Baud DIP switch settings**

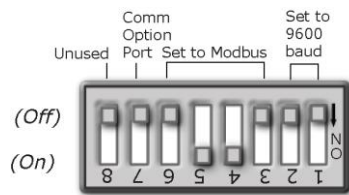
Baud rate	2	1
9,600 bps	Off	Off
19.2 kbps	On	Off
38.4 kbps	Off	On
76.8 kbps	On	On

- 4 Set the remaining DIP switches as follows:

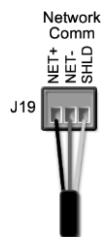
**Modbus DIP switch settings**

8	7	6	5	4	3
Off	Off	Off	On	On	Off

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



- 5 Connect the Modbus EIA-485 network to the WSHP Open's **J19 Network Comm** port. Connect to **Net+**, **Net-**, and **SHLD**.



**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 WSHP Open's power.

## Troubleshooting Modbus

### Check the following to troubleshoot your WSHP 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 The BAS and the controller are both set for the same baud rate:
  - Baud rate DIP switches DS2 and DS1
  - 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 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 The BAS and the controller have the same communication settings (8 data bits, No Parity, and 1 stop bit).
  - Proper connection wiring between the BAS and the controller.
- 1 Verify that the rotary address switches are set for the controller's unique slave address.
- 2 BAS must be reading or writing to the proper point addresses on the controller.
- 3 BAS is sending requests to the proper slave address of the controller.

**NOTE** Refer to *Appendix C* (page 46) 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 WSHP Open for N2

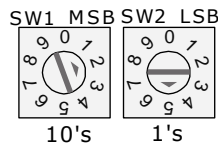
Refer to *Appendix D* (page 48) for the N2 Protocol Implementation Conformance Statement (PICS).

- 1 Turn **off** the WSHP 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 WSHP 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 (SW2)** switch to 1.



- 3 Set the DIP switches **1** and **2** for 9600 bps baud.

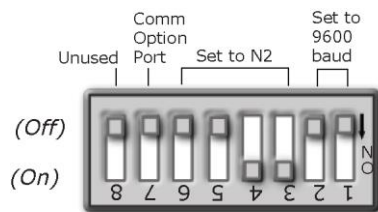
**NOTE** Use the same baud rate and communication settings for all controllers on the network segment. The WSHP Open is fixed at 9600 bps baud, 8 data bits, No Parity, and 1 Stop bit.

- 4 Set the remaining DIP switches as follows:

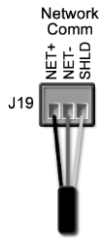
#### N2 DIP switch settings

8	7	6	5	4	3	2	1
Off	Off	Off	Off	On	On	On	On

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



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



#### 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 WSHP Open's power.

## Troubleshooting N2

### Check the following to troubleshoot your WSHP Open:

- 1 Verify that the BAS and controller are both set to speak N2 protocol on the Comm Selector DIP switches **DS3 - DS6**.
  - 2 The BAS and the controller are both set for the same baud rate:
    - 9600 for N2
    - Baud rate DIP switches DS2 and DS1
    - 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 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 The BAS and the controller have the same communication settings (8 data bits, No Parity, and 1 stop bit).
    - Proper connection wiring between the BAS and the controller.
- 1 Verify that the rotary address switches are set for the controller's unique slave address.
  - 2 BAS must be reading or writing to the proper point addresses on the controller.
  - 3 BAS is sending requests to the proper slave address of the controller.

#### NOTES

- Refer to *Appendix A* (page 35) for the Network Points list.
- Refer to *Appendix D* (page 48) for the Protocol Implementation Conformance Statement.

## LonWorks

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### **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* (page 50) for the LonWorks Protocol Implementation Conformance Statement (PICS).



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

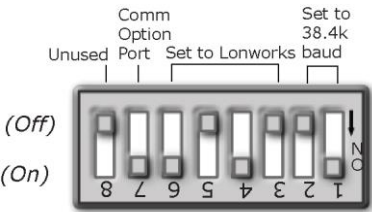
- 1 Turn **off** the WSHP Open's power.

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 SW3 DIP switches for LonWorks as follows:

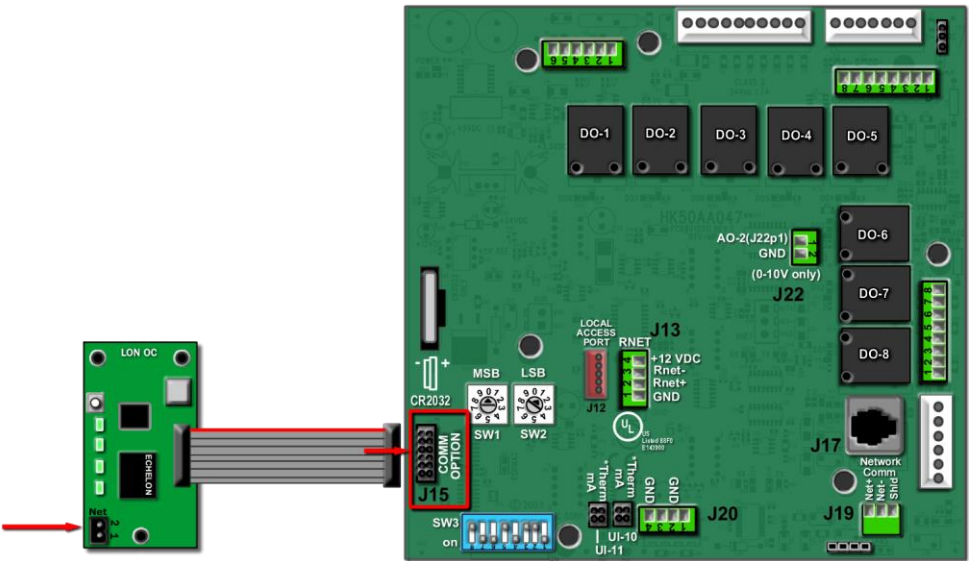
8	7	6	5	4	3	2	1
Off	On	On	Off	On	Off	Off	On



- 3 Plug the LonWorks Option Card's ribbon cable into Comm Option port **J15** on the controller. See illustration below.



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



- 4 Connect the LonWorks network to the LonWorks Option Card's 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.

- 5 Turn **on** the WSHP Open's power.
- 6 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 WSHP 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 WSHP 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 WSHP Open:

- 1 Verify that the BAS and controller are both set to speak the LonWorks protocol by theComm Selector DIP switches **DS3 - DS6**.
- 2 The BAS and the controller are both set for the same baud rate:
  - 38.4k for LonWorks
  - Baud rate DIP switches DS2 and DS1
  - 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 20).



- 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.

## Start-up

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

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

<sup>1</sup> Requires a USB Link (Part #USB-L).

<sup>2</sup> See the *Equipment Touch Installation and Setup Guide* for detailed instructions.

<sup>3</sup> 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 multi-protocol WSHP Open controls mechanical cooling, heating, and waterside economizer outputs, based on its own space temperature input and setpoints. An optional CO<sub>2</sub> IAQ (Indoor Air Quality) sensor that is mounted in the space maximizes the occupant's comfort. The WSHP Open has its own hardware clock that is automatically set when you download the heat pump software to the board.

See *Scheduling* (page 23) for occupancy types.

The following sections describe the multi-protocol controller's functions. All point objects mentioned in this sequence of operation reference the touchscreen interface. Points in Field Assistant and the i-Vu® application are the same or similar.

