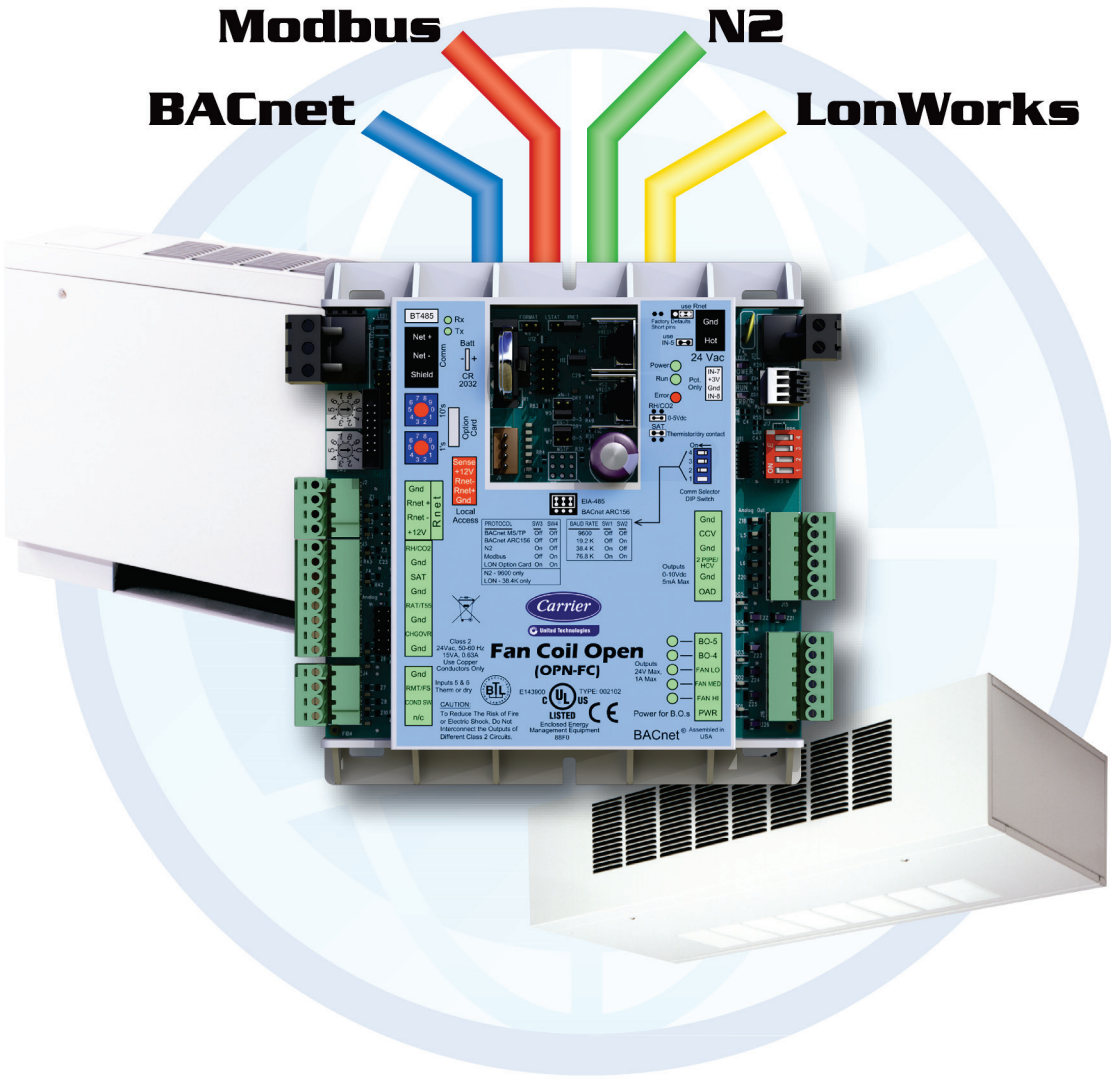
Fan Coil
Integration Guide



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

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

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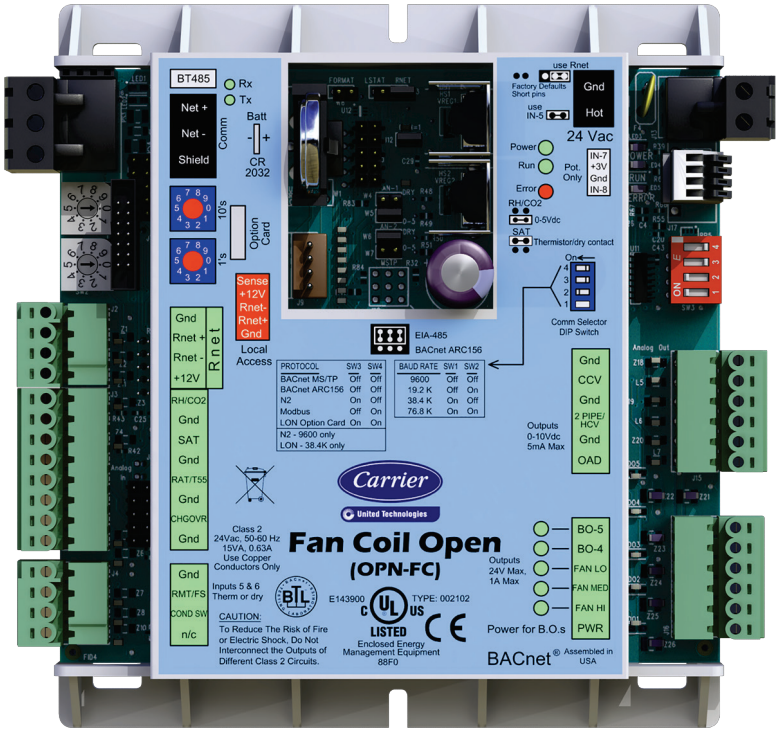
Introduction

What is the Fan Coil controller?

