Metasys® System LN Series Variable Air Volume (VAV)/ Variable Air Volume and Temperature (VVT) Unit Controllers

User's Guide

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User's Guide

Introduction

This section introduces the Variable Air Volume (VAV)/Variable Air Volume and Temperature (VVT) line of controllers, summarizes their features, and provides an overview of this user guide.

Introduction to the VAV/VVT Product Line

The VAV/VVT line of controllers uses the latest technology to provide more flexibility of control and reliability than traditional VAV/VVT controllers. Advancements include an integrated brushless constant torque actuator with a longer life expectancy than standard brushed motors; and a drift-free differential pressure sensor that resists loss of accuracy over time due to dust particle accumulation. In addition, a 16-bit analog-digital converter provides high accuracy input and flow pressure sensor readings that enable precise VAV balancing.

The VAV/VVT line of controllers features expanded I/O capability with 4 universal analog/digital inputs, 4 digital outputs, 2 universal analog/digital outputs, and 6 network outputs that allow you to simultaneously control 8 pieces of Heating, Ventilating, and Air Conditioning (HVAC) equipment. Controlled HVAC equipment can include duct heaters, fans, multi-stage heaters, coolers, analog and floating valve actuators, lights, as so on. The network outputs are bound to the physical outputs of other controllers on the network. The universal inputs similarly allow for the connection of any HVAC equipment or peripheral. The controller dynamically adapts its sequence of operations based on the connected equipment without any need for user intervention. Spare I/O points on the controller can also be linked to other controllers on the network to allow for efficient control of devices that are close to the VAV/VVT.

The VAV is designed to function with the LN-VSTAT Smart-Sensor, a digital sensor that features a Light Crystal Display (LCD) and VAV balancing capability.

Models

Table 1: VAV/VVT Product Line Models and Features

Model Name	4 Universal Inputs 4 Triac Digital Outputs 2 Analog Outputs	On-Board Pressure Transducer	Brushless Actuator	Actuator Feedback
LN-VAVLF-1	X	X	X	X
LN-VAVLN-1	X	X		
LN-VVTLF-1	X		X	X

Functional Profile

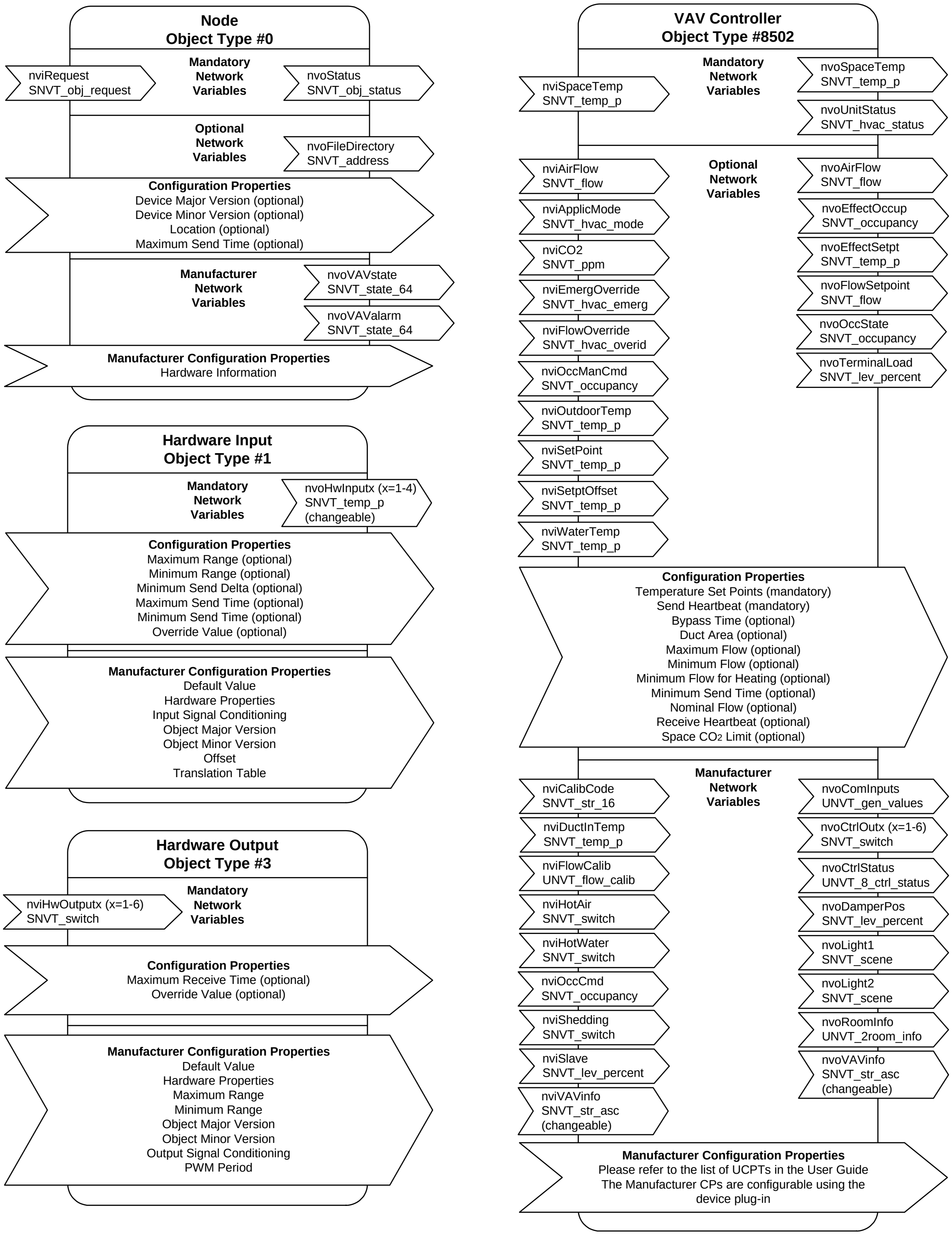

Figure 1: Metasys System LN Series VAV/VVT Controllers Functional Profile

Purpose of This User's Guide

This document provides you with information for configuring and using the VAV/VVT line of products to control various types of HVAC equipment.

For the purpose of the examples used in this user's guide, some features or applications require a specific device or software to function properly. Refer to the product data sheets or contact your sales representative for more information about the product line.

This document only explains hardware installation in a general sense. Refer to the individual device's installation instructions for specific hardware installation information.

This document does not provide instructions for safe wiring practices. It is your responsibility to adhere to the safety codes, safe wiring guidelines, and safe working practices of your area. In addition, this document does not provide you with all the information and knowledge of an experienced HVAC technician or engineer.

VAV Device Configuration

The VAV Device Configuration window specifies the equipment to be controlled by the VAV; specify the heating, cooling, and CO2 setpoints; perform VAV balancing; set device alarm limits; and set up various input and output parameters.

Sensor Input Configuration (Hardware Input)

The Hardware Input tab allows you to configure the four universal inputs of the VAV.

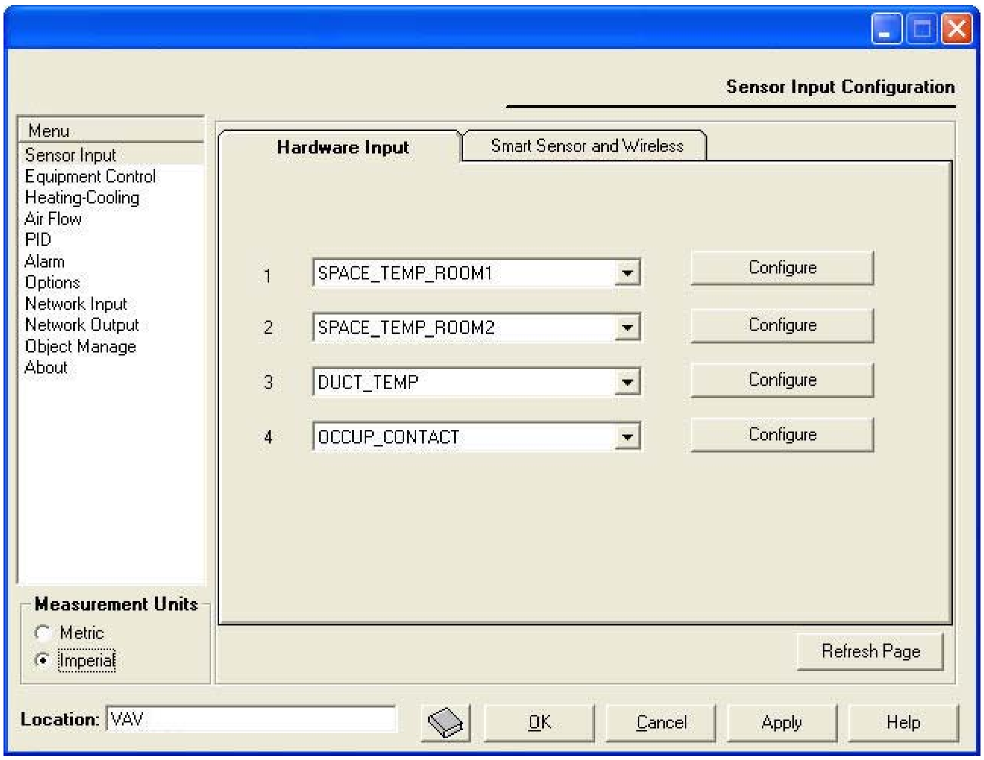

Figure 2: Hardware Input Tab of Sensor Input Configuration Window

Table 2 shows the variety of standard input types supported by the VAV/VVT controllers. After selecting an input type from the drop-down menu, click Configure to open the Hardware Input Configuration window.

Input Type

The input type drop-down menus allow you to specify the type of hardware signal on the associated input. The input can either be voltage, current, resistance, or discrete level. You can specify the type of input signal by clicking Configure.

Table 2: Hardware Input Types and Description

Input	Description
UNUSED	Shows that the input is unused.
SPACE_TEMP_ROOM1	Specifies a temperature sensor input for room 1; this input is usually a 10k ohm thermistor, 0–10 V signal, or 4–20 mA signal.
SETPOINT_ROOM1	Specifies a midpoint setpoint input (see *Midpoint/Midrange Setpoint Definition* section) for room 1. This input is usually a 10k ohm potentiometer or 0–10 V signal. **Note:** Input nviSetpoint, overrides this physical setpoint input.
SETPOINT_OFFSET_ROOM1	Specifies a setpoint offset input for room 1. This input is usually a 10k ohm potentiometer or 0–10 V signal. **Note:** Input nviSetptOffset overrides this physical setpoint offset input.
SPACE_TEMP_ROOM2	Specifies a temperature sensor input for room 2. This input is usually a 10k ohm thermistor, 0–10 V signal, or 4–20 mA signal. **Note:** Input nviSpaceTemp overrides this physical space temperature input.
SETPOINT_ROOM2	Specifies a midpoint setpoint input (see *Midpoint/Midrange Setpoint Definition* section) for room 2. This input is usually a 10k ohm potentiometer or 0–10 V signal. **Note:** Input nviSetpoint overrides this physical setpoint input.
SETPOINT_OFFSET_ROOM2	Specifies a setpoint offset input for room 2. This input is usually a 10k ohm potentiometer or 0–10 V signal. **Note:** Input nviSetptOffset overrides this physical setpoint offset input.
DUCT_TEMP	Specifies a duct temperature sensor. This input is usually 10k ohm thermistor, 0–10 V signal, or 4–20 mA signal.
WATER_TEMP	Specifies a water temperature sensor. This input is usually a 10k ohm thermistor, 0–10 V signal, or 4–20 mA signal.
DISCHARGE_TEMP	Specifies a discharge air temperature sensor. This input is usually a 10k ohm thermistor, 0–10 V signal, or 4–20 mA signal.
CO2_LEVEL	Specifies a CO_2 concentration level sensor. This input is usually a 0–10 V signal or 4–20 mA signal.
OCCUP_CONTACT	Specifies an occupancy contact switch (such as a motion detector).
BYPASS_CONTACT	Specifies a bypass contact switch (such as an override button). If the bypass switch is turned on while in OC_UNOCCUPIED or OC_STANDBY mode, nvoOccState is set to OC_BYPASS.
WINDOW_CONTACT	Specifies a window contact switch. If the window contact is closed (ON), the nvoOccState is set to OC_UNOCCUPIED or nvoUnitStatus is set to OFF.
EMERG_CONTACT	Specifies an emergency contact switch. When the switch is turned on, the HVAC unit status is set to OFF and the HVAC system enters Purge or Shutdown mode (depending on the Emergency Action selection in the Options Configuration window).
LIGHT_SWITCH_ROOM1	Specifies a light switch for room 1.
LIGHT_SWITCH_ROOM2	Specifies a light switch for room 2.

Midpoint/Midrange Setpoint Definition

The midpoint or midrange setpoint is the median value between the cooling and heating setpoints. If an occupant changes the midrange setpoint, the cooling and heating setpoints change by the same value. For example, if the heating setpoint is 20°C (68°F), and the cooling setpoint is 22°C (72°F), the midrange setpoint is 21°C (70°F).

If the HVAC mode is cooling, the effective setpoint (actual setpoint) is the cooling setpoint. If the HVAC mode is heating, the effective setpoint (actual setpoint) is the heating setpoint.

Hardware Input Configuration

The Hardware Input Configuration window launches when you click Configure in the Hardware Input tab.

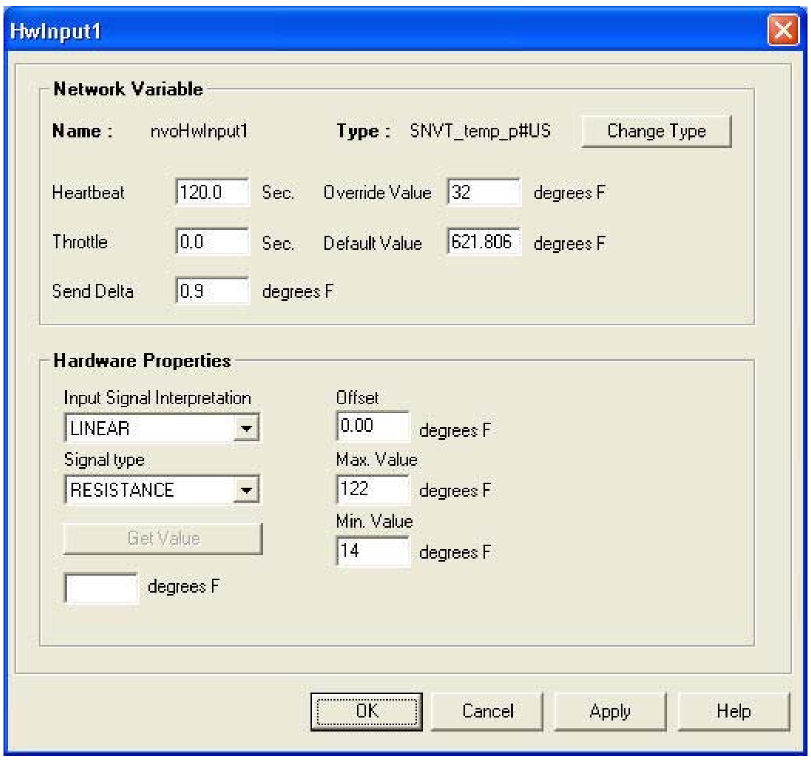

Figure 3: Hardware Input Configuration Window

Table 3: Network Variable Field Descriptions (Part 1 of 2)

Field	Description
Name	The network variable output corresponding to the hardware input that you are configuring.
Type	The current network variable type for the network variable output. The network variable type can be changed by clicking Change Type.
Change Type	The option that launches the window.
Heartbeat	The maximum time period between automatic transmissions of the network variable on the network (regardless of if the variable's value has changed). Set Heartbeat to 0 to disable it. **Note:** Heartbeat is also referred to as Maximum Send Time.

Table 3: Network Variable Field Descriptions (Part 2 of 2)

Field	Description
Throttle	The minimum time period that must pass between network variable updates on the network. If the value of the network variable changes by more than the configured Send Delta value, an update is sent only after this time expires. Setting the Throttle to 0 disables it. **Note:** Throttle is also referred to as Minimum Send Time.
Send Delta	The amount by which the network variable must change for it to be automatically transmitted on the network. If a network variable changes by the amount specified in the Send Delta field, it transmits on the network as long as the throttle time has elapsed.
Override Value	The value that the hardware input and its network variable output assumes if either the hardware input object or entire VAV is overridden.
Default Value	The value that the network variable assumes if the hardware input object is in the disabled state or if the input reading is invalid due to an electrical fault or a severed connection.

Hardware Properties

Depending on the Input Signal Interpretation type that is selected, the options that you see under Hardware Properties vary.

Input Signal Interpretation

Input Signal Interpretation determines how the input reading is converted into units of measurement, such as degrees Celsius. Depending on the type of input that you configured in the Hardware Input tab (Table 2), a number of options appear in the drop-down menu relevant to your input type. Table 4 provides descriptions of these options.

Table 4: Input Signal Interpretation Options

Option	Description
DISCONNECTED	The physical input is not used, and the network variable output for the input assumes the value you entered in the Default Value field.
LINEAR	A linear curve that interprets a voltage (0–10 V), current (4–20 mA), or resistance (0–10k ohm) input. The lowest input value (0 V, 4 mA, or 0k ohm) corresponds to the value entered in the Min. Value field. The highest input value (10 V, 20 mA, or 10k ohm) corresponds to the value entered in the Max. Value field. The VAV generates a linear interpolation curve based on these points.
TRANS_TABLE	A translation table is applied to the input. You can define your own curve to interpret the signal in the Transtable window.
DIGITAL	Two-state input: ON/OFF
STD_THERMISTOR	Predefined translation tables that apply to the standard type thermistors used within sensors.
SETPOINT_OFFSET	An offset input (±) that is applied to SCPTsetPnts. For example, if the cooling setpoint is 22°C (72°F) and the offset input is set to -2°C, then the effective cooling setpoint is 20°C (68°F). The unoccupied setpoints are not affected by this setpoint offset.

Signal Type

This parameter determines the input signal type of the connected sensor. Table 5 lists the supported signal types.

Table 5: Supported Signal Types

Signal Type	Description
RESISTANCE	Resistance input, usually 0–10k ohm
VOLTAGE_0_10V	Voltage input, 0–10 V
MILIAMPS_4_20MA	Current input, 4–20 mA (DC)

For linear and setpoint offset input signal interpretations, if the input value falls out of the expected input range, the input value is interpreted as the lower or upper value of the range.

For example, if the input is 3.5 mA, then it is rounded up to 4 mA, and if the input is 21 mA, it is not interpreted beyond 20 mA. Exceeding the upper limits for current and voltage limits damages the controller.

For current inputs (4–20 mA), any input below 3.5 mA causes an electrical fault.

For resistance inputs (0–10k ohm), disconnection causes an electrical fault.

Get Value

The Get Value option functions only if the device is configured, online, and attached. Once the input is fully configured, you can use this option to retrieve the current sensor value from the network.

Offset

The offset is a constant value that is applied to the sensor input reading to compensate for reading errors, such as to perform sensor calibration.

For example, assume that a temperature sensor is connected to one of the hardware inputs of the VAV. If the actual room temperature is 22°C (72°F), but the sensor reading is 24°C (75°F), an offset of -2°C is applied to correct the error.

Min. Value/Max. Value

The Min. Value and Max. Value set up a correlation between the raw input reading and the interpreted results.

For example, with a linear Input Signal Interpretation, if a resistance input (0–10k ohm) is configured with a Min. Value of 20°C (68°F) and a Max. Value of 24°C (75°F), then 0k ohm corresponds to 20°C (68°F) and 10k ohm corresponds to 24°C (75°F).

ON Value

The ON Value is the network variable output value when the input is ON.

If the network variable output is Standard Network Variable Type (SNVT) SNVT_switch, it has the format: [value state].

For example, if you want the network variable output's value to be 50 when the input is high, enter 50.0 1 into this field.

OFF Value

The OFF Value is network variable output's value when the input is OFF.

If the network variable is type SNVT_switch, it has the format: [value state].

For example, if you want the network variable output's value to be 0 when the input is low, enter 0.0 0 into this field.

Reverse

The input is normally ON when the contact is closed and OFF when it is open. When you choose the Reverse option, the input is ON when the contact is open, and OFF when it is closed.

Thermistor Type

This parameter determines the thermistor type being used.

TransTable

This parameter opens the Transtable window.

Change Network Variable Type

The Change Network Variable type window (Figure 4) is used when you need to modify the variable type before creating a binding. See Table 6 for a description of the fields found in this window.

Note: It is important to change the Network Variable (NV) type **before** configuring the input.

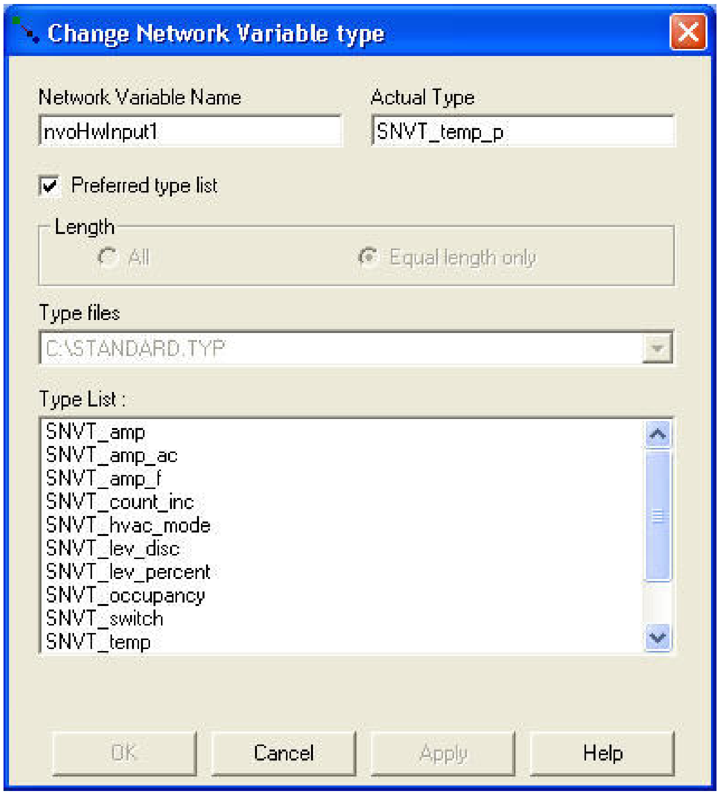

Figure 4: Change Network Variable Type Window

Table 6: Change Network Variable Type Fields

Field	Description
Network Variable Name	Name of the network variable you are configuring (Read-Only).
Actual Type	The current network variable type. The Actual Type field updates when you change the type and click Apply.
Preferred type list	The preferred type list for the network variable. The preferred type varies based on the type of input. This option is selected by default.
Length	List network variable types that have the same length as the Actual Type. Select All to list all network variable types that do not exceed the maximum network variable length.
Type files	A list of all available type files from the device resource file catalog (standard and manufacturer defined.) The Type List changes based on the .TYP file you select.
Type List	A list of types within the selected file that are of the appropriate length.

Translation Table Configuration

The translation table consists of 16 rows that define a curve that converts the raw input value (mA, V, ohm) into the appropriate units of measurement (for example, ºC). The VAV interpolates the curve based on the values you entered. It is not necessary to fill out all of the rows because the VAV automatically generates a linear curve between each pair of points and interpolates/extrapolates as required.

Figure 5 shows the Transtable Window. The column heading Input Value on the left is the raw hardware input reading. The data in this column must be listed in ascending order. In Figure 5, the Input Value column measurement units are ohm. The second column is the translated input, which has a heading of the units you selected for the converted values. In Figure 5, the measurement units are degrees Celsius.

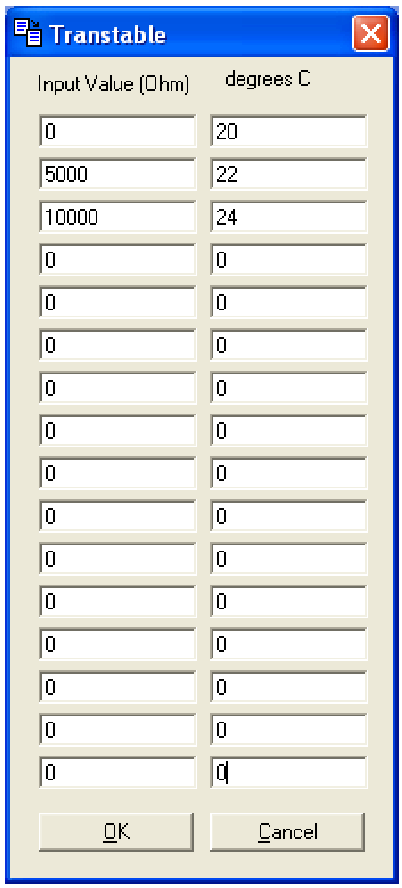

Figure 5: Transtable (Resistance to Temperature Translation)

Sensor Input Configuration (LN-VSTAT Sensor)

The LN-VSTAT sensor and Wireless tab allows you to configure the LN-VSTAT sensor options and Wireless Inputs of the VAV. You can use the Smart Sensor and Wireless fields to toggle between the LN-VSTAT sensor and wireless configuration screens.

Note: You cannot use an LN-VSTAT sensor and wireless input simultaneously. If you connect a LN-VSTAT sensor to a wireless VAV model, the wireless function is disabled until the LN-VSTAT sensor is disconnected. The LN-VSTAT sensor can be temporarily connected to wireless models to perform VAV balancing.

LN-VSTAT Sensor Configuration

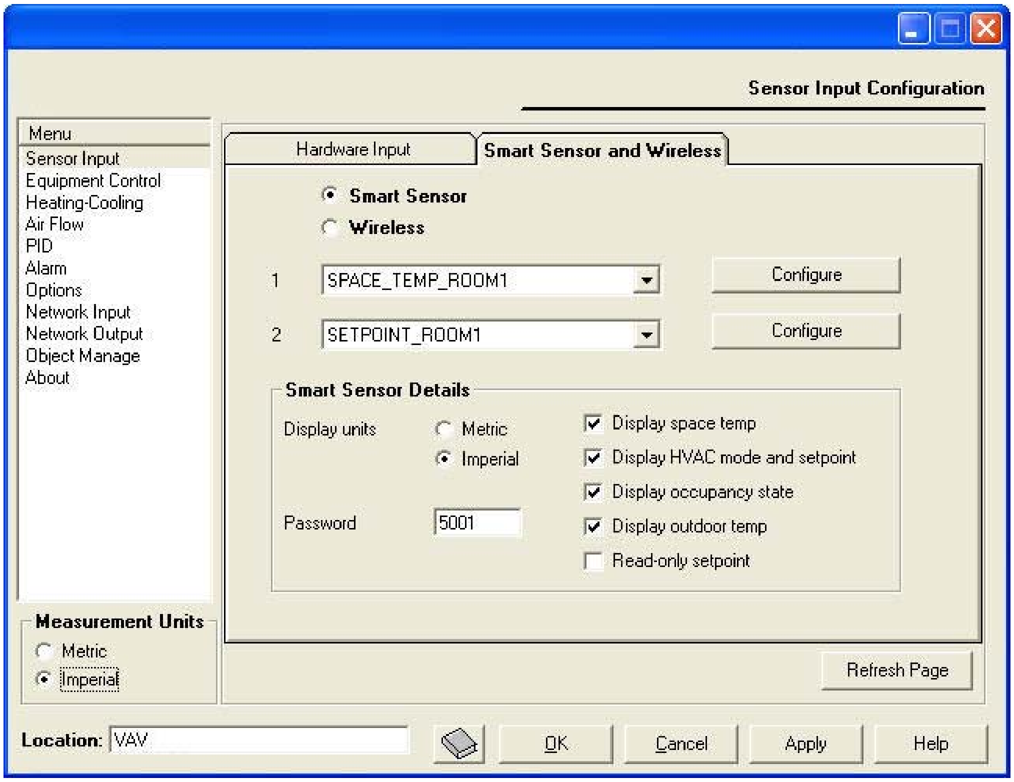

Figure 6: Sensor Input Configuration (LN-VSTAT Sensor)

Input Type

The input type drop-down menus allow you to specify the type of LN-VSTAT sensor used as a sensor input. By clicking Configure, you can specify the type of input signal. Table 7 and Table 8 provide descriptions of the options available in the window.

Table 7: Sensor Input Types and Description (Part 1 of 2)

Input	Description
UNUSED	This input is not used.
SPACE_TEMP_ROOM1	Specifies a temperature sensor input for room 1. **Note:** If you use nviSpaceTemp, it overrides this LN-VSTAT sensor space temperature input.
SETPOINT_ROOM1	Specifies a midpoint setpoint input (see *Midpoint/Midrange Setpoint Definition* section) for room 1. **Note:** If you use nviSetpoint, it overrides this physical setpoint input.
SETPOINT_OFFSET_ROOM1	Specifies a setpoint offset input for room 1. **Note:** If you use nviSetptOffset, it overrides this physical setpoint offset input.

Table 7: Sensor Input Types and Description (Part 2 of 2)

Input	Description
SPACE_TEMP_ROOM2	Specifies a temperature sensor input for room 2. **Note:** If you use nviSpaceTemp, it overrides this physical space temperature input.
SETPOINT_ROOM2	Specifies a midpoint setpoint input (see *Midpoint/Midrange Setpoint Definition* section) for room 2. **Note:** If you use nviSetpoint, it overrides this physical setpoint input.
SETPOINT_OFFSET_ROOM2	Specifies a setpoint offset input for room 2. **Note:** If you use nviSetptOffset, it overrides this LN-VSTAT setpoint offset input.

Table 8: LN-VSTAT Sensor Details

Field	Description
Display units	Toggles between Metric and Imperial units.
Password	Specifies the password for the password-protected configuration mode of the LN-VSTAT sensor.
Display space temp	Specifies if the space temperature is displayed.
Display HVAC mode and setpoint	Specifies if the HVAC mode and setpoint are displayed.
Display occupancy state	Specifies if the occupancy state is displayed.
Display outdoor temp	Specifies if the outdoor temperature is displayed. The temperature can only be displayed if the VAV's nviOutdoorTemp input is fed an outdoor temperature from another controller, such as a Rooftop Unit (RTU).
Read-only setpoint	Specifies if the setpoint is read-only or adjustable by room occupants.
Configure	Launches the LN-VSTAT Sensor Configuration window.

LN-VSTAT Point Configuration

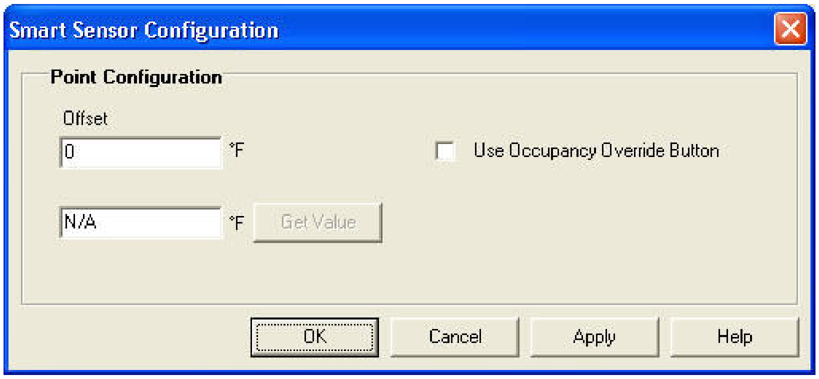

Figure 7: LN-VSTAT Point Configuration

The point configuration options vary depending on the LN-VSTAT sensor input you chose in the LN-VSTAT Sensor tab. Table 9 provides a description of the options found in the window.