## 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 WSHP Open operates continuously in the **Occupied** mode until you configure either a time schedule or a third party control system **Enables/Disables** the **BAS On/Off** point. You must set your local time and date for these functions to operate properly.

You can change the occupancy source to one of the following:

**Occupancy Schedules** - The controller is occupied 24/7 until you configure a time schedule using either the Equipment Touch, Field Assistant, the i-Vu® application, or a third party **Enables/Disables** the **BAS On/Off** point. You can disable this by going to **Configuration > Unit Configuration > Occupancy Schedules**, 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\_Schedule** - The unit operates according to the schedule configured and stored in the unit. The schedule is accessible via the Equipment Touch, the i-Vu® application, or Field Assistant. The daily schedule consists of a start and stop time (standard or 24-hour mode) and 7 days of the week, starting with Monday and ending on Sunday.



**CAUTION** Scheduling can only be controlled from one source.

**Occupancy Input Contact (Option)** - If configured for remote occupancy control (default), the WSHP Open can use an external dry contact closure to determine the occupancy status of the unit. You must disable the **Occupancy Schedules** in order to use the occupancy contact input. The unit enters an occupied mode when it senses the abnormal input. After the input returns to its normal state, the unit stays in the occupied mode for the configured **Occ Override Delay** period (15 minutes default).

**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 system can control the unit through a network communication and the BAS scheduling function.

**Global Occupancy Scheduling** - The WSHP Open can read the occupancy status from another unit so that a group of WSHP's can be controlled from a single occupancy schedule. The local **Occupancy Schedules** must be disabled in order to use the global occupancy input.

**BACnet Network Occupancy Input** - The WSHP Open can accept an external BACnet Binary Network Input for occupancy control. This function is only compatible with units used in BACnet systems. You need to configure the System Occupancy BACnet network input point to locate the device and point name where the external occupancy point information resides. You must also disable **Occupancy Schedules** in order to use this input.

## Fire/Smoke detector input

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The WSHP Open can read the status of a normally closed FSD contact input to determine if a fire or smoke detector alarm is present. If the controller determines an alarm condition is present, all heating, cooling, and the fan are disabled. The switch is factory-set to **Normally Closed** and cannot be changed.

## Shutdown input

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The WSHP Open controller has a shutdown input (software point) which, when set to its **Active** mode causes the WSHP to safely shutdown in a controlled fashion. Heating and cooling is disabled after any minimum runtime conditions expire and the fan is disabled after the fan-off timer expires. All alarms are reset but any active alarm remains active. After the shutdown input transitions from **Active** mode to **Inactive**, the WSHP Open restarts after the configured power fail restart delay expires.

## Indoor fan

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

- **Auto** - intermittent operation during both occupied and unoccupied periods
- **Continuous** (default) - intermittent operation during unoccupied periods and continuous during occupied periods
- **Always on** - operates the fan continuously during both occupied and unoccupied periods

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

- It is in occupied mode, which is determined by the occupancy status
- There is a demand for cooling or heating in the unoccupied mode
- There is a call for dehumidification (optional)

When power is reapplied after a power outage, there is a configurable delay of 5 - 600 seconds (default 60) before starting the fan. You must configure the fan delay:

- The **Fan On Delay** defines the delay time (0 - 30 seconds, default 10) before the fan begins to operate after heating or cooling is started.
- The **Fan Off Delay** defines the delay time (0 - 180 seconds, default 45) the fan continues to operate after heating or cooling is stopped.

**NOTE** The fan continues to run as long as the compressors, heating stages, or the dehumidification relays are on. If the SPT failure alarm, ZS Sensor failure alarm, or condensate overflow alarm is active, the fan is shutdown immediately, regardless of occupancy state or demand.

**Automatic Fan Speed Control** - The WSHP Open can control up to 3 fan speeds using the ECM (Electronically Commutated Motor). The motor operates at the lowest speed possible to provide quiet and efficient fan operation with the best latent capability. The motor increases speed if additional cooling or heating is required to reach the desired space temperature setpoint. The control increases the motor's speed as the space temperature rises above the cooling or below the heating setpoint. The amount of space temperature increase above or below the setpoint required to increase the fan speed is configurable in the setpoint. Also, the control increases the fan speed as the **Supply Air Temperature** approaches the configured minimum or maximum limits.

#### Fan Speed Control

- **During heating** – When 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** (110°F default). As the SAT approaches this value, the control increases the fan speed as required to ensure the SAT remains within the limit. This provides the most quiet and efficient operation by running the fan at the lowest speed possible.
- **During cooling** – When mechanical cooling is required and active, the control continuously monitors the supply air temperature to verify it does not fall below the configured **Minimum Cooling SAT Limit** (50°F default). As the SAT approaches this value, the control increases the fan speed as required to ensure the SAT will remain within the limit. Fan operates at the lowest speed during dehumidification to maximize latent capacity during cooling.

**Fan Status** - You can configure an optional input as either an occupancy input contact 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 compressor(s) and auxiliary heat is disabled and the optional OA damper closes.

## Cooling

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The WSHP Open operates 1 or 2 stages of compression to maintain the desired cooling setpoint. The compressor outputs are controlled by the PI (Proportional-integral) cooling loop and cooling stages capacity algorithm. The algorithm calculates the desired number of stages needed to satisfy the space by comparing the space temperature (SPT or ZS) to the appropriate cooling setpoint.

**NOTE** The waterside economizer, if applicable, is used for 1st stage cooling, in addition to the compressor(s).

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

- **Cooling** is set to **Enable**
- The **Fire/Smoke Input** and **Shutdown** modes are inactive
- **Heat** mode is not active and the compressor time guard(s) have expired
- **Condensate Overflow** input in **Normal**
- **Fan Status** is **True** (if option is enabled)
- If occupied, the SPT or ZS is greater than the occupied cooling setpoint
- Space temperature reading is valid
- If unoccupied, the SPT or ZS is greater than the unoccupied cooling setpoint
- If economizer cooling is available and active, and the economizer alone is insufficient to provide enough cooling
- $OAT > \text{Cooling Lockout Temperature}$  if OAT is available
- **Source Water Pump** is on (if **Source Water Linkage** is active)

If all of the above conditions are met, the compressors' relays are energized as required. Otherwise, they will be de-energized. If cooling is active and if the SAT approaches the minimum SAT limit, the fan will be indexed to the next higher speed. If this is insufficient, and if the SAT falls further (equal to the minimum SAT limit), the fan will be indexed to the maximum speed. If the SAT still continues to fall 5 °F below the minimum SAT limit, all cooling stages will be disabled.

During **Cooling**, the reversing valve output is held in the cooling position (either B or O type, as configured), even after the compressor is stopped. The valve does not switch position until the heating mode is required.

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

There is a 5-minute off-time for the compressor, as well as a 5-minute time delay, when staging up to allow the SAT to achieve a stable temperature, before energizing a second stage of capacity. Likewise, there is a 45 second delay when staging down.

After a compressor is staged off, it may be restarted again after a normal time-guard period of 5 minutes and if the supply air temperature has increased above the minimum supply air temperature limit.

The WSHP Open provides a status input to monitor the compressor operation. The status is monitored to determine if the compressor status matches the commanded state. This input is used to determine if a refrigerant safety switch or other safety device has tripped and caused the compressor to stop operating normally. If this occurs, an alarm is generated to indicate the faulted compressor condition.