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



Safety considerations

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

Wiring inputs and outputs

I/O	Type	I/O Terminal	Gnd Terminal	Point Name/ Function	Hardware/ Signal	Jumper Position of Pins
Zone Temp/ Zone Temp	AI	Rnet	Gnd	Space Temperature - Prime Variable	Communicating	N/A
CO_2 or RH Sensor	AI	IN-1*	2 - Gnd	Optional IAQ or RH sensor	0-5 Vdc	IN-1 Bottom
SAT Sensor	AI	IN-2	4 - Gnd	Supply Air Temperature	10K Thermistor	IN-2 Top
RAT Sensor	AI	IN-3	6 - Gnd	Return Air Temperature	10K Thermistor	N/A
Changeover Temp	AI	IN-4*	8 - Gnd	Changeover switch Changeover sensor	Dry Contact Thermistor	N/A
Input Channel #5	BI	IN-5*	1 - Gnd	Remote Occupancy Contact Fan Status	Dry Contact	N/A
Overflow Contact	BI	IN-6	1 - Gnd	Condensate Overflow Switch	Dry Contact	N/A
OA Damper	AO	AO-1*	2 - Gnd	Outdoor Air Damper	0-10 Vdc 2-10 Vdc	N/A
2-Pipe Valve / Heating Valve	AO	AO-2	4 - Gnd	2-Pipe Valve/Heating Coil Valve	0-10 Vdc	N/A
Cooling Valve	AO	AO-3	6 - Gnd	Cooling Valve	0-10 Vdc	N/A
Fan High Spd	BO	BO-1*	1 - Pwr	High Speed Fan Stage 2 EH	Relay	N/A
Fan Med Spd	BO	BO-2*	1 - Pwr	Medium Speed Fan Stage 3 EH	Relay	N/A
Fan G / Low Spd	BO	BO-3	1 - Pwr	Low Speed Fan	Relay	N/A
2-Pos Valve/ Heating Valve	BO	BO-4*	1 - Pwr	2-Pipe Valve Heating Valve (4-pipe) EH stage 1 (4-pipe)	Relay	N/A
Cooling Valve	BO	BO-5*	1 - Pwr	Cooling Valve (4-pipe) EH stage 1 (w/2-Pipe/Electric Heat) DX stage 1	Relay	N/A
Legend **AI** - Analog Input **BI** - Binary Input		**AO** - Analog Output **BO** - Binary Output				
*These channels are configurable. **NOTE** Connect ZS or SPT sensor to the Rnet port.						

Communications wiring

Protocol Overview

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

- *BACnet MS/TP* (page 4)
- *BACnet ARC156* (page 8)
- *N2* (page 12)
- *Modbus* (page 9)
- *LonWorks* (page 13)

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

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

NOTES

- Changing protocol requires no programming or point assignment by the installer or operator.
- Power must be cycled after changing the Comm Selector DIP switches or connecting the LonWorks Option Card.

Comm Selector DIP switch settings for protocols and baud

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

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

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

BACnet MS/TP

To set up the Fan Coil for BACnet MS/TP

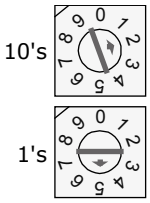
The Fan Coil's latest supported function codes and capabilities are listed on the associated Protocol Implementation Conformance Statement (PICS), *Carrier BACnet PICS website http://www.bacnetinternational.net/catalog/index.php?m=28*.

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

1 Turn off the power for the Fan Coil by disconnecting power terminals.

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

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



NOTE The Fan Coil recognizes its address only after power has been cycled.

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

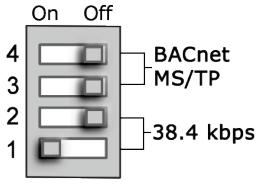
4 Set DIP switches **1** and **2** for the appropriate communications speed. See table below.

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

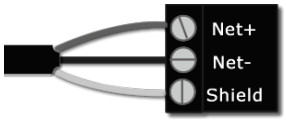
Baud Rate	**1**	**2**
9,600 bps	Off	Off
19.2 kbps	Off	On
38.4 kbps	On	Off
76.8 kbps	On	On

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

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



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



Wire specifications

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

NOTE Use the same polarity throughout the network segment.

7 Turn on the power for the Fan Coil by connecting power terminals.

Adjusting BACnet MS/TP properties using an Equipment Touch

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

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

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

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

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

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

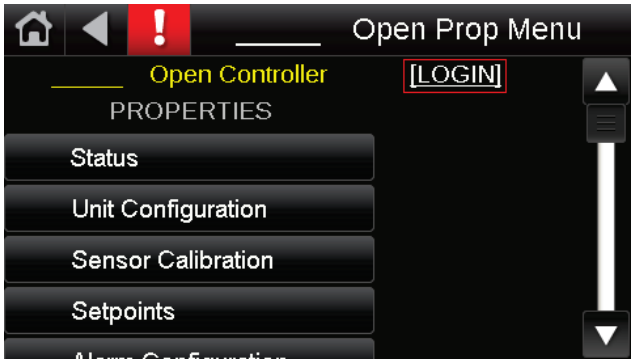
NOTES

- BACnet MS/TP networks can be comprised of both master and slave nodes. Valid MAC addresses for master nodes are 0 – 127 and valid addresses for Slave nodes are 0 - 254.
- If the third party attempts to communicate to the controller but does not get a response, make sure the controller is set as a BACnet MS/TP (m) master. The BACnet software asks the controllers, "Who Is?" This is to auto-locate devices on the network. Only controllers set as masters will answer this request.
- See *Appendix A* (page 27) for Network Points List.
- See *Appendix B* (page 35) for the BACnet Protocol Implementation Conformance Statement (PICS).

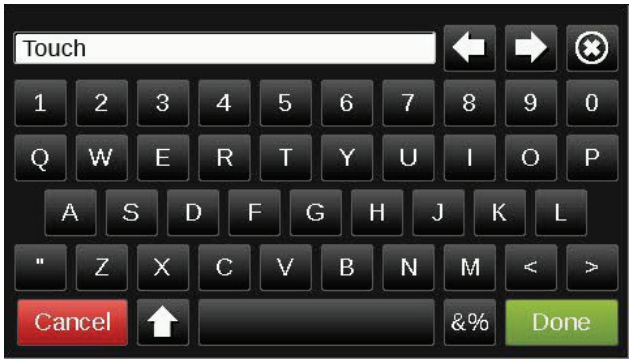
To set the Device Instance number or adjust the Max Masters or Max Info Frames using an Equipment Touch

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

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



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



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

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

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

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

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

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

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

9 Click **Save**.

Troubleshooting BACnet MS/TP communication

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

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

Verify accuracy of the following:

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

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

NOTES

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

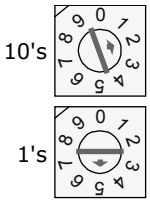
BACnet ARC156

To set up the Fan Coil for BACnet ARC156

1 Turn off the power for the Fan Coil by disconnecting power terminals.

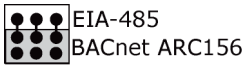
2 Using the rotary switches, set a unique address. Set the **Tens** (**10's**) switch to the tens digit of the address, and set the **Ones** (**1's**) switch to the ones digit.