Table 9: Point Configuration Field Descriptions

Field	Description
Minimum	This option is only available if you select a setpoint offset input in the LN-VSTAT Sensor tab. This field specifies the value of the minimum setpoint offset. When the potentiometer dial is rotated to the minimum position, the midpoint setpoint is set to the value in this field.
Maximum	This option is only available if you select a setpoint offset input in the LN-VSTAT Sensor tab. This field specifies the value of the maximum setpoint offset. When the potentiometer dial is rotated to the maximum position, the midpoint setpoint is set to the value in this field.
Offset	This option is only available if you select a temperature input in the LN-VSTAT Sensor tab. The offset is a constant value that is applied to the sensor input reading to compensate for reading errors, such as to perform sensor calibration. For example, assume that a LN-VSTAT sensor temperature sensor is used with a wireless VAV. If the actual room temperature is 22°C (72°F), but the sensor reading is 24°C (75°F), you can apply an offset of -2°C to correct the error.
Get Value	This option functions only if the device is configured, online, and attached. Once the input is fully configured, you can use this option to retrieve the current sensor value from the network.
Use Occupancy Override Button	This option is only available if you select a space temperature input in the LN-VSTAT Sensor tab. Selecting this box enables the occupancy override button on sensors that have an override button. If the override button is pressed while in OC_UNOCCUPIED or OC_STANDBY mode, nvoOccState is set to OC_BYPASS.

Equipment Control Configuration

The Equipment Control Configuration window (Figure 8) allows you to configure the VAV to control up to 8 pieces of equipment. The controlled equipment can be attached to a local hardware output or it can be controlled via a network variable output (that is, it is connected to the hardware outputs of some other device, but it is controlled by the VAV). See Table 10 for a description of Equipment Types available on this window.

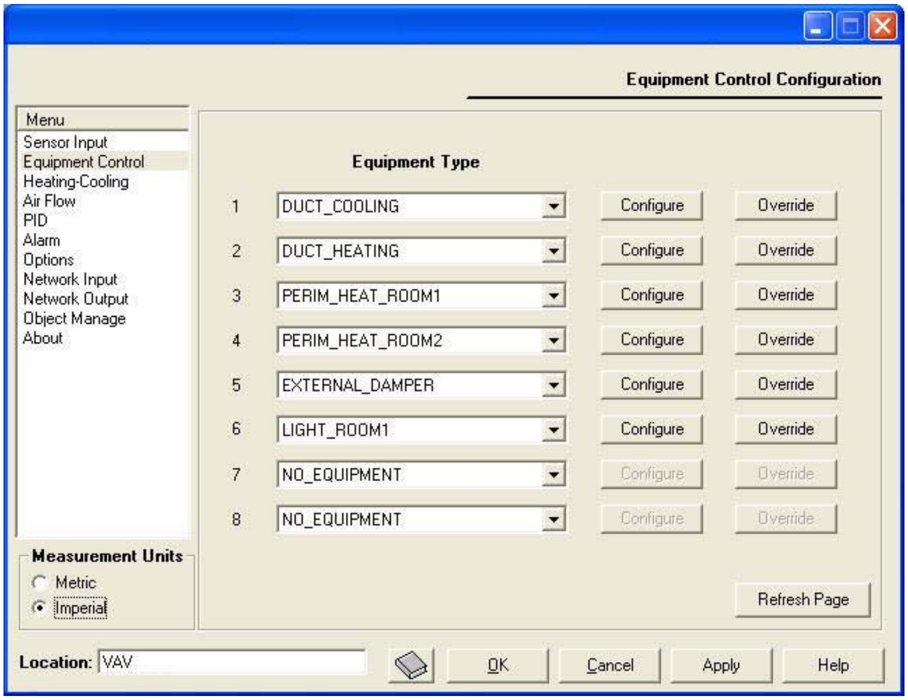

Figure 8: Equipment Control Configuration

Table 10: Equipment Type Description (Part 1 of 2)

Type	Description
NO_EQUIPMENT	Specifies no equipment is available to control.
DUCT_HEATING	Specifies that a duct heater is under control.
DUCT_COOLING	Specifies that a duct cooler is under control.
DUCT_HEAT_COOL	Specifies that a duct heating/cooling coil is under control. The same coil carries hot or cold water depending on the demand.
PERIM_HEAT_ROOM1	Specifies perimeter heating equipment (for example, base board) for room 1.
PERIM_HEAT_ROOM2	Specifies perimeter heating equipment for room 2 when the VAV is used for 2-room control.
HEATER_FAN	Specifies specify a fan that is associated with an electric heater or chiller. The fan turns on only when the heater or chiller is active.
CONSTANT_FAN	Specifies a fan that is always on in occupied mode or bypass mode if heating or cooling is active. In unoccupied mode, the fan only turns on when the heater or chiller is active.
EXTERNAL_DAMPER	Specifies that an external damper is attached to the VAV. If an external damper is used with a controller that has a built-in actuator, then the built-in actuator is disabled.

Table 10: Equipment Type Description (Part 2 of 2)

Type	Description
LIGHT_ROOM1	Specifies lighting control for room 1. The physical output corresponding to the control output can drive a 24 V AC relay (digital output) or a 10 V DC relay (analog output).
LIGHT_ROOM2	Specifies lighting control for room 2. The physical output corresponding to the control output can drive a 24 V AC relay (digital output) or a 10 V DC relay (analog output).
OCCUPIED_STATE	If the VAV is in occupied or bypass mode, the output is ON. If the VAV is in standby or unoccupied mode, the output is OFF. Controlled equipment usually shows the occupancy state on a Light-Emitting Diode (LED), such as a wall sensor.
Configure	Click this option to launch the Control Properties window for the associated equipment type.
Override	Click this option to launch the Override window for the associated equipment type.

Control Properties

The Control Properties window (Figure 9) opens automatically when you specify an equipment type using one of the drop-down menus in the Equipment Control Configuration window.

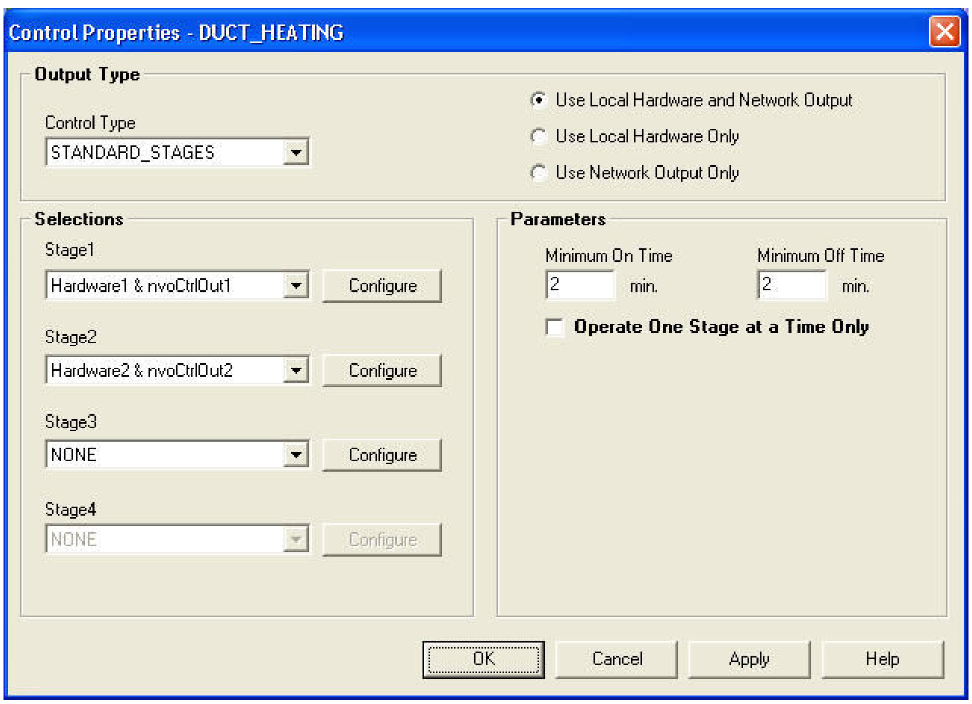

Figure 9: Control Properties Window

The options in the Control Properties window vary depending on the Control Type. The following tables list all possible options that can appear in the Control Type drop-down menu (Table 11), and Output Type (Table 12), Selections (Table 13), and Parameters (Table 14) sections of the Control Properties window.

Table 11: Control Type Drop-Down Menu Options

Option	Description
ON_OFF	Controls a single physical state. The output is binary and can either be ON or OFF.
STANDARD_STAGES	Controls one or more stages. Each stage can either be ON or OFF. For example, as the demand for heating increases, additional heating stages are turned ON in a sequential manner. The first stage turns on, followed by the second stage, and so on as heating demand increases. If you select the STANDARD_STAGES option but only configure a single stage, it is equivalent to having selected ON_OFF from the Control Type drop-down menu.
STANDARD_MODULATION	Used with a single stage only. The stage turns on once the load reaches the value specified in the Minimum Percent field. The stage output rises from this minimum percentage, up to 100% and then remains at 100% for as long as is needed. When the load falls, the stage modulates down from 100 to 0%. For example, Figure 10 shows the reaction of an output controlled by standard modulation and has a Minimum Percent set to 20%. Even though the output remains off until the demand rises to 20%, in the opposite case, it does not immediately turn off when the demand falls to 20%.
FLOATING_ACTUATOR	Controls the floating actuator with 2 digital inputs, such as open and close. The controller calculates the time needed for the actuator motor to reach the correct position. For example, assume that it takes 90 seconds for the actuator to go from fully closed to fully open, then a 25% demand means that the actuator opens for 25% x 90 s = 22.5 s. If the actuator is already at 15% and the demand is 25%, the controller calculates that it must move for (25%-15%)*90 = 9 s. A floating actuator requires 2 digital outputs: one to send the close signal to the actuator and another to send the open signal.

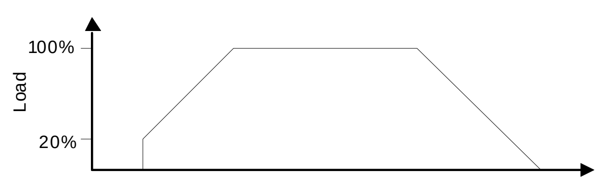

Figure 10: Standard Modulation

Table 12: Output Type (Radio Buttons) Descriptions

Option	Description
Use Local Hardware and Network Output	Select this option when the controlled equipment is connected to a local analog or digital output of the controller. The network output is simultaneously used for binding or monitoring purposes.
Use Local Hardware Only	Select this option when the controlled equipment is connected to a local analog or digital output of the controller.
Use Network Output Only	Select this option when the controlled equipment is connected to the physical output of some other controller on the network. The physical outputs of the remote controller are bound to an nvoCtrlOut of the VAV/VVT controller being configured.

Table 13: Selections

Field	Description
Selection Drop Down Menu	The Control Properties window features 4 drop-down menus that specify the hardware output and/or nvoCtrlOut used to control the equipment. Clicking Configure next to a drop-down menu opens the Output Configuration window. The name of each drop-down menu varies depending on the Control Type for the equipment.

Table 14: Parameters[1]

Field	Description
Minimum On Time	Defines the minimum time period during which a stage remains ON. The Minimum On Time applies to all of the stages. This option is available when you select the ON_OFF or STANDARD_STAGES control types.
Minimum Off Time	Defines the minimum time period during which a stage remains OFF. The Minimum Off Time period applies to all of the stages. This option is available when you select the ON_OFF or STANDARD_STAGES control types.
Minimum Percent	Defines the minimum load/demand that must be met before the output turns ON. This option is available when you select the FLOATING_ACTUATOR or STANDARD_MODULATION control types.
Minimum Pulse On	Defines the minimum amount of time for which the actuator can move. This option is available when you select the FLOATING_ACTUATOR control type.
Minimum Pulse Off	Defines the minimum amount of time during which the actuator cannot move. This option is available when you select the FLOATING_ACTUATOR control type.
Drive Time	Defines the amount of time it takes for the actuator to move from fully closed to fully open, or vice versa. This option is available when you select the FLOATING_ACTUATOR control type.
Operate One Stage at a Time Only	Permits only 1 stage to be active at a time. This option is not commonly used in heating or cooling applications. This option is available when you select the STANDARD_STAGES control type.

1. The available parameter options vary depending on the Control Type selected.

Output Configuration

The Output Configuration window (Figure 11) opens when you click any of the Configure buttons located next to the drop-down menus in the Control Properties window.

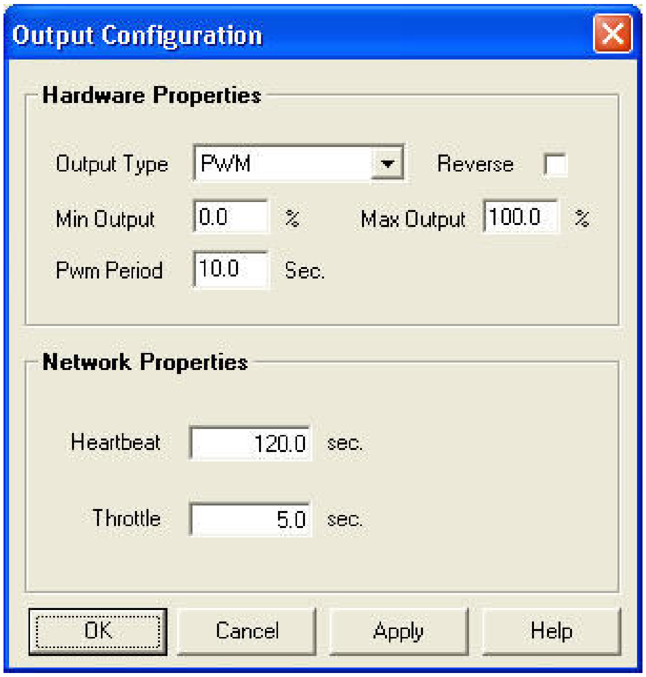

Figure 11: Output Configuration

Note: If you are using the Local Hardware Only option in the Control Properties window, only the Hardware Properties options are shown in the Output Configuration window. Similarly, if you select Use Network Output Only option, only the Network Properties options are shown in the window.

Hardware Properties

The options that you see under Hardware Properties vary depending on the Control Type and the Output Type.

Table 15: Hardware Properties Descriptions

Field	Description
Output Type	Shows output type: for hardware outputs DO1 to DO4, the drop-down menu only shows DIGITAL or PWM. Outputs AO1 and AO2 are universal outputs that can be configured to be DIGITAL, ANALOG_0_10V, or PWM.
Reverse	Inverts the output. This option is useful when using equipment that uses negative logic.
Min Output	Displays the minimum output allowed for PWM and Analog outputs.
Max Output	Displays the maximum output allowed for PWM and Analog outputs. **Note:** The output is rescaled between these Min and Max Outputs.
PWM Period	Specifies the PWM period. Lowering the default value results in a faster response and provides a more stable temperature when using perimeter heating. However, you must ensure that the PWM period is not too low (fast) for your equipment. **Note:** The period must be between 2–900 s.

Network Properties

Table 16: Network Properties Parameters

Field	Description
Heartbeat	The maximum time period between automatic transmissions of the network variable on the network (regardless of if the variable's value has changed). Setting Heartbeat to 0 disables it. **Note:** Heartbeat is also referred to as the Maximum Send Time.
Throttle	The minimum time period that must pass before the network variable value is sent over the network (even if the network variable has changed value). Setting Throttle to 0 disables it. **Note:** Throttle is also referred to as Minimum Send Time.

Override

Clicking Override in the Equipment Control Configuration window launches the Override menu Figure 12). Each piece of equipment controlled by the VAV has its own override settings.

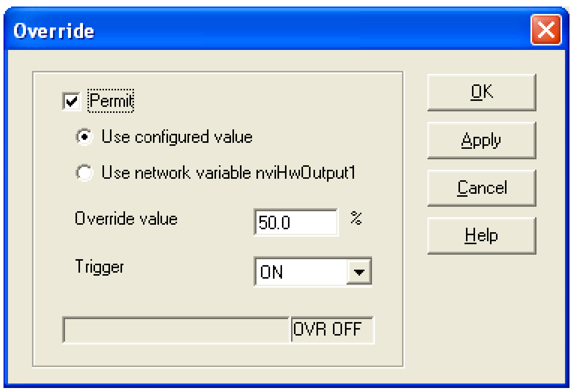

Figure 12: Override Menu

The options available vary depending on the Control Type that was specified in the Control Properties window. The following text provides descriptions of the Override menu options.

Permit

Selecting this box enables the override output value sent to the equipment when the VAV object is overridden.

Use configured value

Selecting this option forces the specified Configuration Property (CP) to store the override value.

This override is active when you override the VAV object in the Equipment Control Configuration window.

Use network variable nviHWOutputx

Selecting this option forces the specified network variable to store the override value.

You cannot select this option when you have selected the Use Network Output Only option in the Control Properties window.

Note: For nviHWOutput*x*, *x* ranges from 1–6 depending upon the output you selected.

Override value

The output value that is sent to the equipment when the VAV object is overridden.

Stages

The Stages drop-down menu is available only if you selected STANDARD_STAGES from the Control Type drop-down menu in the Control Properties window. The options in this drop-down menu depend upon the number of stages you have configured. See Table 17 for stage options.

OVR

If the VAV object is overridden, the text box displays OVR ON. If the VAV object is not overridden, the text box displays OVR OFF.

Table 17: Stage Options

Option	Description
ALL OFF	All stages are turned OFF when the VAV object is overridden.
ONLY 1 ON	Only stage 1 is turned ON when the VAV object is overridden.
1 to 2 ON	Stages 1 and 2 are turned ON when the VAV object is overridden.
1 to 3 ON	Stages 1 to 3 are turned ON when the VAV object is overridden.
1 to 4 ON	Stages 1 to 4 are turned ON when the VAV object is overridden.

Equipment Control Configuration Example

A number of configuration steps must be completed to control equipment using the VAV controller. This section provides a brief overview of the configuration process by outlining the steps required to configure local 2-stage duct heating, perimeter heating (controlled with a floating valve), and networked lighting. A detailed explanation of all drop-down menu items, sub-windows, and options is provided in subsequent sections of this document.

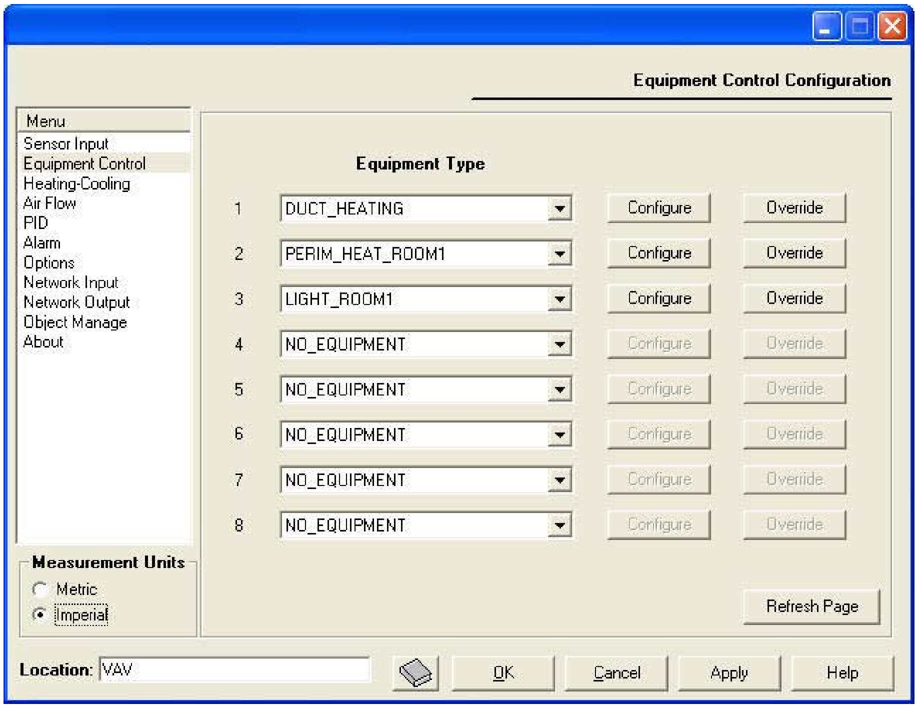

Figure 13: Equipment Control Configuration Example

Example Assumptions/Requirements

- The first heating stage (a standard ON/OFF stage) is connected to digital output 1 of the VAV.
- The second heating stage is connected to digital output 2 of the VAV.
- The heating stages are off for at least 5 minutes before they turn back on.
- The perimeter heating is controlled using a floating valve connected to digital outputs 3 and 4.
- If the VAV is in override, the heating demand is forced to 50% and the lighting is forced ON.
- The controlled lighting is not connected to any of the physical outputs of the VAV (that is, the lighting relay is connected to the output of some other controller on the network).

To configure the equipment to be controlled, perform the following actions:

1. Select DUCT_HEATING from the first Equipment Type drop-down menu. The Control Properties window opens (Figure 14).

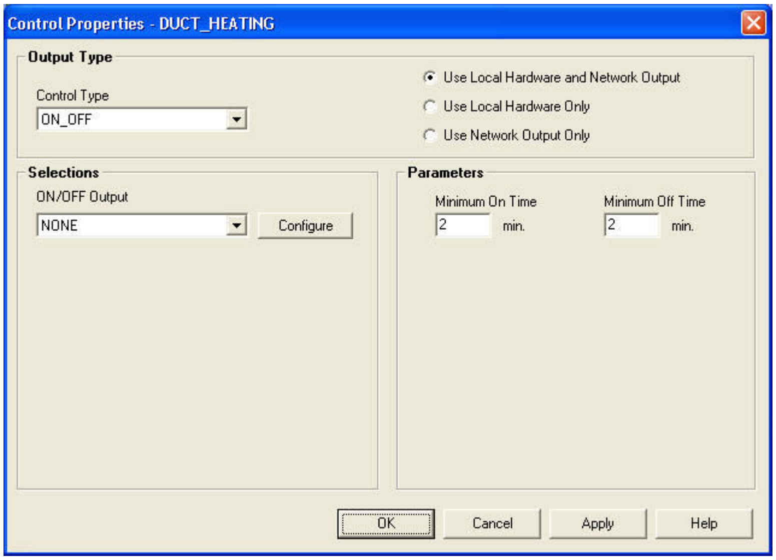

Figure 14: Control Properties Window, Example

2. Select STANDARD_STAGES from the Control Type drop-down menu. New options appear, and the options under Selections are updated to support multiple stages.
3. Select the Use Local Hardware Only radio button.
4. Select Hardware1 from the Stage1 drop-down menu. The Output Configuration window opens (Figure 15).

   Note: Hardware1 corresponds to the output labeled DO1 on the VAV.
5. Click OK to confirm the default Output Type DIGITAL setting.

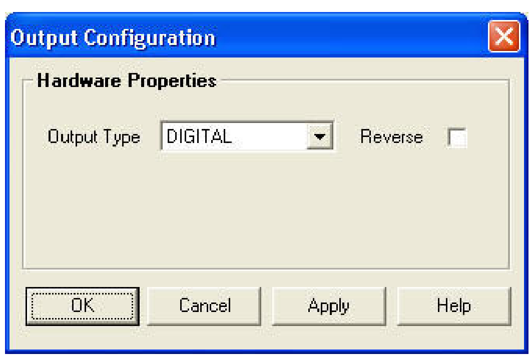

Figure 15: Duct Heating Output Configuration

6. Select Hardware2 from Stage2 drop-down menu. The Output Configuration window opens.

   Note: Hardware2 corresponds to the output labeled DO2 on the VAV.

7. Click OK to confirm the default Output Type DIGITAL setting.
8. Set the Minimum Off Time to 5 minutes to fulfill the requirements for this example (that is, the heating stages are off for at least 5 minutes before they turn back on).

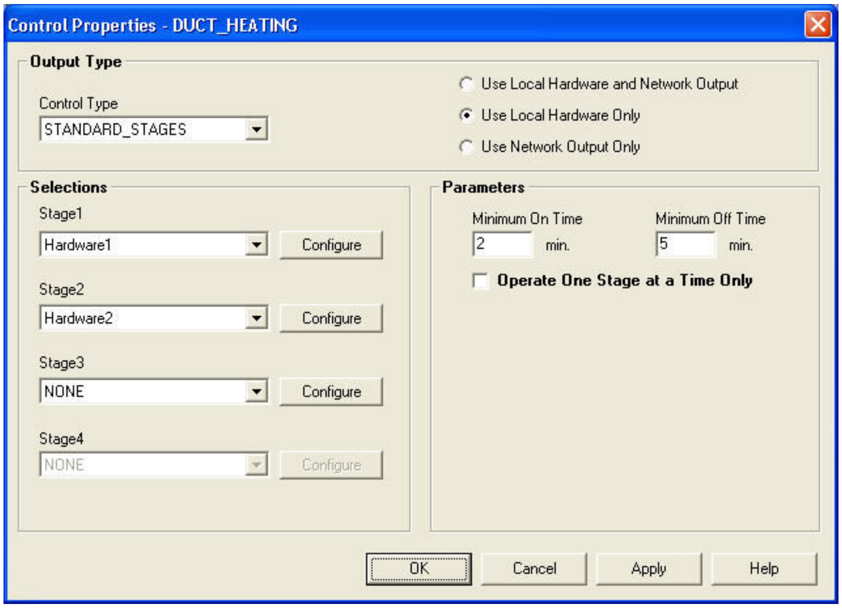

Figure 16: Control Properties, Duct Heating

9. Click OK to exit the Control Properties window.
10. Click the Override that corresponds to the duct heating you have configured to set up the override condition. The Override window opens (Figure 17).

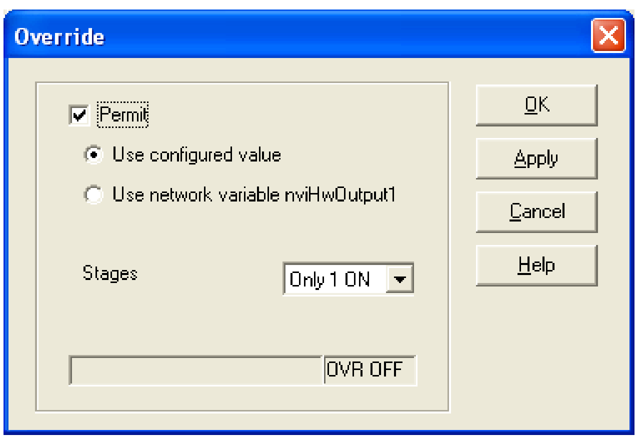

Figure 17: Override Window

11. Check the Permit option and in the Stages drop-down menu, select Only 1 ON. Forcing one of the 2 stages to be on when the override is active is equivalent to forcing a 50% demand.
12. Click OK to return to the Equipment Control Configuration window.

13. Select PERIM_HEAT_ROOM1 from the second Equipment Type drop-down menu. The Control Properties window opens (Figure 18).

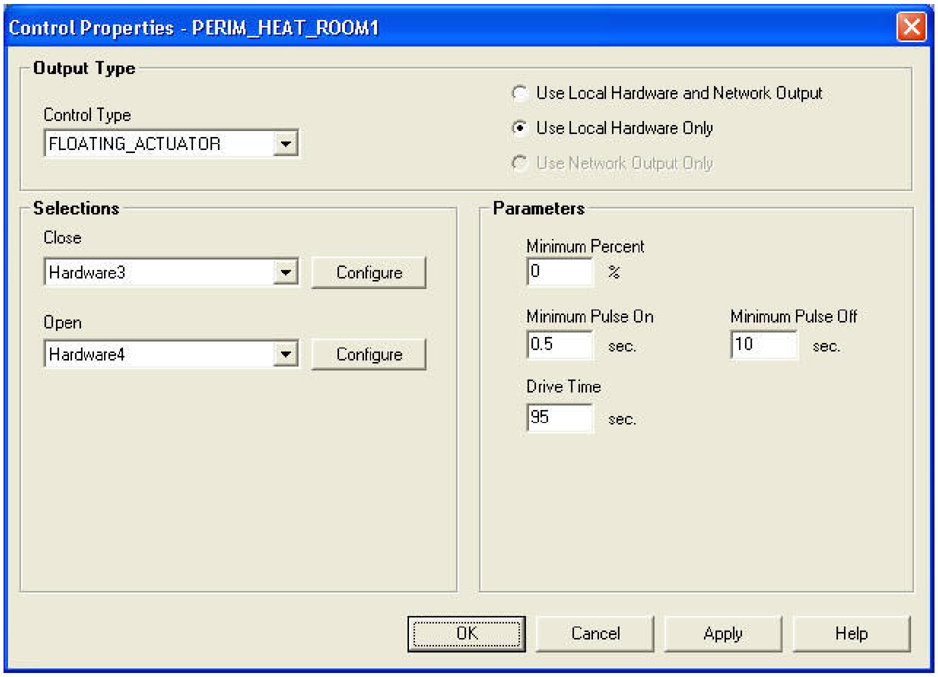

Figure 18: Control Properties Perimeter Heating

14. Select FLOATING_ACTUATOR from the Control Type drop-down menu. A number of new options appear.
15. Select the Use Local Hardware Only radio button.
16. Under Selections, set the Close output to Hardware3 and set the Open output to Hardware4. In the Output Configuration pop-up window for each output, set the Output Type to DIGITAL. Click OK to close each Output Configuration window. Click OK in the Control Properties window to save your changes and return to the Equipment Control Configuration window.

17. Select LIGHT_ROOM1 from the third Equipment Type drop-down menu. The Control Properties window opens (Figure 19).

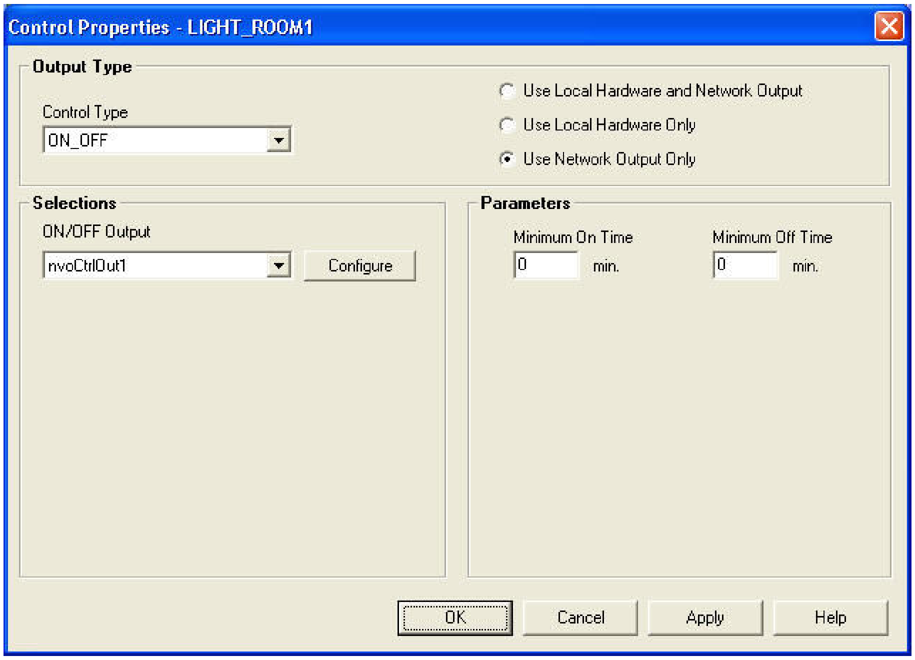

Figure 19: Control Properties Networked Lighting

18. The Control Type should already be set to ON_OFF. If not, select ON_OFF from the Control Type drop-down menu.
19. Select the Use Network Output Only radio button.
20. Select nvoCtrlOut1 from the ON/OFF Output drop-down menu. the Output Configuration window opens (Figure 20).

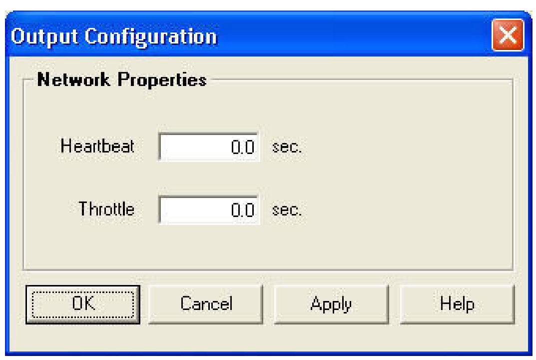

Figure 20: Network Output Configuration Window

21. Change the Heartbeat and Throttle to 0.0 seconds because lighting is event driven.
22. Click OK to return to the Control Properties window.
23. Set the Minimum On Time and Minimum Off Time to 0 minutes to ensure that lighting responds immediately when a light switch is toggled.