## Reverse cycle heating

---

The WSHP Open operates 1 or 2 stages of compression to maintain the desired cooling setpoint. The compressor outputs are controlled by the heating PI (Proportional-integral) loop and heating stages capacity algorithm. The algorithm calculates the desired number of stages needed to satisfy the space by comparing the space temperature (SPT or ZS) to the appropriate heating setpoint.

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

- **Heating** is set to **Enable**
- The **Fire/Smoke Input** and **Shutdown** modes are inactive
- **Cool** mode is not active and the compressor time guard has expired
- **Condensate Overflow** input in **Normal**
- **Fan Status** is **True** (if option is enabled)
- If occupied, the SPT or ZS is less than the occupied heating setpoint
- **Space Temperature** reading is valid
- If unoccupied, the SPT or ZS is less than the unoccupied heating setpoint
- **OAT > Heating Lockout Temperature** if OAT is available
- **Source Water Pump** is on (if **Source Water Linkage** active)

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 fan is indexed to the next higher speed. If this is insufficient, and if the SAT rises further and reaches the **Maximum Heating SAT** limit, the fan is indexed to the maximum speed. If the SAT still continues to rise 5 °F above the maximum limit, all heating stages are disabled.

During **Heating**, the reversing valve output is held in the heating position (either B or O-type, as configured), even after the compressor is stopped. The valve does not switch position until the cooling mode is required.

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.

There is a 5-minute off-time for the compressor, as well as a 5-minute time delay, when staging up to allow the SAT to achieve a stable temperature before energizing a second stage of capacity. Likewise, a 45 second delay is used when staging down.

After a compressor is staged off, it may be restarted again after a normal time-guard period of 5 minutes and if the supply air temperature has fallen below the maximum supply air temperature limit.

The WSHP Open provides a status input to monitor the compressor operation. The status is monitored to determine if the compressor status matches the commanded state. This input is used to determine if a refrigerant safety switch or other safety device has tripped and caused the compressor to stop operating normally. If this occurs, an alarm is generated to indicate the faulted compressor condition. Also, if auxiliary heat is available (see below), the auxiliary heat replaces the reverse cycle heating and maintains the space temperature as required.

## Auxiliary heat

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The WSHP Open can control a 2-position, or modulating water, or steam valve, connected to a coil on the discharge side of the unit and supplied by a boiler, or a single stage ducted electric heater, in order to maintain the desired heating setpoint. If **Aux Heat Control** is configured for **Boilerless** control operation, the aux heat only operates if a compressor failure occurs or the source water temperature is insufficient for reverse cycle heating. If **Aux Heat Control** is configured for **Auxiliary Heat**, in addition to the above, it also operates to supplement the heat provided by the compressor, if the space temperature falls more than 1°F below the desired heating setpoint. (This amount is configurable.) The heat is controlled so the SAT does not exceed the **Maximum Heating SAT** limit.

The same conditions required for **Reverse Cycle Heating** must be true in order for the **Auxiliary Heat** algorithm to run.

**Auxiliary Modulating Hot Water / Steam Heating Reheat** - The control can modulate a hot water or steam valve connected to a coil on the discharge side of the unit, and supplied by a boiler in order to maintain the desired heating setpoint, if the compressor capacity is insufficient, or a compressor failure occurs. Unless a compressor fault condition exists, the valve only operates to supplement the heat provided by the compressor if the space temperature falls more than 1°F below the desired heating setpoint. The valve is controlled so the SAT does not exceed the **Maximum Heating SAT** limit.

**2- Position Hot Water / Steam Heating Reheat** - The control can operate a 2-position, NO or NC, hot water or steam valve, connected to a coil on the discharge side of the unit and supplied by a boiler, in order to maintain the desired heating setpoint, if the compressor capacity is insufficient or a compressor failure occurs. Unless a compressor fault condition exists, the valve only opens to supplement the heat provided by the compressor, if the space temperature falls more than 1°F below the desired heating setpoint. The valve is controlled so the SAT does not exceed the **Maximum Heating SAT** limit and is subject to a 2 minute minimum OFF-time to prevent excessive valve cycling.

**Single Stage Electric Auxiliary Heat** - The control can operate a field-installed single stage of electric heat that is installed on the discharge side of the unit, in order to maintain the desired heating setpoint, if the compressor capacity is insufficient or a compressor failure occurs. Unless a compressor fault condition exists, the heat stage only operates to supplement the heat provided by the compressor if the space temperature falls more than 1°F below the desired heating setpoint. The heat stage is controlled so the SAT does not exceed the **Maximum Heating SAT** limit and is subject to a 2-minute minimum OFF-time to prevent excessive cycling.

## Indoor air quality (IAQ) and demand control ventilation (DCV)

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If the optional hardwired indoor air quality sensor is installed, ZS CO<sup>2</sup> (IAQ), or the **System Space AQ** network input point is used, the WSHP Open maintains indoor air quality with a modulating OA damper, which provides demand-controlled ventilation. The control operates the modulating OA damper during occupied periods, monitors the CO<sub>2</sub> level, compares it to the configured setpoints, and adjusts the ventilation rate, 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<sub>2</sub> level increases. The control proportionally increases ventilation when the CO<sub>2</sub> level rises above the start ventilation setpoint and reaches the full ventilation rate when the CO<sub>2</sub> level is at or above the maximum setpoint. You can configure a minimum damper position to ensure that proper base ventilation is delivered when occupants are not present. Access the IAQ configurations through the **Configuration** screen.

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

- **Damper Control** is configured for **DCV**
- The **Fire/Smoke Input** and **Shutdown** modes are inactive
- **Fan Status** is **True** (if option is enabled)
- The unit is in an occupied mode
- IAQ sensor reading is greater than the **DCV Start CTRL Setpoint**

The control has the following 4 adjustable setpoints:

- **DCV Start Ctrl Setpoint**
- **DCV Max Ctrl Setpoint**
- **Minimum Dmpr Pos**
- **DCV Max Vent Damper Pos**

**NOTE** In order for the damper to maintain proper base ventilation, you must configure the fan as **Continuous** or **Always On**.

**2-position OA Damper** - You can configure the control to operate as a ventilation damper in a 2-position ventilation mode to provide the minimum ventilation requirements during occupied periods.

## Dehumidification

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The WSHP Open provides occupied and unoccupied dehumidification only on units that are equipped with the reheat option. This function requires an accessory hardwired space relative humidity sensor. When using a relative humidity sensor to control dehumidification during occupied or unoccupied times, the dehumidification setpoints are used accordingly. Also, you may use a ZS Humidity Sensor or a network input point **System Space RH** in place of the hardwired RH sensor.

When the indoor relative humidity becomes greater than the dehumidification setpoint, a dehumidification demand is acknowledged. Once acknowledged, the dehumidification output is energized, bringing on the supply fan (medium speed), mechanical cooling, and the integral reheat coil. The controls engage cooling mode and the waste heat from the compressor cooling cycle is returned to the reheat coil simultaneously, meaning that the reversing valve causes the compressor to operate in the cooling mode.

**NOTE** During cooling mode, the unit cools and dehumidifies, and disables the reheat coil. However, once the call for cooling has been satisfied and there is still a call for dehumidification, the unit continues to operate in the reheat mode.



## Waterside economizer

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The WSHP Open can provide modulating, or 2-position water economizer operation (for a field-installed economizer coil mounted to the entering return air side of the unit and connected to the source water loop), in order to provide free cooling or preheating, when water conditions are optimal. Water economizer settings can be accessed on **Properties > Equipment > Status**.

