VVT Bypass Controller

Installation and Start-up Guide

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Table of Contents

Introduction

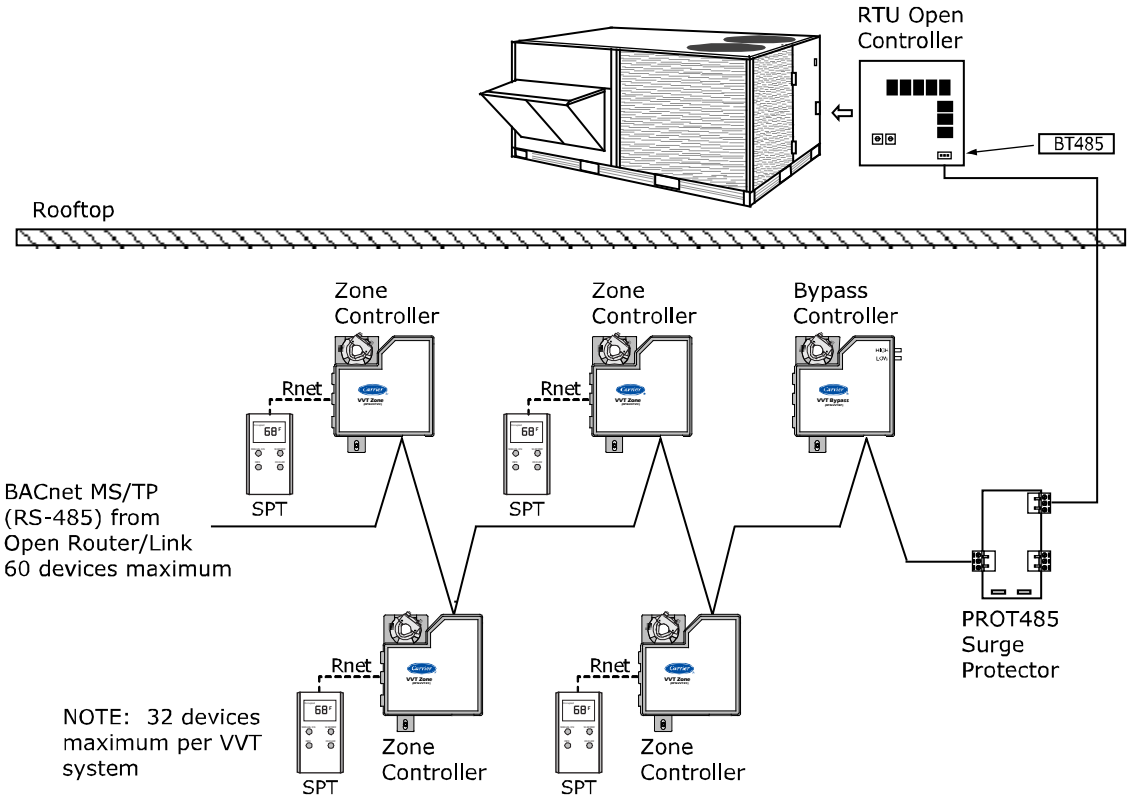
What is a VVT Bypass Controller?

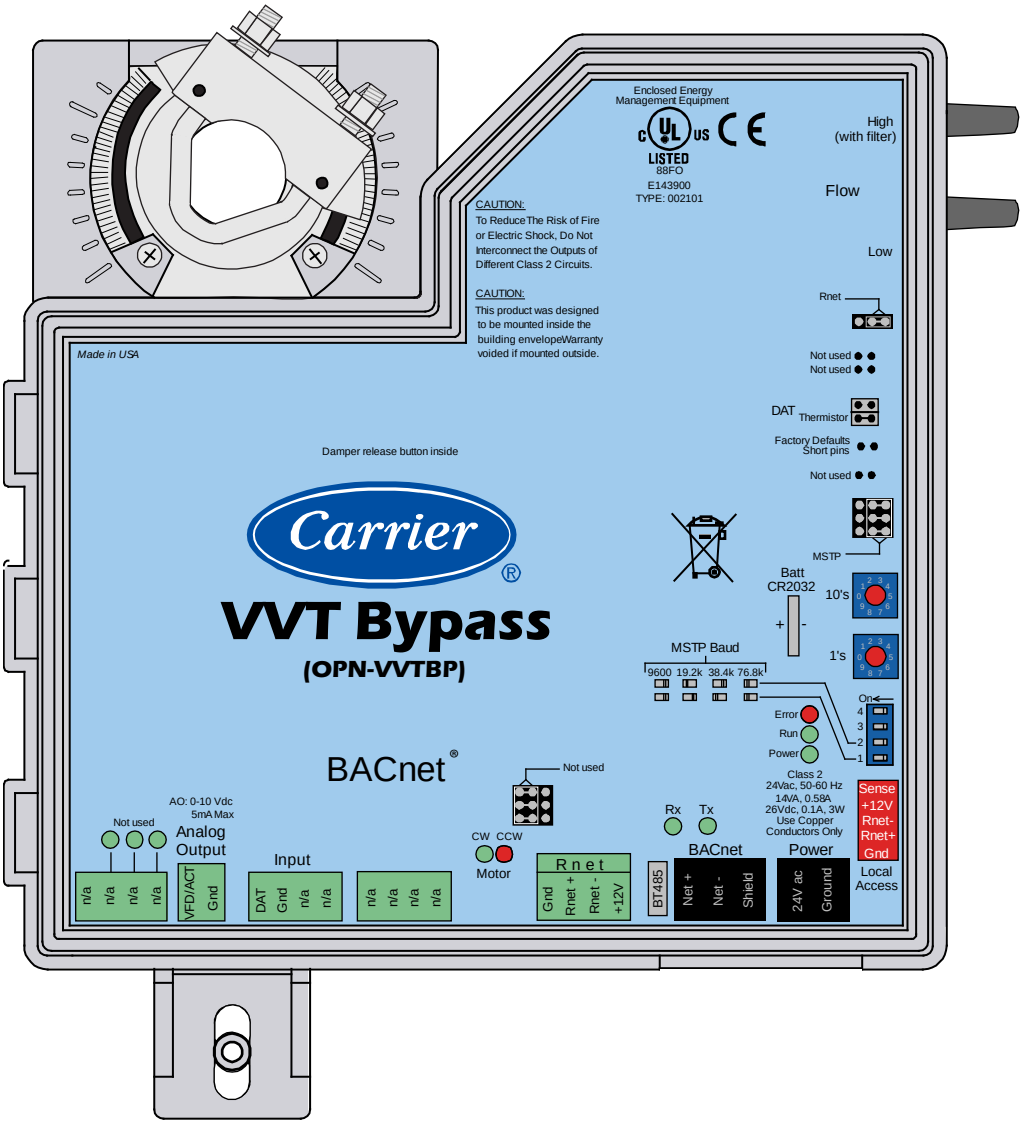
The VVT Bypass Controller (#OPN-VVTBP), a component of the i-Vu Open Control System, regulates the supply duct static pressure by controlling one of the following:

- The system's bypass damper
  The controller's built-in damper actuator provides 35 in/lbs of torque. If the built-in actuator's torque is insufficient, the VVT Bypass Controller can be used to drive an external high-torque actuator. Or, the controller can drive multiple external damper actuators.
- The air source supply fan's variable frequency drive (VFD)

The i-Vu Open Control System uses linkage to exchange data between the zone terminals and their air source to form a coordinated HVAC system. The system's air source controller, zone controllers, and bypass controller are linked so that their data exchange can be managed by one zone controller configured as the VVT Master.