24. Click OK to return to the Equipment Control Configuration window.

This completes the equipment control configuration.

Heating-Cooling Configuration

The Heating-Cooling Configuration window allows you to specify the heating and cooling setpoints as well as the heating and cooling equipment order.

Heating and Cooling Options

Occupied/Bypass

This value is the approximate temperature maintained by the VAV when it is in Occupied and Bypass modes. This temperature should be comfortable to building occupants. The cooling and heating setpoints for Occupied and Bypass modes are stored in the occupied_cool and occupied_heat fields of nciSetPts, respectively.

Standby

This value is the approximate temperature maintained by the VAV when it is in Standby mode. In Standby mode, the space temperature is allowed a greater degree of variance than in Occupied mode. However, the space is still maintained at a temperature close enough to the occupied setpoints to ensure it is made ready for occupancy quickly. The cooling and heating setpoints for standby mode are stored in the standby_cool and standby_heat fields of nciSetPts, respectively.

Unoccupied

This value is the approximate temperature maintained by the VAV when it is in Unoccupied mode. In Unoccupied mode, the space temperature is allowed a greater degree of variance than in Occupied mode, thereby lowering operating costs. The cooling and heating setpoints for the Unoccupied mode are stored in the unoccupied_cool and unoccupied_heat fields of nciSetPts, respectively.

Heating Order

This field determines the order in which heating equipment connected to the VAV is turned on. The selected option is written to UCPTheatOrder. Available options for Heating Order include the following:

- **DUCT_HEAT_FIRST**: Duct heating activated first, perimeter heating activated second (according to demand.)
- **PERIM_HEAT_FIRST**: Perimeter heating activated first, duct heating activated second (according to demand).
- **SIMULTANEOUS**: Duct and perimeter heating are activated simultaneously.

General Options

Changeover Delay

Changeover Delay defines the minimum time that heating must be OFF before cooling can be turned ON, as well as the minimum time that cooling must be OFF before heating turns ON. This function prevents the system from continuously oscillating between heating and cooling modes. The value entered in this field is written to UCPTchngeOverDelay.

Enable Frost Protection

Enable Frost Protection protects your space from freezing when temperature control is off (that is, nviApplicMode is set to HVAC_OFF). If the space temperature falls below 6°C (43°F), heating equipment is turned on according to the settings in the Heating Order field. When the space temperature reaches 8°C (46°F), heating is turned off.

Heating Lockout Options

The Heating Lockout function ensures that the HVAC system is not heating the building more than necessary when the outdoor temperature exceeds certain temperature limits. Therefore, energy costs are reduced because heating is disabled when it is sufficiently warm outside.

Max Duct Enable Temp

When the outdoor temperature exceeds the value in this field, the duct heating is disabled. It is recommended that this value be set to approximately 20°C (68°F).

Max Perimeter Enable Temp

When the outdoor temperature exceeds the value in this field, the perimeter heating is disabled. It is recommended that this value be set approximately to 10°C (50°F) if your building has duct heating with supplemental perimeter heating.

If your building has areas that are primarily heated by perimeter heaters, you should set this value to 20°C (68°F) to ensure that those areas have sufficient heating.

Note: To effectively disable the heating lockout function, you should set both the Max Duct Enable Temp and Max Perimeter Enable Temp to high values, such as 40°C (104°F).

Air Flow Configuration

This Air Flow Configuration window (Figure 21) specifies the airflow settings, operation mode, damper parameters, and performs flow calibration (VAV balancing).

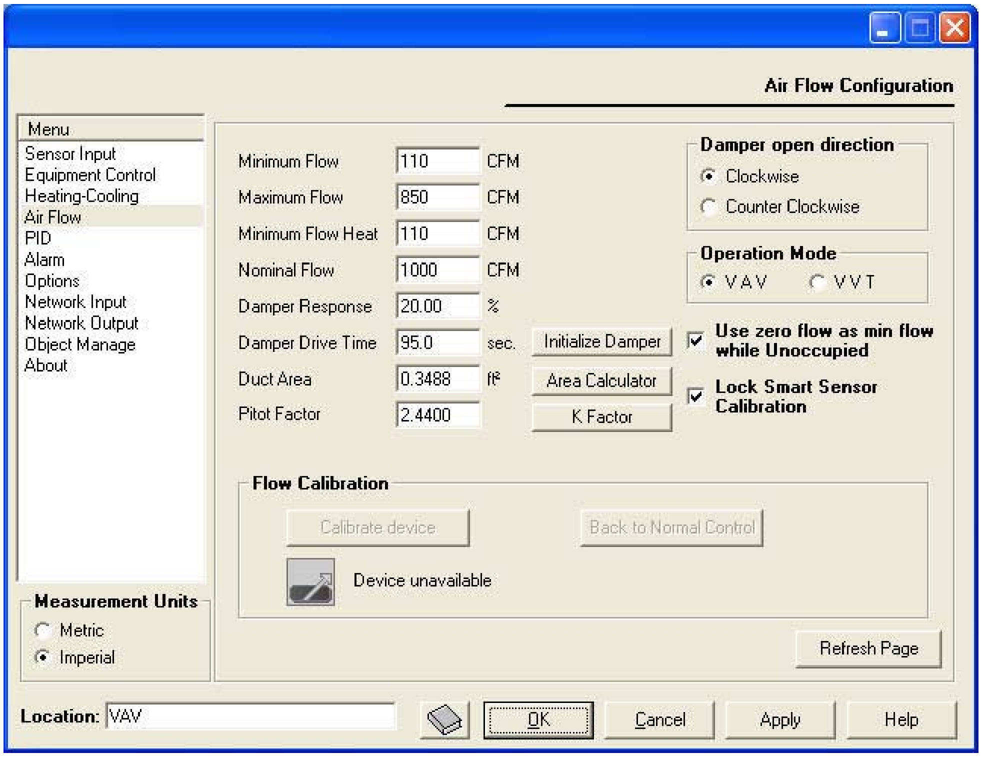

Figure 21: Air Flow Configuration

Air Flow Configuration Options

Minimum Flow

Minimum Flow is the minimum airflow maintained by the VAV box during normal operation. The flow setpoint falls below the Minimum Flow only if the **Use zero flow as min flow while Unoccupied** option is selected, or if the flow setpoint is overridden. Setting the Minimum Flow to zero means the damper can be fully closed, in which case no fresh air is supplied to the zone that the VAV controls.

The value entered in this field is written to SCPTminFlow.

Maximum Flow

Maximum Flow is the maximum allowable airflow. The flow setpoint never exceeds this value unless overridden.

The value entered in this field is written to SCPTmaxFlow.

Minimum Flow Heat

Unless overridden, Minimum Flow Heat is the minimum airflow maintained by the VAV when duct heating is turned ON.

The Minimum Flow Heat option is provided to allow a higher minimum airflow that is sometimes required for duct heaters. If this airflow value is not met, the duct heater does not turn ON.

The value entered in this field is written to SCPTminFlowHeat.

Nominal Flow

Nominal Flow is the expected airflow when the damper is fully open. The nominal flow is used during pre-calibration. It also determines the next damper movement. If you do not know the nominal flow, leave the value at zero.

The value entered in this field is written to SCPTnomAirFlow.

Damper Response

Damper Response is a multiplier (in %) applied to the calculated damper movement. For example, VAV determines that the damper should move for 30 seconds to achieve the desired setpoint; if the Damper Response is set to 20%, the damper moves for 20% x 30 s = 6 seconds. The controller then waits for 10 seconds to perform a new calculation that determines how much the damper should be moved again. This iterative process prevents the damper from overshooting and prevents hunting (oscillations). Minimizing hunting reduces wear on the damper actuator and minimizes irregular flow.

The value entered in this field is written to UCPTdamperResponse.

Damper Drive Time

Damper Drive Time specifies the time the damper takes to move from the fully closed position to the fully open position, or vice versa. This option is used for built-in actuators only.

The damper drive time can be set to 45 to 150 seconds; however, it is recommended to use the default value of 95 seconds.

The value entered in this field is written to UCPTdamperDriveTime.

Duct Area

This value performs a pre-calibration of the VAV box, without using a reference instrument.

The value entered in this field is written to SCPTductArea.

Pitot Factor

Most VAV box / Pitot tube manufacturers create their Pitot tubes so it amplifies the differential pressure by a certain factor. Contact them to acquire the value of this factor if they have not provided it to you.

The Pitot factor is therefore a divider applied to the differential pressure reading that compensates for varying characteristics and flow effects in VAV box equipment and pickup probes (that is, the amplification factor). Enter the Pitot Factor along with the Duct Area to ensure precise pre-calibration.

The value entered in this field is written to SCPTGainVAV.

Initialize Damper

Initialize Damper resets the damper position and calculates the total number of steps between the stops.

Use this option if the mechanical stops on the actuator have been moved to limit the range of movement of the damper.

Note: The actuator mechanical stops should not be moved when you are using a VAV system.

Area Calculator

Area Calculator launches the Duct Area Calculator Window.

K Factor

K Factor launches the K Factor Calculator window. If your VAV box / Pitot tube manufacturer has only provided you with a K Factor, you can use the K Factor Calculator window to calculate the Pitot Factor.

Damper open direction

Damper open direction specifies the direction Clockwise (CW) or Counterclockwise (CCW) in which the actuator rotates to open the damper.

A binary value representing the damper direction is written to the DamperCCW field of UCPTvavOptions.

Operation Mode

Operation Mode specifies whether you are using a VAV or VVT controller. This option can also can force a VAV to operate in VVT mode.

A binary value representing the operation mode is written to the VVTmode field of UCPTvavOptions.

Note: In VVT mode, the settings for Minimum Flow, Minimum Flow Heat, Maximum Flow, and Nominal Flow are required to determine the damper position limits and perform proper control.

Use zero flow as min flow while unoccupied

Selecting this option closes the damper completely during unoccupied periods, as long as no heating or cooling demand exists.

This option is used so that when the building is unoccupied or in standby mode, if an override is initiated in a certain zone, the air flows only to that specific zone and not to other areas.

A binary value representing if this option is checked is written to the UnoccZeroFlowSp field of UCPTvavOptions.

Note: Only use this option if you are sure that the building ducts have been designed to accommodate the high static pressure that occurs if all the VAVs, except one (the one in the overridden zone), are closed.

Lock LN-VSTAT sensor Calibration

When this option is selected, you cannot calibrate the VAV using the LN-VSTAT sensor. If you have already calibrated the VAV using the window, you can select this option to prevent anyone from mistakenly recalibrating the device using the LN-VSTAT sensor.

Flow Calibration Options

Calibrate Device

Calibrate Device launches the Flow Calibration window.

Back to Normal Control

This option terminates calibration mode and returns the VAV to normal operation. Calibration mode activates when the Flow Calibration window is opened, and automatically ends when the VAV configuration window is closed. While the controller is in calibration mode, it does not respond to control demands. You cannot calibrate the VAV using the LN-VSTAT sensor unless you click Back to Normal Control or close the configuration window.

Duct Area Calculator

The Duct Area Calculator window (Figure 22) allows you to determine the duct area. The duct area is used only when you perform a pre-calibration of a VAV box without using a reference instrument. See Table 18 for the parameters associated with this window.

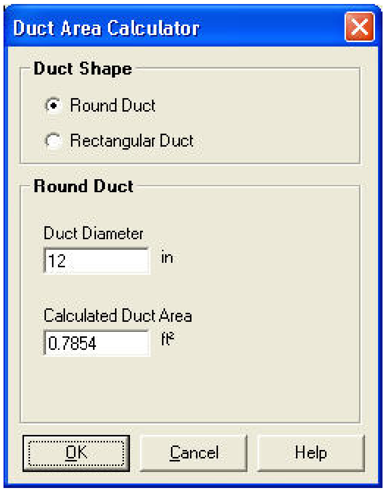

Figure 22: Duct Area Calculator

Table 18: Duct Area Calculator Parameters

Field	Description
Duct Shape	Specify whether the duct is Round or Rectangular. Depending on the type of duct that is selected, the window allows you to enter information for a Round Duct or a Rectangular Duct.
Round Duct	When you enter the Duct Diameter, the Calculated Duct Area field updates automatically.
Rectangular Duct	When you enter the Duct Width and Duct Height, the Calculated Duct Area field updates automatically.
Calculated Duct Area	The result of area calculation.

K Factor Calculator

The K Factor is an alternative to the Pitot correction factor that is commonly used in VAV applications. Correction factors compensate for varying characteristics and flow effects in VAV box equipment and pickup probes. The K Factor Calculator window (Figure 23) calculates the corresponding Pitot amplification factor used by the VAV if you perform a pre-calibration. See Table 19 for K Factor Calculator Parameters.

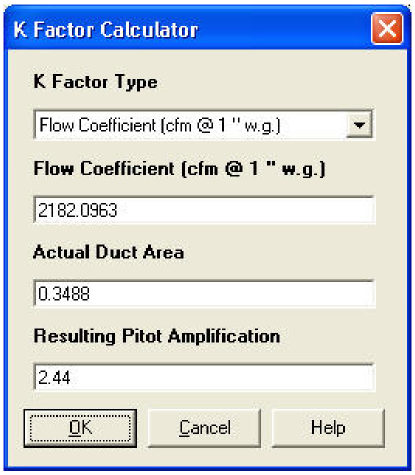

Figure 23: K Factor Calculator

Table 19: K Factor Calculator Parameters

Field	Description
K Factor Type	The manufacturer of your VAV box or Pitot tubes can specify the K factor in one of two ways: as a Flow Coefficient or a Velocity Coefficient. Select the type of K Factor you are entering.
Flow Coefficient	Specifies the flow coefficient value that has been provided by the equipment manufacturer.
Velocity Coefficient	Specifies the velocity coefficient value that has been provided by the equipment manufacturer.
Actual Duct Area	Corresponds to the Duct Area entered in the Air Flow Configuration window, read-only
Resulting Pitot Amplification	The Pitot factor that corresponds to the specified coefficient and duct area.

Note: Refer to the *Air Physics* section for a detailed description of how airflow calculations are performed.

Flow Calibration

Figure 24 shows the Flow Calibration window.

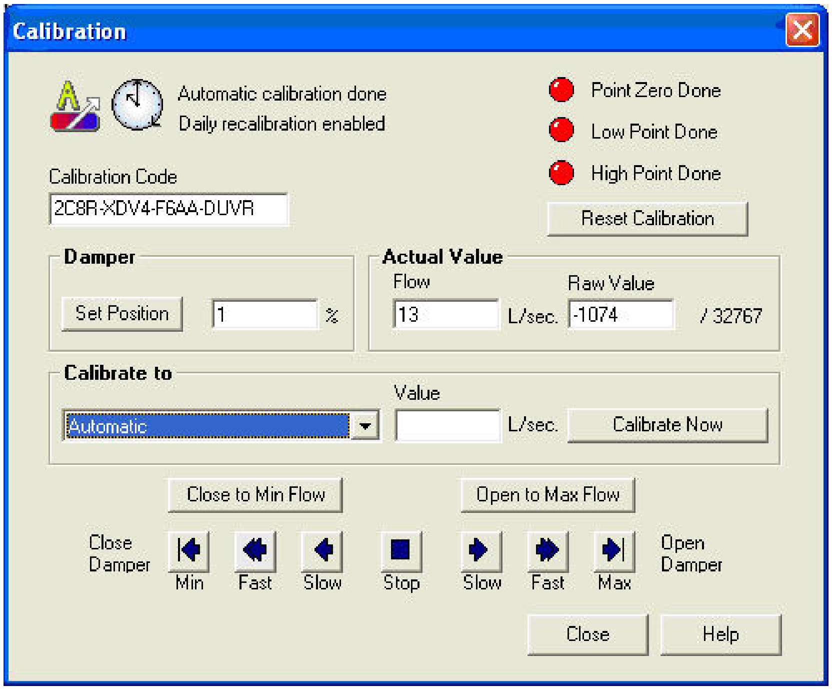

Figure 24: Flow Calibration Window

Flow Calibration Options

General Options

Reset Calibration

Resets the calibration code and flow readings. This button allows you to perform a recalibration by returning the VAV to the uncalibrated state.

Calibration Code

A code that corresponds to the current calibration of the VAV. The calibration code is generated once you have calibrated at least one point.

The value entered in this field is written to nviCalibCode.

Once air balancing has been completed, the calibration code of each VAV should be stored for safety, in case the calibration is lost. The proper VAV calibration can then be restored by entering the correct calibration code that you recorded into this field. You must press the Enter key after entering the calibration code to upload it to the device.

Note: The calibration code is unique to each VAV and cannot be copied to another VAV.

Close to Min Flow

Only use this button if the VAV is already calibrated. When you press this button, the VAV automatically maintains the Minimum Flow that was specified in the window by adjusting the damper position. The VAV dynamically compensates for changes in air pressure to ensure that the minimum airflow is maintained.

The VAV continues to maintain the minimum airflow until the **Back to Normal Control** button is pressed in the Air Flow Configuration window, you exit the VAV Device Configuration window, or perform another balancing command.

Open to Max Flow

Only use this button if the VAV is already calibrated. When you press this button, the VAV automatically maintains the Maximum Flow that was specified in the Air Flow Configuration window by adjusting the damper position. The VAV dynamically compensates for changes in air pressure to ensure that the maximum flow is maintained.

The VAV continues to maintain the maximum airflow until the Back to Normal Control button is pressed in the Air Flow Configuration window, you exit the Configuration window, or perform another balancing command.

Damper Control Buttons

Table 20 provides a description of the Damper Control Buttons.

Table 20: Damper Control Buttons

Button	Description
Min	Clicking this button once drives the damper towards the closed position, until the mechanical stop is reached or the Stop button is clicked.
Fast	Moves the damper in the desired direction, at high speed, until the button is released. At this speed, the damper takes 45 s to complete a full sweep between the stops.
Slow	Moves the damper in the desired direction, at low speed, until the button is released. At this speed, the damper takes 150 s to complete a full sweep between the stops.
Stop	Interrupts the damper movement if you have pressed the Close to Min Flow, Open to Max Flow, Min, or Max buttons.
Max	Clicking this button once drives the damper towards the open position, until the mechanical stop is reached, or the Stop button is clicked. **Note:** If you are using an external non-Halamo motor, damper movement has only a single speed. The value you entered in the Damper Drive Time field of the Air Flow Configuration window determines the speed.

Damper

Set Position

Moves the damper to the position specified in the **%** field.

%

The percentage applied to the damper position. Value is between 0% (fully closed) and 100% (fully open).

Actual Value

Flow

The real-time airflow supplied to the zone. The flow reading is available only if the VAV has been calibrated. The flow value is read from nvoAirFlow.

Raw Value

The raw value corresponding to the current differential pressure, as read by the 16-bit A/D converter.

Calibrate to

Calibrate to

Table 21 provides a description of the selections found in the Calibrate to drop-down menu.

Table 21: Calibrate to Drop-Down Menu Selections

Selection	Description
Minimum	Select this option to calibrate to the Minimum Flow you specified in the Air Flow Configuration window. When you select this option, the Value field automatically fills in. Manually adjust the damper position until your flow hood (capture hood) reading shows the precise minimum flow value, then click Calibrate Now.
Maximum	Select this option to calibrate to the Maximum Flow you specified in the Air Flow Configuration window. When you select this option, the Value field automatically fills in. Manually adjust the damper position until your flow hood reading shows the precise maximum flow value, then click Calibrate Now.
Nominal	Select this option to calibrate to the Nominal Flow you specified in the Air Flow Configuration window. When you select this option, the Value field automatically fills in. Manually adjust the damper position until your flow hood reading shows the precise nominal flow value, then click Calibrate Now.
Automatic	Performs an automatic calibration of the VAV. Depending on if duct area has been entered in the Air Flow Configuration window, the VAV uses one of two automatic calibration methods. A detailed description of these methods is provided in the *Automatic Calibration (Pre-calibration)* section.
High Value	Select this option to take a reading for your high calibration point. When you use the High Value option, you can adjust the damper so that the airflow is relatively close to the Maximum Flow, and then perform a reading. This method is faster than using the Maximum option and making-micro adjustments to the damper as required.
Low Value	Select this option to take a reading for your low calibration point. When you use the Low Value option, you can adjust the damper so that the airflow is relatively close to the Minimum Flow, and then perform a reading. This method is faster than using the Minimum option and making micro-adjustments to the damper as required.
Zero	Select this option to take a reading for the zero flow calibration point. When you select this option, the Value field automatically fills in. Close the damper fully when using this option before taking the reading. **Note:** This calibration temporarily overrides the factory zero calibration until a reset calibration is done.
Value	Enter the flow hood reading in this field before pressing the Calibrate Now button. The value field is required when you use the Low Value or High Value option. This field is read-only for all other options.
Calibrate Now	Click this button to calibrate to the level specified in the drop-down menu.

Calibration Accuracy

If you have used the clutch on the VAV to change the position of the damper, you **must** perform a reset of the VAV by either performing a power cycle of the VAV or by initiating a reset from the network management tool.

The factory-calibrated Zero Flow does not need to be recalibrated unless a compensation for leaks is required.

Table 22 shows the accuracy level of each Calibration Reading.

Table 22: Calibration Accuracy

Calibration Readings	Accuracy
Automatic (Pitot factor and duct area unknown)	1 (Least Accurate)
Automatic (Pitot factor and duct area known)	2
Manual (1-Point)	3
Manual (2-Point)	4
Manual (3-Point)	5 (Most Accurate)

Automatic Calibration (Pre-calibration)

To perform an automatic calibration, follow these steps:

1. Select Automatic from the Calibrate to drop-down menu.
2. Press the Calibrate Now button to initiate automatic calibration.

Examples

Depending on the Air Flow Configuration window settings, two types of automatic calibration are available.

Method #1 - Pitot factor and duct area unknown

If you did not enter a duct area in the Air Flow Configuration window, the controller performs an automatic 1-point calibration as follows: the controller uses the factory-calibrated Zero Flow (damper at the mechanical minimum position) as the low calibration point and then opens the damper fully to take the high calibration point reading. The controller assumes that when the damper is fully open, the airflow is equivalent to the Nominal Flow. The Pitot factor is ignored in this case because the actual duct area is unknown. Using this method, calibration completes in approximately 2 minutes.

Method #2 - Pitot factor and duct area known

This method is used by the VAV if you entered Duct Area and Pitot Factor values in the Air Flow Configuration window. The Pitot factor and duct area calculate a curve defining the relationship between the airflow and differential pressure. Using this method, calibration is instantaneous.

This type of calibration can also be performed by assigning the value AUTO_TMP_CALIB to nviFlowCalib and copying this setting to all other VAVs.

Note: This method is the quickest way to calibrate a VAV box. Depending on the Pitot factor and duct area accuracy, it is as reliable as any manual calibration.

Manual Calibration

Manual calibration is more accurate than automatic calibration. When you perform a manual calibration, you can use 1, 2, or 3 points to calculate a curve that defines the relationship between airflow and differential pressure. The following examples better illustrate each procedure.

Note: All examples are taken from an actual test conducted on a 12.0 in. (30.5 cm) round duct under normal conditions.

Examples

Method #1: 1-Point

This method uses the factory-calibrated Zero Flow as the Low Value, while you set the Maximum or High Value.

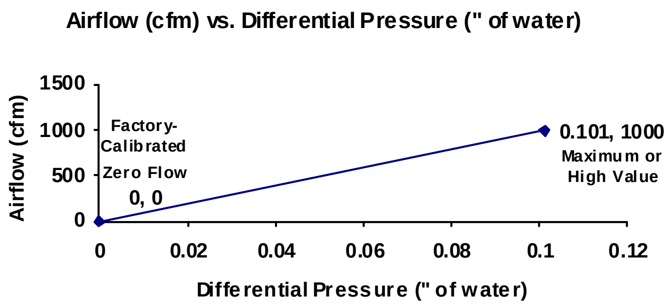

Figure 25: Method #1: 1-Point

Method #2: 2-Point

In this method, you recalibrate the Zero Flow and set the Maximum or High Value.

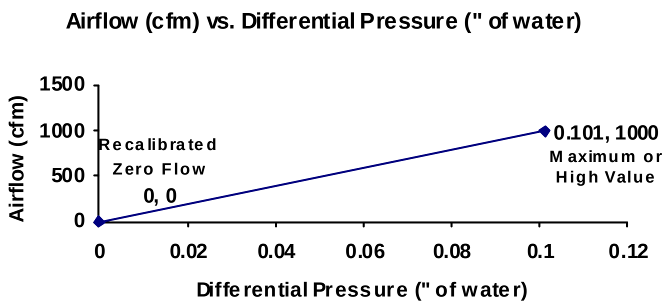

Figure 26: Method #2: 2-Point with Recalibrated Zero Flow

Or, set the Minimum or Low Value and set the Maximum or High Value.

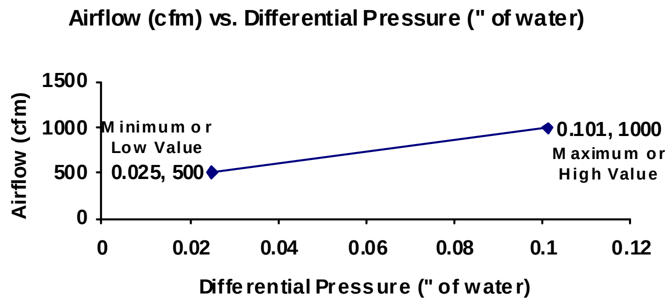

Figure 27: Method #2: 2-Point with Minimum Value

Method #3: 3-Point

In this method you recalibrate the Zero Flow, set the Minimum or Low Value, and set the Maximum or High Value.

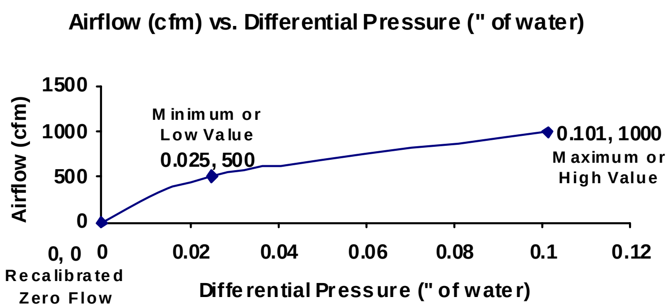

Figure 28: Method #3: 3-Point

You need a capture hood / flow hood with which you can measure the airflow that is passing through the VAV.

In the case of Minimum, Nominal, and Maximum readings, you must adjust the damper position using the arrow keys or the set position in the Flow Calibration window. Adjust the position until the measured airflow stabilizes, and the flow hood reading is the same as the number that is shown in the Value field of the window. Click Calibrate Now to take the reading.

In the case of Low Value or High Value readings, you must enter the flow hood reading into the Value field, then click Calibrate Now.

Note: The Raw Value field must be stabilized before you click Calibrate Now. Clicking Calibrate Now before stabilizing the Raw Value field results in an inaccurate calibration.

Proportional plus Integral plus Derivative (PID) Configuration

The PID Configuration window (Figure 29) allows you to adjust PID loops for space temperature control and CO_2 control. The PID Configuration window provides a simplified interface for specifying the PID curve using the proportional band, as well as an advanced interface enabling full control of the integral and derivative parameters.

Space Temperature PID Configuration

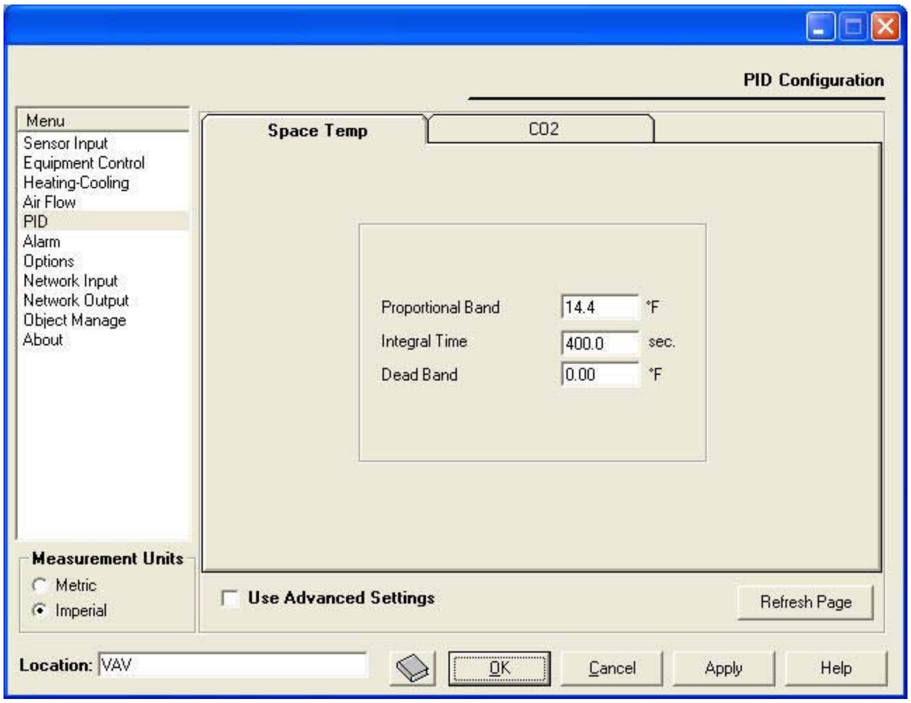

Figure 29: Space Temperature PID Configuration

Proportional Band

The proportional band is the error value that is necessary to span the extent of the output range (that is, move the output from 0 to 100%).

For example, if the proportional band is set to 4.0ºC (39.2°F), then a 2C° error (deviation from the setpoint) results in 100% output. The proportional band is sometimes referred to as a Throttling Range or Modulating Range.

The value (200/proportional band) is written to the Proportional Gain and Integral Gain fields of UCPTtempPIDparam. The Derivative Gain field of UCPTtempPIDparam is set to 0.

Integral Time

The integral time is a factor of the effect of the error (deviation from setpoint) over time. The integral time determines how quickly the system responds to a given error.

The value entered into the integral time field is written to the Integral Time field of UCPTtempPIDparam.

Deadband

The deadband is a temperature range (centered about the setpoint) in which no corrective action is taken by the VAV; that is, the output of the PID loop remains the same.

For example, if the deadband is set to 3°C (±1.5°C), then the output of the PID loop does not change if the space temperature deviates by less than 1.5°C from the setpoint.

The value entered into the deadband field is written to the Integral Time field of UCPTtempPIDparam.

Note: If the system is oscillating, start by increasing the proportional band and then increase the integral time. Refer to the *Appendix B: Tuning the PID Loop* section for further information.

Advanced Space Temperature PID Configuration

The advanced settings screen of the space temperature PID configuration allows you to specify the proportional, integral, and derivative gain parameters. The relationship between the PID parameters and the output can be illustrated as follows:

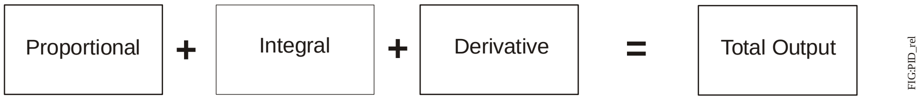

Figure 30: PID Output Relationship

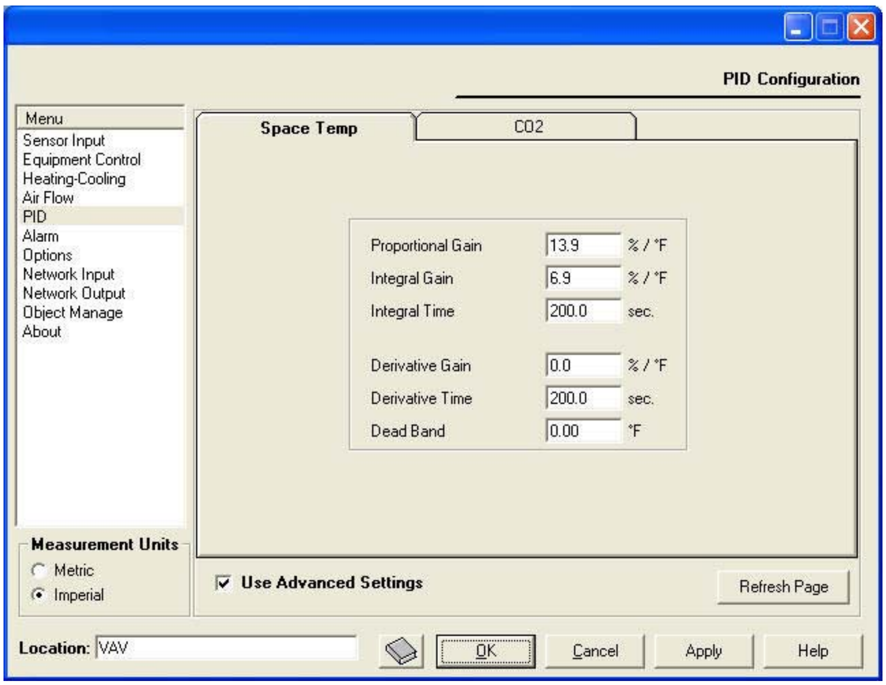

Figure 31: Space Temperature PID Configuration Advanced Settings

Proportional Gain

The proportional gain is the instant effect of the error on the output. The proportional gain and proportional band have the following relationship: proportional gain = 200 / proportional band.