The following conditions must be true for economizer operation:

- SAT reading is available
- EWT reading is available
- If occupied, the ZS is greater than the occupied cooling setpoint or less than the occupied heating setpoint and the source water is suitable
- Space temperature reading is valid
- If unoccupied, the ZS is greater than the unoccupied cooling setpoint, or less than the unoccupied heating setpoint, and the source water is suitable

**Modulating water/2-Position water economizer control** - modulates a water valve to control source water flowing through a coil on the entering air side of the unit

- **Cooling** - Provides an economizer cooling function by using the water loop when the entering water loop temperature is at least 5 °F below space temperature. If the water loop conditions are suitable, the valve modulates open to maintain a **Supply Air Temperature** that meets the load conditions. If the economizer coil capacity alone is insufficient for a period greater than 5 minutes, or if a high humidity condition occurs, then the compressor starts, in order to satisfy the load. If the SAT approaches the **Minimum Cooling SAT** limit (**HOME > CONFIG > UNIT**), the economizer valve modulates closed during compressor operation.
- **Heating** - In addition, the control modulates the water valve if the entering source water loop temperature is suitable for heating (at least 5 °F above space temperature) and heat is required. The valve is controlled in a similar manner, except to satisfy the heating requirement. If the coil capacity alone is insufficient to satisfy the space load conditions for more than 5 minutes, then the compressor starts in order to satisfy the load. If the SAT approaches the **Maximum Heating SAT** limit, the economizer valve modulates closed during compressor operation.

**2-position water economizer control** - has the capability to control a NO or NC, 2-position water valve to control source water flow through a coil on the entering air side of the unit.

- **Cooling** - The purpose is to provide a cooling economizer function directly from the source water loop when the entering water loop temperature is at least 5 °F below space temperature. If the optional coil is provided and the water loop conditions are suitable, then the valve opens to provide cooling to the space, when required. If the capacity is insufficient for a period greater than 5 minutes, or if a high humidity condition occurs, the compressor is started in order to satisfy the load. If the SAT reaches the **Minimum Cooling SAT** limit, the economizer valve closes during compressor operation.
- **Heating** - In addition, the economizer control opens the water valve, if the entering water loop temperature is suitable for heating (at least 5 °F above space temperature) and heat is required. The valve is controlled in a similar manner, except to satisfy the heating requirement. If the coil capacity is insufficient to satisfy the space load for more than 5 minutes, then the compressor is started to satisfy the load. If the SAT reaches the **Maximum Heating SAT** limit, the economizer valve closes during compressor operation.

## Demand limiting

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The WSHP Open can accept 3 levels of demand limit from the BACnet 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 configure the temperature adjustment for both heating and cooling and for each demand level. You can also set the response to a particular demand level to 0.

## Power failure restart delay

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The control provides a delay when recovering from a power failure, a shutdown mode, or when transitioning from unoccupied to occupied mode, in order to prevent excessive demand when many units start simultaneously. Each unit can be configured for a unique delay between 0 and 600 seconds. The factory-programmed default delay is 60 seconds.

## Alarms

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**Fire/Smoke Detector Alarm** – The control monitors the voltage input to J1-9 to detect if a smoke detector or fire detector NC contact has opened, indicating an alarm condition. The control verifies the presence of 24 Vac on this input. If the input opens at any time, an alarm is generated after 3 seconds and the equipment (fan, compressor, aux heat, and damper) immediately shuts down.

**Space Temperature Alarms** – The control provides the ability to generate an alarm when the space temperature exceeds the alarm setpoint. A separate unoccupied hysteresis and fixed unoccupied high and low alarm setpoints are provided. The control provides a 5-minute alarm delay during unoccupied periods. During occupied periods, the control uses the occupied temperature setpoint and applies the hysteresis value to determine the alarm setpoints. When occupancy transitions from unoccupied to occupied or the occupied temperature setpoints are changed, causing an alarm condition to occur, the control automatically calculates an alarm delay (equivalent to the configured delay time in minutes/ °F, multiplied by the temperature error, + 15 minutes). This prevents nuisance alarms when an occupancy change occurs and allows time for the unit to correct an alarming temperature condition.

**Source Water Temperature Alarm** – The control has 4 configurable alarm limits for source water temperature. The control verifies that the water temperature is within operating range (between high and low limits) for the specific operating mode (heating or cooling) before energizing the compressor. Once the compressor is started, the source water temperature is further monitored to verify that it is within limits to insure sufficient water is flowing through the coil. If the leaving water temperature rises above or falls below the appropriate limits, and lasts for more than 15 seconds, an alarm is generated and the compressor shuts down.

**Supply Air Temperature Alarm** – The control has 2 configurable alarm limits for supply air temperature. The control verifies that the supply air temperature is within operating range (between high and low limits) when the compressor or auxiliary heat is operating. If the air temperature rises above or falls below the appropriate limits, and this lasts for more than 5 minutes, an alarm is generated.

**High Condensate/Overflow Alarm** – The control monitors a discrete input to determine the state of a condensate level switch. You can configure the input to alarm on either an open or closed switch condition. If this input is in an alarm state, the control starts a timer, and after the timer exceeds a configurable **Condensate Overflow Alarm Delay** limit (10 second default), the control generates an alarm and the unit disables the compressor and fan outputs.

**Fan Status Alarm** (optional) – The control generates a fan status alarm if the fan status input detects the fan is OFF after any fan speed output has been enabled. A 30 second alarm delay is used to allow the fan to start operation before an alarm condition is detected. The control monitors the fan output and if the fan is operating at any speed, the fan status must detect the fan is operating.

**Compressor Status Alarm** – The control generates a compressor failure alarm if the compressor status input detects the compressor is OFF after the compressor output has been energized. A 6-minute alarm delay is used to allow the compressor to start (prevents alarms due to timeguard operation) before an alarm condition is detected. The control monitors the compressor output and if the compressor output is energized, the compressor status input must detect the compressor operation.

**Filter Status Alarm** – The control provides the ability to generate a dirty filter alarm after the number of fan run hours exceeds a configurable filter alarm timer limit. The control monitors the fan output and if the fan is operating at any speed, it accumulates run time. If the fan run time hours exceed the configurable limit, an alarm is generated. To reset the alarm timer after the alarm has been generated, a **Reset Filter Alarm** input is provided. You can disable the filter alarm by setting the **Filter Alarm Timer Delay** to **0** (factory default).

**Indoor Air Quality Alarm** – The control provides the ability to generate a high CO<sub>2</sub> level alarm during occupied periods when the CO<sub>2</sub> sensor value exceeds the adjustable limit. When a transition from unoccupied to occupied occurs, or the occupied alarm limit is changed to a value that causes an alarm condition to occur, the control will automatically calculate an alarm delay (equivalent to the configured delay time in minutes/ppm, times the error that occurred, + 15 minutes). This prevents nuisance alarms from occurring when occupancy changes or the setpoint is changed. You can disable the IAQ alarm by setting **Occupied High IAQ Alarm Limit** to **0**.