The following illustration shows the VVT Bypass Controller in a typical i-Vu Open Control System.

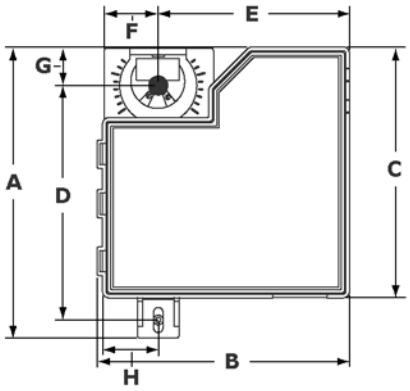




NOTE This document gives instructions for field-installation of a VVT Bypass Controller in an i-Vu Open Control System.

Specifications

Module driver	drv_bpopen_<latest version>.driver
Maximum number of control programs	1
Maximum number of BACnet objects	300, depending on available memory
Power	24 Vac ±10%, 50–60 Hz 14 VA power consumption (20 VA with BAC*view* attached) 26 Vdc (25 V min, 30 V max) Single Class 2 source only, 100 VA or less
BACnet port	For communication with the controller network using MS/TP (9600 bps, 19.2 kbps, 38.4 kbps, or 76.8 kbps)
Rnet port	For connection of a BAC*view*[6] keypad/display unit.
Local Access port	For system start-up and troubleshooting using a PC or BAC*view*[6] (115.2 kbps)
Inputs	1 input for connecting the Duct air temperature sensor (#33ZCSENDAT)
Input resolution	10 bit A/D
Analog output	1 analog output, 0–10 Vdc (5 mA max). The controlled device must have a minimum of 2000 Ohms resistance measured from its input to ground and must share the same ground as the controller.
Output resolution	8 bit D/A
Integral airflow sensor	Precision low flow AWM series 0–2 in. H20, sensitive down to ±0.001 in. H20. Barbed tapered airflow connections accept 3/16 in. (4.75 mm) I.D. tubing. Allows for readings across the 0–2 in. H20 range, accurate to ±5% of full flow at 2 in. H20.
Integral actuator	Brushless DC motor, torque 35 inch-pounds (4 Nm), runtime 205 seconds for 90 degree travel during control, or 25 seconds in high-speed test and balance mode
Battery	10-year Lithium CR2032 battery provides a minimum of 10,000 hours of data retention during power outages
Protection	Incoming power and network connections are protected by non-replaceable internal solid-state polyswitches that reset themselves when the condition that causes a fault returns to normal. The power, network, input, and output connections are also protected against voltage transient and surge events.
BT485 connector	You attach a BT485 (not included) to a controller at the beginning and end of a network segment to add bias and to terminate a network segment.
Status indicators	LED's indicate status of communications, running, errors, power, and digital outputs
Environmental operating range	0 to 130° F (-18 to 54°C), 0 to 90% relative humidity, non-condensing
Storage temperature range	-24 to 140°F (-30 to 60°C), 0 to 90% relative humidity, non-condensing

Physical	UL94-5VA plenum rated enclosure for installation in plenum (or other space for environmental air) in accordance with NEC Section 300.22 (c) and (d)
	
Overall dimensions	A: 7 in. (17.8 cm) B: 6 1/32 (15.4 cm) C: 6 in. (15.24 cm)
Mounting dimensions	D: 5 5/8 in. (14.3 cm) E: 4 9/16 in. (24.3 cm) F: 1 5/16 in. (3.3 cm.) G: 7/8 in. (2.2 cm) H: 1 5/16 in. (3.3 cm)
Panel depth	2 1/2 in. (6.4 cm) minimum
Shaft dimension	Minimum shaft diameter: 3/8 in. (.95 cm.) Maximum shaft diameter: 1/2 in. (1.27 cm) Minimum shaft length: 1 3/4 in. (4.45 cm)
Weight	1.7 lbs (0.77 kg)
BACnet support	Conforms to the Advanced Application Controller (B-AAC) Standard Device Profile as defined in ANSI/ASHRAE Standard 135-2004 (BACnet) Annex L
Listed by	UL-916 (PAZX), cUL-916 (PAZX7), FCC Part 15-Subpart B-Class A, CE EN50082-1997

Safety Considerations

SAFETY NOTE

Air conditioning equipment will provide safe and reliable service when operated within design specifications. The equipment should be operated and serviced only by authorized personnel who have a thorough knowledge of system operation, safety devices, and emergency procedures.

Good judgment should be used in applying any manufacturer's instructions to avoid injury to personnel or damage to equipment and property.

⚠ Warning!

ELECTRICAL SHOCK HAZARD

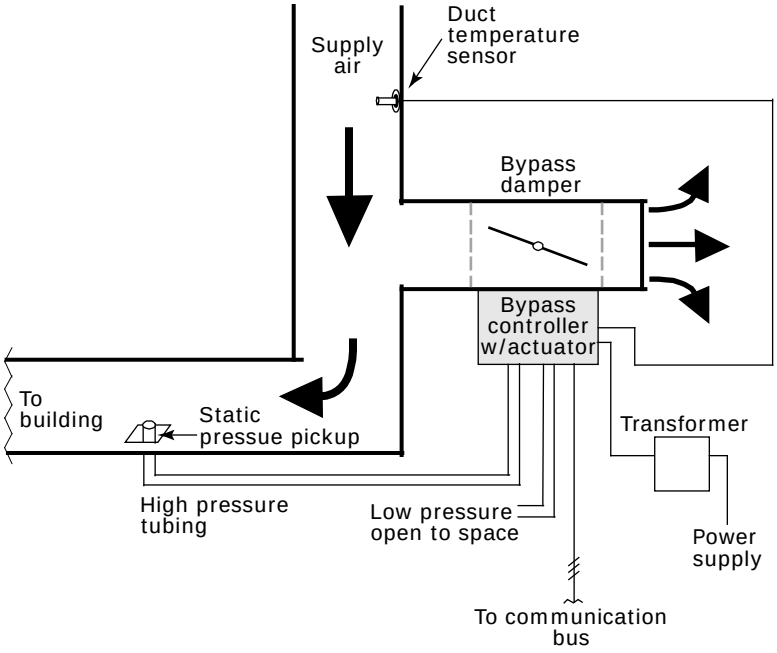
Failure to follow this warning could cause personal injury, death, and/or equipment damage.

Disconnect all power to the unit before performing maintenance or service. Unit may automatically start if power is not disconnected.

⚠ Warning!

Follow all local, state, and federal laws regarding disposal of equipment containing hazardous materials such as mercury contactors.

Installation



To install the VVT Bypass Controller:

1 *Mount the controller* (page 7).

2 *Wire the controller for power* (page 9).

3 *Set the controller's address* (page 10).