For example, if a room temperature is 20ºC (68°F) and the setpoint is 23ºC (74°F), the error is 3ºC. If you assume that the proportional gain is 10% per ºC, the output of the PID loop is 30%.

The value entered in the proportional gain field is written to the Proportional Gain field of UCPTtempPIDparam.

Integral Gain

Integral gain is a multiplication factor that adds weight to the integral part of the PID loop. The accumulated error is multiplied by the integral gain value and contributes to the control output. The integral gain should be set to the same value as the proportional gain.

The value entered in the integral gain field is written to the Integral Gain fields of UCPTtempPIDparam.

Derivative Gain

Derivative gain is a multiplier giving weight to the derivative part of the PID loop. The derivative gain should be set to 0, unless otherwise needed or recommended.

The value entered in the derivative gain field is written to the Derivative Gain fields of UCPTtempPIDparam.

Derivative Time

Derivative time determines the effect of the derivative action on the system response. The derivative time is sometimes referred to as Rate Time. The derivative time should be set to 0, unless otherwise needed or recommended.

The value entered into the derivative time field is written to the Derivative Time field of UCPTtempPIDparam.

Deadband

The deadband is a temperature range centered about the setpoint in which no corrective action is taken by the VAV. Within this range, the output of the PID loop remains the same.

For example, if the deadband is 3°C (±1.5°C), the output of the PID loop does not change if the space temperature deviates by less than 1.5°C from the setpoint.

The value entered into the deadband field is written to the Integral Time field of UCPTtempPIDparam.

Note: Derivative control is generally not used in HVAC control systems due to the slow reaction time of the input and slow reaction of the equipment.

Note: If the system is oscillating, refer to the *Tuning the PID Loop - Advanced Settings* section for further information.

CO_2 PID Configuration

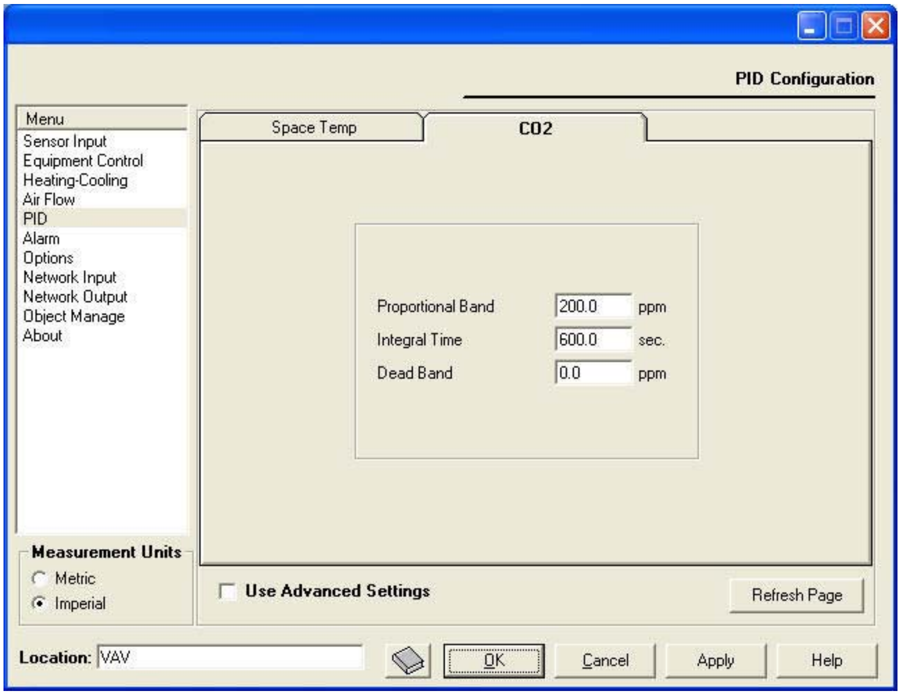

Figure 32: CO_2 PID Configuration

Proportional Band

The proportional band is the error value that is necessary to span the extent of the output range and move the output from 0 to 100%.

For example, if the proportional band is set to 200 ppm, a 100 ppm error, or deviation from the setpoint, results in 100% output. The proportional band is sometimes referred to as a Throttling Range or Modulating Range.

The value of (200 / proportional band) is written to the Proportional Gain and Integral Gain fields of UCPTCO2PIDparam. The Derivative Gain field of UCPTCO2PIDparam is set to 0.

Integral Time

The integral time is a factor of the effect of the error–a deviation from the setpoint–over time. The integral time determines how quickly the system responds to a given error.

The value entered into the integral time field is written to the Integral Time field of UCPTCO2PIDparam.

Deadband

The deadband is a CO_2 concentration range centered about the setpoint in which no corrective action is taken by the VAV; that is, the output of the PID loop remains the same.

For example, if the deadband is set to 200 ppm (±100 ppm), the output of the PID loop does not change if the CO_2 level deviates by less than 100 ppm from the setpoint.

The value entered into the deadband field is written to the Integral Time field of UCPTCO2PIDparam.

Note: If the system is oscillating, start by increasing the proportional band and then increase the integral time. See the *Tuning the PID Loop* section for further information.

Advanced CO_2 PID Configuration

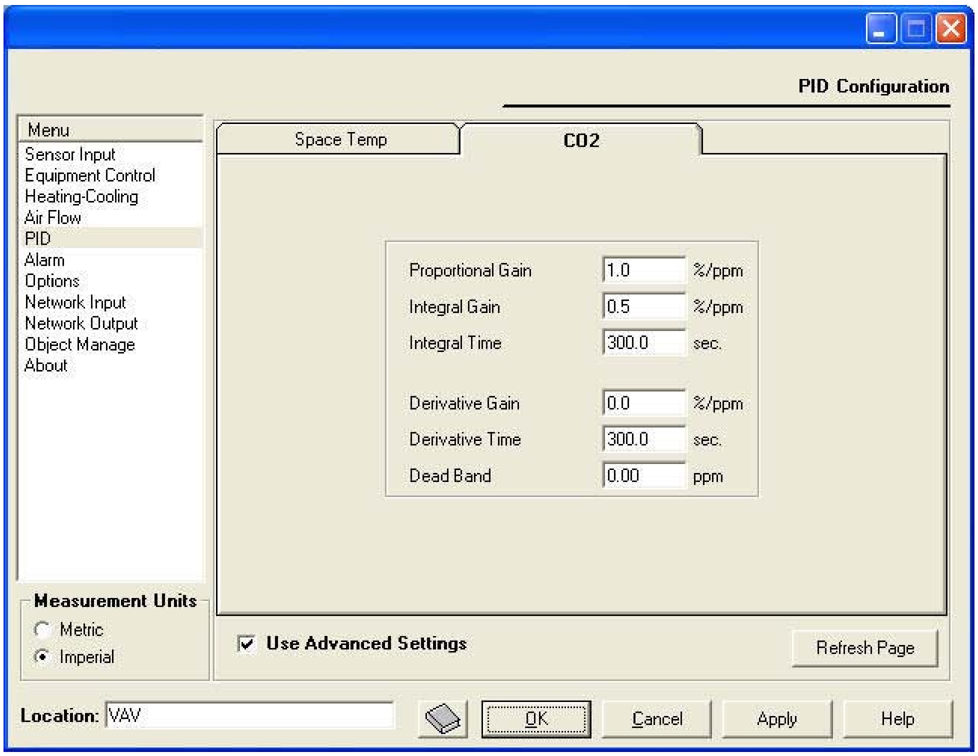

Figure 33: CO_2 PID Configuration Advanced Settings

Proportional Gain

The proportional gain is the instantaneous effect of the error on the output. The proportional gain and proportional band have the following relationship: proportional gain = 200 / (proportional band).

For example, if the CO_2 level in the zone of control is 1,000 ppm and the setpoint is 800 ppm, the error is 200 ppm. If the proportional gain is 0.5% per ppm, the output of the PID loop is 100%.

The value entered in the proportional gain field is written to the Proportional Gain field of UCPTCO2PIDparam.

Integral Gain

Integral gain is a multiplication factor that adds weight to the integral part of the PID loop. The accumulated error is multiplied by the integral gain value and contributes to the control output. The integral gain should be set to the same value as the proportional gain.

The value entered in the integral gain field is written to the Integral Gain fields of UCPTCO2PIDparam.

Integral Time

The integral time is a factor of the effect of the error–a deviation from the setpoint–over time. The integral time determines how quickly the system responds to a given error.

The value entered into the integral time field is written to the Integral Time field of UCPTCO2PIDparam.

Derivative Gain

Derivative time is a multiplier giving weight to the derivative part of the PID loop. The derivative gain should be set to 0, unless otherwise needed or recommended.

The value entered in the derivative gain field is written to the Derivative Gain fields of UCPTCO2PIDparam.

Derivative Time

The derivative time determines the effect of the derivative action on the system response. The derivative time is sometimes referred to as Rate Time. The derivative time should be set to 0, unless otherwise needed or recommended.

The value entered into the derivative time field is written to the Derivative Time field of UCPTCO2PIDparam.

Deadband

The deadband is a CO_2 concentration range centered about the setpoint in which no corrective action is taken by the VAV; that is, the output of the PID loop remains the same.

For example, if the deadband is set to 200 ppm (±100 ppm), the output of the PID loop does not change if the CO_2 level deviates by less than 100 parts per million (ppm) from the setpoint.

The value entered into the deadband field is written to the Integral Time field of UCPTCO2PIDparam.

Note: Derivative control is generally not used in HVAC control systems due to the slow reaction time of the input and slow reaction of the equipment.

Note: If the system is oscillating, see the *Tuning the PID Loop - Advanced Settings* section for further information.

Alarm Configuration

The Alarm Configuration window allows you to specify how much the Space Temperature or Air Flow can deviate from their setpoints before an alarm occurs. This screen is also specifies the CO_2 level (an absolute limit) that causes an alarm. When an alarm is generated, the in_alarm field of nvoUnitStatus is updated.

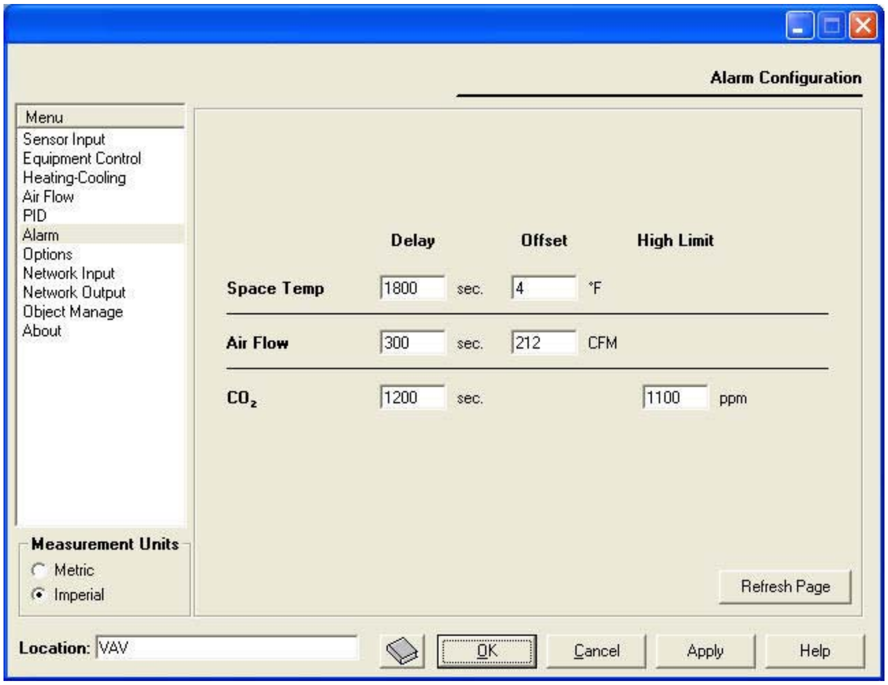

Figure 34: Alarm Configuration Window

Alarm Configuration Options

Space Temp

Either of the following conditions generates a space temperature alarm:

- The space temperature is lower than the active heating setpoint.
- The space temperature is higher than the active cooling setpoint.

Temperature variance must be more than the value specified in the Offset field for longer than the time specified in the Delay field. Includes delta from setpoint and alarm delay.

The value entered in this field is written to UCPTspaceTempAlarm.

Air Flow

An airflow alarm is generated if the airflow is lower or higher than the flow setpoint, by more than the value specified in the Offset field for longer than the time specified in the Delay field. Include delta from setpoint and alarm delay.

The value entered in this field is written to UCPTflowAlarm.

CO_2

A CO_2 alarm is generated if the CO_2 concentration is higher than the CO_2 High Limit, for longer than the time specified in the Delay field. CO_2 concentration is an absolute limit rather than a relative limit, such as the space temperature and airflow Deltas.

The value entered in this field is written to UCPTCO2Alarm.

Note: The alarm state also has an effect on nvoStatus and nvoVAValarm. For further details see the *VAV Object Network Variable and Configuration Property List* section.

Options Configuration

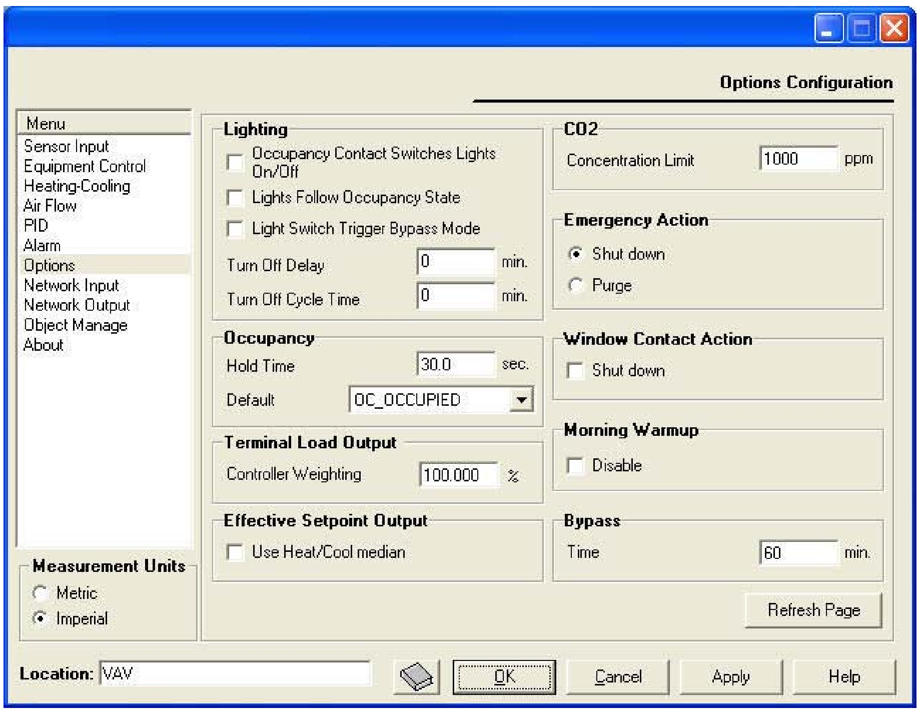

Figure 35: Options Configuration Window

Lighting

Occupancy Contact Switches Lights On/Off

Select this option to toggle the lights based on the occupancy contact. The lights turn on immediately once the occupancy contact (for example, motion sensor) is activated. When the occupancy contact detects that the room is unoccupied, it waits until the sum of the Turn Off Delay and Hold Time has elapsed before turning off the lights.

Lights Follow Occupancy State

Select this option to toggle the lights based on the occupancy state. The lights turn on immediately as soon as the occupancy status is OC_OCCUPIED or OC_BYPASS. When the occupancy status changes to OC_UNOCCUPIED or OC_STANDBY, the controller waits until the sum of the Turn Off Delay and Hold Time has elapsed before turning off the lights.

Light Switch Trigger Bypass Mode

Select this option if you want the light switch to function as an override/bypass button. If the occupancy state is OC_UNOCCUPIED or OC_STANDBY, putting the light switch into the ON position changes the occupancy state to OC_BYPASS, which is then written to nvoOccState.

Turn Off Delay

This field determines the time delay that must elapse before the lights turn off automatically.

If the occupancy state changes to OC_UNOCCUPIED or OC_STANDBY from OC_OCCUPIED or OC_BYPASS, the controller waits until the sum of the Turn Off Delay and Hold Time has elapsed before turning off the lights.

The value you enter in this field is written to UCPTlightOffDelay.

Turn Off Cycle Time

The Turn Off Cycle Time specifies how often the controller turns off the lights when the occupancy state is OC_UNOCCUPIED or OC_STANDBY.

For example, if you enter 10 minutes into this field, and the occupancy state is OC_UNOCCUPIED or OC_STANDBY, the controller turns off all light outputs every 10 minutes.

The value you enter in this field is written to UCPTlightOffCycleTime.

Occupancy

Hold Time

Hold Time is a delay that must elapse before the occupancy sensor/contact considers the zone unoccupied.

For example, if the occupancy sensor/contact serves as a motion detector and does not detect any movement in a previously occupied room, it waits for the Hold Time to elapse before it considers the room to be unoccupied. Most occupancy sensors already have a built-in hold time; therefore, this field adds an additional delay, if required.

The value you enter in this field is written to SCPTHoldTime.

Default

Default refers to the default occupancy state of zones controlled by the VAV. The controller reverts to the default occupancy state if a communication or heartbeat failure occurs on the bound network input variable nviOccCmd.

Terminal Load Output

Controller Weighting

The nvoVAVinfo controller weighting represents the product of the terminal load and the value as seen by the associated Rooftop Unit (RTU).

The value entered in this field is written to SCPTcontrolTemperatureWeighting.

Effective Setpoint Output

Use Heat/Cool median

Select this option to set nvoEffectSetpoint to the midrange setpoint value. This option is usually selected if you are binding nvoEffectSetpoint to the nviSetpoint of another controller. If this option is not selected, the value of the current heating or cooling setpoint is stored in nvoEffectSetpoint.

CO2

Concentration Limit

The Concentration Limit field specifies the maximum CO_2 concentration allowed in the monitored zone. If this limit is reached, the damper opens per the PID loop to allow more airflow, thereby lowering the CO_2 concentration.

The value entered in this field is written to SCPTlimitCO2.

Emergency Action

The emergency contact signal originates from a fire panel that sends the emergency signal to the RTU and all VAVs.

Shut Down

If this option is selected and an emergency contact is activated, the controller initiates a shutdown of the HVAC system by setting nvoUnitStatus to HVAC_OFF. It essentially closes the damper and disables heating and cooling.

Purge

If this option is selected and an emergency contact is activated, the controller fully opens the damper, allowing air (or smoke) to flow up through the duct and out of the RTU (assuming that the RTU has been set up to turn off in an emergency situation) and the controller initiates a shutdown of the HVAC system by setting nvoUnitStatus to HVAC_OFF.

Window Contact Action

Shut down

If this option is selected, when a window contact is activated (a window is opened), the controller initiates a shutdown of the HVAC system by setting nvoUnitStatus to HVAC_OFF. The controller closes the damper and disables heating and cooling. However, frost protection remains active even if this option selected.

If this option is not selected then the occupancy state is set to OC_UNOCCUPIED.

Morning Warm-up

Disable

Select this option to disable heating and cooling in morning warm-up mode. The morning warm-up mode preheats the building so that when building occupants enter in the morning, the temperature is already at or close to the occupied setpoint.

Bypass

Time

If the VAV is in standby or unoccupied mode, it can temporarily enter occupied mode for the time period specified in this field (it uses the occupied setpoints for the specified time period). The bypass time is written to SCPTbypassTime.

Bypass mode creates a comfortable environment for occupants if they are in the building during off hours. The VAV enters bypass mode in the following cases:

- The Override button is pressed on a sensor that is connected to the VAV.
- An input to the VAV, such as a bypass contact switch, becomes active.
- nviOccCmd is set to OC_BYPASS. This setting usually happens if the VAV’s nviOccCmd is bound to the occupancy state of some other controller, such as an RTU. It does not reset the bypass time.
- nviOccManCmd resets the bypass time.

Network Input Configuration

The network input configuration screen allows you to specify the heartbeat and persistent state for all network variable inputs that support a heartbeat or network persistent state.

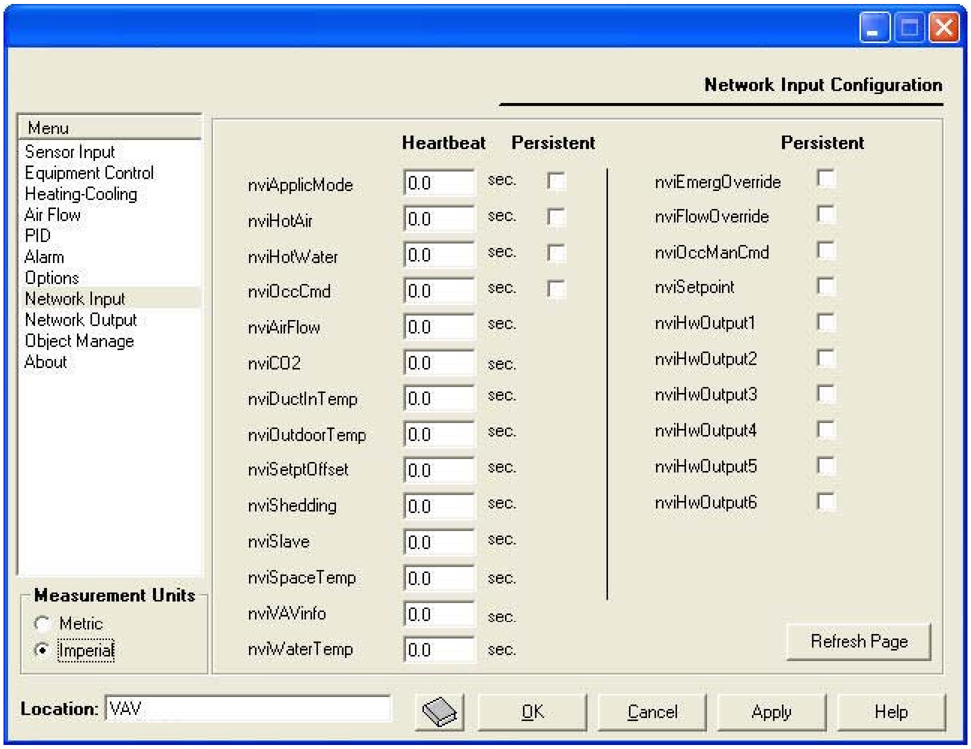

Figure 36: Network Input Configuration Window

Note: The network variables in this screen are explained in detail in the *VAV Object Network Variable and Configuration Property List* List section.

Heartbeat

Heartbeat refers to the maximum time period between received updates of the network variable on the network (regardless of a change in variable value). The heartbeat is essentially the maximum receive time for a network variable.

A heartbeat failure occurs if a network variable update is not received on the network within the time period set in the Heartbeat field. On a heartbeat failure, the device enters into an alarm state and the device status updates to indicate a failure. In addition, the Network Variable Input (NVI) returns to its default value.

The appropriate bits of nvoVAValarm and nvoStatus update on a heartbeat failure. See the *VAV Object Network Variable and Configuration Property List* section for more details.

Persistent

When a network variable is marked as persistent, the network variable value is written to Electrically Erasable Programmable Read-Only Memory (EEPROM). Once written to EEPROM, the network variable value is preserved during power failures and resets. Each time a new network variable value is received, the new value is written into EEPROM.

When this option is selected, the current value of the NVI is not written to the EEPROM, the VAV waits until the NVI changes to the next value before saving it.

The EEPROM is limited to approximately 10,000 physical writes. If the network variable is constantly changing, and if it is received from the network on every change, the network variable could exhaust the ability of the EEPROM to store it in permanent memory. The factory-calibrated Zero Flow does not need to be recalibrated unless a compensation for leaks is required.

The persistent option is ignored for NVIs that are bound.

Network Output Configuration

The network output window enables you to customize how often network variable output values are sent on the network. The heartbeat time and throttle values can be customized for some of the network variable outputs. The Minimum and Maximum Send Times settings apply to the remaining network variable outputs. The Minimum Send Time and Send on Delta options optimize a node’s overall transmission rate to match the available network bandwidth.

Network congestion occurs when the VAV transmits network variables too frequently on the network. You can reduce network congestion by only transmitting network variables as frequently as is necessary to meet the system requirements.

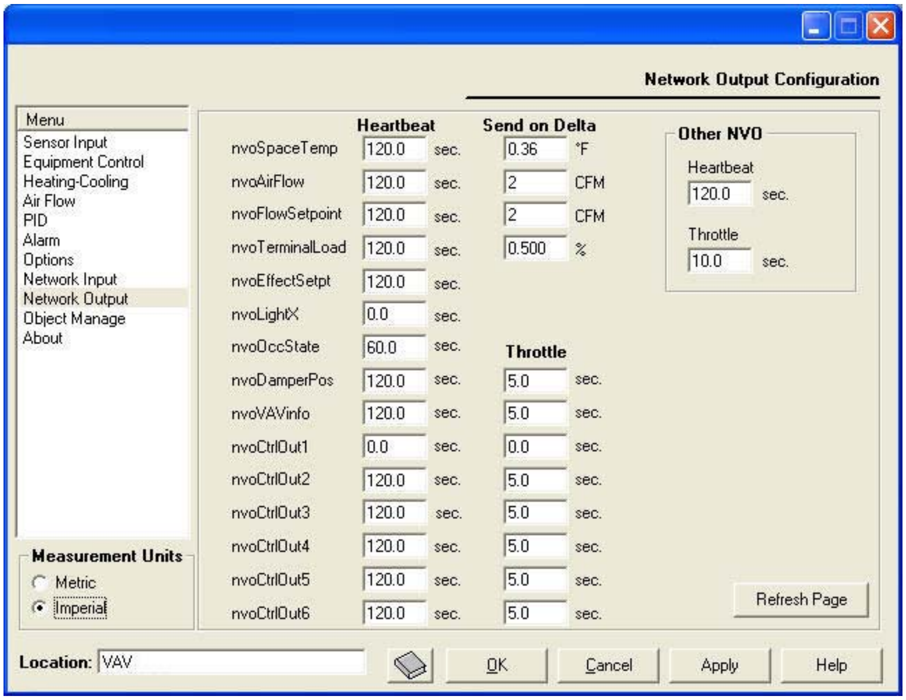

Figure 37: Network Output Configuration Window

Note: The network variables in this screen are explained in detail in the *VAV Object Network Variable and Configuration Property List* section.

Heartbeat

The maximum amount of time between transmissions of the network variable. The network variable is pushed onto the network if the time specified in this field elapses. Setting the Heartbeat to 0 disables it.

The heartbeat is often referred to as the Maximum Send Time.

Send on Delta

The amount by which the network variable must change for it to automatically transmit on the network. If a network variable changes by the amount specified in the Send on Delta field, it transmits on the network.

Throttle

The minimum time period that must pass between network variable updates on the network. If the value of the network variable changes, an update is sent only after this time expires. Setting the Throttle to 0 disables it.

The throttle is often referred to as the Minimum Send Time.

Other Network Variable Outputs

Heartbeat

The maximum send time you apply to all network variable outputs that do not have an individual heartbeat setting.

Throttle

The minimum send time you apply to all network variable outputs that do not have an individual throttle setting.

Object Manage

The Object Manage window shows the state of the VAV object, and allows you to perform object requests. The VAV must be online for you to use the options in this window.

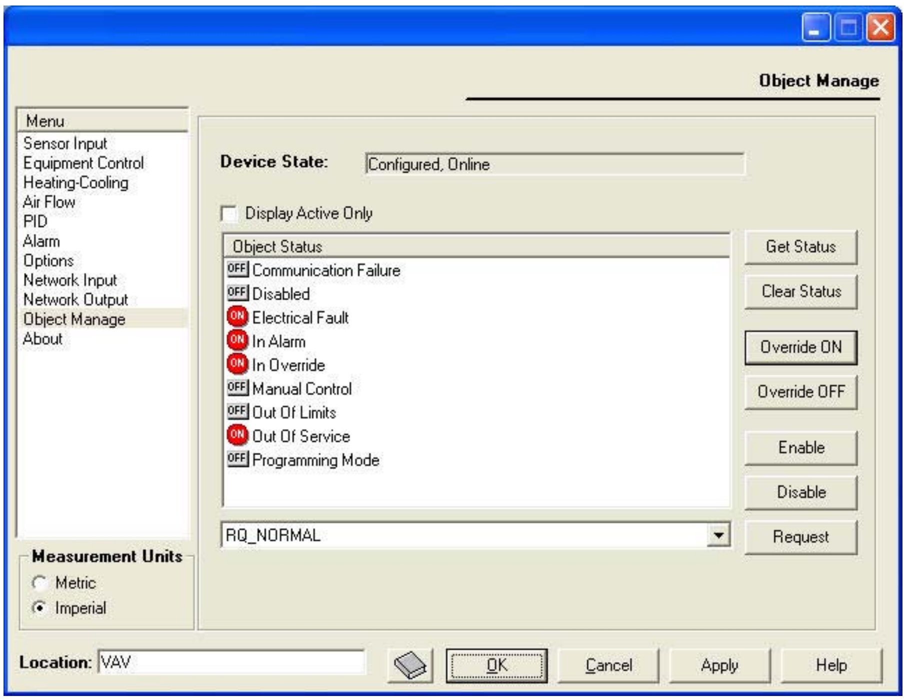

Figure 38: Object Manage Screen

Device State

The current state of the VAV.

Display Active Only

When this option is selected, only active status flags (displayed in red) are shown in the Object Status pane; otherwise, the Object Status pane remains empty, indicating that the object is in normal mode.

Object Status Pane

A list of all status attributes supported by the device as per its configuration. A red ON icon indicates an active state and a grey OFF icon indicates an inactive state.

Depending on the way in which the device is configured, the following attributes can be active (ON) in the Object Status pane.

Communication Failure

Active if a heartbeat is not being received.

Disabled

Active if you have disabled the device by pressing the Disable button.

Electrical Fault

Active if a hardware input detects an electrical or disconnect fault.

For example, a fault occurs if an open circuit (infinite resistance) is detected on an input that is connected to a thermistor, or a 4–20mA current input detects an input that is outside its range.

In Alarm

Active if a communications failure or electrical fault has occurred, or if any of the conditions in the window have been met.

In Override

Active if you have placed the device into override by pressing the Override button.

Manual Control

Active when the VAV uses nviFlowCalib or nviFlowOverride, or if the VAV is in the process of being calibrated.

Out of Limits

Active if any of the parameters being monitored in the window are out of the permitted range.

Out of Service

Active when the VAV cannot control the temperature in the zone of control because it is not receiving a space temperature or the slave input (nviSlave) is unavailable.

Programming Mode

Active when the device is in learning mode (wireless).

Get Status

Refreshes the device’s status information in the Object Status pane.

Clear Status

Temporarily clears all status flags for the device and updates the object status network variable output (nvoObjStatus).

Override ON

Sets the VAV object into override mode. The output network variables are set to their configured override values. Only outputs that have the Permit option selected in the Override window are overridden.