**Relative Humidity Alarm** – The control provides the ability to generate an alarm when the space relative humidity exceeds the alarm setpoint. Separate occupied and unoccupied high humidity alarm setpoints are provided. The control provides a 5-minute alarm delay during unoccupied periods. During occupied periods, the controller uses the occupied high RH alarm limit. When an occupancy transition from unoccupied to occupied occurs, or the occupied high alarm limit is lowered, causing an alarm condition to occur, the control automatically calculates an alarm delay (equivalent to the configured delay time in minutes/% RH, times the humidity error condition that occurred, + 15 minutes). This prevents nuisance alarms when an occupancy change occurs and allows time for the unit to correct an alarming humidity condition.

**Source Water Linkage Failure Alarm** (if **Source Water Linkage** was active) – The control generates a **Source Water Linkage** failure alarm if Linkage fails after once being active. The Linkage status is monitored and if it fails to be updated from the Loop controller, then a **Source Water Linkage** alarm is generated. There is a 6-minute alarm delay to prevent false alarms.

**NOTE** You can reset this alarm only by re-establishing Linkage and correcting the condition that caused the Linkage failure, or by momentarily setting the **Shutdown** point to **Active**.

**Airside Linkage Failure Alarm** (if **Airside Linkage** was active) – The control generates an **Airside Linkage** failure alarm if Linkage fails after once being active. The Linkage status is monitored and if it fails to be updated from the master zone controller, then an **Airside Linkage** alarm is generated. There is a 6-minute alarm delay to prevent false alarms.

**NOTE** You can reset this alarm only by re-establishing Linkage and correcting the condition that caused the Linkage failure, or by momentarily setting the **Shutdown** point to **Active**.

**OAT Sensor Alarm** (if **Network OA Temperature** was active) – The control generates an OAT Sensor failure alarm if the value of OAT fails to be updated through the network after once being active. The update status is monitored and if it fails to be updated, then an OAT sensor alarm is generated. There is an alarm delay (approximately 1 hour) to prevent false alarms, while minimizing the required update rate for OAT.

**NOTE** You can reset this alarm by momentarily setting the **Shutdown** point to **Active**.

**SPT Sensor Alarm** (if SPT sensor was active) – The control generates an SPT sensor failure alarm if the SPT sensor fails to communicate with the control for 5 minutes or greater. The update status is monitored and if it fails to be updated, then an SPT sensor alarm is generated.

**ZS Sensor Alarm** (if ZS sensor was active) – The control generates a ZS sensor failure alarm if the ZS sensor fails to communicate with the control for 5 minutes or greater. The update status is monitored and if it fails to be updated, then a ZS sensor alarm is generated.

## Troubleshooting the WSHP Open

The WSHP Open controller acts as an intelligent embedded thermostat to the water source heat pump, but can be monitored and controlled from a third party network.

You must determine which of the following needs troubleshooting:

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

The WSHP Open controller can troubleshoot itself with Service Test, communicating LED's, and built-in alarms. See the unit's Controls and Troubleshooting instructions.

Disconnecting the WSHP 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. When disconnected from the unit control inputs, you can use simple 24V signals to activate G, Y1, Y2, W1, W2, etc. to verify proper unit operation. If the problem occurs without the WSHP Open connected, then you should begin troubleshooting the unit/equipment rather than the WSHP Open or network.

## 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 WSHP Open show the status of certain functions.

If this LED is on...	Status is...
<b>Power</b>	The WSHP Open has power.
<b>Rx</b>	The WSHP Open is receiving data from the network segment
<b>Tx</b>	The WSHP Open is transmitting data over the network segment
<b>BO#</b>	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 <b>Run</b> LED	Five minute auto-restart delay after system error
2 flashes per second	3 flashes, then off	Controller has just been formatted

If Run LED shows...	And Error LED shows...	Status is..
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 <b>Run</b> LED	Ten second recovery period after brownout
14 flashes per second	14 flashes per second, alternating with <b>Run</b> LED	Brownout
On	On	Failure. Try the following solutions: <ul style="list-style-type: none"> <li>• Turn the WSHP Open off, then on.</li> <li>• Replace the WSHP Open.</li> </ul>

## Compliance

### FCC Compliance

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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

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**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

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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 WSHP Open

### Third party access to BACnet points in a controller

BACnet system points in the i-Vu® Open controllers match physical I/O points to data, such as **Outside Air Temp**, to be written to the controller through the network, rather than by using a local hardwired sensor.

When a BACnet system point is written to, the controller uses the network value, even when there is a local sensor, as long as it is within the Min/Max refresh times noted below.

#### BACnet writes to system points

The following table lists all of the writeable system points that could be present in an i-Vu® Open controller. The list of points is application-specific, therefore not all points are present in all i-Vu® Open controllers. This information applies whether the system point is being accessed by another i-Vu® Open controller or by a third party system.

In the i-Vu® interface, select the controller in the navigation tree and go to **Properties > BACnet Objects** tab. When an i-Vu® Open controller or a third party system writes to any of the system points, you must use **BACnet Priority Level 16** and the value **must** not be written to or refreshed more than once per minute (60 seconds).



**CAUTION** If any other **Priority Level** is used, the value will not be recognized by the controller.

BACnet System Points Display Name	Valid Range	BACnet/Modbus /N2 Default Value*	LonWorks Default Value*	Recommended Write Rrefresh Time (min/max)
<b>System Space Temperature</b>	-50 – 150 °F	-999	~180 °F	1 min/5 min
<b>System Space RH</b>	1 – 100%	-999	-15.96	5 min / 10 min
<b>System Space AQ</b>	200 – 9999 ppm	-999	64537	5 min / 10 min
<b>System OA Temperature</b>	-50 – 150 °F	-999	~180 °F	5 min / 60 min
<b>[OA] Enthalpy (BACnet)</b>	High (0) / Low (1)	Low (1)	Low (1)	On change of state
<b>System Outdoor AQ</b>	200 – 9999 ppm	-999	-999	5 min / 60 min
<b>System Water Temperature</b>	-50 – 150 °F	-999	~180 °F	5 min / 60 min
<b>†System Fire/Smoke</b>	Inactive (0) / Active (1)	Inactive (0)	N/A	On change of state
<b>†System</b>	Inactive (0) / Active (1)	Inactive (0)	N/A	On change of state

BACnet System Points Display Name	Valid Range	BACnet/Modbus /N2 Default Value*	LonWorks Default Value*	Recommended Write Rrefresh Time (min/max)
<b>Pressurization</b>				
<b>Occupancy control configuration</b>	1 = Always Occupied 2 = BACnet Schedule (WebCTRL® only) 3 = BAS On/Off (third party control)* 4 = Remote Occ Input	1 = Always Occupied (Only available through BACnet)	N/A	N/A
<b>BAS On/Off* (Occupancy)</b>	1=Inactive 2=Occupied 3=Unoccupied	Inactive (1)	Inactive (1)	On change of state
<b>Occupancy control configuration must be set for 3 = BAS On/Off</b>				

\* Modbus, N2, and LonWorks default values only apply to multi-protocol controllers.

† Points do not apply to multi-protocol controllers.

### Reading System Points

To verify that the system point is being written to within the refresh time specified (value varies by point), the i-Vu® Open controller clears any value that is written, once it has been processed by the controller and returned the system point to its default value. Therefore, a BAS should never read back the system point's value to confirm the commanded value was successfully received. To confirm a write, refer to the table below for the corresponding control point that should be read.

**NOTE** A confirming “read” should take place at least 30 seconds following the “write” to verify that the write has been processed by the controller.