4 *Wire the controller to the MS/TP network* (page 10).

5 *Connect the inputs and outputs* (page 11).

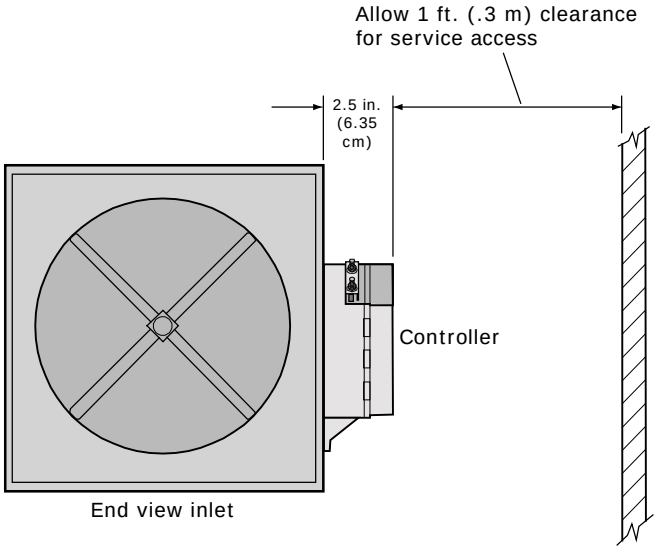
Field-supplied hardware

Each VVT Bypass Controller installation requires the following field-supplied components:

- damper
- damper actuator (if high-torque actuator or slaved dampers are required)
- duct air temperature sensor
- transformer— 24 Vac, 40 Va
- wiring

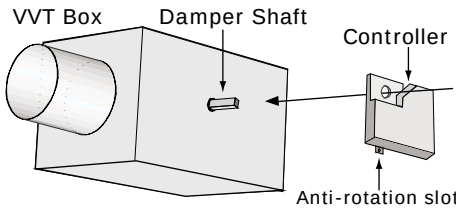
Mounting the VVT Bypass Controller

Mount the VVT Bypass Controller on the bypass duct damper actuator shaft. For service access, allow at least 1 foot (.3 m) of clearance between the front of the controller and adjacent surfaces.

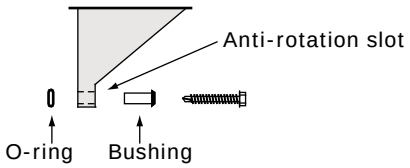


To mount the controller

1. Turn the damper shaft to fully close the damper.
2. Remove the controller's cover.
3. Mount the controller to the VVT box by sliding the clamp assembly onto the damper shaft.

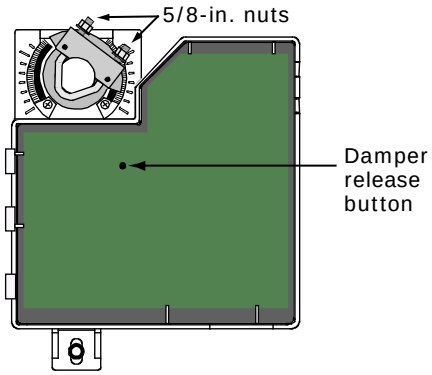


4. Secure the controller by installing the screw provided through the anti-rotation slot's bushing and o-ring.



NOTE Center the bushing in the slot. Failure to do so may cause the actuator to stick or bind.

5. Hold down the controller's damper release button and rotate the actuator clamp in the same direction that closed the damper. Rotate the clamp until it stops, then rotate it back one notch.



6 Release the button.

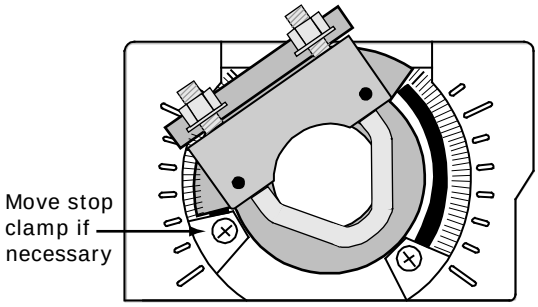
7 Tighten the actuator clamp to the damper shaft by tightening the two 5/16 inch nuts.

8 Hold down the damper release button and rotate the damper from fully closed to fully open. If the damper traveled less than 90 degrees, do the following to set the actuator's fully open position:

a) Loosen the appropriate stop clamp screw. See figure below.

b) Move the stop clamp until it contacts the edge of the actuator cam.

c) Tighten the screw.

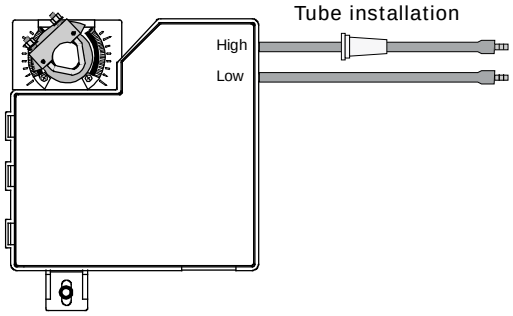


9 Hold down the damper release button, rotate the damper to verify that it fully opens and closes, then release the button.

10 Connect the filter tube provided to the controller's **High** connector. See figure below. Using 1/4" poly tubing, connect the other end to a static pressure pickup located in the supply air duct downstream of the bypass damper, but before the first branching of ductwork. See diagram in *Installation* (page 6).

NOTE Tubing should be at least 2 feet long for stable airflow measurement.

11 Leave the controller's **Low** connector open for plenum return or to a room space if using ducted return.



12 Replace the controller’s cover.

Wiring the VVT Bypass Controller for power

⚠ Caution!

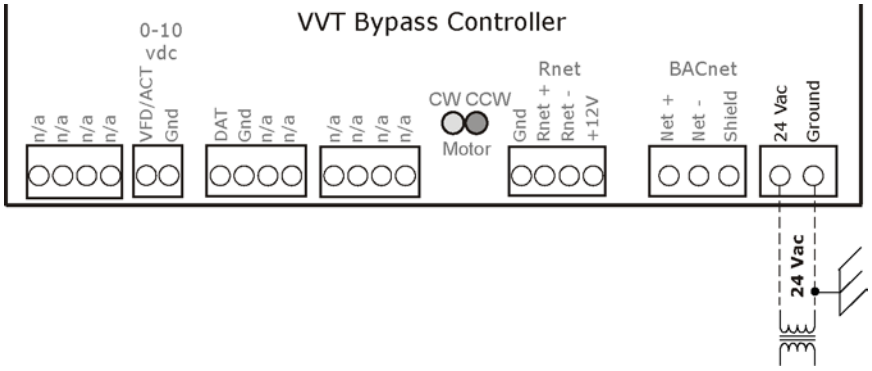
The VVT Bypass Controller is powered by a Class 2 power source. Take appropriate isolation measures when mounting it in a control panel where non-Class 2 circuits are present.

Carrier controllers can share a power supply as long as you:

- Maintain the same polarity
- Use the power supply only for Carrier controllers

To wire the controller for power

1. Remove power from the power supply.
2. Pull the screw terminal connector from the controller's power terminals labeled **Gnd** and **24 Vac** or **Hot**.