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



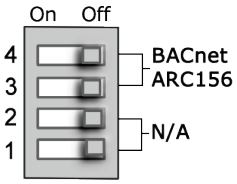
NOTE The Fan Coil recognizes its address only after power has been cycled.

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

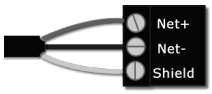


4 Set the both DIP switches **3** and **4** OFF for BACnet ARC156.

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



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



Wire specifications

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

NOTE Use the same polarity throughout the network segment.

6 Turn on the power for the Fan Coil by connecting power terminals.

Troubleshooting ARC156 communication

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

Verify accuracy of the following:

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

NOTES

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

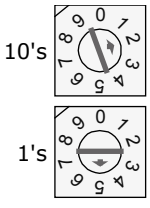
Software settings defined through the Equipment Touch device. To confirm settings, obtain a Modstat of the device. On the Equipment Touch, click the link to the Modstat.

Modbus

To set up the Fan Coil for Modbus RTU

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

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

   NOTE The Fan Coil recognizes its address only after power has been cycled.

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

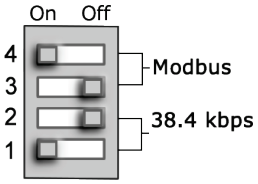
4 Set DIP switches **1** and **2** for the appropriate communications speed. See table below.

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

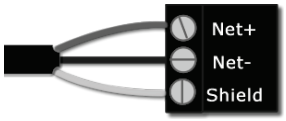
Baud Rate	1	2
9,600 bps	Off	Off
19.2 kbps	Off	On
38.4 kbps	On	Off
76.8 kbps	On	On

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

The following example is set for 38.4 kbps and Modbus.



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



Wire specifications

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

NOTE Use the same polarity throughout the network segment.

7 Turn on the power for the Fan Coil by connecting power terminals.

Troubleshooting Modbus communication

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

Verify accuracy of the following:

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

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

NOTES

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

Modbus Exception Codes that might be returned from this controller

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

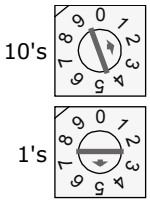
Johnson N2

To set up the Fan Coil for N2

1 Turn off the power for the Fan Coil by disconnecting power terminals.

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

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



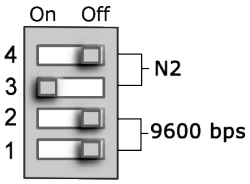
3 Set communications selector for **EIA-485**.

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

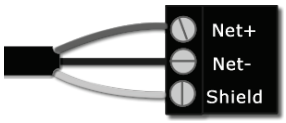
NOTE Use the same baud rate for all devices on the network segment.

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

The following example is set for 9600 bps and N2.



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



Wire specifications

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

NOTE Use the same polarity throughout the network segment.

7 Turn on the power for the Fan Coil by connecting power terminals.

Troubleshooting N2 communication

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

Verify accuracy of the following:

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

- Baud rate DIP switches 1 and 2 set to 9600 bps
- Protocol DIP switches 3 and 4
- Jumper set to EIA-485
- Proper connection wiring
- Unique rotary address switches 1 – 99. If controllers have duplicate addresses, network communication can be lost.
- Unique BACnet Device Instance numbers. Default is 16101XX, with the rotary address switches defining XX. If controllers have duplicate device instance numbers, network communication can be lost.

NOTES

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

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

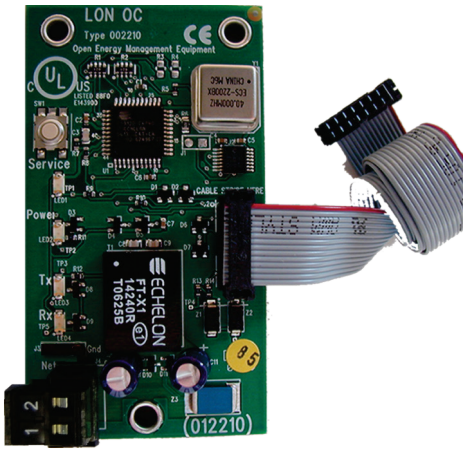
LonWorks

WARNING

When you handle the LonWorks Option Card:

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

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

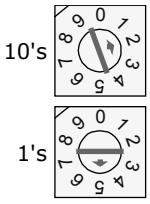


To set up the Fan Coil for the LonWorks Option Card (#LON-OC)

1 Turn off the power for the Fan Coil by disconnecting power terminals.

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

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



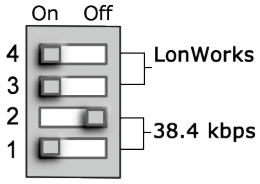
3 Set communications selector for **EIA-485**.

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

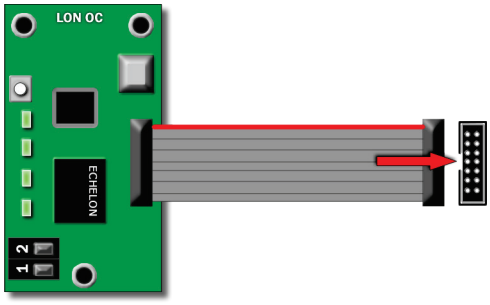
NOTE Use the same baud rate for all devices on the network segment.

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

The following example is set for 38.4 kbps and LonWorks.



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



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

NOTE The 2-pin **Net** port provides TP/FT-10 channel compatibility. The TP/FT-10 or "Free Topology" network type is **polarity insensitive**. Use 24 to 16 AWG twisted pair wire.