Commanded Points			Control Points		
Display Name	Type / Instance	Object Name	Display Name	Type / Instance	Object Name
<b>System Space Temperature</b>	av:1902	system_spt	<b>Space Temperature - Prime Variable</b>	av:2007	space_temp
<b>System Space RH</b>	av:1904	system_rh	<b>Space Relative Humidity</b>	av:1011	space_rh
<b>System Space AQ</b>	av:1903	system_iaq	<b>Indoor Air Quality CO2 (ppm)</b>	av:1009	iaq
<b>System OA Temperature</b>	av:1901	system_oat	<b>Outdoor Air Temperature</b>	av:1003	oa_temp



Commanded Points			Control Points		
Display Name	Type / Instance	Object Name	Display Name	Type / Instance	Object Name
<b>[OA] Enthalpy (BACnet)</b>	bv:1901	oae	<b>[OA] Enthalpy Status</b>	bv:1002	enthalpy_status
<b>System Outdoor AQ</b>	av:1908	system_oaq	<b>Outdoor Air Quality CO2 (ppm)</b>	av:1012	oaq
<b>System Water Temperature</b>	av:1905	system_water_temp	<b>Changeover Mode</b>	av:1014	chgovr_mode
<b>†System Fire/Smoke</b>	bv:1907	fire_shutdown	<b>Fire/Smoke Shutdown</b>	bv:7007	fire_alarm
<b>†System Pressurization</b>	bv:1906	press_override	<b>Pressurization</b>	bv:7038	press_alarm
<b>BAS On/Off [Occupancy]</b>	msv:1001	keypad_ovrde	<b>Occupancy Status</b>	bv:2008	occ_status

† Points do not apply to multi-protocol controllers.

## 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 #
Aux Heat Control Setpoint	R	°F		aux_heat_stpt	AV:3014	Input Register (Float)	161
Auxiliary Heat Output	R	%		aux_heat_output	AV:2021	Input Register (Float)	163
Cooling Lockout Temperature	R/W	°F	45	oat_cl_lockout	AV:9002	Holding Register (Float)	43
Damper Output	R	%		oa_dpr_pos	AV:2022	Input Register (Float)	169
Leaving Source Water Temp	R	°F		cwl_temp	AV:1017	Input Register (Float)	167
Vent Dmpr Pos / DCV Min Pos	R/W	%	20	econ_min	AV:4005	Holding Register (Float)	131
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
Setpoint	R/W	°F		occ_ht_stpt	AV:3002	Holding Register (Float)	19
Setpoint Adjustment	R	°F		stpt_adj	AV:1006	Input Register (Float)	99
Space Temperature - Prime Variable	R	°F		space_temp	AV:2007	Input Register (Float)	107
Supply Air Temperature	R	°F		sa_temp	AV:1008	Input Register (Float)	109
System Space AQ	R/W	no units	-999	system_iaq	AV:1903	Holding Register (Float)	149
System Space RH	R/W	%	-999	system_rh	AV:1904	Holding Register (Float)	151
System Space Temperature	R/W	°F	-999	system_spt	AV:1902	Holding Register (Float)	123
Unocc Relative Humidity Setpoint	R/W	%rh	95	unocc_dehum_stpt	AV:3012	Holding Register (Float)	129
Water Economizer Control Setpoint	R	°F		h2o_econ_ctrl_stpt	AV:3015	Input Register (Float)	171

				BACnet		Modbus	
Point Name	Point Access	Units	Default Value	BACnet Point Name	BACnet Object ID	Modbus Register Type	Modbus Register #
Water Economizer Output	R	%		h2o_econ_output	AV:2023	Input Register (Float)	173
Compressor Status	R	(0) Normal (1) Alarm		comp_alarm	BV:7013	Discrete Input	30
Condensate Overflow	R	(0) Normal (1) Alarm		overflow_alarm	BV:7028	Discrete Input	60
Source Water Temperature	R	(0) Normal (1) Alarm		cwt_alarm	BV:7027	Discrete Input	61
Cool Enable	R/W	(0) Disable (1) Enable	(1) Enable	cl_enable	BV:1011	Coil	36
Dehumidification	R	(0) Disable (1) Enable		dehum	BV:2006	Discrete Input	9
Supply Fan Status	R	(0) Off (1) On		sfan_status	BV:1003	Discrete Input	24
Filter	R	(0) Normal (1) Alarm		filter_alarm	BV:7017	Discrete Input	31
Fire / Smoke Shutdown	R	(0) Normal (1) Alarm		fire_alarm	BV:7007	Discrete Input	32
Heat Enable	R/W	(0) Disable (1) Enable	(1) Enable	ht_enable	BV:1012	Coil	37
High Space Temperature	R	(0) Normal (1) Alarm		spt_hi_alarm	BV:7011	Discrete Input	35
Indoor Air Quality	R	(0) Normal (1) Alarm		iaq_alarm	BV:7005	Discrete Input	33
Low Space Temperature	R	(0) Normal (1) Alarm		spt_lo_alarm	BV:7012	Discrete Input	39
Occupancy Status	R	(0) Unoccupied (1) Occupied		occ_status	BV:2008	Discrete Input	18
Setpoint Adjustment	R/W	(0) Disable (1) Enable	(1) Enable	stpt_adj_enable	BV:1013	Coil	26
Shutdown	R/W	(0) Inactive (1) Active	(0) Inactive	shutdown	BV:9001	Coil	1
Space Relative Humidity	R	(0) Normal (1) Alarm		sprh_hi_alarm	BV:7018	Discrete Input	34
Space Temp Sensor	R	(0) Normal (1) Alarm		spt_fail	BV:7001	Discrete Input	46
Supply Air Temperature	R	(0) Normal (1) Alarm		sat_alarm	BV:7004	Discrete Input	47
Supply Fan Failure	R	(0) Normal (1) Alarm		sfan_fail_alarm	BV:7008	Discrete Input	5
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

				BACnet		Modbus	
Point Name	Point Access	Units	Default Value	BACnet Point Name	BACnet Object ID	Modbus Register Type	Modbus Register #
System Mode	R	(1) Off (2) Fan Only (3) Economize (4) Cooling (5) Heating (6) Cont Fan (7) Test (8) Start Delay		run_status	MSV:2002	Input Register (Signed)	1
Occ Relative Humidity Setpoint	R/W	%rh	60	occ_dehum_stpt	AV:3011	Holding Register (Float)	83
Optimal Start	R/W	hr	1	optm_start	AV:9026	Holding Register (Float)	147
Smoke Detector Contact	R	(0) Alarm / Open (1) Normal / Closed		smk_detect	BV:1004	Discrete Input	1
Effective Cool Setpoint	R	°F		eff_cl_stpt	AV:3005	Input Register (Float)	55
Setpoint	R/W	°F		unocc_cl_stpt	AV:3003	Holding Register (Float)	15
Heating Lockout Temperature	R/W	°F	65	oat_ht_lockout	AV:9003	Holding Register (Float)	69
Power Fail Restart Delay	R/W	seconds	180	start_delay	AV:9007	Holding Register (Float)	127
Setpoint	R/W	°F		occ_cl_stpt	AV:3001	Holding Register (Float)	9
Filter Service Alarm Timer	R/W	hr	600	filter_service_hrs	AV:2019	Holding Register (Float)	67
Indoor Air Quality CO2 (ppm)	R	ppm		iaq	AV:1009	Input Register (Float)	73
Setpoint	R/W	°F		unocc_ht_stpt	AV:3004	Holding Register (Float)	17
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
Reset Filter Alarm	R/W	(0) Off (1) On	(0) Off	filter_rntm_clr	BV:7517	Coil	22
Effective Heat Setpoint	R	°F		eff_ht_stpt	AV:3006	Input Register (Float)	57
Maximum Heating SAT	R/W	°F	110	sat_ht_max	AV:83004	Input Register (Float)	41