3. Connect the transformer wires to the screw terminal connector.
4. Apply power to the power supply.
5. Measure the voltage at the VVT Bypass Controller's power input terminals to verify that the voltage is within the operating range of 21.6–26.4 Vac.
6. Connect a 4-inch (10.2 cm) wire from **Gnd** to earth ground.
7. Insert the screw terminal connector into the VVT Bypass Controller's power terminals.
8. Verify that the **Power** LED is on and the **Run** LED is blinking.

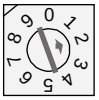
To address the VVT Bypass Controller

You must give the VVT Bypass Controller an address that is unique on the network. You can address the VVT Bypass Controller before or after you wire it for power.

1 If the VVT Bypass Controller has been wired for power, pull the screw terminal connector from the controller's power terminals labeled **Gnd** and **24 Vac**. The controller reads the address each time you apply power to it.

2 Using the rotary switches, set the controller's 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.



10's

1's

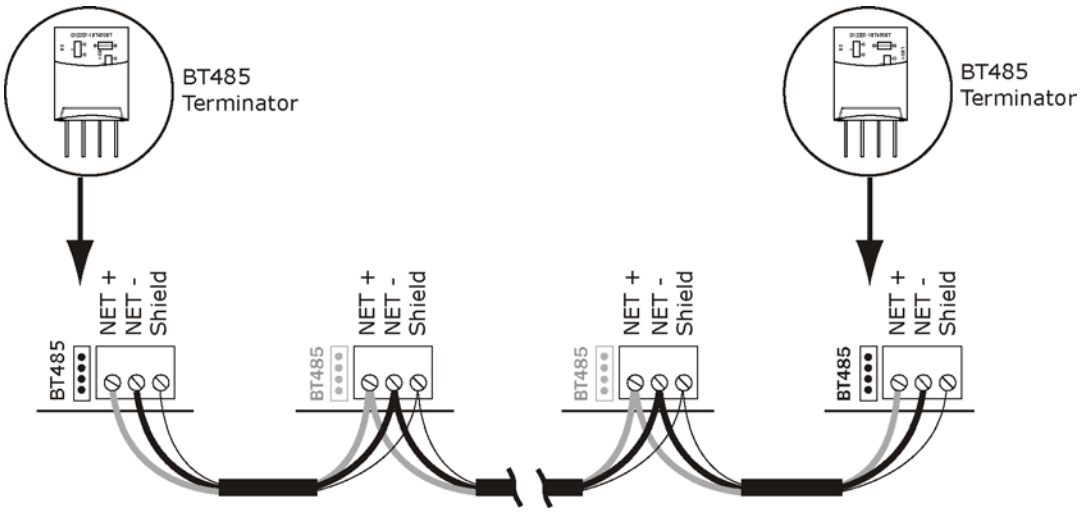
NOTE The factory default setting is "00" and must be changed to successfully install your VVT Bypass Controller.

Wiring the VVT Bypass Controller to the MS/TP network

The VVT Bypass Controller communicates using BACnet on an MS/TP network segment communications at 9600 bps, 19.2 kbps, 38.4 kbps, or 76.8 kbps.

Wire the controllers on an MS/TP network segment in a daisy-chain configuration.

Install a BT485 on the first and last controller on a network segment to add bias and prevent signal distortions due to echoing.



See the *MS/TP Networking and Wiring Installation Guide* for more details.

Wiring specifications

Cable:	22 AWG or 24 AWG, low-capacitance, twisted, stranded, shielded copper wire
Maximum length:	2000 feet (610 meters)

To wire the controller to the network

1. Pull the screw terminal connector from the controller's power terminals labeled **Gnd** and **24 Vac** or **Hot**.
2. Check the communications wiring for shorts and grounds.
3. Connect the communications wiring to the BACnet port's screw terminals labeled **Net +**, **Net -**, and **Shield**.

   NOTE Use the same polarity throughout the network segment.
4. Verify that the **MSTP** jumper is set to **MSTP**.
5. Set DIP switches 1 and 2 to the appropriate baud rate. See the MSTP baud diagram on the VVT Bypass Controller. The default baud rate is 76.8 kbps.

   NOTE Use the same baud rate for all controllers on the network segment.
6. Insert the power screw terminal connector into the VVT Bypass Controller's power terminals.
7. Verify communication with the network by viewing a module status report.

VVT Bypass Controller inputs and outputs

⚠ Warning!

Disconnect electrical power to the VVT Bypass Controller before wiring it. Failure to follow this warning could cause electrical shock, personal injury, or damage to the controller.

⚠ Caution!

- Do not run sensor or relay wires in the same conduit or raceway with Class 1 AC or DC service wiring.
- Do not abrade, cut, or nick the outer jacket of the cable.
- Do not pull or draw cable with a force that may harm the physical or electrical properties.
- Avoid splices in any control wiring.

Wiring a Duct Air Temperature sensor to an input

Part #33ZCSENDAT

The VVT Bypass Controller must be connected to a Duct Air Temperature (DAT) sensor that monitors the temperature of the air delivered by the air source.

NOTE This document gives instructions for wiring the sensor to the VVT Bypass Controller. For mounting and wiring the sensor, see the *Carrier Sensors Installation Guide*.

Wiring specifications

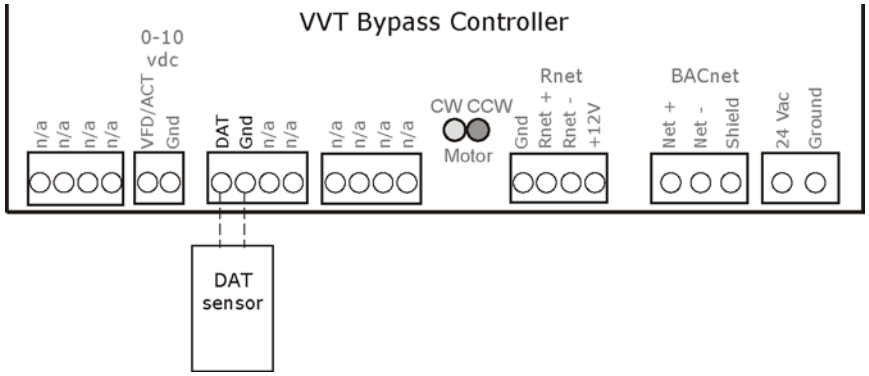
Cable from sensor to controller:	If <100 ft (30.5 meters) If >100 ft (30.5 meters)	22 AWG, unshielded 22 AWG, shielded
Maximum length:	500 feet (152 meters)	

To wire and mount the DAT sensor

1 Wire the sensor to the controller. See diagram below.

NOTE Sensor wiring does not have polarity. The wires can be connected to either terminal.

2 Using electrical tape, insulate any exposed wire to prevent shorting.



Wiring field-supplied actuators to the analog output

You can wire a high-torque actuator or parallel actuators to the controller's 0–10 Vdc analog output.