7 Turn on the power for the Fan Coil by connecting power terminals.

8 Commission the controller for LonWorks communication. See instructions below.

Commissioning the controller for LonWorks communication

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

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

When a new device is first commissioned onto the LonWorks network, the system integrator must upload the device's External Interface File (XIF) information. LonWorks uses the XIF to determine the points (network variables) that are available from a device. The Fan Coil 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 Fan Coil. The Network Management Tool allows you to test integration prior to binding the controller's network variables to other LonWorks nodes.

Troubleshooting LonWorks communication

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

Verify accuracy of the following:

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

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

NOTES

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

Start-up

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

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

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

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

Sequence of Operation

The Fan Coil controls mechanical cooling and heating based on its own space temperature input and setpoints. An optional CO_2 (Indoor Air Quality) sensor mounted in the space maximizes occupant comfort when used with the DCV ventilation damper option. See *Scheduling* (page 18) for occupancy types.

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

Scheduling

Scheduling

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

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

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

- **Schedule**

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

- **Occupancy Input Contact** (optional)

  If configured for remote occupancy control (default), the controller can use an external dry contact closure to determine the occupancy status of the unit. Disable the **Occupancy Schedules** to use the occupancy contact input.

  NOTE Scheduling can only be controlled from one source.

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

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

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

- **System Occupancy**

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

  NOTE Scheduling can only be controlled from one source.

Indoor fan

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

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

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

- It is in occupied mode, as detemined by its 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, or when transitioning from unoccupied to occupied, you can configure a delay of 5 - 600 (default 60) seconds before starting the fan. Configure as follows:

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

If the condensate overflow alarm, the test mode is active, or a **Fire / Smoke Shutdown** alarm is active; the fan is shut down immediately, regardless of occupancy state or demand. The fan continues to run as long as the cooling, heating, DCV, or dehumidification is active. If the space temperature failure alarm, condensate overflow alarm, or the test mode is active, the fan shuts down immediately, regardless of occupancy state or demand.

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

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

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

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

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

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

Fan Status (Option) - The optional input can be configured as 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 supply fan alarm is generated after 1 minute and the equipment's OAD is disabled. If the equipment has hydronic heat configured, the heating algorithm maintains the desired fan-off setpoint.

Cooling

The Fan Coil operates one stage of DX cooling or chilled water valve (2-position or modulating) to maintain the desired cooling setpoint. The PI (Proportional-integral) cooling algorithm controls the cooling. The desired **Supply Air Temperature** setpoint [**Cooling Control Setpoint**] is calculated by the controller. This setpoint is compared to the actual supply air temperature and determines valve operation for modulating or 2-position control valves or staging for DX control.

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

- **Cooling** is set to **Enable**.
- Space temperature reading is valid.
- For 2-pipe systems, the water temperature is suitable for cooling
- Heat mode is not active and for DX, the 5-minute compressor time-guard timer has expired
- OAT is greater than the **Cooling Lockout Temperature** if OAT is available.
- **Condensate Overflow** input is **Normal**.
- If occupied, the SPT is greater than the **Occupied Cooling Setpoint**.
- If unoccupied, the SPT is greater than the **Unoccupied Cooling Setpoint**.

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

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

For DX cooling, there is a 5-minute minimum off-time for the compressor as well as a 4-minute minimum on-time to prevent oil migration.

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 increases above the minimum supply air temperature limit.

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

2- Position Chilled Water - The control can operate a 2-position, NO or NC, chilled water valve connected to the cooling coil of the unit to maintain the desired cooling setpoint. The valve is controlled so the SAT does not exceed the **Minimum Cooling SAT** limit.

Single Stage Direct Expansion (DX) - The control can operate a single stage of DX cooling in order to maintain the desired cooling setpoint. The DX stage is controlled so the SAT does not exceed the **Minimum Cooling SAT** limit and is subject to a 4-minute minimum on-time. The compressor output is not energized unless the SAT is > **Minimum Cooling SAT** limit plus 15Δ°F (8.3Δ°C). Once disabled, the compressor cannot be restarted for at least 5 minutes.

Heating

The Fan Coil operates one stage of electric heat or a hot water valve (2-position or modulating) to maintain the desired heating setpoint. The heating is controlled by the PI (Proportional-integral) heating algorithm. The desired **Supply Air Temperature** setpoint [**Heating Control Setpoint**] is calculated by the Fan Coil. This setpoint is compared to the actual supply air temperature and used to determine valve operation for modulating or 2-position control valves or staging for electric heat.

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

- **Heat Enable** is set to **Enable**.
- Space temperature reading is valid.
- For 2-pipe systems, the water temperature is suitable for heating.
- **Cool** mode is not active and, for electric heat, the 2-minute minimum off-timer has expired.
- **Condensate Overflow** input is **Normal**.
- OAT is less than the **Heating Lockout Temperature** if OAT is available.
- If occupied, the SPT is greater than the **Occupied Cooling Setpoint**.
- If unoccupied, the SPT is greater than the **Unoccupied Cooling Setpoint**.

If all the above conditions are met, the heating outputs are energized as required, otherwise they are de-energized. If the heating is active and the SAT approaches the maximum SAT limit, the heating valve modulates closed. For electric heating, if the SAT rises above the configured **Maximum SAT** limit minus 10Δ°F (5.5Δ°C), the fan is indexed to a higher speed. If this is insufficient and the SAT rises above the maximum limit, the EH heating stage is disabled. After the electric heater stage is turned off, it may be restarted again after the supply air temperature falls below the **Maximum Heating SAT** limit minus 15Δ°F (8.3Δ°C). There is a 2-minute minimum off-timer for the electric heater stage to insure protection against excessive cycling.

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

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

2- Position Hot Water / Steam Heating - The control can operate a 2-position, NO or NC, hot water or steam valve, connected to the heating coil of the unit and supplied by a boiler in order to maintain the desired heating setpoint. The valve is controlled so the SAT does not exceed the **Maximum Heating SAT** limit. If the fan is off, the valve opens and closes to maintain the SAT at the configured **Fan Off Value**.

Single Stage Electric Heat - The control can operate a single stage of electric heat in order to maintain the desired heating setpoint. The heat stage is controlled so the SAT does not exceed the **Maximum Heating SAT** limit. The electric heat output is not energized unless the SAT is < **Maximum Heating SAT** limit minus 15Δ°F (8.3Δ°C) and, once disabled, cannot be restarted for at least 2 minutes to prevent excessive cycling.