Override OFF

Removes the VAV object from override mode. The VAV object functions normally when override is off.

Enable

Activates the VAV object if it was in a disabled state.

Disable

Disables the VAV object. The VAV object output turns off when it is disabled. The device must be online for this command to be effective.

Note: The Disable option has a priority over the Override option.

Request

Allows users to query the device. The query is performed through a network variable of the SNVT_obj_request type. The device must be online to use this command.

Select a command from the drop-down menu, then click Request.

Refer to Table 23 for a list of possible request types.

Table 23: Request Types

Value	Identifier	Description
0	**RQ_NORMAL**	Enables the object and removes override.
1	**RQ_DISABLED**	Disables object.
2	**RQ_UPDATE_STATUS**	Reports object status/refreshes the screen.
3	**RQ_SELF_TEST**	Performs object self-test.
4	**RQ_UPDATE_ALARM**	Updates alarm status.
5	**RQ_REPORT_MASK**	Reports status bit mask and sets all of the status bits of nvoStatus to 1.
6	**RQ_OVERRIDE**	Overrides object.
7	**RQ_ENABLE**	Enables object.
8	**RQ_RMV_OVERRIDE**	Removes object override.
9	**RQ_CLEAR_STATUS**	Clears object status and sets all of the status bits of nvoStatus to 0.
10	**RQ_CLEAR_ALARM**	Clears object alarm.
11	**RQ_ALARM_NOTIFY_ENABLED**	Enables alarm notification.
12	**RQ_ALARM_NOTIFY_DISABLED**	Disables alarm notification.

Table 23: Request Types

Value	Identifier	Description
13	**RQ_PROGRAM**	Puts wireless VAVs into learning mode. When you initiate this request, the learn LED on the VAV starts blinking.
14	**RQ_MANUAL_CTRL**	Enables object for manual control.
15	**RQ_REMOTE_CTRL**	Enables object for remote control.
16	**RQ_CLEAR_RESET**	Clears the bit that indicates that the object has been previously reset.
17	**RQ_RESET**	Resets the object.

Note: A detailed description of important network variables supported by the VAV is provided in the *VAV Object Network Variable and Configuration Property List* section.

Sensor Configuration

The Sensor Configuration window helps you to configure individual hardware inputs and network outputs to properly interpret sensor input signals.

Hardware Input Configuration

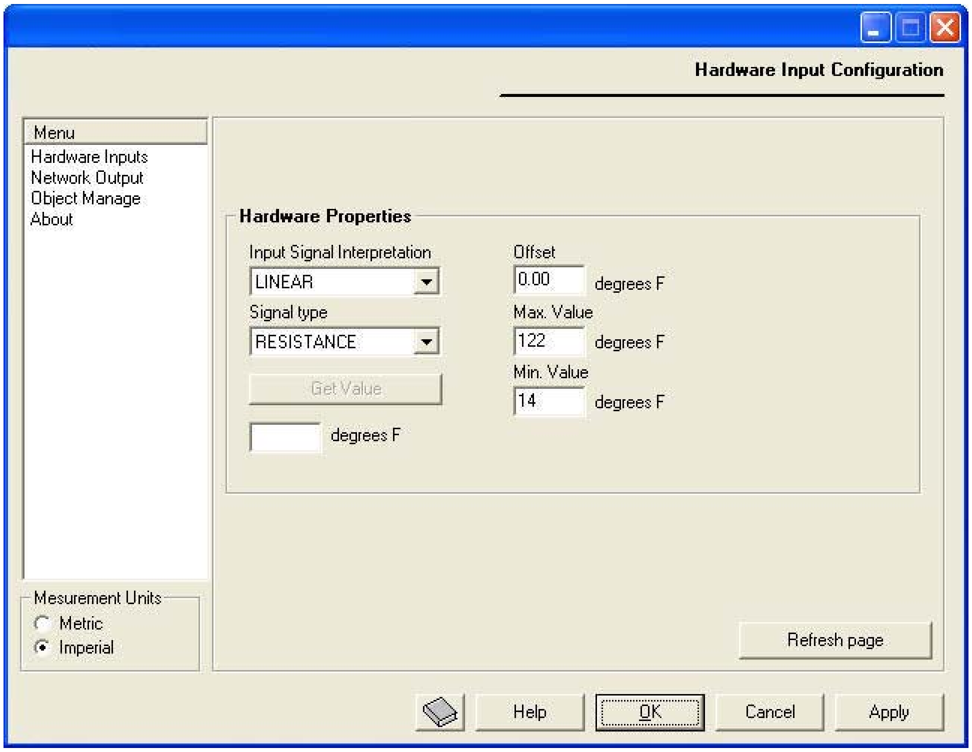

Figure 39: Hardware Input Configuration

Hardware Properties

The options you see under Hardware Properties vary depending on the Input Signal Interpretation type selected.

Input Signal Interpretation

Input Signal Interpretation determines how the input reading is converted into units of measurement (for example, °C).

Table 24: Input Signal Interpretation Options

Option	Description
DISCONNECTED	The physical input is not used, and the network variable output for the input is forced to the value you entered in the Default Value field.
LINEAR	A linear curve that interprets a voltage (0–10 V), current (4–20 mA), or resistance (0–10k ohm) input. The lowest input value (0 V, 4 mA, or 0k ohm) corresponds to the value entered in the Min. Value field. The highest input value (10 V, 20 mA, or 10k ohm) corresponds to the value entered in the Max. Value field. The VAV generates a linear interpolation curve based on these points.
TRANS_TABLE	A translation table is applied to the input. You can define your own curve to interpret the signal in the Transtable window.
DIGITAL	Two state input (ON/OFF).
STD_THERMISTOR	Predefined translation tables that apply to the standard type thermistors that are used within sensors.
SETPOINT_OFFSET	An offset input (+/-) that is applied to SCPTsetPnts. For example, if the cooling setpoint is 22°C (72°F), and the offset input is set to -2°C by a room occupant, then the effective cooling setpoint is 20°C (68°F). **Note:** The unoccupied setpoints are not affected by this setpoint offset.

Signal Type

This parameter determines the input signal type of the connected sensor. Table 25 provides a description of supported signal types.

Table 25: Supported Signal Types

Signal Type	Description
RESISTANCE	Resistance input, typically 0–10k ohm
VOLTAGE_0_10V	Voltage input, 0–10 V
MILLIAMPS_4_20MA	Current input, 4–20 mA (DC)

For linear and setpoint offset input signal interpretations, if the input value falls out of the expected input range, it is interpreted as the lower or upper value of the range.

For example, if the input is 3.5 mA, then it is rounded up to 4 mA; and if the input is 21 mA, then it is clipped at 20 mA. Exceeding the upper limits for current and voltage limits is not recommended and damages the controller.

For current inputs (4–20 mA), any input below 3.5 mA causes an electrical fault.

For resistance inputs (0–10k ohm), disconnection causes an electrical fault.

Get Value

This option functions only if the device is configured, online, and attached. Once the input is fully configured, you can use this option to retrieve the current sensor value from the network.

Offset

A constant value you apply to the sensor input reading to compensate for reading errors, or to perform sensor calibration.

For example, assume that a temperature sensor is connected to one of the hardware inputs of the VAV. If the actual room temperature is 22°C (72°F), but the sensor reading is 24°C (75°F), you can apply an Offset of -2°C to correct the error.

Min. Value/Max. Value

The Min. Value and Max. Value set up a correlation between the raw input reading and the interpreted result.

For example, with a linear Input Signal Interpretation, if a resistance input (0-10k ohm) has a Min. Value of 20°C (68°F) and a Max. Value of 24°C (75°F), then 0k ohm corresponds to 20°C (68°F) and 10k ohm corresponds to 24°C (75°F).

ON Value

The value of the Network Variable Output (NVO) when the input is ON.

If the NVO is type SNVT_switch, it has the format: [value state].

For example, if you want the NVO to have a value of 50 when the input is high, enter 50.0 1 into this field.

OFF Value

The value of the NVO when the input is OFF.

If the NVO is type SNVT_switch, it has the format: [value state].

For example, if you want the NVO to have a value of 0 when the input is low, enter 0.0 0 into this field.

Reverse

The input is normally ON when the contact is closed and OFF when it is open. If you choose the Reverse option, the input is ON when the contact is open, and OFF when it is closed.

Translation Table Configuration

The translation table consists of 16 rows that define a curve that converts the raw input value (mA, V, ohm) into the appropriate units of measurement, such as °C. The VAV interpolates the curve based on the values you entered. It is not necessary to fill out all the rows because the VAV automatically generates a linear curve between each pair of points and interpolates/extrapolates as required.

Figure 40 shows the Transtable Window. The left column heading Input Value is the raw hardware input reading. The data in this column must be listed in ascending order. In Figure 40, the input value units of measurement are ohm, but can also be mA or V. The right column is the translated input, which has a heading of the units you selected for the converted values. In Figure 40, the converted value unit is °C.

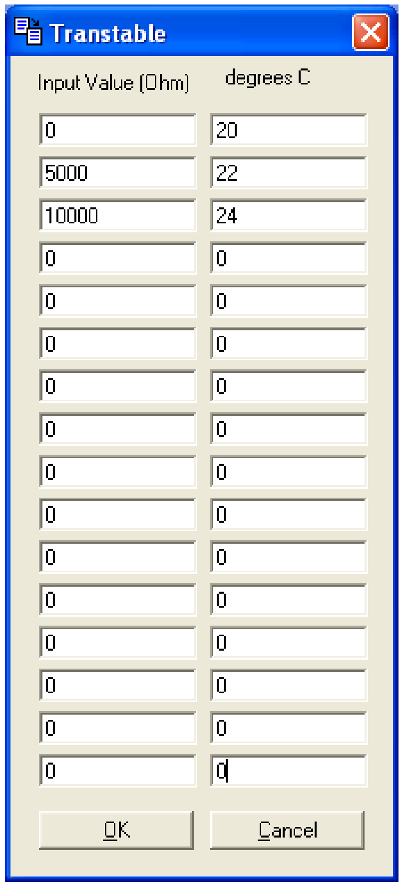

Figure 40: Transtable (Resistance to Temperature Translation)

Network Output Configuration

The following sections provide descriptions of the options found within the Network Output Configuration window.

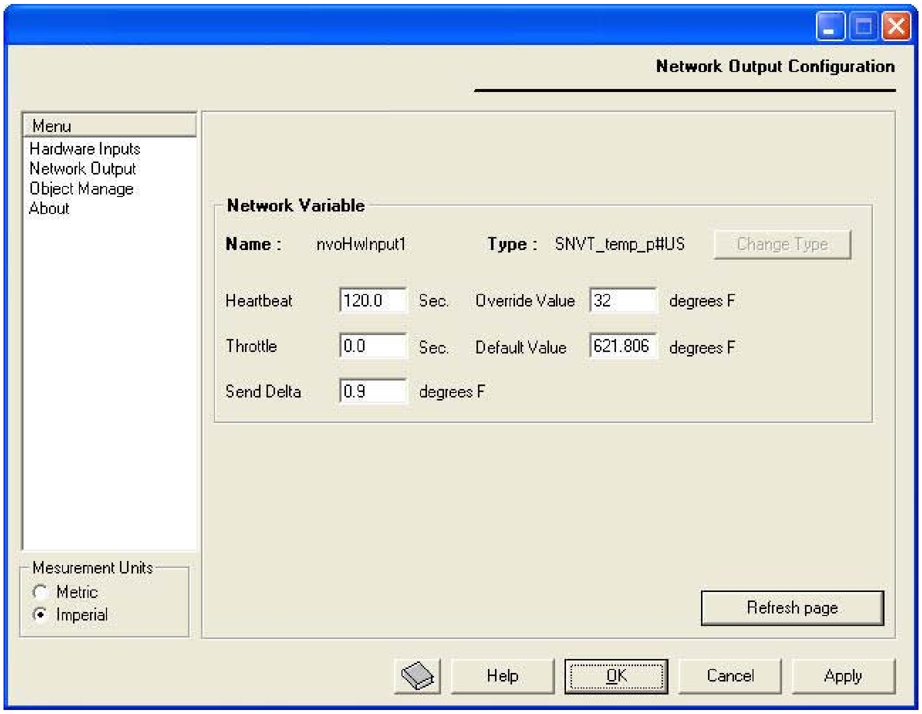

Figure 41: Network Output Configuration

Network Variable

Name

The NVO corresponding to the hardware input that you are configuring.

Type

The current network variable type for the NVO. The network variable type can be changed by clicking Change Type.

Change Type

This button launches the Change Network Variable type window.

Heartbeat

The maximum time period between automatic transmissions of the network variable on the network (regardless of a change in variable value). Setting the Heartbeat to 0 disables it.

The heartbeat is often referred to as the Maximum Send Time.

Throttle

The minimum time period that must pass between network variable updates on the network. If the value of the network variable changes by more than the configured Send Delta value, the network variable sends an update after this time expires. Setting Throttle to 0 disables it.

The throttle is often referred to as the Minimum Send Time.

Send Delta

The amount by which the network variable must change for it to automatically transmit on the network. If a network variable changes by the amount specified in the Send Delta field, it transmits on the network as long as the throttle time has elapsed.

Override Value

The hardware input and its network variable output are forced to this value if either the hardware input object or the entire VAV is overridden.

Default Value

The network variable is forced to this value if the hardware input object is in the disabled state or if the input reading is invalid due to an electrical fault or a severed connection.

Change Network Variable Type

The Change Network Variable type window is typically used when you need to modify the variable type before creating a binding.

Note: Change the NV type **before** configuring the input.

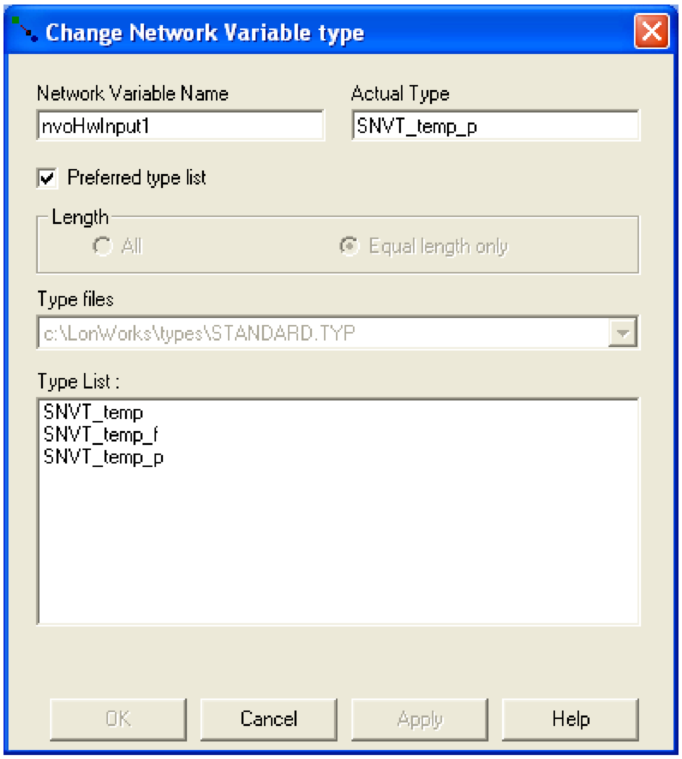

Figure 42: Change Network Variable Type

Table 26: Change Network Variable Type Fields

Field	Description
Network Variable Name	The name of the network variable you are configuring (Read-Only).
Actual Type	The current network variable type. This field updates when you change the type and click Apply.
Preferred type list	Selecting this option shows you the preferred type list for the network variable. The preferred type varies based on the type of input. This option is the default selection.
Length	Select Equal length only to only list network variable types that have the same length as the Actual Type. Select All to list all network variable type that do not exceed the maximum network variable lengths.
Type files	A list of all available type files from the device resource file catalog (standard and manufacturer defined). The Type List changes based upon the.TYP file you select.
Type List	A list of types within the selected file that are the appropriate length.

Object Manage

The Object Manage window shows the state of the VAV object, and allows you to perform object requests. The VAV must be online for you to use the options on this window.

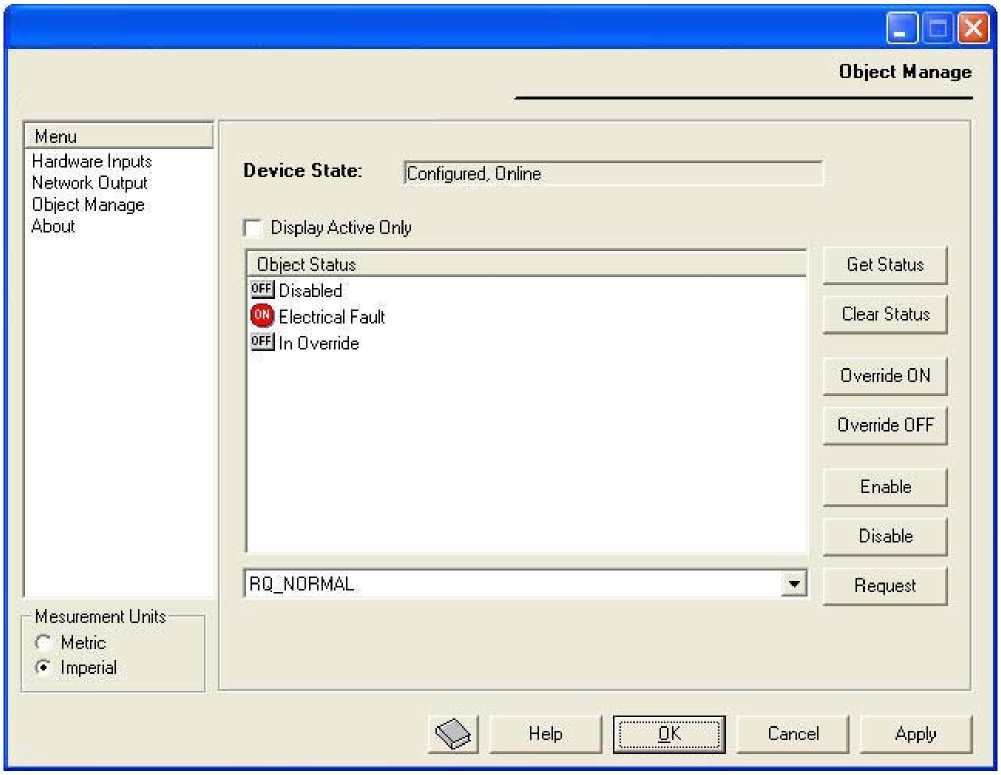

Figure 43: Object Manage

Device State

The current state of the VAV.

Display Active Only

When this option is selected, only active status flags, shown in red, are displayed in the Object Status pane; otherwise, the Object Status pane remains empty, indicating that the object is in normal mode.

Object Status Pane

A list of all status attributes supported by the device as per its configuration. A red ON icon indicates an active state, and a grey OFF icon indicates an inactive state. Depending on the way you configured the device, the following options can be active (ON) in the Object Status pane:

Disabled

Active if you have disabled the device by pressing the Disable button.

Electrical Fault

Active if a hardware input detects an electric or disconnect fault.

For example, a fault occurs if an open circuit (infinite resistance) is detected on an input connected to a thermistor, or a 4-20mA current input detects an input outside its range.

In Override

Active if you have placed the device into override by pressing the Override button.

Get Status

Refreshes the device's status information in the Object Status pane.

Clear Status

Temporarily clears all status flags for the device and updates the object status network variable output (nvoObjStatus).

Override ON

Sets the VAV object in override. The output network variables are set to their configured override values. Only outputs that have the Permit option selected in the Override window are overridden.

Override OFF

Removes the VAV object from override. The VAV object functions normally when override is off.

Enable

Activates the VAV object if it was disabled.

Disable

Disables the VAV object. The VAV object output turns off when you disable it. The device must be online for this command to have an effect.

Note: The Disable option has a priority over the Override option.

Request

This allows users to query the device. A network variable of the SNVT_obj_request type performs the query.

Select a command from the drop-down menu, and then click Request button. The device must be online to use this command.

See Table 27 for a list of possible request types.

Table 27: Request Types

Value	Identifier	Description
0	**RQ_NORMAL**	Enables the object and removes override.
1	**RQ_DISABLED**	Disables object.
2	**RQ_UPDATE_STATUS**	Reports object status/refreshes the screen.
3	**RQ_SELF_TEST**	Performs object self test.
4	**RQ_UPDATE_ALARM**	Updates alarm status.
5	**RQ_REPORT_MASK**	Reports status bit mask and sets all of the status bits of nvoStatus to 1.
6	**RQ_OVERRIDE**	Overrides object.
7	**RQ_ENABLE**	Enables object.
8	**RQ_RMV_OVERRIDE**	Removes object override.
9	**RQ_CLEAR_STATUS**	Clears object status and sets all of the status bits of nvoStatus to 0.
10	**RQ_CLEAR_ALARM**	Clears object alarm.
11	**RQ_ALARM_NOTIFY_ENABLED**	Enables alarm notification.
12	**RQ_ALARM_NOTIFY_DISABLED**	Disables alarm notification.
13	**RQ_PROGRAM**	Puts Wireless VAVs into learning mode. you initiate this request, the learn LED on the VAV starts blinking.
14	**RQ_MANUAL_CTRL**	Enables object for manual control.
15	**RQ_REMOTE_CTRL**	Enables object for remote control.
16	**RQ_CLEAR_RESET**	Clears the bit that indicates that the object has been previously reset.
17	**RQ_RESET**	Resets the object.

Actuator Configuration

You can use the Actuator Configuration window to configure individual hardware outputs and network inputs.

Hardware Output Configuration

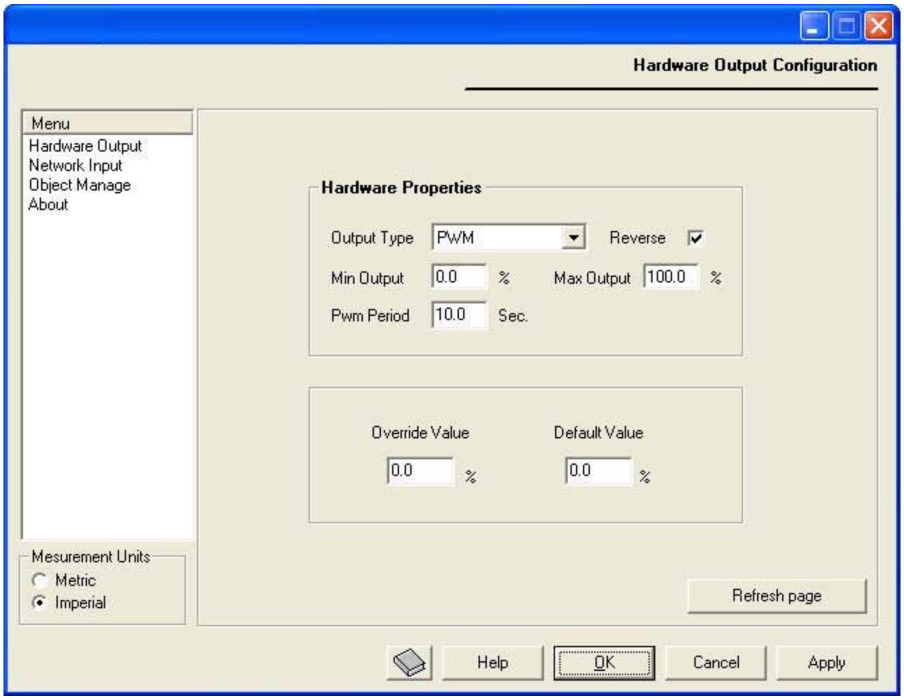

Figure 44: Hardware Output Configuration

Hardware Properties

The options available under Hardware Properties vary depending on the Control Type and the Output Type.

Output Type

For hardware outputs DO1 to DO4, the drop-down menu only shows DIGITAL or PWM. Outputs AO1 and AO2 are universal outputs you can configure to DIGITAL, ANALOG_0_10V, or PWM.

Reverse

Select this option to invert the output. This option is useful when using equipment that employs negative logic.

Min Output

The minimum output allowed for PWM and Analog outputs.

Max Output

The maximum output allowed for PWM and Analog outputs.

Note: The output is rescaled between these minimum and maximum outputs.

PWM Period

Specifies the PWM period. Lowering the default value results in a faster response and provides a more stable temperature when using perimeter heating. However, you must ensure that the PWM period is not too low (fast) for your equipment.

Note: The period must be between 2–900 s.

Override

Override Value

The output value sent to the hardware output when override is enabled.

Default Value

The default output value when the controller has an invalid nviHwOutput value. This default output value is also used when the hardware output is not used or disabled. However, if you configure the output for equipment control, the default value is ignored.

Network Input Configuration

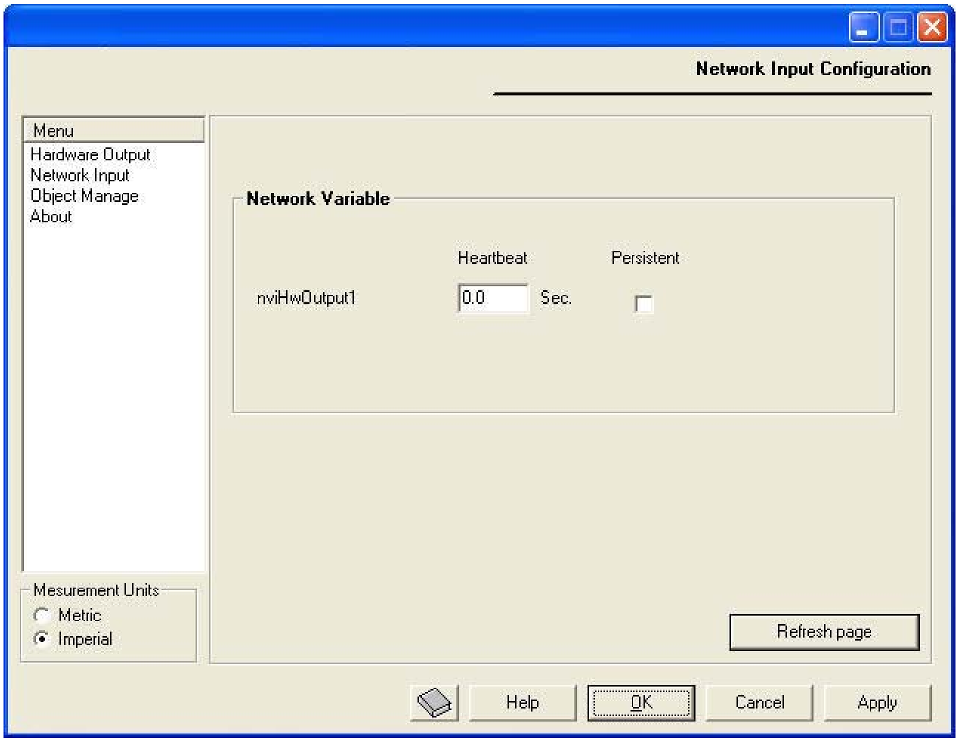

Figure 45: Network Input Configuration

Network Variable

Heartbeat

The maximum time period between received updates of the network variable on the network, regardless of a variable value change. The Heartbeat is essentially the maximum receive time for a network variable.

A Heartbeat failure occurs if a network variable update is not received on the network within the time period set in the Heartbeat field. On a Heartbeat failure, the device enters an alarm state, and the device status updates to indicate a failure. On a Heartbeat failure, the NVI returns to its default value.

The appropriate bits of nvoVAValarm and nvoStatus are updated on a Heartbeat failure. See the *Hardware Output Object Network Variable and Configuration Property List* section for more details.

Persistent

When a network variable is marked as persistent, the network variable value is written to EEPROM. Once written to EEPROM, the network variable value is preserved during power failures and resets. Each time a new network variable value is received, the new value is written into the EEPROM.

When you select this option, the current value of the NVI is not written to the EEPROM, the VAV waits until the NVI changes to the next value before saving it.

The EEPROM is limited to approximately 10,000 physical writes. If the network variable is constantly changing, and if it is received from the network on every change, the network variable could exhaust the ability of the EEPROM to store it in permanent memory. The factory-calibrated Zero Flow does not need to be recalibrated unless a compensation for leaks is required.

The persistent option is ignored for NVIs that are bound.

Object Manage

The Object Manage window shows the state of the VAV object, and allows you to perform object requests. The VAV must be online to use the options on this window.

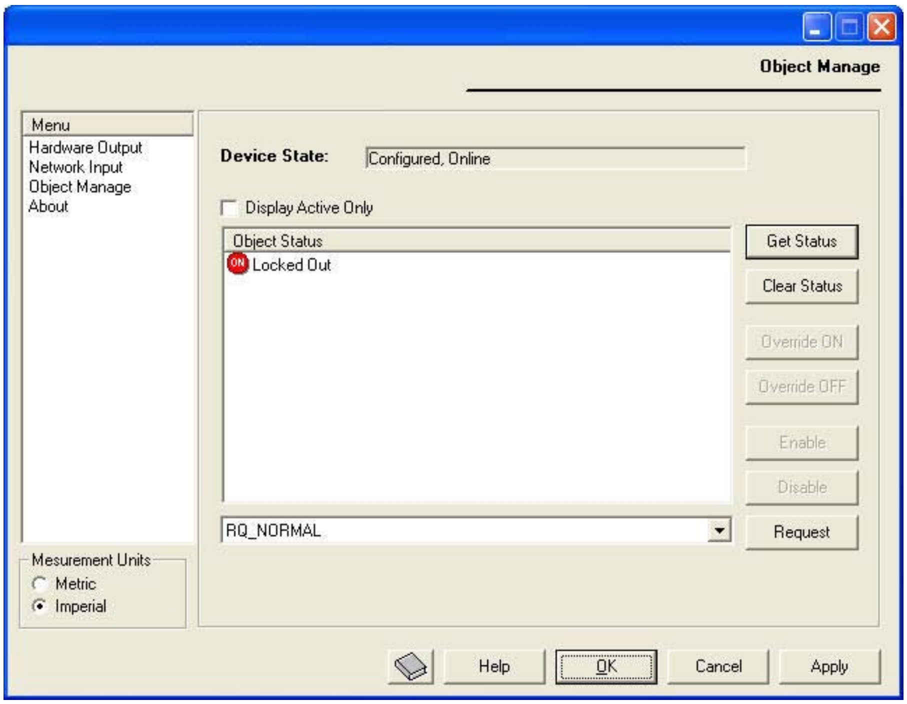

Figure 46: Object Manage Screen

Device State

The current state of the VAV.

Display Active Only

When you select this option, only active status flags, shown in red, are displayed in the Object Status pane; otherwise, the Object Status pane remains empty, indicating that the object is in normal mode.

Object Status Pane

A list of all status attributes supported by the device as per its configuration. A red ON icon indicates an active state and a grey OFF icon indicates an inactive state.

Depending on the way in which the device is configured, the following attributes can be active (ON) in the Object Status pane.

Locked Out

Active if the controller output is used within the control loop.

Get Status

Refreshes the device's status information in the Object Status pane.

Clear Status

Temporarily clears all status flags for the device and updates the object status network variable output (nvoObjStatus).

Override ON (Grayed out)

Sets the VAV object to override. The output network variables are set to their configured override values. Only outputs that have the Permit option selected in the Override window are overridden.

Override OFF (Grayed out)

Removes the VAV object from the override state. The VAV object functions normally when the override is off.

Enable (Grayed out)

Activates the VAV object if it was disabled.

Disable (Grayed out)

Disables the VAV object. The VAV object output turns off when it is disabled. The device must be online for this command to have an effect.

Note: The Disable option has a priority over the Override option.

Request

This allows users to query the device. The query is performed through a network variable of the SNVT_obj_request type.

Select a command from the drop-down menu, then click Request. The device must be online to use this command.

See Table 28 for a list of possible request types.

Table 28: Request Types

Value	Identifier	Description
0	**RQ_NORMAL**	Enables the object and removes override.
1	**RQ_DISABLED**	Disables object.
2	**RQ_UPDATE_STATUS**	Reports object status/refreshes the screen.
3	**RQ_SELF_TEST**	Performs object self test.
4	**RQ_UPDATE_ALARM**	Updates alarm status.