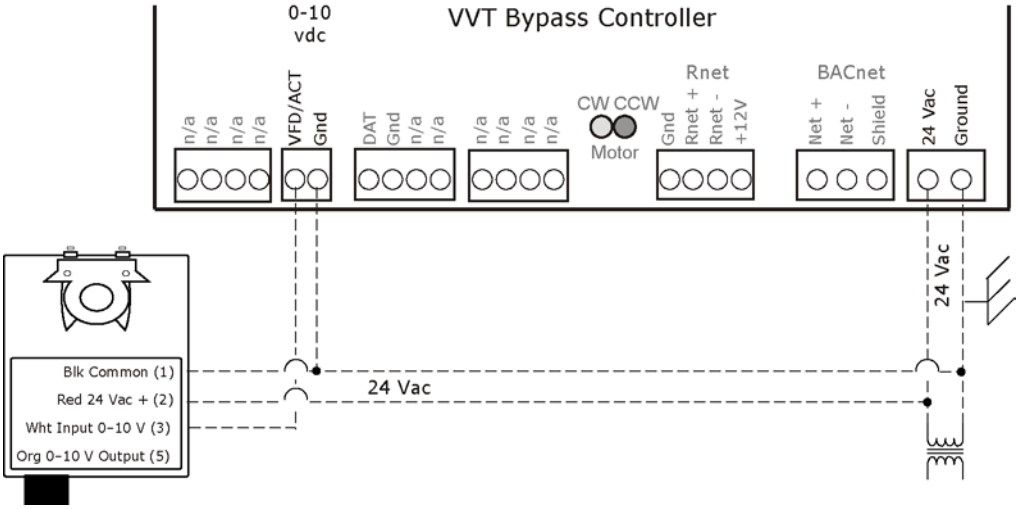
NOTE You cannot use the VVT Bypass Controller's built-in actuator if wiring external actuator(s) to the analog output.

High-torque actuators

You can wire one of the following Belimo actuators to the VVT Bypass Controller's analog output instead of using the controller's built-in, 35 in.-lb actuator.

NMX24-MFT P-10028	90 in.-lb actuator with 0–10 Vdc control and 0–10 Vdc feedback
AMX24-MFT P-10028	180 in.-lb actuator with 0–10 Vdc control and 0–10 Vdc feedback

1. Install the actuator according to the manufacturer's instructions.
2. Wire the actuator to the controller using the diagram below.



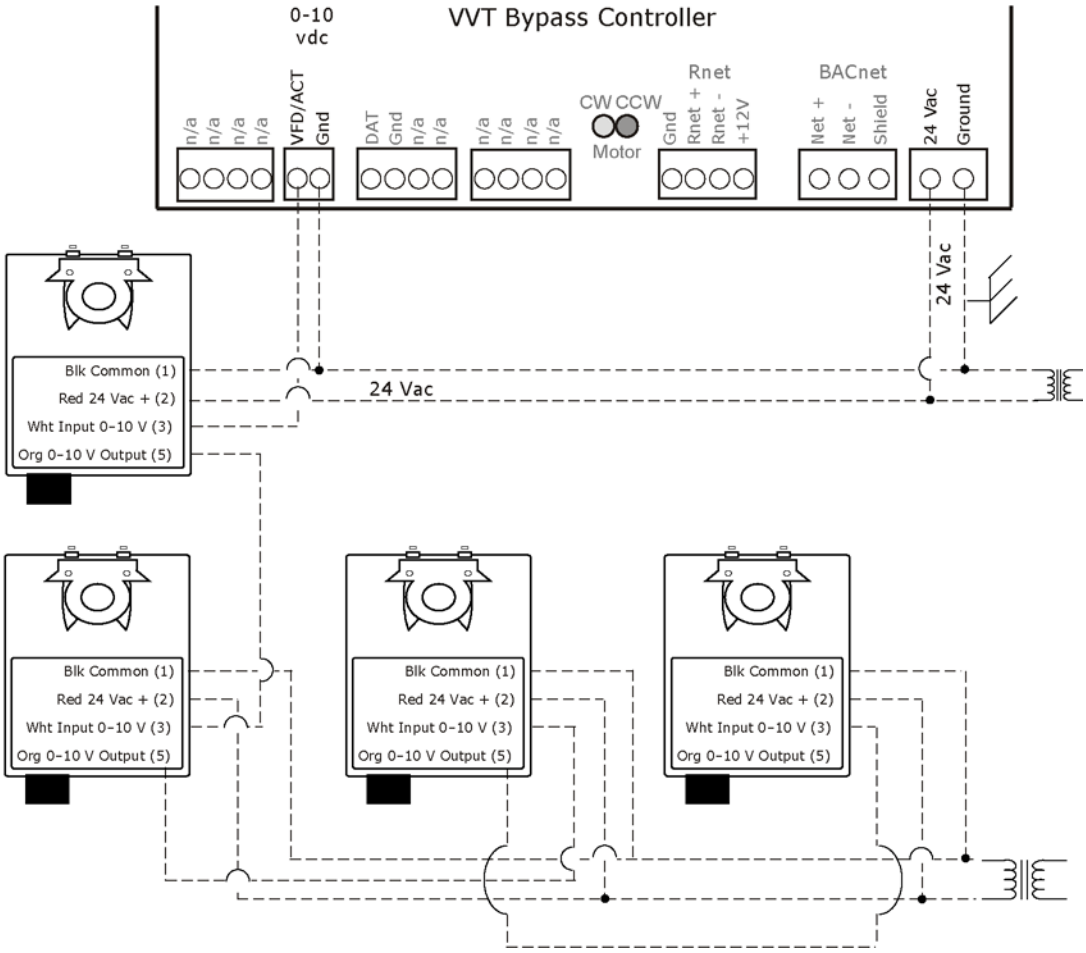
NOTE For proper operation and to prevent damage to the devices, use the same polarity for the actuator's power and the VVT Bypass Controller's power.

Linked actuators

You can wire up to 4 of the following Belimo actuators to the VVT Bypass Controller's analog output. Link actuators whose travel times and other parameters coincide.

LMX24-MFT P-10028	45 in.-lb actuator with 0–10 Vdc control
NMX24-MFT P-10028	90 in.-lb actuator with 0–10 Vdc control
AMX24-MFT P-10028	180 in.-lb actuator with 0–10 Vdc control

1. Install the actuators according to the manufacturer's instructions.
2. Wire the actuators to the controller using the diagram below.
3. Set the direction rotation switch on each actuator to CW.



NOTE Maintain polarity if using the same power supply for more than one actuator.

Start-up

To start up the VVT Bypass Controller, you need one of the following user interfaces. These items let you access the controller information, read sensor values, and test the controller.

This interface...	Provides a...
i-Vu Open software	Permanent interface
Field Assistant software - runs on a laptop connected to controller's Local Access port [1]	Temporary interface
Virtual BACview software - runs on a laptop connected to controller's Local Access port [1, 2]	Temporary interface
BACview6 Handheld keypad/display unit - connects to controller's Local Access port [1, 2]	Temporary interface
BACview6 keypad/display unit connected to controller's Rnet port [2]	Permanent interface

[1] Requires a USB Link (USB-L).
[2] See the *BACview Installation and User Guide* for instructions on connecting and using the above items.

Configuring the VVT Bypass Controller's properties

To start up the VVT Bypass Controller, you need to configure the properties described below. These properties affect the unit operation and/or control. Review and understand the meaning and purpose of each property before changing it.