Combination Heating - The control can operate a modulating (0-10 Vdc) type, or 2-position type, NO or NC, water valve connected to a 2-pipe heating/cooling coil of the unit and also a single stage of electric heat in order to maintain the desired heating setpoint. The valve is used to meet the heating requirements in the space when the changeover mode is heat. The electric heater is used when the changeover mode is cool. The heat is controlled so that the SAT does not exceed the **Maximum Heating SAT** limit. If the fan is off and the changeover mode is heat, the valve is controlled to maintain the SAT at the configured **Fan Off Value** temperature.

Changeover mode detection

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

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

Indoor air quality

The Fan Coil controls either 2-position or **Demand Controlled Ventilation** (DCV) to provide the necessary ventilation to the occupied space. To meet any ventilation requirement, the fan must always be configured for the **Continuous** or **Always On** mode of operation. If the fan is configured for **Automatic** operation, the fan is started during occupied periods, if required, but ASHRAE base ventilation requirements will NOT be met using **Automatic** fan operation.

Demand Control Ventilation (DCV)

If the optional indoor air quality sensor (CO_2) is installed, the Fan Coil maintains indoor air quality, via a modulating OA damper providing demand-controlled ventilation. The control operates the modulating OA damper during occupied periods. The control monitors the CO_2 level and 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_2 level increases. The control begins to proportionally increase ventilation when the CO_2 level rises above the start ventilation setpoint and reaches the full ventilation rate when the CO_2 level is at or above the maximum setpoint.

A user-configurable minimum damper position insures that proper base ventilation is delivered when occupants are not present. If the additional outdoor air being introduced for ventilation causes an unacceptable drop in the supply air temperature, or could cause a coil freeze-up condition, then the control can be set to temper the supply air during DCV control. **Reheat Enable** must be set to **Enable** and **2-Pipe Changeover** must be set to **No**. Heating must be available. The control uses heating to prevent the supply air from falling below the user-configured **Temper/Reheat SAT** setpoint. Access the IAQ configurations on the **Properties** page > **Equipment** tab > **Configuration**.

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

- **Damper Control** is configured for **DCV**
- The unit is in an occupied mode
- The fan is on
- If enabled, the fan status must be **On**
- IAQ sensor reading is greater than the **DCV Start Control Setpoint**

The control has 4 adjustable setpoints:

- **DCV Start Control** setpoint
- **DCV Maximum Control** setpoint
- **Minimum** damper position
- **DCV Maximum** damper position

2-Position OA Ventilation Damper Type - The control can be configured to operate an OA ventilation damper in a 2-position mode to provide ventilation during occupied periods. The damper opens 100% during any occupied or override period to insure proper ventilation is delivered to the occupied space. If the fan is off or the space is unoccupied, the damper closes.

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

- **Damper Control** is configured for **2-position**
- The unit is in an occupied mode
- Fan is on
- If enabled, the fan status must be on

Dehumidification

The Fan Coil provides occupied and unoccupied dehumidification, which requires an accessory space relative humidity sensor. When using a relative humidity sensor to control dehumidification during occupied or unoccupied times, the appropriate dehumidification setpoints are used accordingly. A request for dehumidification is generated when the indoor relative humidity becomes greater than the dehumidification setpoint. The dehumidification request starts the unit, if not already operating. If cooling or heating is currently operating, then dehumidification is delayed until the cooling or heating load is satisfied. Once satisfied, dehumidification enables cooling and the fan operates at its lowest speed.

During cooling, the unit both cools and dehumidifies. However, once the requirement for cooling is satisfied, and if there is still a call for dehumidification, the unit continues to provide dehumidification and reheat. If a heating coil is installed downstream of the cooling coil and **REHEAT** is enabled while dehumidification is active, the hydronic heating coil maintains the supply air temperature at the configured **Temper/Reheat SAT** setpoint. This prevents overcooling of the space, as long as the space temperature remains at least 1°F (-17.2°C) below the occupied cooling setpoint. Dehumidification is disabled if the SPT falls below the **Occupied Heating Setpoint**.

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

- Cooling is set to **Enable**
- Space temperature reading is valid
- OAT is greater than the **Cooling** lockout temperature if OAT is available
- **Condensate Overflow** input is **Normal**
- Space temperature is above the occupied heating setpoint
- Space temperature is below the current cooling setpoint
- If unoccupied, the space RH is greater than the **Unocc Relative Humidity** setpoint
- If occupied, the space RH is greater than the **Occ Relative Humidity** setpoint

The following must also be true for the reheat to operate during dehumidification:

- A hydronic heating coil is installed in the reheat position
- Space temperature is at least 1°F (-17.2°C) below the occupied cooling setpoint
- **2-Pipe Changeover** is set to no

Demand Limiting

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

Thermostat Linkage

The Fan Coil uses one wall-mounted SPT-type sensor to control multiple units using **Thermostat Linkage**. A single unit is selected as a master and configured for the total number of linked units (including the master). The slave units must be sequentially addressed, below the master's address.

The master sends the setpoints, occupancy status, space temperature, and optional sensor value from the master to the slave units. Each slave then sends its operating mode and supply air temperature. If a local sensor for either RH or CO_2 is provided, the value at the slave fan coil, rather than the value received through **Thermostat Linkage,** is used.

Each slave sends its operating mode and supply air temperature. When using **Thermostat Linkage**, the units do not need to be the same type or have the same coils. Each unit may be independently configured for coil types, fan operation, etc. **Thermostat Linkage** is designed to support a maximum of 8 units operating together, using a single SPT sensor.

Airside Linkage

The Fan Coil receives information through **Airside Linkage** and operates as an air source for a sub-zoned system using VVT terminals. The fan coil becomes the equipment master and receives its setpoints, occupancy, and space temperature from the zoning system. If the optional CO_2 or RH sensors is connected to any zone, the fan coil also receives this data through Linkage.

NOTE Do not connect a RH or CO_2 sensor to the fan coil unit if you use **Airside Linkage**. The local value is overridden by Linkage.

The fan coil uses this information to provide the air required to satisfy the load in the zones. The operating mode and supply air temperature of the fan coil is sent to all the zones in the system. **Airside Linkage** has the highest priority and overrides both local control and **Thermostat Linkage**.