Table 28: Request Types

Value	Identifier	Description
5	**RQ_REPORT_MASK**	Reports status bit mask and sets all of the status bits of nvoStatus to 1.
6	**RQ_OVERRIDE**	Overrides object.
7	**RQ_ENABLE**	Enables object.
8	**RQ_RMV_OVERRIDE**	Removes object override.
9	**RQ_CLEAR_STATUS**	Clears object status and sets all of the status bits of nvoStatus to 0.
10	**RQ_CLEAR_ALARM**	Clears object alarm.
11	**RQ_ALARM_NOTIFY_ENABLED**	Enables alarm notification.
12	**RQ_ALARM_NOTIFY_DISABLED**	Disables alarm notification.
13	**RQ_PROGRAM**	Puts Wireless VAVs into learning mode. When you initiate this request, the learn LED on the VAV starts blinking.
14	**RQ_MANUAL_CTRL**	Enables object for manual control.
15	**RQ_REMOTE_CTRL**	Enables object for remote control.
16	**RQ_CLEAR_RESET**	Clears the bit that indicates that the object has been previously reset.
17	**RQ_RESET**	Resets the object.

LN-VSTAT Smart-Sensor

The Smart-Sensor is an advanced LCD sensor specifically designed to interface with the VAV/VVT line of controllers. The Smart-Sensor provides precision local temperature sensing, a variety of public functions that can be accessed by room occupants, and password-protected functions for technicians.

LN-Smart-Sensor Overview

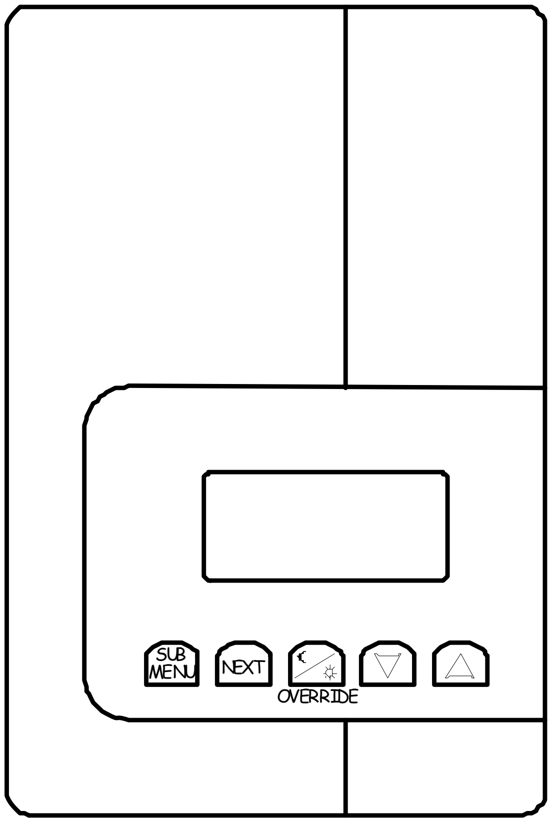

Figure 47: LN-VSTAT Smart-Sensor

The Smart-Sensor has a built-in thermistor for temperature sensing, a 2-line/8-character LCD, and five push buttons. The Smart-Sensor measures the room temperature every 5 seconds, updates the value displayed on the LCD, and sends the temperature to the controller.

The Smart-Sensor has a regular user mode for building occupants and a password-protected configuration mode that consists of a main configuration menu and 3 sub-menus (I/O display mode, flow configuration mode, and flow calibration mode). The menu hierarchy and the options available in each menu and submenu are illustrated in Figure 48.

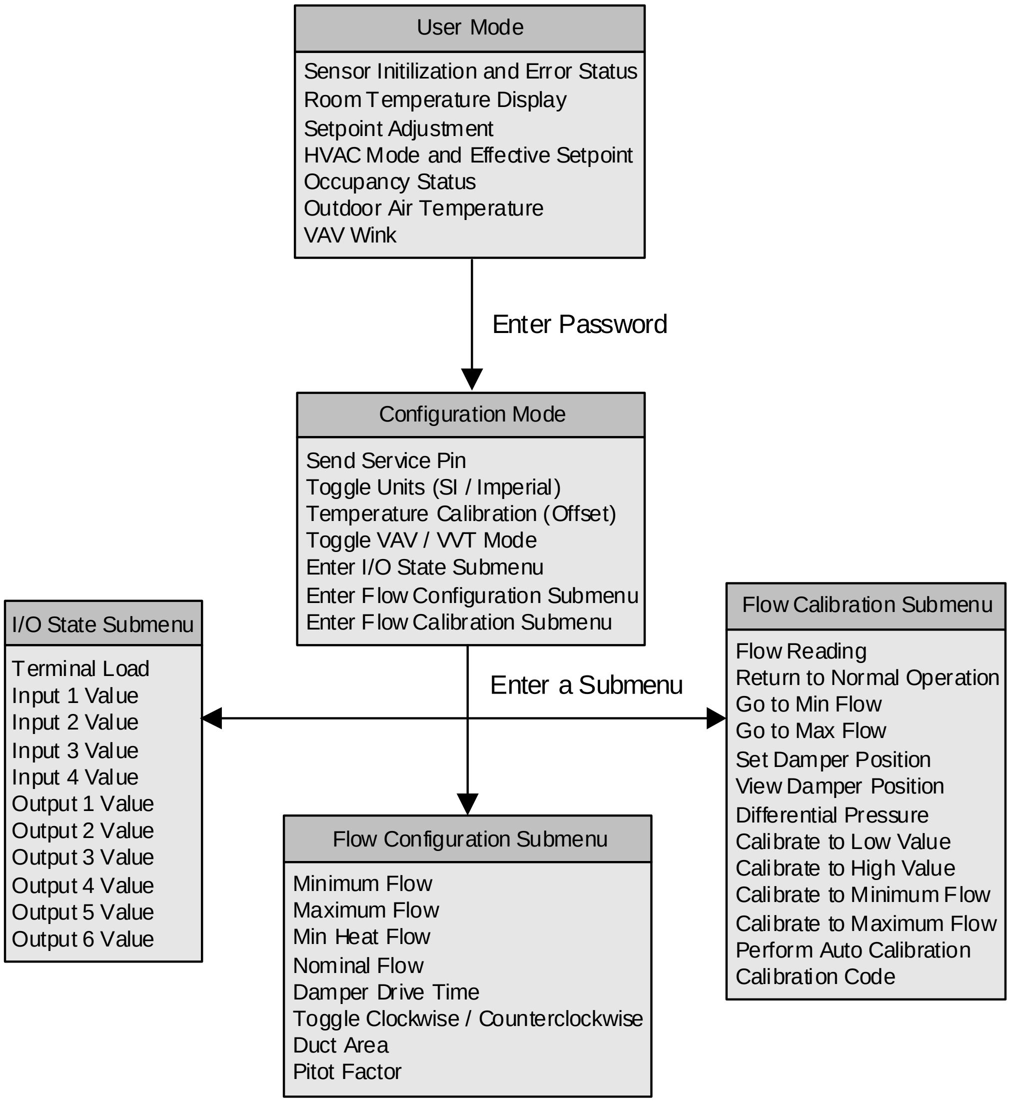

Figure 48: Smart-Sensor System Overview

Button Operation

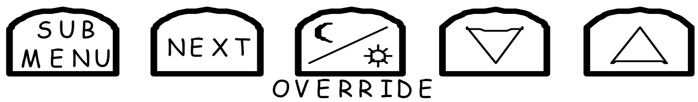

Figure 49: LN-VSTAT Smart-Sensor Push Buttons

The Smart-Sensor has five push buttons that are scanned every 100 ms to determine if a button has been pressed. You can press-and-release a button to scroll through menu items, or change displayed values one at a time. Alternatively, you can hold down a button to simulate repeated button presses. This option is convenient when making changes to setpoints, adjusting the damper position, and so on.

The Smart-Sensor has a 5 second time-out in the regular user mode. The 5 second timer begins after each button release. Once it times out, it returns to the default display screen which typically displays the room temperature. The Smart-Sensor has a 20 minute time-out in the password configuration mode. This timer thereby provides sufficient time for an air-balancing technician to perform various air balancing tasks, take readings, and enter data without the configuration mode timing out.

The Smart-Sensor ceases to sample the room temperature while buttons are pressed. Temperature sampling resumes 5 seconds after the last button press.

Even though the LCD screen does not time-out and return to the default temperature display screen for 20 minutes, it does begin sampling the temperature and sending the value to the controller 5 seconds after the last button press if in configuration mode.

Startup and Errors

Normally, the first time that the Smart-Sensor powers up (is connected to a VAV/VVT from which it draws power), the text **SENSOR INIT…** appears on the LCD screen. The Smart-Sensor also shows this text after any power cycle of the VAV, signifying that it is communicating with the VAV and initializing.

If a loss of communication occurs between the Smart-Sensor and the VAV during regular operation, or if communication cannot be established on powerup, the text **SENSOR COM FAIL** appears on the LCD. The Smart-Sensor periodically attempts to reestablish communication with the VAV and displays the text **SENSOR RETRY!**. If communication cannot be established, the LCD alternates between these two messages.

Note: If you encounter a communications problem, examine the wiring between the Smart-Sensor and the VAV. Ensure that the wires are properly inserted into the wire terminals and that you have not exceeded a wire length of 15 meters (50 feet). If the problem is not wiring related, connect another Smart-Sensor to the VAV to determine if the problem is with the original Smart-Sensor or the VAV. Contact your Johnson Controls representative for Return Materials Authorization (RMA) information.

User Mode

The user mode enables building occupants to view temperatures, adjust the setpoint, and initiate an override. By default, the Smart-Sensor displays the room temperature. Table 29 provides descriptions of button usage in user mode.

Button Usage in User Mode

Table 29: Button Usage in User Mode

Button Description	Usage
SUB MENU	Not used in user mode.
NEXT	Views the next available menu option.
OVERRIDE	Sets the VAV into override mode. The occupancy state temporarily changes to BYPASS.
Down Arrow	This button allows you to view and decrease the setpoint. Pressing the button once displays the setpoint. Pressing it a second time decreases the temperature by 0.5 degrees. Holding down the button decreases the value continuously until you release the button or you reach the lower limit.
Up Arrow	This button allows you to view and increase the setpoint. Pressing the button once displays the setpoint. Pressing it a second time increases the temperature by 0.5 degrees. Holding down the button increases the value continuously until you release the button or you reach the upper limit.

User Mode Display Text Definitions

RoomTemp

RoomTemp is a read-only field. It displays the current room temperature and updates its value every 5 seconds. The room temperature is the default display screen for the Smart-Sensor.

The temperature is read from the onboard temperature sensor and written to nvoSpaceTemp.

(SI Units: °C/IP Units: °F)

Setpoint

Setpoint is an editable field. It displays the current midrange setpoint. You can use the up and down arrows to modify the midrange setpoint. The midrange setpoint is the median value between the heating and cooling setpoints. See the *Midpoint/ Midrange Setpoint Definition* section for more information.

The setpoint entered using the Smart-Sensor (when in occupied, bypass, or standby modes) is written to nvoEffectSetpt only if you set up the VAV for single room control. However, nvoEffectSetpt equals nviSetpoint if nviSetpoint has been assigned a value.

If you use the VAV for two room control and the Smart-Sensor is associated with the first room (specifically, it provides SPACE_TEMP_ROOM1 and specifies SETPOINT_ROOM1), nvoEffectSetpt equals the average of SETPOINT_ROOM1 and SETPOINT_ROOM2.

If you do not have a sensor providing a reading for SETPOINT_ROOM2, then the controller averages SETPOINT_ROOM1 with the median of the heating and cooling setpoints stored in nciSetPts.

Note: Because nviSetpoint overrides all other setpoint values, network variable output nvoEffectSetpt equals nviSetpoint if has been assigned a value.

(SI Units: °C/IP Units: °F)

Cooling

Cooling is a read-only field. If the HVAC mode is in cooling, the Smart-Sensor displays the text **Cooling** followed by the cooling setpoint, which is the effective setpoint at that time.

The HVAC mode is read from nvoUnitStatus.

Heating

Heating is a read-only field. If the HVAC mode is in heating, the Smart-Sensor displays the text **Heating** followed by the heating setpoint, which is the effective setpoint at the time.

The HVAC mode is read from nvoUnitStatus.

OccState

OccState is a read-only field and shows the current occupancy status.

The occupancy state is read from nvoOccState.

Override

Override is a read-only field. The text **Override** appears when you press the Override button and set nvoOccState to OC_BYPASS.

The controller remains in bypass mode for the time period specified in SCPTbypassTime.

OutdoorTemp

Outdoor Temp is a read-only field. The outdoor temperature is displayed only if you have bound nviOutdoorTemp to a controller that provides an outdoor temperature reading.

(SI Units: °C/IP Units: °F)

Password-Protected Configuration Mode

A password protects and hides the Smart-Sensor configuration mode from building occupants. The configuration mode provides building personnel with a number of advanced configuration, monitoring, and air-balancing options. Table 30 describes these options.

Entering the Configuration Mode

To access the password-protected configuration mode, perform the following actions:

1. Hold the **SUBMENU** and the **NEXT** buttons simultaneously for approximately 10 seconds. Release the buttons when you see the display screen text change to **Login 5000**.

2. Use the arrow keys to increase or decrease the displayed number until it matches your configured password. By default, the password is 5001.

Note: If you have previously changed the password and do not remember it, examine the value of UCPTcomPassword or check the Password field in the LN-VSTAT sensor Configuration window.

3. Press the **OVERRIDE** button to submit your password.
4. If you have entered the correct password, the Smart-Sensor displays the **Srvc Pin** screen. If you have entered an incorrect password, the Smart-Sensor displays the text **Password Failed**.

Note: The Smart-Sensor automatically exits the configuration mode 20 minutes after the last button press. To exit the configuration mode manually, hold the SUBMENU and the NEXT buttons simultaneously for approximately 10 seconds.

Button Usage in Configuration Mode

Table 30: Button Usage in Configuration Mode

Button Description	Usage
SUBMENU	Accesses one of the three available submenus. This button does not have any effect unless the Smart-Sensor displays the text **Submenu**, which indicates that it is possible to access a specific submenu.
NEXT	Views the next available menu option.
OVERRIDE	Functions like an Enter key on a keyboard. When you press this button, the specified value is sent to the controller.
Down Arrow	Decreases the displayed parameter value.
Up Arrow	Increases the displayed parameter value.

Configuration Mode Display Text Definitions

Srvc Pin

This menu sends a service pin message over the network. You can edit the Service Pin field. Setting the value to **1** and pressing the **OVERRIDE** button is equivalent to pressing the service pin button on the controller.

SI Units

This menu specifies the display units for temperature values. You can edit the SI Units field. Setting the value to **0** causes the Smart-Sensor to display temperatures in IP units (°F and CFM). Setting the value to 1 causes the Smart-Sensor to display SI units (°C and LPS).

The value is written to the SmartSensorInSI field of UCPTvavOptions.

Temp Cal

This menu calibrates the temperature sensor. You can edit the Temp Cal field, and use the arrow buttons to increase or decrease the temperature calibration offset value by 0.1° per button press. The offset range is ± 12.7°C or ± 22.8°F.

The value is written to UCPTcomInputCfgOffset.

(SI Units: ºC/IP Units: ºF)

VAV Mode

This menu specifies if you are using a VAV or VVT controller. You can edit the VAV Mode and use this menu to put a VAV controller into VVT mode. Setting the value to 0 puts the controller into VVT mode. Setting the value to 1 puts the controller into VAV mode.

The value is written to the VVTmode field of the UCPTvavOptions.

Submenu IO State

This field functions as a submenu link. Pressing the **SUBMENU** button while you are in this menu takes you to the I/O state submenu.

Submenu Flow Cfg

This field functions as a submenu link. Pressing the **SUBMENU** button while you are in this menu takes you to the flow configuration submenu.

Submenu Flow Cal

This menu functions as a submenu link. Pressing the **SUBMENU** button while you are in this menu takes you to the flow calibration submenu.

I/O State Configuration Submenu Display Text Definitions

Trm Load

Terminal Load is a read-only field that displays the controller's terminal load. The terminal load value is read from nvoTerminalLoad.

Input N

Input N is a read-only field that displays the value of hardware input N (where N is a whole number between 1 and 4).

The value is read from nvoHwInputN (where N is a whole number between 1 and 4).

Output N

Output N is a read-only field that displays the value of hardware output N (where N is a whole number between 1 and 6).

The value is read from the output value.

Note: All values displayed in the I/O submenu are updated every 3 seconds.

Flow Configuration Submenu

Min Flow

Minimum Flow is an editable field defined as the minimum airflow maintained by the VAV box during normal operation. The flow setpoint only falls below the Minimum Flow if the **Use zero flow as min flow while Unoccupied** option is selected or if the flow setpoint is overridden.

Setting the Minimum Flow to zero means the damper is fully closed, in which case no fresh air is supplied to the zone that the VAV controls.

The value entered in this field is written to SCPTminFlow.

(SI Units: LPS/IP Units: CFM)

MinFlwHt

Minimum Flow Heat is an editable field defined as the minimum airflow maintained by the VAV when duct heating is turned ON (unless it is overridden).

The Minimum Flow Heat option allows a higher minimum airflow sometimes required for duct heaters. If this flow value is not met, the duct heater does not turn ON.

The value entered in this field is written to SCPTminFlowHeat.

(SI Units: LPS/IP Units: CFM)

Max Flow

Maximum Flow is an editable field defined as the maximum allowable airflow. Unless overridden, the flow setpoint never exceeds this value.

The value entered in this field is written to SCPTmaxFlow.

(SI Units: LPS/IP Units: CFM)

Nom Flow

Nominal Flow is an editable field defined as the expected airflow when the damper is fully open. Nominal flow determines the next damper movement and is used by the VAV during pre-calibration. If you do not know the nominal flow, you can leave it at zero.

The value entered in this field is written to SCPTnomAirFlow.

(SI Units: LPS/IP Units: CFM)

DmpDrTm

Damper Drive Time is an editable field defined as the specific time the damper takes to move from the fully closed position to the fully open position or vice versa. This option is used only for built-in actuators.

The damper drive time has a range of 45 to 150 seconds. However, using the default value of 95 seconds is recommended.

The value entered in this field is written to UCPTdamperDriveTime.

Open CCW

Open Clockwise or Counterclockwise is an editable field that specifies the rotation direction (Clockwise or Counterclockwise) of the actuator. Set the value to 0 for clockwise or 1 for counterclockwise.

A binary value representing the damper direction is written to the DamperCCW field of UCPTvavOptions.

Area

Area is an editable field. The Area value is important only to perform a pre-calibration of the VAV box, without using a reference instrument.

The value entered in this field is written to SCPTductArea.

(SI Units: cm^2/IP Units: in^2)

PitotFct

Pitot Factor is an editable field defined as a divider applied to the differential pressure reading. The Pitot Factor compensates for varying characteristics and flow effects in VAV box equipment and pickup probes. You can ensure precise pre-calibration by entering the Pitot Factor along with the Duct Area.

Contact your VAV box manufacturer / Pitot tube manufacturer for the Pitot Factor value if they have not provided it to you.

The value entered in this field is written to SCPTGainVAV.

Flow Calibration Submenu

Flow

Flow is a read-only field defined as the real-time airflow supplied to the zone. The flow reading is available only if the VAV has been calibrated.

The flow value is read from nvoAirFlow.

(SI Units: LPS/IP Units: CFM)

RunNrmOp

Run Normal Operation is an editable field that terminates calibration mode and puts the VAV controller back into normal operation. Calibration mode activates as soon as you send a command from the flow calibration submenu, and ends automatically when the Smart-Sensor returns to user mode, or the RunNrmOp command is sent to the VAV.

While the controller is in calibration mode, it does not respond to control demands.

GotoMinF

Go to Minimum Flow is an editable field and used only if the VAV is already calibrated. When you press this button, the VAV automatically maintains the minimum flow that you specified in the Min Flow screen of the Flow Configuration Submenu, by adjusting the damper position. The VAV dynamically compensates for changes in air pressure to ensure the minimum airflow is maintained.

The VAV continues to maintain the minimum airflow until the RunNrmOp command is sent to the VAV or you exit the password protected menu and return to the user mode.

GotoMaxF

Go to Maximum Flow is an editable field and used only if the VAV is already calibrated. When you press this button, the VAV automatically maintains the maximum flow you specified in the Max Flow screen of the Flow Configuration Submenu, by adjusting the damper position. The VAV dynamically compensates for changes in air pressure to ensure maximum airflow is maintained.

The VAV continues to maintain the minimum airflow until you send the RunNrmOp command to the VAV, or you exit the password protected menu and return to user mode.

Dmp Cmd

Damper Command is an editable field that moves the damper to the position that you specify in this screen. The damper range is 0% (fully closed) to 100% (fully open).

The damper remains at the position you specify until the RunNrmOp command is sent to the VAV, or you exit the password protected menu and return to user mode.

Dmp Pos

Damper Position is a read-only field that displays the current damper position (in %).

DifPress

Differential Pressure is a read-only field that displays the current differential pressure reading.

(SI Units: Pa/IP Units: Water Column [W.C.])

CalLoVal

This is an editable field. When you use this option, you calibrate the VAV based on an airflow that is close to the minimum flow you specified in the Min Flow screen of the Flow Configuration Submenu. Adjust the damper until your flow hood (capture hood) reading is close to the minimum flow. Enter the flow hood reading, then press **OVERRIDE**. This method is quicker than making micro adjustments to the damper as required when using the CalToMin option.

CalHiVal

This is an editable field. When you use this option, you calibrate the VAV based on an airflow that is close to the maximum flow you specified in the Max Flow screen of the Flow Configuration Submenu. Adjust the damper until your flow hood reading is close to the maximum flow. Enter the flow hood reading, then press **OVERRIDE**. This method is quicker than making micro adjustments to the damper as required when using the CalToMax option.

CalToMin

This is an editable field. When you use this option, you calibrate the VAV to the exact airflow you specified in the Min Flow screen of the Flow Configuration Submenu. Adjust the damper until your flow hood reading is equal to the minimum flow, change the on-screen value from 0 to 1, then press **OVERRIDE**.

CalToMax

This is an editable field. When you use this option, you calibrate the VAV to the exact airflow you specified in the Max Flow screen of the Flow Configuration Submenu. Adjust the damper until your flow hood reading is equal to the maximum flow, change the on-screen value from 0 to 1, then press **OVERRIDE**.

DoAutoCal

This is an editable field. The DoAutoCal option performs an automatic calibration of the VAV. Depending on if you entered duct area in the Area screen of the Flow Configuration Submenu, the VAV uses one of two automatic calibration methods. A detailed description of these methods is provided in the *Automatic Calibration (Pre-calibration)* section.

NOT CALIBRAT

This is a read-only field. The text **NOT CALIBRAT** displays if the VAV has not been calibrated. However, if the VAV has been calibrated, it shows the calibration code that is stored in nviCalibCode.

Note: All read-only values are updated every 3 seconds.

Note: The values that can be changed by the Smart-Sensor are read directly from the device in the VAV Device Configuration window.

VAV Object Network Variable and Configuration Property List

The following section provides a complete list of the network variables and configuration properties in the VAV Object.

Overview

The network interface definition is based on the LONMARK® Space Comfort Controller VAV profile (#8502). This object is primarily used to control a VAV box with (optional) heating and cooling equipment, but it also has some lighting capabilities.

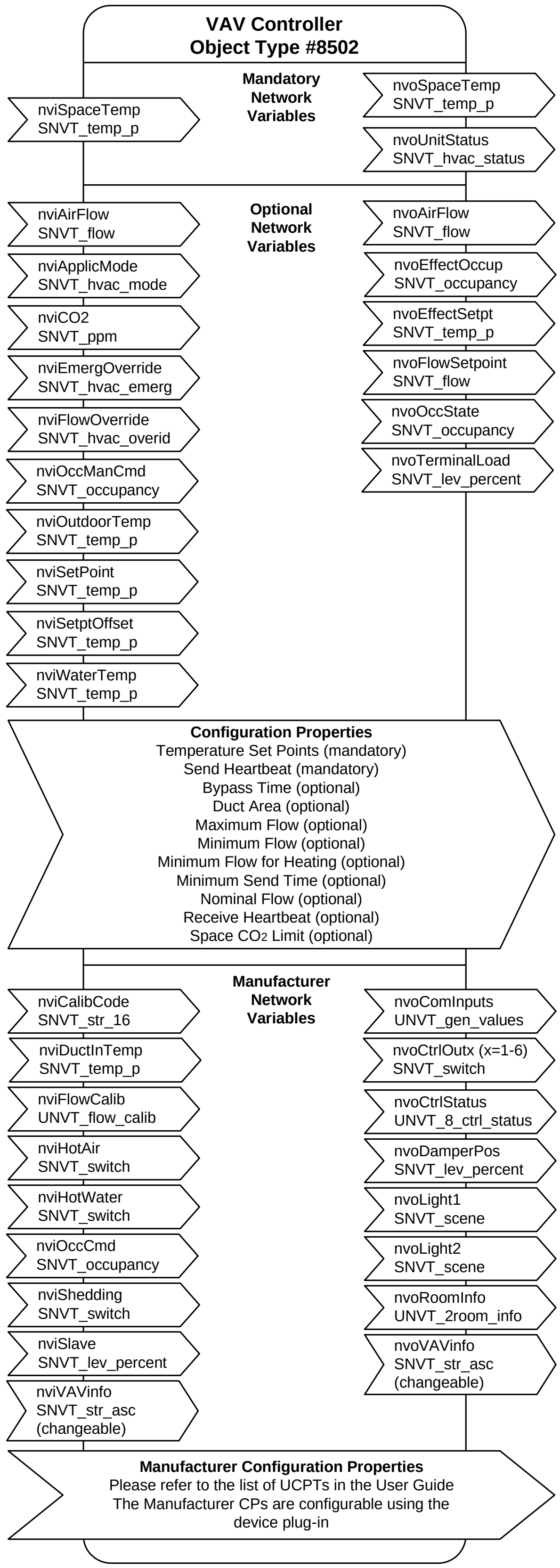

Figure 50: VAV Object Functional Profile

Table 31: VAV Object Input Network Variable Quick Reference

Network Variable Name	Type	Size, byte	Description
nviSpaceTemp	SNVT_temp_p	2	Space Temperature Input
nviSetpoint	SNVT_temp_p	2	Temperature Setpoint Input
nviSetptOffset	SNVT_temp_p	2	Setpoint Offset Input
nviOccCmd	SNVT_occupancy	1	Occupancy Input
nviApplicMode	SNVT_hvac_overid	1	Application Mode Input
nviFlowOverride	SNVT_hvac_overid	5	Air Flow Override Input
nviEmergOverride	SNVT_hvac_emerg	1	Emergency Override Input
nviWaterTemp	SNVT_temp_p	2	Water Temperature Input
nviOutdoorTemp	SNVT_temp_p	2	Outdoor Air Temperature Input
nviCO2	SNVT_ppm	2	CO_2 Sensor Input
nviAirFlow	SNVT_flow	2	Air Flow Input
nviDuctInTemp	SNVT_temp_p	2	Duct Inlet Temperature Input
nviHotAir	SNVT_switch	2	Duct Air Temperature State Input
nviHotWater	SNVT_switch	2	Water Temperature State Input
nviShedding	SNVT_switch	2	Shedding Input
nviSlave	SNVT_lev_percent	2	Slave Input
nviVAVinfo	SNVT_str_asc	31	VAV Operational Information Input
nviFlowCalib	UNVT_flow_calib	3	Flow Calibration Input
nviCalibCod	UNVT_str_16	16	Calibration Code Input

Table 32: VAV Object Output Network Variable Quick Reference

Network Variable Name	Type	Size, byte	Description
nvoSpaceTemp	SNVT_temp_p	2	Space Temperature Output
nvoUnitStatus	SNVT_hvac_status	12	Reports operational status of controller
nvoEffectSetpt	SNVT_temp_p	2	Effective Setpoint Output
nvoFlowSetpoint	SNVT_flow	2	Flow Setpoint Output
nvoTerminalLoad	SNVT_lev_percent	2	Terminal Load Output
nvoEffectOccup	SNVT_occupancy	1	Effective Occupancy State Output
nvoDamperPos	SNVT_lev_percent	2	Actual Damper Position Output
nvoRoomInfo	UNVT_2room_info	24	Room Information Output
nvoCtrlOutx	SNVT_switch	2	Equipment Control Output
nvoLightx	SNVT_scene	2	Light Command Output
nvoAirFlow	SNVT_flow	2	Air Flow Reading Output
nvoCtrlStatus	UNVT_8_ctrl_status	16	Detailed Equipment Control Status Output
nvoComInputs	UNVT_gen_values	30	LCD and Return Fan (RF) Input Values
nvoVAVinfo	SNVT_str_asc	31	VAV Operational Information Input

Table 33: VAV Object CP Quick Reference

CP Type Name and Index	NV Type Name and Index	Size, byte	Description
SCPTmaxSendTime (49)	SNVT_time_sec (107)	2	Maximum Send Time (output heartbeat)
SCPTsetPnts (60)	SNVT_temp_setpt (106)	12	Occupancy Temperature Setpoints
SCPTobjMajVer (167)	unsigned short	1	Object Major Version (constant)
SCPTobjMinVer (168)	unsigned short	1	Object Minor Version (device-specific constant)
SCPTminSendTime (52)	SNVT_time_sec (107)	2	Minimum Send Time
SCPTmaxRcvTime (48)	SNVT_time_sec (107)	2	Maximum Receive Time (input heartbeat)
SCPTlimitCO2 (42)	SNVT_ppm (29)	2	CO2 Concentration Limit
SCPTbypassTime (34)	SNVT_time_min (123)	2	Bypass Time
SCPTholdTime (91)	SNVT_time_sec (107)	2	Occupancy Sensor Hold Time
SCPTminFlow (54)	SNVT_flow (15)	2	Minimum Air Flow
SCPTminFlowHeat (55)	SNVT_flow (15)	2	Heating Minimum Air Flow
SCPTmaxFlow (51)	SNVT_flow (15)	2	Maximum Air Flow
SCPTnomAirFlow (57)	SNVT_flow (15)	2	Nominal Air Flow
SCPTductArea (46)	SNVT_area (110)	2	Duct Area
SCPTgainVAV (66)	SNVT_multiplier (82)	2	Dynamic to Differential Pressure Gain (or Pitot Amplification Factor)
SCPTcontrol TemperatureWeighting (215)	SNVT_lev_percent (81)	2	VAV Weight
UCPTdefaultOccupancy (112)	SNVT_occupancy (109)	1	Default Occupancy
UCPTlockFlowCalib (14)	UNVT_lock_nm (6)	1	Flow Calibration Security Lock
UCPTchngeOverDelay (2)	SNVT_time_min (123)	2	Change Over Delay
UCPTdamperResponse (38)	SNVT_lev_percent (81)	2	Damper Response
UCPTdamperDriveTime (1)	SNVT_time_sec (107)	2	Damper Drive Time
UCPTheatOrder (7)	UNVT_heat_order (1)	2	Duct and Perimeter Heating Order
UCPTlightOffDelay (109)	SNVT_time_min (123)	2	Delay before Turning the Lights Off
UCPTlightOffCycleTime (110)	SNVT_time_min (123)	2	Cycle Time for Turning the Lights Off
UCPTtempPIDparam (8)	UNVT_PID parameters (2)	15	Temperature PID Loop Configuration Parameters

Table 33: VAV Object CP Quick Reference

CP Type Name and Index	NV Type Name and Index	Size, byte	Description
UCPTCO2PIDparam (9)	UNVT_PID parameters (2)	15	CO2 PID Loop Configuration Parameters
UCPTspaceTempAlarm (78)	UNVT_alarm_cfg_ delta (12)	4	Space Temperature Alarm Configuration Parameters
UCPTflowAlarm (98)	UNVT_alarm_cfg_ delta (12)	4	Air Flow Alarm Configuration Parameters
UCPTCO2limitAlarm (111)	---	4	CO2 Alarm Configuration Parameters
UCPTvavInputType[10] (100)	vav2_input_types_t	1x10	VAV input types for all 10 inputs (4 hardware inputs and 6 LCD and RF inputs)
UCPTvavOutputCfg[8] (99)	---	18x8	VAV equipment control and output configuration for 8 equipments
UCPT learnedComModule[12] (104)	---	4x12	Learned RF module IDs (read-only)
UCPT usedComModule[6] (108)	---	4x6	Used RF module IDs
UCPT comModuleType[6] (105)	com_module_type_t	1x6	LCD and RF Module Type
UCPTcomInputCfg[6] (106)	---	8x6	LCD and RF Input Configuration
UCPTcomPassword (103)	---	2	LCD Password
UCPTvavOptions (68)	SNVT_state_64 (165)	8	VAV Discrete (True/False) Options
UCPT vavHeatOutdoorLimits (114)	---	4	VAV Duct and Perimeter Permissions versus Outdoor Temperature Limits
UCPTextraConfig (87)	---	30	Extra Configurations (reserved for future use)

Note: All configuration properties apply to the object and are implemented as read-write memory.