See *Appendix A* (page 24) for a complete list of the controller's points/properties.

Navigation: i-Vu / Field Assistant: **Properties** > **Equipment** > **Unit Configuration**
BACview: **HOME** > **CONFIG**

Point Name/Description	Default/Range
Control Device Type – The device the controller uses to control static pressure.	D: Actuator R: Actuator/VFD drive
Maximum Heating SAT – The value that the SAT must exceed to cause the static pressure setpoint to be set to the **LAT Duct Static Pressure Setpoint**. This is also the **Supply Air Temperature Alarm**'s high limit.	D: 120°F R: 40 to 180°F
Minimum Cooling SAT – The minimum low limit value that the SAT must exceed to cause the static pressure setpoint to be set to the LAT Duct Static Pressure Setpoint. This is also the **Supply Air Temperature Alarm**'s low limit.	D: 45°F R: 40 to 180°F

Point Name/Description	Default/Range
Bypass Control	
Direction Clockwise – Set this field to the damper's position when it rotates clockwise. (Only in i-Vu/Field Assistant)	D: Close R: Open/Close
Duct Static Pressure Setpoint – The normal static pressure setpoint the controller will maintain.	D: .5 in. H_2O R: .1 to 2.0 in. H_2O
LAT Duct Static Pressure Setpoint – The static pressure setpoint that the controller will maintain if the SAT exceeds the **Maximum Heating SAT** or **Minimum Cooling SAT** value. To disable this function, set this value less than or equal to the **Duct Static Pressure Setpoint**.	D: .8 in. H_2O R: .1 to 2.0 in. H_2O

Performing system checkout

Bypass damper

1. Verify the VVT Bypass Controller is securely fastened to the bypass damper shaft and duct work.
2. Verify duct air temperature sensor is installed at the inlet of the damper or in the air source supply duct upstream of the bypass damper connection.
3. Verify that the high pressure tubing from the controller's airflow (pressure) sensor is connected to the supply duct static pickup downstream of the bypass damper. Then verify that the low pressure connector is not blocked.
4. Calibrate damper and pressure sensor:
   a) Disable the air source heating, cooling, and fan outputs using one of the following methods:
      - Physically disconnect the air source controller's output wiring to the unit.
      - In the i-Vu or Field Assistant tree, select the RTU Open controller. Go to **Properties** > **Equipment** > **Configuration** > **Service Configuration** > **Service Test**, then enable **Service Test**. Make sure all other outputs under **Service Test** are disabled.
   b) Select the Bypass controller in the tree, then go to **Properties** > **Equipment** > **Unit Configuration** > **Bypass Control** > **Details** tab.
   c) Click **Damper Full Close**, then verify that the damper is fully closed.
   d) Click **Damper Full Open**, then verify that the damper is fully open.
   e) Click **Zero Cal** to close the bypass damper and zero the pressure sensor. When **Done** appears, click **Apply**.
   f) Enable the air source fan output using one of the following methods:
      - Physically connect the air source controller's fan enable wiring at the unit.
      - In the i-Vu or Field Assistant tree, select the RTU Open controller. Go to **Properties** > **Equipment** > **Configuration** > **Service Configuration** > **Service Test**, then enable **Fan Test**. Make sure all other outputs under **Service Test** are disabled.
   g) Select the Bypass controller in the tree, then go to **Properties** > **Equipment** > **Unit Configuration** > **Bypass Control** > **Details** tab.

h) After the static pressure has stabilized, make sure that **Target Damper Position** and **Duct Static Pressure** are not locked and that **Target Damper Position** is >0% and <100%. You may have to adjust the **Duct Static Pressure Setpoint** slightly to get the damper within this range.

i) Using a branch-tee, connect a magnehelic gauge to the **High** connector on the controller's airflow sensor, then measure the static pressure. If the measured static pressure is different from the **Duct Static Pressure** by ±.05", click **Pressure Sensor Cal**, enter the measured value next to the button, then click **Apply**.

j) Remove the magnehelic gauge from the **High** connector, then reinsert the pressure tubing.

k) Click **Automatic Control** to return the bypass to normal control.

l) Enable the air source's heating and cooling outputs using one of the following methods:

- Reconnect the air source controller's output wiring at the unit.
- In the i-Vu or Field Assistant tree, select the RTU Open controller. Go to **Properties** > **Equipment** > **Configuration** > **Service Configuration** > **Service Test**, then disable **Service Test** and **Fan Test**. Make sure all other outputs under **Service Test** are disabled.

CAUTION Pressing the actuator release button and moving the damper or disconnecting the actuator ribbon connector while the bypass controller is powered will cause the damper position to be out of calibration. To recalibrate the damper position, you must perform steps 4c and 4d above or power cycle the controller.

Variable frequency drive (VFD)

1 Verify that the controller's **VFD/ACT** output wiring is correctly connected to the VFD and that the VFD is configured for a 0-10 Vdc control signal.

2 In the i-Vu or Field Assistant tree, select the Bypass controller. Go to **Properties** > **Equipment** > **Unit Configuration**, then verify that **Control Device Type** is set to **VFD**.

3 Verify duct air temperature sensor is installed in the air source supply duct.

4 Verify that the high pressure tubing from the controller's airflow (pressure) sensor is connected to the supply duct static pickup downstream of the bypass damper. Then verify that the low pressure connector is not blocked.

5 Calibrate the VFD and pressure sensor:

a) Disable the air source heating, cooling, and fan outputs using one of the following methods:

- Physically disconnect the air source controller's output wiring to the unit.
- In the i-Vu or Field Assistant tree, select the RTU Open controller. Go to **Properties** > **Equipment** > **Configuration** > **Service Configuration** > **Service Test**, then enable **Service Test**. Make sure all other outputs under **Service Test** are disabled.

b) Select the Bypass controller in the tree, then go to **Properties** > **Equipment** > **Unit Configuration** > **Bypass Control** > **Details** tab.

c) Click **Damper Full Open**, then verify the voltage at **VFD/ACT** and **Gnd** is 0 Vdc.

d) Click **Damper Full Close**, then verify the voltage at **VFD/ACT** and **Gnd** is 10 Vdc.

e) Click **Zero Cal** to zero the pressure sensor. When **Done** appears, click **Apply**.

f) Enable the air source fan output using one of the following methods:

- Physically connect the air source controller's fan enable wiring at the unit.
- In the i-Vu or Field Assistant tree, select the RTU Open controller. Go to **Properties** > **Equipment** > **Configuration** > **Service Configuration** > **Service Test**, then enable **Fan Test**. Make sure all other outputs under **Service Test** are disabled.

g) Select the Bypass controller in the tree, then go to **Properties** > **Equipment** > **Unit Configuration** > **Bypass Control** > **Details** tab.

h) After the static pressure has stabilized, make sure that **Target Damper Position** and **Duct Static Pressure** are not locked and that **Target Damper Position** is >0% and <100%. You may have to adjust the **Duct Static Pressure Setpoint** slightly to get the damper within this range.

i) Using a branch-tee, connect a magnehelic gauge to the **High** connector on the controller's airflow sensor, then measure the static pressure. If the measured static pressure is different from the **Duct Static Pressure** by ±.05”, click **Pressure Sensor Cal**, enter the measured value next to the button, then click **Apply**.

j) Remove the magnehelic gauge from the **High** connector, then reinsert the pressure tubing.

k) Click **Automatic Control** to return the bypass to normal control.

l) Enable the air source’s heating and cooling outputs using one of the following methods:

- Reconnect the air source controller’s output wiring at the unit.
- In the i-Vu or Field Assistant tree, select the RTU Open controller. Go to **Properties** > **Equipment** > **Configuration** > **Service Configuration** > **Service Test**, then disable **Service Test** and **Fan Test**. Make sure all other outputs under **Service Test** are disabled.