Compliance

FCC Compliance

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

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

CE Compliance

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

BACnet Compliance

Compliance of listed products to requirements of ASHRAE Standard 135 is the responsibility of BACnet International. BTL® is a registered trademark of BACnet International.

Appendix A: Fan Coil Network Points List

Network points list for BACnet and Modbus

				BACnet		Modbus	
Point Name	Point Access	Units	Default Value	BACnet Point Name	BACnet Object ID	Modbus Register Type	Modbus Register #
Cooling Lockout Temperature	R/W	°F	45	oat_cl_lockout	AV:9002	Holding Register (Float)	43
Cooling Output	R	%		clg_output	AV:2025	Input Register (Float)	21
Damper Output	R	%		oa_dpr_pos	AV:2022	Input Register (Float)	169
Effective Cool Setpoint	R	°F		eff_cl_stpt	AV:3005	Input Register (Float)	55
Effective Heat Setpoint	R	°F		eff_ht_stpt	AV:3006	Input Register (Float)	57
Filter Service Alarm Timer	R/W	hr	600	filter_service_hrs	AV:2019	Holding Register (Float)	67
Heating Lockout Temperature	R/W	°F	65	oat_ht_lockout	AV:9003	Holding Register (Float)	69
Heating Output	R	%		htg_output	AV:2026	Input Register (Float)	37
Occ 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
Override Time Remaining	R	min		ovrde_time	AV:2016	Input Register (Float)	93
Power Fail Restart Delay	R/W	seconds	5	start_delay	AV:9007	Holding Register (Float)	127
Return Air Temperature	R	°F		ra_temp	AV:1010	Input Register (Float)	65
Outdoor Air Temperature	R	°F		oa_temp	AV:1003	Input Register (Float)	87
Setpoint	R/W	°F		occ_cl_stpt	AV:3001	Holding Register (Float)	9
Setpoint Adjustment	R	°F		stpt_adj	AV:1006	Input Register (Float)	99
Setpoint Adjustment Range	R/W	°F	5	stpt_adj_range	AV:9015	Holding Register (Float)	101
Space Relative Humidity	R	%rh		space_rh	AV:1011	Input Register (Float)	103
Space Temperature - Prime Variable	R	°F		space_temp	AV:2007	Input Register (Float)	107
System Outdoor Air Temperature	R/W	°F	-999	system_oat	AV:1901	Holding Register (Float)	119
System Setpoint Adjustment	R/W	°F	-999	system_stpt_adj	AV:1913	Holding Register (Float)	53
System Space AQ	R/W	no units	-999	system_iaq	AV:1903	Holding Register (Float)	149

				BACnet		**Modbus**	
Point Name	Point Access	Units	Default Value	BACnet Point Name	BACnet Object ID	Modbus Register Type	Modbus Register #
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
System Water Temperature	R/W	°F	-999	system_water_temp	AV:1905	Holding Register (Float)	105
Unocc Relative Humidity Setpoint	R/W	%rh	95	unocc_dehum_stpt	AV:3012	Holding Register (Float)	129
Changeover Mode	R	(0) Off (1) On		chgovr_mode	BV:1014	Discrete Input	2
Condensate Overflow	R	(0) Normal (1) Alarm		overflow_alarm	BV:7028	Discrete Input	60
Cool Enable	R/W	Disable Enable	Active (1)	cl_enable	BV:1011	Coil	36
Dehumidification	R	Inactive Active		dehum_status	BV:2006	Discrete Input	9
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	Disable Enable	Active (1)	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	Unoccupied Occupied		occ_status	BV:2008	Discrete Input	18
Reheat Enable	R/W	Disable Enable	Inactive (0)	reht_enable	BV:1015	Coil	4
Reset Filter Alarm	R/W	(0) Off (1) On	Inactive (0)	filter_rntm_clr	BV:7517	Coil	22
Return Air Temperature	R	(0) Normal (1) Alarm		rat_alarm	BV:7035	Discrete Input	21
Setpoint Adjustment	R/W	Disable Enable	Active (1)	stpt_adj_enable	BV:1013	Coil	26
Shutdown	R/W	Inactive Active	Inactive (0)	shutdown	BV:9001	Coil	27
Space Relative Humidity	R	(0) Normal (1) Alarm		sprh_hi_alarm	BV:7018	Discrete Input	34
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	48
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	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 #
		Adaptive					
System Mode	R	(1) Off (2) Fan Only (3) Economize (4) Cooling (5) Heating (6) Cont Fan (7) Test (8) Start Delay (9) Temper SAT (10) Fire Shutdown (11) Shutdown (12) IAQ Override (13) Dehumidify		run_status	MSV:2002	Input Register (Signed)	1
Setpoint	R/W	°F		occ_ht_stpt	AV:3002	Holding Register (Float)	19
Setpoint	R/W	°F		unocc_cl_stpt	AV:3003	Holding Register (Float)	15
Setpoint	R/W	°F		unocc_ht_stpt	AV:3004	Holding Register (Float)	17
Vent Dmpr Pos / DCV Min Pos	R/W	%	20	econ_min	AV:4005	Holding Register (Float)	131
Indoor Air Quality CO2 (ppm)	R	ppm		iaq	AV:1009	Input Register (Float)	73
Freezestat	R	(0) Normal (1) Alarm		llt_alarm	BV:7037	Discrete Input	7
Space Temp Sensor	R	(0) Normal (1) Alarm		spt_fail	BV:7001	Discrete Input	46
Outdoor Air Temp Sensor	R	(0) Normal (1) Alarm		oat_fail	BV:7029	Discrete Input	27
Occ Override Delay	R/W	min	15	occ_ovr_delay	AV:9028	Holding Register (Float)	63
Unoccupied Fan Cycling	R/W	Disable Enable	Active (1)	fan_cycle	BV:1016	Coil	9
Supply Air Temperature	R	°F		sa_temp	AV:1008	Input Register (Float)	109
Thermostat Linkage	R	(0) Normal (1) Alarm		link_therm_fail	BV:7033		
Maximum Heating SAT	R/W	°F	110	sat_ht_max	AV:83004	Holding Register (Signed)	41
Minimum Cooling SAT	R/W	°F	50	sat_cl_min	AV:83003	Holding Register (Float)	61
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		
Space Temp Source	R	(1) Sensor Failure (2) SPT Sensor (3) RAT / T55 (4) Network		spt_status	MSV:2003		