				BACnet		Modbus	
Point Name	Point Access	Units	Default Value	BACnet Point Name	BACnet Object ID	Modbus Register Type	Modbus Register #
Minimum Cooling SAT	R/W	°F	50	sat_cl_min	AV:83003	Input Register (Float)	61
Setpoint Adjustment Range	R/W	°F	5	stpt_adj_range	AV:9015	Holding Register (Float)	101
BAS On / Off	R/W	(1) Inactive (2) Occupied (3) Unoccupied	1	keypad_ovrde	MSV:1001	Holding Register (Signed)	133
ZS Sensor Configuration	R	(0) Normal (1) Alarm		zs_config_fail	BV:7055	Discrete Input	63
Space Relative Humidity	R	%rh		space_rh	AV:1011	Input Register (Float)	103
Space Temp Source	R	(1) Sensor Failure (2) SPT Sensor (3) T55 / T56 (4) Network (5) Airside Linkage (6) Locked Value		spt_status	MSV:2003		
Fan Off Delay	R/W	seconds	90	fan_delay_off	AV:9024		
Air Source Supply Air Temp	R	°F		link_sat	AV:2608		
Water Loop Temp	R	°F		link_cwt	AV:2701		
Aux Heat Boiler Water Temp	R	°F		link_hwt	AV:2702		
Airside Linkage	R	(0) Normal (1) Alarm		air_linkage_fail	BV:7030		
Source Water Linkage	R	(0) Normal (1) Alarm		cond_water_linkage_fail	BV:7031		
System Heating Demand Level	R	no units		heat_demand_level	AV:9036		
Airside Linkage	R	(0) Not Active (1) Active		a_link_status	BV:2601		
Occ Override Delay	R/W	min	15	occ_ovr_delay	AV:9028		
Loop Pump Request	R	no units		loop_request	AV:2024		
Source Water Linkage	R	(0) Not Active (1) Active		cw_link_status	BV:2701		
Aux Heat HW Pump Status	R	(0) Off (1) On		hw_pump	BV:2703		
System Cooling Demand Level	R	no units		cool_demand_level	AV:9006		
Filter Runtime	R	hr		filter_rntm	AV:2015		
Compressor Capacity	R	%		comp_cap	AV:5001	Input Register (Float)	165
Air Source Mode	R	(1) Off (2) Warmup (3) Heat (4) Cooling (5) Freecool (6) Pressure (7) Evac (8) Vent		link_ahu_mode	MSV:2005	-	-

				BACnet		Modbus	
Point Name	Point Access	Units	Default Value	BACnet Point Name	BACnet Object ID	Modbus Register Type	Modbus Register #
SPT Sensor	R	(0) Normal (1) Alarm		spt_sensor_fail	BV:7032	Discrete Input	38
ZS Temp Sensor	R	(0) Normal (1) Alarm		zst_sensor_fail	BV:7051		
Loop Pump Status	R	(0) Off (1) On		loop_pump	BV:2702		
Outdoor Air Temp Sensor	R	(0) Normal (1) Alarm		oat_fail	BV:7029		
Fan On Delay	R/W	seconds	10	fan_delay_on	AV:9025		

## 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
Aux Heat Control Setpoint	R	°F		ADF	70	nvoAuxHtSP	SNVT_temp_p(105)
Auxiliary Heat Output	R	%		ADF	71	nvoAuxHtOut	SNVT_lev_percent(81)
Cooling Lockout Temperature	R/W	°F	45	ADF	16	nviClLckTemp	SNVT_temp_p(105)
Damper Output	R	%		ADF	74	nvoOAVntDmpr	SNVT_lev_percent(81)
Leaving Source Water Temp	R	°F		ADF	73	nvoLvgCWTemp	SNVT_temp_p(105)
Vent Dmpr Pos / DCV Min Pos	R/W	%	20	ADF	60	nviDCVMinPos	SNVT_lev_percent(81)
Outdoor Air Temperature	R	°F		ADF	38	nvoOAT	SNVT_temp_p(105)
Override Time Remaining	R	min		ADF	41	nvoOvrTmRem	SNVT_time_min(123)
Setpoint	R/W	°F		ADF	9	nviOccHeatSP	SNVT_temp_p(105)
Setpoint Adjustment	R	°F		ADF	44	nvoSPAdjust	SNVT_temp_p(105)
Space Temperature - Prime Variable	R	°F		ADF	48	nvoSpaceTemp	SNVT_temp_p(105)
Supply Air Temperature	R	°F		ADF	49	nvoSAT	SNVT_temp_p(105)
System Space AQ	R/W	no units	-999	ADF	39	nviSysSpAQ	SNVT_ppm(29)
System Space RH	R/W	%	-999	ADF	40	nviSysSpRH	SNVT_lev_percent(81)
System Space Temperature	R/W	°F	-999	ADF	56	nviSysSpTmp	SNVT_temp_p(105)
Unocc Relative Humidity Setpoint	R/W	%rh	95	ADF	59	nviUnoccRHSP	SNVT_lev_percent(81)
Water Economizer Control Setpoint	R	°F		ADF	75	nvoWtrEconSP	SNVT_temp_p(105)
Water Economizer Output	R	%		ADF	76	nvoWtrEcnOut	SNVT_lev_percent(81)
Compressor Status	R	(0) Normal (1) Alarm		BI	30	nvoCmpSafety	SNVT_switch(95)

				N2		LonWorks	
Point Name	Point Access	Units	Default Value	N2 Network Point Type	N2 Network Point Address	SNVT Type	SNVT Name
Condensate Overflow	R	(0) Normal (1) Alarm		BI	60	nvoOvrflwAlm	SNVT_switch(95)
Source Water Temperature	R	(0) Normal (1) Alarm		BI	61	nvoCWTempAlm	SNVT_switch(95)
Cool Enable	R/W	(0) Disable (1) Enable	(1) Enable	BO	36	nviClEnb	SNVT_switch(95)
Dehumidification	R	(0) Disable (1) Enable		BI	9	nvoDehmRelay	SNVT_switch(95)
Supply Fan Status	R	(0) Off (1) On		BI	24	nvoFanStatus	SNVT_switch(95)
Filter	R	(0) Normal (1) Alarm		BI	31	nvoFilter	SNVT_switch(95)
Fire / Smoke Shutdown	R	(0) Normal (1) Alarm		BI	32	nvoFrShtdwn	SNVT_switch(95)
Heat Enable	R/W	(0) Disable (1) Enable	(1) Enable	BO	37	nviHtEnb	SNVT_switch(95)
High Space Temperature	R	(0) Normal (1) Alarm		BI	35	nvoHiSpTemp	SNVT_switch(95)
Indoor Air Quality	R	(0) Normal (1) Alarm		BI	33	nvoIAQAlm	SNVT_switch(95)
Low Space Temperature	R	(0) Normal (1) Alarm		BI	39	nvoLoSpTmp	SNVT_switch(95)
Occupancy Status	R	(0) Unoccupied (1) Occupied		BI	18	nvoOccStatus	SNVT_switch(95)
Setpoint Adjustment	R/W	(0) Disable (1) Enable	(1) Enable	BO	26	nviSPAdjEnbl	SNVT_switch(95)
Shutdown	R/W	(0) Inactive (1) Active	(0) Inactive	BO	1	nviShutdown	SNVT_switch(95)
Space Relative Humidity	R	(0) Normal (1) Alarm		BI	34	nvoHiSPRHAlm	SNVT_switch(95)
Space Temp Sensor	R	(0) Normal (1) Alarm		BI	46	nvoSPTmpSen	SNVT_switch(95)
Supply Air Temperature	R	(0) Normal (1) Alarm		BI	47	nvoSATSensor	SNVT_switch(95)
Supply Fan Failure	R	(0) Normal (1) Alarm		BI	5	nvoSFAlarm	SNVT_switch(95)
Fan / Speed	R	(1) Off (2) Low (3) Med (4) High (5) On		ADI	4	nvoFanSpeed	SNVT_count_inc(9)
Optimal Start Type	R/W	(1) None (2) Temp Compensated (3) Learning Adaptive	2	ADI	20	nviOptStType	SNVT_count_inc(9)
System Mode	R	(1) Off (2) Fan Only (3) Economize (4) Cooling (5) Heating (6) Cont Fan (7) Test (8) Start Delay		ADI	13	nvoOpMode	SNVT_count_inc(9)