Sequence of operation

The VVT Bypass Controller maintains supply duct static pressure under all system operating conditions.

The controller can operate as part of a linked VVT system or as a stand-alone controller.

Duct static pressure control

The VVT Bypass Controller modulates a bypass damper or VFD to maintain the static pressure in the supply duct of the pressure-dependent VVT system. The controller has a built-in damper actuator that provides 35 in/lbs of torque.

You can use the controller's 0–10 Vdc output to:

- Drive a larger actuator if the built-in actuator's torque is insufficient. The actuator must be installed so that 0 volts causes the bypass damper to fully open. See **NOTE** below and *High-torque actuator* (page 13).
- Drive multiple damper actuators from a single bypass controller. See **NOTE** below and *Linked actuators* (page 13).
- Control a VFD

NOTE You cannot use the built-in actuator if external actuator(s) are wired to the analog output.

If linkage is active, normal duct static pressure control is overridden if the linked air source is in either of the following modes:

- Fire shutdown or evacuation mode – The bypass damper will be fully open. If controlling a VFD, the VFD output will be at 0%.
- Pressurization mode – The bypass damper will be fully closed. If controlling a VFD, the VFD output will be at 100%.

LAT monitoring and limiting

To protect the air source from excessive supply air temperature conditions, the VVT Bypass Controller monitors the supply air temperature. If the temperature reaches either the **Minimum Cooling SAT** (45°F default) or the **Maximum Heating SAT** (120° F default), the Bypass controls to the **LAT Duct Static Pressure Setpoint** which increases airflow through the air source.

The amount of increase in airflow is related to the square root of the pressure increase. For example, a 25% increase in airflow at 1" of static pressure would require a 56% increase in duct static pressure (1 in.H20 * 1.252 = 1.56 in.H20). The default **LAT Duct Static Pressure Setpoint** of 0.8 in.H20 provides a maximum 25% increase in airflow over the default Duct Static Pressure Setpoint of .5 in.H20. (.5 in.H20 * 1.252 = .75 [~.8] in.H20). When the LAT exceeds the **Maximum Heating SAT** or **Minimum Cooling SAT**, the controller detects and indicates the excessive LAT condition and displays the **Controlling Pressure Setpoint** and the associated **LAT Airflow Increase** (%).

The Bypass does not resume normal control to the Duct Static Pressure Setpoint until the SAT drops 15°F below the Maximum Heating Sat or rises 7°F above the Minimum Cooing Setpoint.

If the supply air temperature exceeds the configured limits, a **Supply Air Temperature Alarm** is generated. If Linkage is active, the controller monitors the supply air temperature from the equipment rather than its own temperature input for faster response.

Equipment fan off detection

The VVT Bypass Controller continuously monitors its damper's position and the supply duct static pressure. If the pressure drops below 10% of the nominal setpoint and the bypass damper is fully closed (or VFD is commanded to maximum speed), after 1 minute the controller assumes that the equipment fan turned off. The bypass damper then modulates to 65% open and the VFD speed is commanded to 35% (3.5 volts) to facilitate a fan restart. The controller monitors the static pressure to determine when the equipment fan restarts. If it rises above 10% of the nominal pressure setpoint, the controller assumes the fan restarted and controls to maintain the duct static pressure setpoint. If Linkage is active, the air source mode is provided to the VVT Bypass Controller.

Supply Air Temperature Alarm

The VVT Bypass Controller generates an alarm if the supply air temperature remains above the configured **Maximum Heating SAT** or below the configured **Minimum Cooling SAT** for more than 5 minutes.

Airside linkage

When the VVT Bypass Controller is part of a linked system, it uses data received through Linkage (equipment SAT and mode) to detect excessive leaving air temperature (LAT) conditions at the equipment and equipment operating mode.

Troubleshooting

If you have problems mounting, wiring, or addressing the VVT Bypass Controller, contact Carrier Control Systems Support.

LED's

The LED's on the VVT Bypass Controller show the status of certain functions.

If this LED is on...	Status is...
Power	The VVT Bypass Controller has power
Rx	The VVT Bypass Controller is receiving data from the network segment
Tx	The VVT Bypass Controller is transmitting data over the network segment
CW	The actuator motor is turning clockwise
CCW	The actuator motor is turning counterclockwise

The **Run** and **Error** LED's indicate controller and network status.

If Run LED shows...	And Error LED shows...	Status is...
2 flashes per second	Off	Normal
2 flashes per second	2 flashes, alternating with **Run** LED	Five minute auto-restart delay after system error
2 flashes per second	3 flashes, then off	The controller has just been formatted
2 flashes per second	1 flash per second	The controller is alone on the network
2 flashes per second	On	Exec halted after frequent system errors or control programs halted
5 flashes per second	On	Exec start-up aborted, Boot is running
5 flashes per second	Off	Firmware transfer in progress, Boot is running
7 flashes per second	7 flashes per second, alternating with **Run** LED	Ten second recovery period after brownout
14 flashes per second	14 flashes per second, alternating with **Run** LED	Brownout

If Run LED shows...	And Error LED shows...	Status is...
On	On	Failure. Try the following solutions: • Turn the VVT Bypass Controller off, then on. • Format the VVT Bypass Controller. • Download memory to the VVT Bypass Controller. • Replace the VVT Bypass Controller.

Serial number

If you need the VVT Bypass Controller's serial number when troubleshooting, the number is on:

- a sticker on the back of the main controller board
- a Module Status report (modstat) from your user interface

Replacing the VVT Bypass Controller's battery

The VVT Bypass Controller's 10-year Lithium CR2032 battery provides a minimum of 10,000 hours of data retention during power outages.

If the VVT Bypass Controller experiences a power outage and the control program stops functioning, replace the battery.

1. Remove the VVT Bypass Controller's cover.
2. Remove the battery from the controller, making note of the battery's polarity.
3. Insert the new battery, matching the battery's polarity with the polarity indicated on the controller's cover.
4. Replace the VVT Bypass Controller's cover.
5. Download memory to the VVT Bypass Controller.