Mandatory Network Variables

Space Temperature Input

nviSpaceTemp

This input network variable connects an external space temperature sensor to the node. It does not have to be bound if a locally wired space temperature sensor is provided. If unbound, any update to nviSpaceTemp is ignored. If it is bound and a valid value is present, the nviSpaceTemp network variable has priority and overrides the internal space temperature reading.

If bound, this network variable input overrides the internal sensor reading when updated from the network. If this network variable is not bound, updates are ignored.

The Space Temperature input is checked for input heartbeat, unless the Maximum Receive Time CP is set to zero (default). It defaults to the invalid value and removes temperature override on heartbeat failure and after reset.

Type: SNVT_temp_p

Valid Range

The valid range is -10 to 50°C (14 to 122°F). The value 0x7FFF=+327.67°C is considered the invalid value.

Default Value

The default value is the invalid value (0x7FFF=+327.67°C). This value is adopted at powerup and when an update is not received within the specified receive heartbeat time. If the preceding instance occurs, the VAV uses the wired temperature sensor.

Configuration Considerations

Space Temperature input has receive heartbeat checking enabled if it is bound and the configured Maximum Receive Time in SCPTmaxRcvTime is greater than zero.

Effective Space Temperature Output

nvoSpaceTemp

Effective Space Temperature output monitors the effective space temperature the VAV is using for control. If the input nviSpaceTemp has a valid value, this output reflects the value of the input. If the value for nviSpaceTemp is invalid, the wired sensor value is used. If neither value is available, the output sends the invalid value.

Optional heartbeat and send delta.

Type: SNVT_temp_p

Typical Range

The typical range is -10 to 50°C (14 to 122°F).

Default Value

The invalid value (0x7FFF=+327.67°C) is used at start-up until a valid value is present or a sensor failure occurs.

When Transmitted

The variable transmits immediately when its value has changed significantly (configurable by SCPTminDeltaTemp). In addition, this network variable also transmits as a heartbeat output on a regular basis as dictated by the Maximum Send Time CP SCPTmaxSendTime.

Update Rate

This value updates every second.

Default Service Type

The default service type is unacknowledged.

Unit Status Output

nvoUnitStatus

Unit Status output reports comprehensive HVAC status information of the VAV. It combines the operating mode, the actual load of heating and cooling, the status of the fan, and an indication if any alarms are present in the object.

Type: SNVT_hvac_status

Valid Range

- **Mode**: VAC_HEAT, HVAC_MRNG_WRMUP, HVAC_COOL, HVAC_NIGHT_PURGE, HVAC_PRECOOL, HVAC_OFF, HVAC_EMERG_HEAT.
- **heat_output_primary**: 0–100%
- **heat_output_secondary**: 0–100%
- **cool_output**: 0–100%
- **econ_output**: 0–100%
- **fan_output**: 0 = Fan OFF, 100 = Fan ON
- **in_alarm**: 0 = no alarm, NOT 0 = alarm

When Transmitted

The variable is transmits immediately when one of its values or a status has changed. This network variable also transmits as a heartbeat output on a regular basis as dictated by the Maximum Send Time CP SCPTmaxSendTime.

Update Rate

This value updates no faster than the Minimum Send Time CP SCPTminSendTime.

Default Service Type

The default service type is unacknowledged.

Optional Network Variables

Temperature Setpoint Input (absolute)

nviSetpoint

This input network variable allows the temperature setpoints for the occupied and standby modes to be changed via the network (the unoccupied setpoints are not changed). If a valid value is not present, either a locally wired setpoint or the appropriate setpoint configured in SCPTsetPnts remains unused.

If its value is valid, this network variable input overrides the internal setpoint reading. If Temperature Setpoint is not bound, persistency over power cycles and resets are enabled.

This network variable is checked for input heartbeat, unless the Maximum Receive Time CP is set to the default zero value. Temperature Setpoint input defaults to the invalid value and removes setpoint override on heartbeat failure and after reset.

Type: SNVT_temp_p

Valid Range

The valid range is 10 to 35°C (50 to 95°F). The value 0x7FFF=+327.67°C is invalid.

Default Value

The default value is the invalid value (0x7FFF=+327.67°C). This value is adopted at powerup.

Setpoint Offset Input

nviSetptOffset

This input network variable shifts the effective occupied and standby temperature setpoints by adding its offset to the current setpoints (the unoccupied setpoints are not changed). It is usually bound to a supervisory node or to an external wall module. If a valid value is not present, no offset is applied to the setpoints. If its value is valid, this network variable input overrides the internal setpoint offset reading.

This network variable is checked for input heartbeat, unless the Maximum Receive Time CP is set to the default zero value. It defaults to the invalid value and removes the setpoint offset override on heartbeat failure and after reset.

Type: SNVT_temp_p

Valid Range

The valid range is -10 to 10°C (14 to 50°F). The value 0x7FFF=+327.67°C is invalid.

Default Value

The default value is 0°C (32°F) and does not override the wired setpoint offset. This value is adopted at powerup and in cases where an update is not received within the specified receive heartbeat time. This instance causes the VAV to use the wired setpoint offset.

Configuration Considerations

This network variable input has receive heartbeat checking enabled if the configured receive heartbeat time in SCPTmaxRcvTime is greater than zero. It does not have to be bound to enable heartbeat checking.

Air Flow Override Input

nviFlowOverride

This input network variable commands the VAV into a manual mode for overriding airflow control (most commonly when air balancing the system). It can override heating and/or cooling flow device action to a specific position or to maintain a specific flow.

The operator can enable persistency over power cycles and resets if this network variable is not bound.

Type: SNVT_hvac_overid

Valid Range

Table 34 provides descriptions for the valid ranges of each state.

Table 34: Valid Ranges for nviFlowOverride

State	Description
0 = HVO_OFF	Sets normal Control.
1 = HVO_POSITION	Sets the damper position to the value in the percent field.
2 = HVO_FLOW_VALUE	Controls flow to the value in the flow field.
3 = HVO_FLOW_PERCENT	Controls flow to the value in the percent field. 0% to Minimum flow, 100% to Maximum flow.
4 = HVO_OPEN	Fully opens the damper.
5 = HVO_CLOSE	Fully closes the damper.
6 = HVO_MINIMUM	Controls flow to the minimum flow setting.
7 = HVO_MAXIMUM	Controls flow to the maximum flow setting.
0xFF = HVO_NUL	Functions as invalid value, same as HVO_OFF.
Percent	0% to 100%
Flow	0 to 65534 L/s.

Default Value

The default value is HVO_OFF,0,0. This value is adopted at powerup.

Emergency Override Input

nviEmergOverride

Emergency Override input commands the VAV into different emergency modes. A supervisory node typically sends the input command.

The operator can enable persistency over power cycles and resets if this network variable is not bound.

Type: SNVT_hvac_emerg

Valid Range

Table 35 shows valid ranges for nviEmergOverride.

Table 35: Valid Ranges for nviEmergOverride

State	Description
0 = EMERG_NORMAL	Normal Control
1 = EMERG_PRESSURIZE	Fully opens the damper.
2 = EMERG_DEPRESSURIZE	Fully closes the damper.
3 = EMERG_PURGE	Fully opens the damper and disables heating and cooling.
4 = EMERG_SHUTDOWN	Fully closes the damper and disables heating and cooling.
5 = EMERG_FIRE	Fully closes the damper and disables heating and cooling.
0xFF = EMERG_NUL	Invalid value, normal control

Default Value

The default value is EMERG_NORMAL. This value is adopted at powerup.

Configuration Considerations

This network variable input has receive heartbeat checking enabled if the configured receive heartbeat time in SCPTmaxRcvTime is greater than zero. It does not have to be bound to enable heartbeat checking.

Occupancy Override Input

nviOccManCmd

This input network variable overrides the VAV into different occupancy modes. It is typically sent by a Human-Machine Interface (HMI) or a supervisory node.

The operator can enable persistency over power cycles and resets if this network variable is not bound.

This network variable is checked for input heartbeat, unless the Maximum Receive Time CP is set to zero (default). This input defaults to the invalid value (OC_NUL) and removes the occupancy override on heartbeat failure and after reset.

Type: SNVT_occupancy

Valid Range

Table 36 shows the valid ranges for nviEmergOverride.

Table 36: Valid Ranges for nviEmergOverride

State	Description
0 = OC_OCCUPIED	Operates in occupied mode.
1 = OC_UNOCCUPIED	Operates in unoccupied mode.
2 = OC_BYPASS	Operates in occupied/bypass mode for time period defined by SCPTbypassTime.
3 = OC_STANDBY	Operates in standby mode
0xFF = OC_NUL	Indicates that nviEmergOverride is invalid or unused or cancels a previous command. Initial value at powerup that remains until another value is received. Receiving an invalid value restores the scheduled or default occupancy.

Default Value

The default value OC_NUL = 0xFF. This value is adopted at powerup.

Application Mode Input

nviApplicMode

This network variable input coordinates the VAV with any supervisory controller. If a mode is requested that is not supported by the unit controller, the unit controller uses the mode HVAC_AUTO.

The operator can enable persistency over power cycles and resets if this network variable is not bound.

Type: SNVT_hvac_mode

Valid Range

Table 37 shows the valid ranges for nviApplicMode.

Table 37: Valid Ranges for nviApplicMode

State	Description
0 = HVAC_AUTO	HVAC mode is automatically determined by the VAV to provide control objects, such as to change between heating and cooling.
1 = HVAC_HEAT	Control loop is in heating mode and working to maintain setpoints.
2 = HVAC_MRNG_WRMUP	Control loop is in HVAC_HEAT mode and working to maintain heating setpoints.
3 = HVAC_COOL	Control loop is in HVAC_COOL mode and working to maintain cooling setpoints.
4 = HVAC_NIGHT_PURGE	Control loop is in HVAC_HEAT mode, working to maintain heating setpoints.
5 = HVAC_PRE_COOL	Control loop is in HVAC_HEAT mode, working to maintain heating setpoints.
6 = HVAC_OFF	Unit operation is not allowed; heating and cooling are switched OFF.
0xFF = HVAC_NUL	HVAC mode is automatically determined by the VAV to provide control objects, such as to change between heating and cooling.

All other enumerations are not supported and processed as HVAC_AUTO.

Default Value

The default value is HVAC_AUTO. This value is adopted at powerup and in cases where an update is not received within the specified receive heartbeat time.

Configuration Considerations

Application mode input has receive heartbeat checking enabled if the configured receive heartbeat time in SCPTmaxRcvTime is greater than zero. It does not have to be bound to enable heartbeat checking.

Airflow Input

nviAirFlow

Airflow input connects a flow sensor to the node. It does not have to be bound because the VAV itself has an internal airflow sensor. If unbound, any update to nviAirFlow is ignored. If this variable is bound and a valid value is present, the nviAirFlow has priority and overrides the internal flow sensor.

This network variable is checked for input heartbeat, unless the Maximum Receive Time CP is set to the default value zero. Airflow input defaults to the invalid value and removes airflow override on heartbeat failure and after reset.

Type: SNVT_flow

Valid Range

The valid range is 0 to 65,534 L/s. The value 0xFFFF = 65,535 L/s is invalid.

Default Value

The default value is the invalid value (0xFFFF = 65535 L/s). This value is adopted at powerup and in cases where an update is not received within the specified receive heartbeat time. This instance causes the VAV to use the built-in flow sensor.

Configuration Considerations

This network variable input has receive heartbeat checking enabled if it is bound and the configured receive heartbeat time in SCPTmaxRcvTime is greater than zero.

CO_2 Sensor Input

nviCO2

This input network variable connects a CO_2 sensor to the node. It does not have to be bound because the VAV itself may have a locally wired CO_2 sensor. If unbound, any update to nviCO2 is ignored. If this variable is bound and a valid value is present, nviCO2 has priority and overrides the temperature reading of the locally wired sensor.

This network variable is checked for input heartbeat, unless the Maximum Receive Time CP is set to zero (default). It defaults to the invalid value and removes the CO_2 input override on heartbeat failure and after reset.

Type: SNVT_ppm

Valid Range

The valid range is 0 to 5,000 ppm. The value 0xFFFF = 65,535 ppm is invalid.

Default Value

The default value is the invalid value (0xFFFF = 65,535 PPM). This value is adopted at powerup and in cases where an update is not received within the specified receive heartbeat time. This instance causes the VAV to use the wired CO_2 sensor.

Configuration Considerations

This network variable input has receive heartbeat checking enabled if it is bound and the configured receive heartbeat time in SCPTmaxRcvTime is greater than zero.

Outdoor Air Temperature Input

nviOutdoorTemp

Outdoor Air Temperature input connects an outdoor air temperature sensor to the node. It does not have to be bound because the VAV itself may have a locally wired outdoor air temperature sensor. If unbound, any update to nviOutdoorTemp is ignored. If this variable is bound and a valid value is present, nviOutdoorTemp has priority and overrides the temperature reading of the locally wired outdoor air temperature sensor.

This network variable is checked for input heartbeat, unless the Maximum Receive Time CP is set to zero (default). It defaults to the invalid value and removes temperature override on heartbeat failure and after reset.

Type: SNVT_temp_p

Valid Range

The valid range is -40 to 50°C (-40 to 122°F). The value 0x7FFF=+327.67°C is invalid.

Default Value

The default value is the invalid value (0x7FFF=+327.67°C). This value is adopted at powerup and in cases where an update is not received within the specified receive heartbeat time. This instance causes the VAV to use the wired temperature sensor.

Configuration Considerations

This network variable input has receive heartbeat checking enabled if it is bound and the configured receive heartbeat time in SCPTmaxRcvTime is greater than zero.

Water Temperature Input

nviWaterTemp

Water Temperature input connects a water temperature sensor to the node. It does not have to be bound because the VAV itself may have a locally wired water temperature sensor. If unbound, any update to nviWaterTemp is ignored. If this variable is bound and a valid value is present, the nviWaterTemp has priority and overrides the temperature reading of the locally wired sensor.

This network variable is checked for input heartbeat, unless the Maximum Receive Time CP is set to zero (default). It defaults to the invalid value and removes temperature override on heartbeat failure and after reset.

Type: SNVT_temp_p

Valid Range

The valid range is 0 to 100°C (32 to 212°F). The value 0x7FFF=+327.67°C is invalid.

Default Value

The default value is the invalid value (0x7FFF=+327.67°C). This value is adopted at powerup and in cases where an update is not received within the specified receive heartbeat time. This instance causes the VAV to use the wired temperature sensor.

Configuration Considerations

This network variable input has receive heartbeat checking enabled if it is bound and the configured receive heartbeat time in SCPTmaxRcvTime is greater than zero.

Effective Setpoint Output

nvoEffectSetpt

Effective Setpoint output monitors the effective temperature setpoint. This temperature setpoint depends on SCPTsetpnts, nvoEffectOccup, nviSetpoint, nviSetptOffset, and any local setpoint or setpoint offset. In addition, this output has optional heartbeat and throttle.

Type: SNVT_temp_p

Typical Range

The typical range is 10 to 35°C (50 to 95°F).

Default Value

The invalid value (0x7FFF=+327.67°C) is used at start-up until a valid value is present.

When Transmitted

The variable transmits immediately when its value has changed. Effective Setpoint output also transmits as a heartbeat output on a regular basis as dictated by the Maximum Send Time CP SCPTmaxSendTime.

Update Rate

This value updates no faster than the Minimum Send Time CP SCPTminSendTime.

Default Service Type

The default service type is unacknowledged.

Effective Airflow Setpoint Output

nvoFlowSetpoint

Effective Airflow Setpoint output indicates the active flow setpoint used by the flow control loop. It can be used for monitoring purposes or used with a compatible remote flow control device. In addition, this variable has optional heartbeat and throttle.

Type: SNVT_flow

Typical Range

The typical range is 0 to 65,534 L/s.

Default Value

The invalid value (0xFFFF=65,535 L/s) is used at start-up until a valid value is present.

When Transmitted

The variable transmits immediately when its value has changed significantly (configurable by SCPTsndDelta). Effective Airflow Setpoint output also transmits as a heartbeat output on a regular basis as dictated by the Maximum Send Time CP SCPTmaxSendTime.

Update Rate

This value updates no faster than every second.

Default Service Type

The default service type is unacknowledged.

Airflow Reading Output

nvoAirFlow

Airflow Reading output indicates the measured airflow. If nviAirFlow has a valid value, this network output reflects nviAirFlow. In addition, nvoAirFlow has optional heartbeat and send on delta.

Type: SNVT_flow

Typical Range

The typical range is 0 to 65,534 L/s.

Default Value

The invalid value (0xFFFF=65,535 L/s) is used at start-up until a valid value is present or in case of a sensor failure.

When Transmitted

The variable transmits immediately when its value has changed significantly (configurable by SCPTsndDelta). Airflow Reading also transmits as a heartbeat output on a regular basis as dictated by the Maximum Send Time CP SCPTmaxSendTime.

Update Rate

This value updates no faster than every second.

Default Service Type

The default service type is unacknowledged.

Terminal Load Output

nvoTerminalLoad

This output network variable indicates the VAVs current heat/cool energy demand. Positive values indicate that cooling energy is required (or in use) by the VAV, whereas negative values indicate that heating energy is required (or in use). Terminal Load also has optional heartbeat and send delta.

Type: SNVT_lev_percent

Typical Range

The typical range is -100% to 100%.

When Transmitted

The variable transmits immediately when its value has changed significantly (configurable by SCPTsndDelta). Terminal Load also transmits as a heartbeat output on a regular basis as dictated by the Maximum Send Time CP SCPTmaxSendTime.

Update Rate

This value updates no faster than every second.

Default Service Type

The default service type is unacknowledged.

Effective Occupancy State Output

nvoEffectOccup

Effective Occupancy State output indicates the actual occupancy mode of the unit. This information is typically reported to a supervisory controller, or provided to another HVAC Controller to coordinate the operation of multiple units. The occupancy command NVI nviOccCmd or the controller’s built-in logic can determine the occupancy mode. In addition, nvoEffectOccup has optional heartbeat.

Type: SNVT_occupancy

Valid Range

Table 38 shows valid ranges for nvoEffectOccup.

Table 38: Valid Ranges for nvoEffectOccup

State	Description
0 = OC_OCCUPIED	Operates in occupied mode.
1 = OC_UNOCCUPIED	Operates in unoccupied mode.
2 = OC_BYPASS	Operates in occupied/bypass mode for time period defined by SCPTbypassTime, unless set by schedule input nviOccCmd.
3 = OC_STANDBY	Operates in standby mode.
0xFF = OC_NUL	Functions as initial value after powerup and remains until occupancy is first calculated.

When Transmitted

Effective Occupancy State output transmits immediately when its value has changed. It also transmits as a heartbeat output on a regular basis as dictated by the Maximum Send Time CP SCPTmaxSendTime.

Default Service Type

The default service type is unacknowledged.

Implementation Specific Network Variables

Occupancy Command Input

nviOccCmd

Occupancy Command input network variable commands the VAV into different occupancy modes. It is typically sent from occupancy sensor, supervisory station, or scheduler.

The operator can enable persistency over power cycles and resets if this network variable is not bound.

This network variable is checked for input heartbeat, unless the Maximum Receive Time CP is set to zero (default). This input defaults to the invalid value (OC_NUL) and removes the occupancy override on heartbeat failure and after reset.

Type: SNVT_occupancy

Valid Range

Table 39 shows the valid ranges for nviOccCmd

Table 39: Valid Ranges for nviOccCmd

State	Description
0 = OC_OCCUPIED	Operates in occupied mode.
1 = OC_UNOCCUPIED	Operates in unoccupied mode.
2 = OC_BYPASS	Operates in occupied/bypass mode.
3 = OC_STANDBY	Operates in standby mode.
0xFF = OC_NUL	Functions as initial value after powerup and remains until another value is received. It indicates that the NVI is invalid, unused, and functions to cancel a previous command. Receiving an invalid value restores the default occupancy.

Default Value

The default value is OC_NUL = 0xFF. This value is adopted at powerup and in cases where an update is not received within the specified receive heartbeat time. This instance causes the VAV to use the default occupancy.

Configuration Considerations

This network variable input has receive heartbeat checking enabled if the configured receive heartbeat time in SCPTmaxRcvTime is greater than zero. It does not have to be bound to enable heartbeat checking.

Duct Inlet Temperature Input

nviDuctInTemp

Duct Inlet Temperature input connects a duct inlet temperature sensor to the node. It does not have to be bound because the VAV itself may have a locally wired duct temperature sensor. If unbound, any update to nviDuctInTemp is ignored. If this variable is bound and a valid value is present, nviDuctInTemp has priority and overrides the temperature reading of the locally wired sensor.

This network variable is checked for input heartbeat, unless the Maximum Receive Time CP is set to zero (default). It defaults to the invalid value and removes temperature override on heartbeat failure and after reset.

Type: SNVT_temp_p

Valid Range

The valid range is 0 to 60°C (32 to 140°F). The value 0x7FFF=+327.67°C is considered the invalid value.

Default Value

The default value is the invalid value (0x7FFF=+327.67°C). This value is adopted at powerup and in cases where an update is not received within the specified receive heartbeat time. This instance causes the VAV to use the wired temperature sensor.

Configuration Considerations

This network variable input has receive heartbeat checking enabled if it is bound, and the configured receive heartbeat time in SCPTmaxRcvTime is greater than zero.

Duct Air Temperature State Input

nviHotAir

Duct Air Temperature State input coordinates the VAV’s duct air temperature state with any supervisory controller, and determines if the air is hot or cold.

If bound, this network variable input overrides the internal sensor reading when updated from the network; if not bound, updates are ignored.

The operator can enable persistency over power cycles and resets if this network variable is not bound.

This network variable is checked for input heartbeat, unless the Maximum Receive Time CP is set to zero (default). It defaults to the invalid value and removes temperature override on heartbeat failure and after reset.

Type: SNVT_switch

Valid Range

The valid range for the value field is 0% to 100%, and the valid range for the state field is -1, 0, and 1. The value 0.0, -1 (value = 0, state = -1) is considered the invalid value. When both fields are set to a value higher than zero, the air is considered hot; if not, it is considered cold.

Default Value

The default value is the invalid value (0.0, -1). This value is adopted at powerup and in cases where an update is not received within the specified receive heartbeat time. This instance causes the VAV to use the wired duct temperature sensor.

Configuration Considerations

This network variable input has receive heartbeat checking enabled if it is bound and the configured receive heartbeat time in SCPTmaxRcvTime is greater than zero.

Water Temperature State Input

nviHotWater

Water Temperature State input coordinates the VAV's water temperature state with any supervisory controller and determines if the water is hot or cold.

If bound, this network variable input overrides the internal sensor reading when updated from the network. If this network variable is not bound, updates are ignored.

The operator can enable persistency over power cycles and resets if this network variable is not bound.

This network variable is checked for input heartbeat, unless the Maximum Receive Time CP is set to zero (default). It defaults to the invalid value and removes temperature override on heartbeat failure and after reset.

Type: SNVT_switch

Valid Range

The valid range for the value field is 0% to 100% and the valid range for the state field is -1, 0, and 1. The value 0.0, -1 (value = 0, state = -1) is considered the invalid value. When both fields are set to a value higher than zero, the water is considered hot; if not, it is considered cold.

Default Value

The default value is the invalid value (0.0, -1). This value is adopted at powerup and in cases where an update is not received within the specified receive heartbeat time. This instance causes the VAV to use the wired water temperature sensor.

Configuration Considerations

This network variable input has receive heartbeat checking enabled if it is bound and the configured receive heartbeat time in SCPTmaxRcvTime is greater than zero.

Shedding Input

nviShedding

Shedding input sheds the VAV's heating and cooling equipment. It does not have to be bound. If this variable is bound and a valid value is present, the heating and cooling equipment sheds by the amount specified. For example, 100% fully sheds and completely disables the equipment.

This network variable is checked for input heartbeat, unless the Maximum Receive Time CP is set to zero (default). It defaults to the invalid value and removes all shedding on heartbeat failure and after reset.

Type: SNVT_switch

Valid Range

The valid range for the value field is 0% to 100%, and the valid range for the state field is -1.0, 0 (no shedding) and 1 (apply shedding). The value 0.0, -1 (value = 0.0, state = -1) is considered the invalid value.

Default Value

The default value is 0.0, 0, meaning no shedding. This value is adopted at powerup and in cases where an update is not received within the specified receive heartbeat time. This instance causes the VAV to stop shedding.

Configuration Considerations

This network variable input has receive heartbeat checking enabled if it is bound and the configured receive heartbeat time in SCPTmaxRcvTime is greater than zero.

Slave Input

nviSlave

Slave input slaves the VAV to another VAV. If unbound, any update to nviSlave is ignored. If this variable is bound and a valid value is present, the heating and cooling equipment follows this value.

This network variable is checked for input heartbeat, unless the Maximum Receive Time CP is set to zero (default). It defaults to the invalid value and returns the heating and cooling control to the VAV on heartbeat failure and after reset.

Type: SNVT_lev_percent

Valid Range

The valid range is -100% to 100% where a negative value is considered a heating command and a positive value is considered a cooling demand. The value 0x7FFF = 163.835% is considered the invalid value and releases the VAV from being slaved.

Default Value

The default value is the invalid value (0x7FFF = 163.835%). This value is adopted at powerup and in cases where an update is not received within the specified receive heartbeat time. In this instance, the VAV is no longer slaved.

Configuration Considerations

This network variable input has receive heartbeat checking enabled if it is bound, and the configured receive heartbeat time in SCPTmaxRcvTime is greater than zero.

VAV Operational Information Input

nviVAVinfo

VAV Operational Information input retrieves information from a supervisory node, including the application mode and the duct inlet temperature. If unbound, any update to nviVAVinfo is ignored. The default type (SNVT_str_asc) is used only for the maximum network variable length of 31 bytes. Currently, only type SNVT_hvac_status is used and provides the application mode if valid.

This network variable is checked for input heartbeat, unless the Maximum Receive Time CP is set to zero (default). It defaults to the invalid value on heartbeat failure and after reset.

Type: changeable_type SNVT_str_asc

Valid Range

The valid range for the mode field of the SNVT_hvac_status type is the same as nviApplicMode and has the same behavior. The value of the mode field HVAC_NUL (0x7F) is considered the invalid value and has the same behavior as with nviApplicMode.

Default Value

The default value for the mode field of the SNVT_hvac_status type is HVAC_AUTO. This value is adopted at powerup and in cases where an update is not received within the specified receive heartbeat time.

Configuration Considerations

This network variable input has receive heartbeat checking enabled if it is bound and the configured receive heartbeat time in SCPTmaxRcvTime is greater than zero.

Airflow Calibration Input

nviFlowCalib

Airflow Calibration input commands the VAV into a manual mode for overriding airflow control (most commonly when air balancing the system) and to calibrate the flow sensor. It can also override heating and/or cooling flow devices.

Airflow Calibration input returns the VAV to normal operation after reset.

Type: UNVT_flow_calib

Valid Range

Table 40 provides descriptions of each command.

Table 40: Valid Range for nviFlowCalib

Command	Description
0 = NORMAL_OPERATION	Indicates normal control.
1 = CALIBRATE_TO_MAX	Sets the damper position to the value in the percent field.
2 = CALIBRATE_TO_MIN	Controls flow to the value in the flow field.
3 = CALIBRATE_TO_NOM	Controls flow to the value in the percent field. 0% to Minimum flow, 100% to Maximum flow.
4 = CALIB_WITH_HI_VAL	Fully opens the damper.
5 = CALIB_WITH_LO_VAL	Fully closes the damper.
6 = AUTO_TMP_CALIB	Controls flow to the minimum flow setting.
7 = OPEN_BOX_SLOW	Controls flow to the maximum flow setting.
8 = CLOSE_BOX_SLOW	Controls flow to the maximum flow setting.
9 = OPEN_BOX_FAST	Controls flow to the maximum flow setting.
10 = CLOSE_BOX_FAST	Controls flow to the maximum flow setting.
11 = BOX_STANDSTILL	Controls flow to the maximum flow setting.
12 = GOTO_MAX	Controls flow to the maximum flow setting.
13 = GOTO_MIN	Controls flow to the maximum flow setting.
14 = GOTO_PERCENT	Controls flow to the maximum flow setting.
15 = VIEW_DP_CAD_VAL	Controls flow to the maximum flow setting.
17 = GET_DRIVE_TIME	Controls flow to the maximum flow setting.
18 = CALIBRATE_TO_ZERO	Controls flow to the maximum flow setting.
19 = RESET_CALIBRATION	Controls flow to the maximum flow setting.
0xFF = HVO_NUL	Functions as invalid value, same as HVO_OFF.

Value

0% to 100% for GOTO_PERCENT and 0 to 65,534 L/s for CALIB_WITH_HI_VAL and CALIB_WITH_LO_VAL.

Default Value

The default value is NORMAL_OPERATION 0. This value is adopted at powerup.

Calibration Code Input

nviCalibCode

Calibration Code input sets the calibration code from a previous calibration.

Type: UNVT_str_16

Valid Range

The calibration code is always 16 characters long including both letters and numbers. The VAV only accepts one of its previous calibration code.

Default Value

The default value is a blank string.

Actual Damper Position Output

nvoDamperPos

Actual Damper Position output indicates the current VAV damper position.

Optional heartbeat and throttle.

Type: SNVT_lev_percent

Typical Range

The typical range is 0% to 100%.

When Transmitted

The variable transmits immediately when its value has changed. It also transmits as a heartbeat output on a regular basis as dictated by the Maximum Send Time CP SCPTmaxSendTime.

Update Rate

This value updates no faster than the Minimum Send Time CP SCPTminSendTime.

Default Service Type

The default service type is unacknowledged.

Two Rooms Information Output

nvoRoomInfo

This output network variable monitors each of the two space temperature, their setpoints, and the effective heating and cooling setpoints.

Includes the two rooms' temperature and setpoints and the average temperature and setpoints.

Type: UNVT_2room_info

Typical Range

The typical ranges for each field follows the SNVT_temp_p range.

Default Value

For each fields, the invalid value (0x7FFF=+327.67°C) is used at start-up until a valid value is present or in case of a sensor failure.

When Transmitted

The variable transmits immediately when its value has changed (configurable by SCPTminDeltaTemp). It also transmits as a heartbeat output on a regular basis as dictated by the general Maximum Send Time CP SCPTmaxSendTime.

Update Rate

This value updates no faster than the general Minimum Send Time CP SCPTminSendTime.

Default Service Type

The default service type is unacknowledged.

Equipment Control Output

nvoCtrlOutX

Equipment Control output remotely commands hardware outputs. It follows the equipment(s) control scheme(s).

Optional heartbeat and throttle.

Type: SNVT_switch

Typical Range

The typical range is 0% to 100%.

Default Value

The invalid value (0.0, -1) is used at start-up until a valid value is present, or if it is not used by any equipment.

When Transmitted

The variable transmits immediately when its value has changed. It also transmits as a heartbeat output on a regular basis as dictated by the general Maximum Send Time CP SCPTmaxSendTime.

Update Rate

This value updates no faster than the general Minimum Send Time CP SCPTminSendTime.

Default Service Type

The default service type is unacknowledged.