				BACnet		**Modbus**	
Point Name	Point Access	Units	Default Value	BACnet Point Name	BACnet Object ID	Modbus Register Type	Modbus Register #
		(5) Airside Linkage (6) Locked Value (7) T-Stat Linkage (8) ZS Sensor					
ZS Temp Sensor	R	(0) Normal (1) Alarm		zst_sensor_fail	BV:7051		
System Cooling Demand Level	R	no units		cool_demand_level	AV:9006		
System Heating Demand Level	R	no units		heat_demand_level	AV:9036		
Air Source Supply Air Temp	R	°F		link_sat	AV:2608		
Airside Linkage	R	(0) Normal (1) Alarm		air_linkage_fail	BV:7030		
Fan Off Delay	R/W	seconds	90	fan_delay_off	AV:9024		
Changeover Sensor	R	(0) Normal (1) Alarm		chgovr_fail	BV:7034		
Freezestat	R	(0) Normal (1) Alarm		frz_status	BV:2009		
Filter Runtime	R	hr		filter_rntm	AV:2015		
Airside Linkage	R	Not Active Active		a_link_status	BV:2601		
Fan On Delay	R/W	seconds	10	fan_delay_on	AV:9025		
SPT Sensor	R	(0) Normal (1) Alarm		spt_sensor_fail	BV:7032	Discrete Input	38
BAS On / Off	R/W	(1) Inactive (2) Occupied (3) Unoccupied	1	keypad_ovrde	MSV:1		
Thermostat Linkage	R	Not Active Active		t_link_status	BV:2801		
Occ Override Delay	R/W	min	15	occ_ovr_delay	AV:9028	Holding Register (Float)	63
Supply Fan Status	R	(0) Off (1) On		sfan_status	BV:1003	Discrete Input	24
ZS Sensor Configuration	R	(0) Normal (1) Alarm		zs_config_fail	BV:7055	Discrete Input	63

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
Cooling Lockout Temperature	R/W	°F	45	ADF	16	SNVT_temp_p(105)	nviClLckTemp
Cooling Output	R	%		ADF	14	SNVT_lev_percent(81)	nvoCoolOut
Damper Output	R	%		ADF	74	SNVT_lev_percent(81)	nvoOAVntDmpr
Effective Cool Setpoint	R	°F		ADF	22	SNVT_temp_p(105)	nvoEffCoolSP
Effective Heat Setpoint	R	°F		ADF	23	SNVT_temp_p(105)	nvoEffHeatSP
Filter Service Alarm Timer	R/W	hr	600	ADF	28	SNVT_count_inc(9)	nviFltAlmTm
Heating Lockout Temperature	R/W	°F	65	ADF	29	SNVT_temp_p(105)	nviHtLckTmp
Heating Output	R	%		ADF	26	SNVT_lev_percent(81)	nvoHeatOut
Occ Relative Humidity Setpoint	R/W	%rh	60	ADF	36	SNVT_lev_percent(81)	nviOcRHSP
Optimal Start	R/W	hr	1	ADF	61	SNVT_count_inc(9)	nviOptmStart
Override Time Remaining	R	min		ADF	41	SNVT_count_inc(9)	nvoOvrTmRem
Power Fail Restart Delay	R/W	seconds	5	ADF	58	SNVT_count_inc(9)	nviUntStrDly
Return Air Temperature	R	°F		ADF	50	SNVT_temp_p(105)	nvoRtnAirTmp
Outdoor Air Temperature	R	°F		ADF	38	SNVT_temp_p(105)	nvoOAT
Setpoint	R/W	°F		ADF	4	SNVT_temp_p(105)	nviOccCoolSP
Setpoint Adjustment	R	°F		ADF	44	SNVT_temp_p(105)	nvoSPAdjust
Setpoint Adjustment Range	R/W	°F	5	ADF	45	SNVT_temp_p(105)	nviSPAdjRng
Space Relative Humidity	R	%rh		ADF	46	SNVT_lev_percent(81)	nvoSpaceRH
Space Temperature - Prime Variable	R	°F		ADF	48	SNVT_temp_p(105)	nvoSpaceTemp
System Outdoor Air Temperature	R/W	°F	-999	ADF	54	SNVT_temp_p(105)	nviSysOAT
System Setpoint Adjustment	R/W	°F	-999	ADF	68	SNVT_temp_p(105)	nviSysSptAdj
System Space AQ	R/W	no units	-999	ADF	39	SNVT_count_inc(9)	nviSysSpAQ
System Space RH	R/W	%	-999	ADF	40	SNVT_lev_percent(81)	nviSysSpRH
System Space Temperature	R/W	°F	-999	ADF	56	SNVT_temp_p(105)	nviSysSpTmp
System Water Temperature	R/W	°F	-999	ADF	62	SNVT_temp_p(105)	nviSysWtrTmp
Unocc Relative Humidity Setpoint	R/W	%rh	95	ADF	59	SNVT_lev_percent(81)	nviUnoccRHSP
Changeover Mode	R	(0) Off (1) On		BI	2	SNVT_switch(95)	nvoChngovrMd
Condensate Overflow	R	(0) Normal (1) Alarm		BI	60	SNVT_switch(95)	nvoOvrflwAlm