Compliance

FCC Compliance

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

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

CE Compliance

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

BACnet Compliance

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

Appendix A: VVT Bypass Controller Points/Properties

Status

Navigation: i-Vu / Field Assistant: **Properties** > **Equipment** > **Status**
BACview: **HOME** > **STATUS**

Point Name/Description	Range
Static Pressure - Prime Variable – The current supply duct static pressure. This value is shown on the default area graphic in i-Vu or Field Assistant.	R: 0 to 2.0 in. H_2O
Supply Air Temperature – If **Airside Linkage Status** is **Active**, this is the air source's current supply air temperature. If **Airside Linkage Status** is **Not Active**, this value is from the local SAT sensor.	R: -56 to 245°F
Damper Position – If **Control Device Type** is **Actuator**, this is the current open damper position.	R: 0 to 100%
VFD output – If **Control Device Type** is **VFD**, this is the current VFD speed capacity.	R: 0 to 100%
LAT Control – The status of LAT Limit duct static pressure override control of the bypass.	R: On/Off
LAT Airflow Increase – If **LAT Control** is **On**, this is the percent of increase in supply airflow that the overriding **LAT Duct Static Pressure Setpoint** will provide above the normal **Controlling Pressure Setpoint**.	R: 0 to 100%

Unit Configuration

Navigation: i-Vu / Field Assistant: **Properties** > **Equipment** > **Unit Configuration**
BACview: **HOME** > **CONFIG**

Point Name/Description	Default/Range
Control Device Type – The device the controller uses to control static pressure.	D: Actuator R: Actuator/VFD drive
Power Fail Restart Delay – How long the controller delays normal operation after the power is restored.	D: 60 seconds R: 60 to 600 seconds
Automatic Deadband Adjustment – If using an actuator, set to Enable to automatically adjust the damper for full travel to correctly scale the damper position. If using a VFD drive, set to Disable.	D: Enable R: Enable/Disable
Maximum Heating SAT – The value that the SAT must exceed to cause the static pressure setpoint to be set to the **LAT Duct Static Pressure Setpoint**. This is also the **Supply Air Temperature Alarm**'s high limit.	D: 120°F R: 40 to 180°F

Point Name/Description	Default/Range
Minimum Cooling SAT – The minimum low limit value that the SAT must exceed to cause the static pressure setpoint to be set to the LAT Duct Static Pressure Setpoint. This is also the **Supply Air Temperature Alarm**'s low limit.	D: 45°F R: 40 to 180°F
Pressure Control Deadband – The amount that is added to and subtracted from the bypass controlling setpoint (Duct Static Pressure Setpoint or LAT Duct Static Pressure Setpoint). When the static pressure is within the controlling setpoint +/- this value, the output to the actuator or VFD drive maintains at its current position. When the static pressure is greater than the controlling setpoint +/- this value, the output modulates accordingly. **CAUTION** If this value is too low, the damper may oscillate to maintain the static pressure. This could cause the actuator to fail prematurely.	D: .05 in H_2O R: 0 to 2.0 in. H_2O
Bypass Control	
Direction Clockwise – Set this field to the damper's position when it rotates clockwise. (Only in i-Vu/Field Assistant)	D: Close R: Open/Close
Duct Static Pressure Setpoint – The normal static pressure setpoint the controller will maintain.	D: .5 in. H_2O R: .1 to 2.0 in. H_2O
LAT Duct Static Pressure Setpoint – The static pressure setpoint that the controller will maintain if the SAT exceeds the **Maximum Heating SAT** or **Minimum Cooling SAT** value. To disable this function, set this value less than or equal to the **Duct Static Pressure Setpoint**.	D: .8 in. H_2O R: .1 to 2.0 in. H_2O
Locks – **CAUTION** Overriding these values may damage equipment or ductwork. **Duct Static Pressure** – Lets you override the static pressure sensor input for testing and troubleshooting.	R: 0 to 2.0 in. H_2O
Target damper position – Allows you to override the normal control of the damper/VFD for the purpose of testing and troubleshooting.	R: 0 to 100%
Test and Balance **Zero Cal** – Closes the bypass damper and waits for the air source to go to the Off mode before zeroing out the static pressure sensor. This does not occur if the static pressure is > .05 in H_2O. **Pressure Sensor Cal** – Allows you to calibrate the pressure sensor after the Zero Cal has been performed. To enter a value here, neither the damper nor the pressure sensor can be locked, the bypass cannot be in LAT mode and the damper position must be >0% and <100%. The value entered will be the actual static pressure measured with an accurate static pressure measuring device. **Damper Full Open** – Overrides the damper to its full open position. **Automatic Control** – Returns the damper to its normal control routines. **This must be activated when you finish using any of the other Test and Balance commands.** **Damper Full Close** – Overrides the damper to its full closed position.	
Local Sensor Calibration	
Supply Air Temperature – The current supply air temperature.	R: -56 to 245°F

Point Name/Description	Default/Range
Supply Air Temp Calibration – A calibration offset value to allow the supply air temperature sensor to be adjusted to match a calibrated standard measuring the temperature in the same location.	R: -20 to 20°F

Maintenance

Navigation: i-Vu / Field Assistant: **Properties** > **Equipment** > **Maintenance**
BACview: **HOME** > **MAINT**

Point Name/Description	Range
Static Pressure – The current supply duct static pressure.	R: 0 to 2.0 in. H_2O
Controlling Pressure Setpoint – The active static pressure setpoint that the bypass controls to.	R: .1 to 2.0 in. H_2O
Max Duct Pressure Setpoint – The Pressure Control Deadband that is added to the active static pressure setpoint.	R: 0 to 2.0 in. H_2O
Min Duct Pressure Setpoint – The Pressure Control Deadband that is subtracted from the active static pressure setpoint.	R: 0 to 2.0 in. H_2O

Alarms

Navigation: i-Vu / Field Assistant: **Properties** > **Equipment** > **Alarms**
BACview: **HOME**> **ALARM**

Point Name/Description	Range
Supply Air Temperature Alarm – Indicates if the supply air temperature exceeds the high temperature alarm limit or drops below the low temperature alarm limit.	R: Normal/Alarm
Airside Linkage Alarm – Indicates that it lost Linkage communications with the air source.	R: Normal/Alarm

Linkage

Navigation: i-Vu / Field Assistant: **Properties** > **Equipment** > **Linkage**
BACview: **HOME**> **LINKAGE**

Point Name/Description	Range
Air Linkage Status – If **Active**, the controller is part of a linked system. If **Not Active**, the controller is operating as a stand-alone device.	R: Active/Not Active
Air Source Mode – If **Airside Linkage Status** is **Active**, this is the current mode of the linked air source. If **Airside Linkage Status** is **Not Active**, this is the mode of the air source as determined by the zone controller's SAT sensor.	R: OFF WARMUP HEAT COOL FREECOOL PRESSURE EVAC VENT
Air Source Supply Air Temp – Shows the air source's SAT when **Airside Linkage Status** is **Active**. If **Airside Linkage Status** is **Not Active**, the controller's local DAT sensor value is displayed.	R: -56 to 245°F

I/O Points

Navigation: i-Vu / Field Assistant: **Properties** > **I/O Points**
BACview: **N/A**

Point Name/Description	Range
Pressure Input – The current duct static pressure of the controller's integrated airflow sensor.	R: 0 to 2.0 in. H_2O
SAT Sensor – The current duct air temperature sensor that is physically connected to the controller.	R: -56 to 245°F
AO Output – The current voltage on the controller's **VFD/ACT** output terminal.	R: 0 to 10 Vdc

Index

R

S

T

U

V

W

Z

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