## Appendix A: Network Points List for WSHP Open

				N2		LonWorks	
Point Name	Point Access	Units	Default Value	N2 Network Point Type	N2 Network Point Address	SNVT Type	SNVT Name
Occ Relative Humidity Setpoint	R/W	%rh	60	ADF	36	nviOcRHSP	SNVT_lev_percent(81)
Optimal Start	R/W	hr	1	ADF	61	nviOptmStart	SNVT_time_hour(124)
Smoke Detector Contact	R	(0) Alarm / Open (1) Normal / Closed		BI	1	nvoSmkDetect	SNVT_switch(95)
Effective Cool Setpoint	R	°F		ADF	22	nvoEffCoolSP	SNVT_temp_p(105)
Setpoint	R/W	°F		ADF	7	nviUnoccCISP	SNVT_temp_p(105)
Heating Lockout Temperature	R/W	°F	65	ADF	29	nviHtLckTmp	SNVT_temp_p(105)
Power Fail Restart Delay	R/W	seconds	180	ADF	58	nviUntStrDly	SNVT_time_sec(107)
Setpoint	R/W	°F		ADF	4	nviOccCoolSP	SNVT_temp_p(105)
Filter Service Alarm Timer	R/W	hr	600	ADF	28	nviFltAlmTm	SNVT_time_hour(124)
Indoor Air Quality CO2 (ppm)	R	ppm		ADF	31	nvoIAQ	SNVT_ppm(29)
Setpoint	R/W	°F		ADF	8	nviUnoccHtSP	SNVT_temp_p(105)
System Outdoor Air Temperature	R/W	°F	-999	ADF	54	nviSysOAT	SNVT_temp_p(105)
System Setpoint Adjustment	R/W	°F	-999	ADF	68	nviSysSptAdj	SNVT_temp_p(105)
Reset Filter Alarm	R/W	(0) Off (1) On	(0) Off	BO	22	nviRstFilAlm	SNVT_switch(95)
Effective Heat Setpoint	R	°F		ADF	23	nvoEffHeatSP	SNVT_temp_p(105)
Maximum Heating SAT	R/W	°F	110	ADF	33	nviMaxHtSAT	SNVT_temp_p(105)
Minimum Cooling SAT	R/W	°F	50	ADF	42	nviMinCISAT	SNVT_temp_p(105)
Setpoint Adjustment Range	R/W	°F	5	ADF	45	nviSPAdjRng	SNVT_temp_p(105)
BAS On / Off	R/W	(1) Inactive (2) Occupied (3) Unoccupied	1	ADI	1	nviBASOnOff	SNVT_count_inc(9)
ZS Sensor Configuration	R	(0) Normal (1) Alarm		BI	63	nvoZsCfgFail	SNVT_switch(95)
Space Relative Humidity	R	%rh		ADF	46	nvoSpaceRH	SNVT_lev_percent(81)
Compressor Capacity	R	%		ADF	72		
SPT Sensor	R	(0) Normal (1) Alarm		BI	38		



## 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: **WSHP Open**

Product Model Number: **Water Source Heat Pump**

### Protocol Description:

The WSHP 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 WSHP Open is a factory-installed water source heat pump 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

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

Date: 11/12/2013

Vendor Name: **Carrier**

Product Names: **WSHP Open**

Product Model Number: **Water Source Heat Pump**

### 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 WSHP Open is a factory-installed water source heat pump controller that is capable of speaking multiple protocols. The WSHP 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: **WSHP Open**

Product Model Number: **Water Source Heat Pump**

### Product Description:

The WSHP Open is a factory-installed water source heat pump controller that is capable of speaking multiple protocols. When the LonWorks Option Card (LON-OC), is installed in the field, it enables the WSHP Open to communicate over a LonTalk network. The WSHP 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 WSHP 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 WSHP Open.

This accessory card must be ordered separately and is connected by attaching its ribbon cable into the **J15** connector on the WSHP Open. The WSHP Open's baud rate (**1** and **2** 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*
11/20/19	Appendix A: Network Points List > Third party access to BACnet points in a controller	New topic	C-TS-JN-E-RD
2/5/19	Wiring inputs and outputs	Corrected Condensate Switch to Connection Pin Numbers J5 - 5 & 6	C-TS-CP-F
	What is the WSHP Open controller?	Label on J5 - IN 2 changed to Remote Occupancy and J% - 6 to Condensate Overflow Switch.	C-TS-CP-F
5/22/18	Troubleshooting BACnet MS/TP Troubleshooting ARC156	Corrected BACnet Device Instance number	C-TS-RD-F
3/14/18	Auxiliary Heat	Aux Heat Control information added	C-AE-WB-E
2/8/17	Network points list for N2 and LonWorks	Lonworks SNVT for System Setpoint Adjustment changed	C-TS-JN-E
	Wiring inputs and outputs	Added Wireless Sensors and references to appropriate sensor guides.	C-AE-WB-O
	Sequence of operation - Linkage air source mode determination	Clarified reason and method for generating a particular mode. Evacuation/Shutdown changed to Evacuation.	C-AE-WB-E
	BACnet ARC156	Added instructions	C-D
	All Troubleshooting sections	Reformatted and information on Static Binding removed since we only use Dynamic Binding now.	C-D
2/22/16	Start-up	Added USB Link wiring caution.	C-TS-RD-E-JH
5/27/15	Wiring inputs and outputs	Correction - added ZS sensors	C-TS-RD-E-WB
5/13/15	Sequence of Operation - Dehumidification	Correction - removed references to specific reheat type.	C-AE-WB-E
3/10/15	Start-up	Removed BACview and added Equipment Touch and System Touch.	C-AE-BR-O-WB
	Adjusting MS/TP properties using an Equipment Touch	New topic	C-AE-BR-O-WB
	Appendix A: Network points list for WSHP Open	Network points list updated for BACnet, Modbus, N2, and LonWorks	C-AE-BR-O-WB
	Entire document	Replaced references to BACview with Equipment Touch	C-AE-BR-O-WB
6/5/14	Configuring for BACnet MS/TP	Added note that controller counts as a full load on the MS/TP bus.	C-TS-RD-E

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