				N2		LonWorks	
Point Name	Point Access	Units	Default Value	N2 Network Point Type	N2 Network Point Address	SNVT Type	SNVT Name
Cool Enable	R/W	Disable Enable	Active (1)	BO	36	SNVT_switch(95)	nviClEnb
Dehumidification	R	Inactive Active		BI	9	SNVT_switch(95)	nvoDehmRelay
Filter	R	(0) Normal (1) Alarm		BI	31	SNVT_switch(95)	nvoFilter
Fire / Smoke Shutdown	R	(0) Normal (1) Alarm		BI	32	SNVT_switch(95)	nvoFrShtdwn
Heat Enable	R/W	Disable Enable	Active (1)	BO	37	SNVT_switch(95)	nviHtEnb
High Space Temperature	R	(0) Normal (1) Alarm		BI	35	SNVT_switch(95)	nvoHiSpTemp
Indoor Air Quality	R	(0) Normal (1) Alarm		BI	33	SNVT_switch(95)	nvoIAQAlm
Low Space Temperature	R	(0) Normal (1) Alarm		BI	39	SNVT_switch(95)	nvoLoSpTmp
Occupancy Status	R	Unoccupied Occupied		BI	18	SNVT_switch(95)	nvoOccStatus
Reheat Enable	R/W	Disable Enable	Inactive (0)	BO	4	SNVT_switch(95)	nviRehtEnbl
Reset Filter Alarm	R/W	(0) Off (1) On	Inactive (0)	BO	22	SNVT_switch(95)	nviRstFilAlm
Return Air Temperature	R	(0) Normal (1) Alarm		BI	21	SNVT_switch(95)	nvoRatAlm
Setpoint Adjustment	R/W	Disable Enable	Active (1)	BO	26	SNVT_switch(95)	nviSPAdjEnbl
Shutdown	R/W	Inactive Active	Inactive (0)	BO	1	SNVT_switch(95)	nviShutdown
Space Relative Humidity	R	(0) Normal (1) Alarm		BI	34	SNVT_switch(95)	nvoHiSPRHAlm
Supply Air Temperature	R	(0) Normal (1) Alarm		BI	47	SNVT_switch(95)	nvoSATSensor
Supply Fan Failure	R	(0) Normal (1) Alarm		BI	58	SNVT_switch(95)	nvoSFAlarm
Fan / Speed	R	(1) Off (2) Low (3) Med (4) High (5) On		ADI	4	SNVT_count_inc(9)	nvoFanSpeed
Optimal Start Type	R/W	(1) None (2) Temp Compensated (3) Learning Adaptive	2	ADI	20	SNVT_count_inc(9)	nviOptStType

				N2		LonWorks	
Point Name	Point Access	Units	Default Value	N2 Network Point Type	N2 Network Point Address	SNVT Type	SNVT Name
System Mode	R	(1) Off (2) Fan Only (3) Economize (4) Cooling (5) Heating (6) Cont Fan (7) Test (8) Start Delay (9) Temper SAT (10) Fire Shutdown (11) Shutdown (12) IAQ Override (13) Dehumidify		ADI	13	SNVT_count_inc(9)	nvoOpMode
Setpoint	R/W	°F		ADF	9	SNVT_temp_p(105)	nviOccHeatSP
Setpoint	R/W	°F		ADF	7	SNVT_temp_p(105)	nviUnoccClSP
Setpoint	R/W	°F		ADF	8	SNVT_temp_p(105)	nviUnoccHtSP
Vent Dmpr Pos / DCV Min Pos	R/W	%	20	ADF	60	SNVT_lev_percent(81)	nviDCVMinPos
Indoor Air Quality CO2 (ppm)	R	ppm		ADF	31	SNVT_ppm(29)	nvoIAQ
Freezestat	R	(0) Normal (1) Alarm		BI	7	SNVT_switch(95)	nvoFreezeAlm
Space Temp Sensor	R	(0) Normal (1) Alarm		BI	46	SNVT_switch(95)	nvoSPTmpSen
Outdoor Air Temp Sensor	R	(0) Normal (1) Alarm		BI	27	SNVT_switch(95)	nvoOatFail
Occ Override Delay	R/W	min	15	ADF	47		
Unoccupied Fan Cycling	R/W	Disable Enable	Active (1)	BO	9	SNVT_switch(95)	nviUnocFnCyc
Supply Air Temperature	R	°F		ADF	49	SNVT_temp_p(105)	nvoSAT
Maximum Heating SAT	R/W	°F	110	ADF	33		
Minimum Cooling SAT	R/W	°F	50	ADF	42		
SPT Sensor	R	(0) Normal (1) Alarm		BI	38		
Occ Override Delay	R/W	min	15	ADF	47		

				N2		LonWorks	
Point Name	Point Access	Units	Default Value	N2 Network Point Type	N2 Network Point Address	SNVT Type	SNVT Name
Supply Fan Status	R	(0) Off (1) On		BI	24	SNVT_switch(95)	nvoFanStatus
ZS Sensor Configuration	R	(0) Normal (1) Alarm		BI	63	SNVT_switch(95)	nvoZsCfgFl

Appendix B: BACnet Protocol Implementation Conformance Statement

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

BACnet Data Link Layer Options

Data Link Layer Options

☐ BACnet IP, (Annex J)

☐ Able to register as a Foreign Device

☐ ISO 8802-3, Ethernet (Clause 7)

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

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

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

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

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

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

☐ LonTalk, (Clause 11), medium: _____

☐☐ Other:

Device Address Binding Methods Supported

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

***Networking Options**

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

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

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

☐ BACnet/IP Broadcast Messaging Device (BBMD)

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

Character Sets Supported

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

XX ANSI X3.4

XX IBM™/Microsoft™ ☐DBCS

XX ISO 8859-1

XX ISO 10646 (UCS-2)

XX ISO 10646 (ICS-4)

XX JIS C 6226

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

Appendix C: Johnson Controls N2 Protocol Implementation Conformance Statement

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

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

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

Protocol Commands	
Identify Device Type	Write Analog Input
Sync Time	Write Binary Input
Poll Without Acknowledge	Write Analog Output
Poll With Acknowledge	Write Binary Output
Read Analog Input	Write Internal Parameter
Read Binary Input	Override Analog Input
Read Analog Output	Override Binary Input
Read Binary Output	Override Internal Parameter
Read Internal Parameter	Override Release Request

Appendix D: Modbus Protocol Implementation Conformance Statement

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

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

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

Register Type:	Range:	Function Codes Used with this Register Type:
Float Value (FLOAT)	Single-Precision IEEE floating point value	3 – Read Holding Register 6 – Preset Single Register 16 – Preset Multiple Register
Unsigned Integer (UINT)	0 - 65535	3 – Read Holding Register 6 – Preset Single Register 16 – Preset Multiple Register
Signed Integer (SINT)	-32768 - 32767	3 – Read Holding Register 6 – Preset Single Register 16 – Preset Multiple Register
Discrete Input (DI)	0 = Off, 1 = On	2 – Read Input Status
Discrete Output (DO)	0 = Off, 1 = On	1 – Read Coil Status 5 – Force Single Coil 15 – Force Multiple Coils

Appendix E: LonWorks Protocol Implementation Conformance Statement

Product Names: **Fan Coil**

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

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

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

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

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

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

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

Document revision history

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

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

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