Network Light Command Output

nvoLightX

Network Light Command output remotely commands lights. It follows the light(s) control scheme(s).

Optional heartbeat.

Type: SNVT_scene

Typical Range

Function:

3 = SC_GROUP_OFF: Turns the light off.

4 = SC_GROUP_ON: Turn the light on.

Scene_number: Always zero.

Default Value

The invalid value (SC_NUL 0) is used at start-up until a valid value is present, or if the appropriate light is not used.

When Transmitted

The variable transmits immediately when its value has changed or when the light switch has been pressed. It also transmits as a heartbeat output on a regular basis as dictated by the Maximum Send Time CP SCPTmaxSendTime.

Default Service Type

The default service type is unacknowledged.

Equipment Control Status Output

nvoCtrlStatus

Equipment Control Status output indicates the equipments state. For each equipment, a value field provides the modulating control part (if applicable), and four state fields provide the state of each digital stage (if applicable).

Optional heartbeat and throttle.

Type: UNVT_8_ctrl_status

Typical Range

The typical range is 0% to 100% for the value field, and 0 or 1 for the state field.

Default Value

All fields are set at zero at start-up until a valid value is present. Unused fields remain at zero.

When Transmitted

The variable transmits immediately when its value has changed. It also transmits as a heartbeat output on a regular basis as dictated by the general Maximum Send Time CP SCPTmaxSendTime.

Update Rate

This value updates no faster than the general Minimum Send Time CP SCPTminSendTime.

Default Service Type

The default service type is unacknowledged.

Return Fan (RF) and LCD Input Values Output

nvoComInputs

This output network variable indicates the value of each Radio Frequency (RF) or LCD input used on the VAV.

Optional heartbeat and throttle.

Type: UNVT_gen_values

Typical Range

The typical range is -3,276.8 to 3,276.6 for each field. The units depend on the input type.

Default Value

All fields are set at zero at start-up until a valid value is present. Unused fields remain at zero.

Note: On the VAV, only 6 RF and LCD inputs are available; therefore, only 6 fields are used out of 15.

When Transmitted

The variable transmits immediately when its value has changed. It also transmits as a heartbeat output on a regular basis as dictated by the general Maximum Send Time CP SCPTmaxSendTime.

Update Rate

This value updates no faster than the general Minimum Send Time CP SCPTminSendTime.

Default Service Type

The default service type is unacknowledged.

VAV Operational Information Output

nvoVAVinfo

This output network variable sends information to a supervisory node, such as the occupancy state, the space temperature, and its setpoint. The default type (SNVT_str_asc) is used only for the maximum network variable length of 31 bytes. Currently, the VAV only uses the types SNVT_lev_percent and SNVT_temp_p. These SNVT types provide the space temperature offset from the setpoint, if valid (in percentage for SNVT_lev_percent). This information is useful for binding many VAVs to the RTU-L's fan-in averaging input.

Optional heartbeat and throttle.

Type: changeable_type SNVT_str_asc

Typical Range

The typical range for the SNVT_lev_percent type is -100% to 100%, and -326.68 to 327.66°C for the SNVT_temp_p type.

Default Value

The invalid value (0x7FFF= 163.835% for SNVT_lev_percent, and 327.67°C for SNVT_temp_p) is used at start-up until a valid value is present or in case of a sensor failure.

When Transmitted

The variable transmits immediately when its value has changed. It also transmits as a heartbeat output on a regular basis as dictated by the Maximum Send Time CP SCPTmaxSendTime.

Update Rate

This value updates no faster than the Minimum Send Time CP SCPTminSendTime.

Default Service Type

The default service type is unacknowledged.

Configuration Properties

Send Heartbeat/Maximum Send Time (Mandatory)

SCPTmaxSendTime cp_family cpMaxSendTime

Send Heartbeat CP sets the maximum period of time that can expire before the VAV automatically updates the appropriate output network variables. It applies to all output network variables of the node.

Valid Range

The valid range is any value between 0.0 s and 6,553.4 seconds. Setting SCPTmaxSendTime to 0.0 disables the Send Heartbeat mechanism.

Default Value

The default value is 120.0 seconds, with some exceptions.

Configuration Requirements/Restrictions

This CP has no modification restrictions and can be operator modified at any time.

SCPT Reference

SCPTmaxSendTime (49)

Occupancy Temperature Setpoints (Mandatory)

network input cp_SCPTsetPnts nciSetPts

Occupancy Temperature Setpoints CP defines the space temperature setpoints for the various heat, cool, and occupancy modes: occupied, standby (not used), unoccupied.

Valid Range

Table 41: Occupancy Temperature Space Temperature Setpoints

Input Type	Minimum	Maximum	Default
occupied_cool	12°C (53.6°F)	37.5°C (99.5°F)	23°C (73.4°F)
standby_cool	12°C (53.6°F)	37.5°C (99.5°F)	25°C (77°F)
unoccupied_cool	12°C (53.6°F)	37.5°C (99.5°F)	28°C (82.4°F)
occupied_heat	4.5°C (40.1°F)	32°C (89.6°F)	21°C (69.8°F)
standby_heat	4.5°C (40.1°F)	32°C (89.6°F)	19°C (66.2°F)
unoccupied_heat	4.5°C (40.1°F)	32°C (89.6°F)	16°C (60.8°F)

Configuration Requirements/Restrictions

This CP has no modification restrictions and can be operator modified at any time.

SCPT Reference

SCPTsetPnts (60)

Minimum Send Time (Optional)

SCPTminSendTime cp_family cpMinSendTime

Minimum Send Time CP determines the minimum time period between transmissions of a particular output network variable. This CP provides a way to tailor the maximum transmission rate to the available network bandwidth. Network variable update throttling is available for network variables that change frequently.

Valid Range

The valid range is any value between 0.0 and 6,553.4 seconds. The transmission mechanism has a 1-second precision. Therefore, a tenth of second has no effect. Transmission updates occur every second.

Default Value

The default value is 0.0 (no throttling of outbound traffic).

Configuration Requirements/Restrictions

This CP has no modification restrictions and can be operator modified at any time.

SCPT Reference

SCPTminSendTime (52)

Receive Heartbeat/Maximum Receive Time (Optional)

SCPTmaxRcvTime cp_family cpMaxRcvTime

This CP determines the maximum time period between updates to a network variable input that has input heartbeat checking. If no update occurs within the time specified, the particular input network variable is reset to its default value.

Valid Range

The valid range is any value between 0.0 and 6,553.4 seconds. Setting SCPTmaxRcvTime to 0.0 disables the Receive Heartbeat mechanism.

Default Value

The default is 0.0 (no input heartbeat checking).

Configuration Requirements/Restrictions

This CP has no modification restrictions and can be operator modified at any time.

SCPT Reference

SCPTmaxRcvTime (48)

Space CO2 Limit

SCPTlimitCO2 cp_family cpCO2Limit

Space CO2 Limit CP defines the CO_2 high limit for the controlled space. The flow increases when the CO_2 reading exceeds the maximum limit.

Valid Range

The valid range is any value between 300 to 3,000 ppm.

Default Value

The default is 1,000 ppm.

Configuration Requirements/Restrictions

This CP has no modification restrictions and can be operator modified at any time.

SCPT Reference

SCPTlimitCO2 (42)

Local Bypass Time

SCPTbypassTime cp_family cpBypassTime

Local Bypass Time CP defines the maximum amount of time that the controller can be in the bypass (occupancy) mode following a single bypass request from either a local (hardwired) bypass switch or nviOccCmd. The timer restarts with additional bypass requests.

Valid Range

The valid range is any value between 0 to 240 minutes (4 hours). Setting SCPTbypassTime to 0 disables the bypass mechanism.

Default Value

The default is 60 minutes.

Configuration Requirements/Restrictions

This CP has no modification restrictions. It can be operator modified at any time.

SCPT Reference

SCPTbypassTime (34)

Minimum Airflow

SCPTminFlow cp_family cpMinFlow

Minimum Airflow CP defines the minimum airflow setpoint. The minimum airflow setpoint must be lower than the maximum airflow setpoint.

Valid Range

The valid range is any value between 0 to 10,000 L/s.

Default Value

The default is 25 L/s.

Configuration Requirements/Restrictions

This CP has no modification restrictions and can be operator modified at any time.

SCPT Reference

SCPTminFlow (54)

Heating Minimum Airflow

SCPTminFlowHeat cp_family cpMinFlowHeat

Heating Minimum Airflow CP defines the heating minimum airflow setpoint. The heating minimum airflow setpoint must be lower than the maximum airflow setpoint. When the VAV has a heating demand, the VAV uses this minimum setpoint instead of SCPTminFlow.

Valid Range

The valid range is any value between 0 to 10,000 L/s.

Default Value

The default is 50 L/s.

Configuration Requirements/Restrictions

This CP has no modification restrictions and can be operator modified at any time.

SCPT Reference

SCPTminFlowHeat (55)

Maximum Airflow

SCPTmaxFlow cp_family cpMaxFlow

Maximum Airflow CP defines the maximum airflow setpoint. The maximum airflow setpoint must be greater than both the minimum airflow setpoint and the heating minimum airflow setpoint.

Valid Range

The valid range is any value between 0 to 10,000 L/s.

Default Value

The default is 250 L/s.

Configuration Requirements/Restrictions

This CP has no modification restrictions and can be operator modified at any time.

SCPT Reference

SCPTmaxFlow (51)

Nominal Airflow

SCPTnomFlow cp_family cpNomlow

Nominal Airflow CP defines the nominal airflow when the VAV box is fully open. The nominal airflow should be greater than the maximum airflow setpoint; if not, it is considered equal to the maximum airflow setpoint.

Valid Range

The valid range is any value between 0 to 10,000 L/s.

Default Value

The default is 0 L/s.

Configuration Requirements/Restrictions

This CP has no modification restrictions and can be operator modified at any time.

SCPT Reference

SCPTnomFlow (57)

Duct Area

SCPTductArea cp_family cpDuctArea

Duct Area CP provides the nominal cross-sectional airflow area. If this CP is not zero, it is used in automatic calibration along with the pitot amplification factor to calculate the slope of the differential pressure to flow curve.

Valid Range

The valid range is any value between 0 to 5.0000 m^2.

Default Value

The default is 0 m^2.

Configuration Requirements/Restrictions

This CP has no modification restrictions and can be operator modified at any time.

SCPT Reference

SCPTductArea (46)

Implementation Specific Configuration Properties

Occupancy Sensor Hold Time

SCPTholdTime cp_family cpHoldTime

Occupancy Sensor Hold Time CP defines the maximum amount of time that the controller can remain in occupied mode following the last detection from the occupancy sensor. And additional detection restarts the timer.

Valid Range

The valid range is any value between 0 to 5,400 seconds (90 minutes). Setting SCPTholdTime to 0 disables the hold time mechanism.

Default Value

The default is 30 seconds.

Configuration Requirements/Restrictions

This CP has no modification restrictions and can be operator modified at any time.

SCPT Reference

SCPTholdTime (91)

Dynamic to Differential Pressure Gain

SCPTgainVAV cp_family cpPressGain

Dynamic to Differential Pressure Gain CP is also called the pitot amplification factor. It defines the dynamic to differential pressure gain from the pitot. The differential pressure sensor reading is divided by this value to determine the dynamic pressure. It is only used in the automatic calibration to calibrate the flow reading by using the duct area.

Valid Range

The valid range is any value between 0.0005 to 32.7675.

Default Value

The default is 1.

Configuration Requirements/Restrictions

This CP has no modification restrictions and can be operator modified at any time.

SCPT Reference

SCPTgainVAV (66)

Control Temperature Weighting

SCPTcontrolTemperatureWeighting cp_family cpVavWeight

Control Temperature Weighting CP defines the VAV weighting compared to other VAV devices in the same ventilation system. This function is useful when the main unit using these VAV devices creates an average of all of the VAVs' heating and cooling demands but not all VAVs are weighted as equally important in the average. Control Temperature Weighting CP only affects nvoVAVinfo.

Valid Range

The valid range is any value between 0.005 to 100%.

Default Value

The default is 100%.

Configuration Requirements/Restrictions

This CP has no modification restrictions and can be operator modified at any time.

SCPT Reference

SCPTcontrolTemperatureWeighting (215)

Default Occupancy

UCPTdefaultOccupancy cp_family cpDefaultOccupancy

Default Occupancy CP defines the occupancy status when the value is OC_NUL, a heartbeat failure occurs, or the network variable is not bound.

Valid Range

Table 42 shows the valid ranges of UCPTdefaultOccupancy.

Table 42: Valid Ranges for UCPTdefaultOccupancy

Valve	Description
0 = OC_OCCUPIED	Operates in occupied mode.
1 = OC_UNOCCUPIED	Operates in unoccupied mode.
2 = OC_BYPASS	Operates in occupied/bypass mode.
3 = OC_STANDBY	Operates in standby mode.
0xFF = OC_NUL	Indicates no default applied.

Default Value

The default is OC_NUL.

Configuration Requirements/Restrictions

This CP has no modification restrictions and can be operator modified at any time.

UCPT Reference

UCPTdefaultOccupancy (112)

Flow Calibration Lockout

UCPTlockFlowCalib cp_family cpLockFlowCalib

Flow Calibration Lockout CP locks access to the flow calibration functions, thereby preventing unauthorized changes to the calibration.

Valid Range

Table 43 shows the valid ranges for UCPTlockFlowCalib.

Table 43: Valid Ranges for UCPTlockFlowCalib

Valve	Description
0 = LOCKED	Calibration is locked out.
1 = NETWORK_UNLOCKED	Network calibration is unlocked (using nviFlowCalib).
2 = MANUAL_UNLOCKED	Manual calibration is unlocked (using LN-VSTAT sensor).
3 = FULLY_UNLOCKED	Both network and manual calibrations are unlocked.

Default Value

The default is FULLY_UNLOCKED.

Configuration Requirements/Restrictions

This CP has no modification restrictions and can be operator modified at any time.

UCPT Reference

UCPTlockFlowCalib (14)

Changeover Delay

UCPTchngeOverDelay cp_family cpChngeOverDelay

Changeover Delay CP defines the minimum time heating must be OFF before cooling turns ON; or, the minimum time cooling must be OFF before heating turns ON.

Valid Range

The valid range is any value between 0 to 65,535 minutes.

Default Value

The default is 15 minutes.

Configuration Requirements/Restrictions

This CP has no modification restrictions and can be operator modified at any time.

UCPT Reference

UCPTchngeOverDelay (2)

Damper Response Factor

UCPTdamperResponse cp_family cpDamperResponse

This CP defines how accurately the VAV box reacts according to the airflow in percent. Because the VAV controller cannot be exact, a VAV box with a response factor of approximately 100% would hunt (oscillate), flow irregularly, and wear down prematurely.

Valid Range

The valid range is any value between 0.005 to 100%.

Default Value

The default is 20%.

Configuration Requirements/Restrictions

This CP has no modification restrictions and can be operator modified at any time.

UCPT Reference

UCPTdamperResponse (38)

Damper Drive Time

UCPTdamperDriveTime cp_family cpDamperDriveTime

Damper Drive Time CP defines the time needed for the damper to move from a closed position to an open position, or vice versa.

Valid Range

The valid range is any value between 0 to 6,553.5 seconds.

Default Value

The default is 95 seconds.

Configuration Requirements/Restrictions

This CP has no modification restrictions and can be operator modified at any time.

UCPT Reference

UCPTdamperDriveTime (1)

Duct and Perimeter Heating Order

UCPTheatOrder cp_family cpHeatOrder

Duct and Perimeter Heating Order CP defines whether the duct or perimeter heating should be activated first.

Valid Range

Table 44 shows the valid ranges for UCPTheatOrder.

Table 44: Valid Ranges for UCPTheatOrder

Valve	Description
0 = DUCT_HEAT_FIRST	Duct heating is first, and perimeter heating is second.
1 = PERIM_HEAT_FIRST	Perimeter heating is first, and duct heating is second.
2 = SIMULTANEOUS	Both duct and perimeter heating work simultaneously.

Default Value

The default is DUCT_HEAT_FIRST.

Configuration Requirements/Restrictions

This CP has no modification restrictions and can be operator modified at any time.

UCPT Reference

UCPTheatOrder (7)

Light Off Delay

UCPTlightOffDelay cp_family cpLightOffDelay

Light Off Delay CP defines the delay before the lights are switched off after effective occupancy switches to unoccupied, or after the occupancy sensor does not detect movement.

Valid Range

The valid range is any value between 0 to 65,535 minutes.

Default Value

The default is 0 minute.

Configuration Requirements/Restrictions

This CP has no modification restrictions and can be operator modified at any time.

UCPT Reference

UCPTlightOffDelay (109)

Light Off Cycle Time

UCPTlightOffCycleTime cp_family cpLightOffCycleTime

Light Off Cycle Time CP defines the maximum time the lights can remain on in unoccupied mode when the effective occupancy light control is enabled.

Valid Range

The valid range is any value between 0 to 65,535 minutes.

Default Value

The default is 0 minute.

Configuration Requirements/Restrictions

This CP has no modification restrictions and can be operator modified at any time.

UCPT Reference

UCPTlightOffCycleTime (110)

Temperature PID Loop Configuration Parameters

UCPTtempPIDparam cp_family cpTempPIDparameters

Temperature PID Loop Configuration Parameters CP defines the proportional, integral, derivative gain, and time of all temperature PID loops. It also includes a deadband where the PID loop output remains unchanged. The Bias and the Reverse Action fields are ignored.

Valid Range

Table 45: Valid Ranges for UCPTtempPIDparam

Field	Minimum	Maximum	Default
Proportional Gain	0%/°C	6553.5%/°C	25%/°C
Integral Gain	0%/°C	6553.5%/°C	12.5%/°C
Integral Time	0 s	6553.5 s	200 s
Derivative Gain	0%/°C	6553.5%/°C	0%/°C
Derivative Time	0 s	6553.5 s	200 s
Deadband	0°C	655.35°C	0°C

Configuration Requirements/Restrictions

This CP has no modification restrictions and can be operator modified at any time.

UCPT Reference

UCPTtempPIDparam (8)

CO_2 PID Loop Configuration Parameters

UCPTCO2PIDparam cp_family cpCO2PIDparameters

CO2 PID Loop Configuration Parameters CP defines the proportional, integral, and derivative gain and time of the CO_2 PID loop. It also includes a deadband where the PID loop output remains unchanged. The Bias and the Reverse Action fields are ignored.

Valid Range.

Table 46: Valid Ranges for UCPTCO2PIDparam

Field	Minimum	Maximum	Default
Proportional Gain	0%/ppm	6553.5%/ppm	1%/ppm
Integral Gain	0%/ppm	6553.5%/ppm	0.5%/ppm
Integral Time	0 s	6553.5 s	300 s
Derivative Gain	0%/ppm	6553.5%/ppm	0%/ppm
Derivative Time	0 s	6553.5 s	300 s
Deadband	0 ppm	655.35°C	0 ppm

Configuration Requirements/Restrictions

This CP has no modification restrictions and can be operator modified at any time.

UCPT Reference

UCPTCO2PIDparam (9)

Space Temperature Alarm Configuration

UCPTspaceTempAlarm cp_family cpSpaceTempAlarm

Space Temperature Alarm Configuration CP defines the space temperature alarm offset and the time period the controller waits before generating an alarm, when the difference between the temperature and its setpoint exceeds this offset.

Valid Range.

Table 47: Valid Ranges for UCPTspaceTempAlarm

Field	Minimum	Maximum	Default
Delay	0 s	65,535 s	1,800 s
Delta	0°C	65,53.5°C	2°C

Configuration Requirements/Restrictions

This CP has no modification restrictions. It can be operator modified at any time.

UCPT Reference

UCPTspaceTempAlarm (78)

Flow Alarm Configuration

UCPTflowAlarm cp_family cpFlowAlarm

Flow Alarm Configuration CP defines the flow alarm offset and the time period the controller waits before generating an alarm when the difference between the flow and its setpoint exceeds this offset.

Valid Range.

Table 48: Valid Ranges for UCPTflowAlarm

Field	Minimum	Maximum	Default
Delay	0 s	65535 s	300 s
Delta	0 L/s	6553.5 L/s	100 L/s

Configuration Requirements/Restrictions

This CP has no modification restrictions and can be operator modified at any time.

UCPT Reference

UCPTflowAlarm (98)

CO_2 Limit Alarm Configuration

UCPTCO2limitAlarm cp_family cpCO2limitAlarm

CO_2 Limit Alarm Configuration CP defines the CO_2 limit alarm offset and the time the controller waits before generating an alarm when the difference between the CO_2 limit and its setpoint exceeds this offset.

Valid Range.

Table 49: Valid Ranges for UCPTCO2limitAlarm

Field	Minimum	Maximum	Default
Delay	0 s	65,535 s	1,200 s
Delta	0 ppm	10,000 ppm	1,100 ppm

Configuration Requirements/Restrictions

This CP has no modification restrictions and can be operator modified at any time.

UCPT Reference

UCPTCO2limitAlarm (111)

VAV Input Type

UCPTvavInputType cp_family cpVAVinputType[10]

VAV Input Type CP sets the input types. The first 4 inputs are hardwired, and the last 6 inputs are RF and LCD inputs.

Valid Range

Table 50 shows the valid ranges for UCPTvavInputType.

Table 50: Valid Range for UCPTvavInputType

Value	Input Type	Description
0	**UNUSED**	Unused input.
1	**SPACE_TEMP_1**	Space temperature for room 1
2	**SETPOINT_1**	Absolute setpoint for room 1
3	**SETPOINT_OFFSET**	Setpoint offset for room 1
4	**SPACE_TEMP_2**	Space temperature for room 2
5	**SETPOINT_2**	Absolute setpoint for room 2
6	**SETPOINT_OFFSET_2**	Setpoint offset for room 2
7	**DUCT_TEMP**	Duct temperature
8	**WATER_TEMP**	Water temperature
9	**DISCHARGE_TEMP**	Discharge temperature
10	**CO2_LEVEL**	CO_2 concentration level
11	**OCCUP_CONTACT**	Occupancy sensor/contact
12	**BYPASS_CONTACT**	Bypass contact
13	**WINDOW_CONTACT**	Window contact
14	**EMERG_CONTACT**	Emergency contact
15	**LIGHT_SWITCH_1**	Light switch for room 1
16	**LIGHT_SWITCH_2**	Light switch for room 2

Default Value

The default is UNUSED.

Configuration Requirements/Restrictions

This CP has no modification restrictions and can be operator modified at any time.

UCPT Reference

UCPTvavInputType (100)

VAV Equipment Control and Output Configuration

UCPTvavOutputCfg cp_family cpVAVoutputCfg[8]

VAV Equipment Control and Output Configuration CP defines the type of equipment to control, the configuration parameters for this control type, and the associated outputs.

Valid Range

Table 51 shows the valid ranges for cpVAVoutputCfg[8]. Table 52 shows the valid equipment control ranges.

Table 51: Valid Ranges for UCPTVAVoutputCfg

Field	Description	Default
Equipment	Controlled equipment	NO_EQUIPMENT
CtrlType	Equipment control type	ON_OFF
OutSelect1	First output used by the equipment	NONE
OutSelect2	Second output used by the equipment	NONE
OutSelect3	Third output used by the equipment	NONE
OutSelect4	Fourth output used by the equipment	NONE
MinOnTime	Minimum on time for stages and trigger	2
MinOffTime	Minimum off time for stages and trigger	2
Period	Smart stage cycle period	20
MinPulseOn	Minimum pulse on time for floating actuators	0.5
MinPulseOff	Minimum pulse off time for floating actuators	10
DriveTime	Floating actuator drive time	95
MinPercent	Minimum demand for trigger, modulating, and floating	0
OverrideVal	Configured override value	0
Override	Permit override using the override value.	0
NetOverride	Permit networked override.	0
OneAtATime	Only one stage on at a time	0
UseHardware	Use hardware outputs.	0
UseNvoCtrlOut	Use nvoCtrlOutX network variable outputs.	0

Equipment

Table 52: Valid Ranges for UCPTVAVoutputCfg Equipment

Value	Input Type	Description
0	**NO_EQUIPMENT**	Disassociated equipment
1	**DUCT_HEATING**	Duct heating equipment
2	**DUCT_COOLING**	Duct cooling equipment
3	**DUCT_HEAT_COOL**	Duct heating and cooling equipment
4	**PERIM_HEAT_1**	Perimeter heating equipment for room 1
5	**PERIM_HEAT_2**	Perimeter heating equipment for room 2
6	**HEATER_FAN**	Heater boosting fan
7	**CONSTANT_FAN**	Constant fan, always on in occupied mode.
8	**EXTERNAL_DAMPER**	External damper actuator
9	**LIGHT_ROOM_1**	Light for room 1
10	**LIGHT_ROOM_2**	Light for room 2
11	**OCCUPIED_STATE**	Occupied state output

CtrlType

Table 53: Valid Ranges for UCPTVAVoutputCfg CtrlType

Value	Input Type	Description
0	**ON_OFF**	Digital on/off output
1	**STANDARD_STAGES**	Standard digital on/off stages
2	**STANDARD_MODULATION**	Standard analog or PWM modulation
3	**FLOATING_ACTUATOR**	Floating actuator

OutSelectX

Table 54: Valid Ranges for UCPTVAVoutputCfg OutSelectX

Value	Input Type	Result
0	**NONE**	No output selected.
1	**OUTPUT1**	Use output 1.
2	**OUTPUT2**	Use output 2.
3	**OUTPUT3**	Use output 3.
4	**OUTPUT4**	Use output 4.
5	**OUTPUT5**	Use output 5.
6	**OUTPUT6**	Use output 6.

Configuration Requirements/Restrictions

This CP has no modification restrictions and can be operator modified at any time.

UCPT Reference

UCPTvavOutputCfg (99)

Learned RF Module IDs

UCPTlearnedComModule cp_family cpLearnedRFModule[12]

Learned RF Module IDs CP retrieves the RF module IDs that were learned. This CP is read-only.

Valid Range

The valid range is any value between 0 to FFFFFFFF (hexadecimal).

Default Value

The default is 0.

Configuration Requirements/Restrictions

This CP is device specific read-only. It cannot be operator modified. It can only be read from the device and only when the device is online.

UCPT Reference

UCPTlearnedComModule (104)

Used RF Module IDs

UCPTusedComModule cp_family cpUsedRFModule[6]

Used RF Module IDs CP sets the RF module IDs that are used by the VAV.

Valid Range

The valid range is any value between 0 to FFFFFFFF (hexadecimal).

Default Value

The default is 0.

Configuration Requirements/Restrictions

This CP has no modification restrictions and can be operator modified at any time.

UCPT Reference

UCPTusedComModule (108)

RF and LCD Module Type

UCPTcomModuleType cp_family cpcomModuleType[6]

RF and LCD Module Type CP sets the modules type.

Valid Range

Table 55 shows the valid ranges for UCPTcomModuleType

Table 55: Valid Ranges for UCPTcomModuleType (Part 1 of 2)

Value	Input Type	Description
0	**UNKNOWN**	Unknown module
1	**WIRED_LCD_SENSOR**	Wired LCD module (LN-VSTAT sensor)
2	**RF_TP_SENSOR**	RF space temperature module
3	**RF_TP_SP_SENSOR**	RF space temperature module with setpoint
4	**RF_TP_SP_OV_SENSOR**	RF space temperature module with setpoint and bypass button
5	**RF_TP_SP_SLDSW_SENSOR**	RF space temperature module with setpoint and slide switch
6	**RF_TP_SP_OV_FANSPD_SENSOR**	RF space temperature module with setpoint, bypass button, and fan speed selector
7	**RF_TP_RH_SENSOR**	RF space temperature module with humidity sensor
8	**RF_TP_RH_SP_SENSOR**	RF space temperature module with humidity sensor and setpoint
9	**RF_TEP_RH_SP_OV_SENSOR**	RF space temperature module with humidity sensor, setpoint, and bypass button
10	**RF_TP_RH_SP_SLDSW_SENSOR**	RF space temperature module with humidity sensor, setpoint, and slide switch
11	**RF_OUTDOOR_TP_SENSOR**	RF outdoor temperature module
12	**RF_CABLE_TP_SENSOR**	RF cabled temperature module

Table 55: Valid Ranges for UCPTcomModuleType (Part 2 of 2)

Value	Input Type	Description
13	**RF_AIRDUCT_TP_SENSOR**	RF duct temperature module
14	**RF_CONTACT_TP_SENSOR**	RF contact temperature module
15	**RF_DIGITAL_INPUT_SENSOR**	RF digital input module
16	**RF_WINDOW_CONTACT**	RF window contact module
17	**RF_LIGHT_SWITCH**	RF light switch

Default Value

The default is UNKNOWN.

Configuration Requirements/Restrictions

This CP has no modification restrictions and can be operator modified at any time.

UCPT Reference

UCPTcomModuleType (105)

RF and LCD Input Configuration Parameters

UCPTcomInputCfg cp_family cpComInputCfg[6]

RF and LCD Input Configuration Parameters CP define which module the input uses, which point to read in the module, and the associated configuration parameters.

Valid Range

Table 56: Valid Range for UCPTComInputCfg

Field	Description	Default
ModuleSelect	Selects which module the input uses.	NOT_SELECTED
DataSelect	Selects which point in the module the input uses.	NOT_SELECTED
MinRange	Functions as minimum range for setpoint and setpoint offset inputs.	0
MaxRange	Functions as maximum range for setpoint and setpoint offset inputs.	0
Offset	Adjusts Offset for a temperature input.	0
LinkButton	Links the module’s bypass button with the space temperature input to go in bypass mode.	0 (not linked)

ModuleSelect

Table 57: Valid Ranges for UCPTComInputCfg ModuleSelect

Value	Input Type	Description
0	**NOT_SELECTED**	No module associated.
1	**MODULE_1**	Module 1 associated.
2	**MODULE_2**	Module 2 associated.
3	**MODULE_3**	Module 3 associated.
4	**MODULE_4**	Module 4 associated.
5	**MODULE_5**	Module 5 associated.
6	**MODULE_6**	Module 6 associated.

DataSelect

Table 58: Valid Ranges for UCPTComInputCfg DataSelect

Value	Input Type	Description
0	**NOT_SELECTED**	No point chosen.
1	**TEMPERATURE**	Temperature input selected.
2	**SETPOINT**	Setpoint input selected.
4	**SWITCH**	Switch input selected.

Configuration Requirements/Restrictions

This CP has no modification restrictions and can be operator modified at any time.

UCPT Reference

UCPTcomInputCfg (106)

LCD Module Password

UCPTcomPassword cp_family cpComPassword

LCD Module Password CP defines the password for entering the configuration menus in the LN-VSTAT sensor (LCD module).

Valid Range

The valid range is any value between 0 to 9999.

Default Value

The default is 5001.

Configuration Requirements/Restrictions

This CP has no modification restrictions and can be operator modified at any time.

UCPT Reference

UCPTcomPassword (103)

VAV Object Options

UCPTvavOptions cp_family cpvavOptions

VAV Object Options CP defines all of the true or false and on or off options of the VAV. See *Valid Range* for details.

Valid Range

All fields can only have a value of either 0 or 1.

Table 59: Valid Range for cpComInputCfg[6]

Input Type	Description	Default
FrostProtection	Enable frost protection.	1
VVTmode	0: VAV mode, 1: VVT mode.	0
UnoccZeroFlowSp	Use zero flow as minimum flow in unoccupied and standby.	0
DamperCCW	Damper direction.	0
DailyZeroRecal	Do a daily zero recalibration of the flow sensor.	0
EmerDoPurge	If set, emergency input activates an emergency purge.	0
LightFollowsOcc	Light goes on in occupied mode.	0
LightFollowHwOcc	Light goes on with occupancy contact input.	0
BypassByLtSwitch	Go in bypass mode when a light switch is turned on.	0
SmartSensorInSI	If set, LN-VSTAT sensor displays units in metric (SI).	0
SmDispOutTemp	LN-VSTAT sensor shows/hides outdoor temperature.	1
SmDispOccState	LN-VSTAT sensor shows/hides occupancy state.	1
SmDispUnitMode	LN-VSTAT sensor shows/hides HVAC mode + effective setpoint.	1
SmUnlockSetpoint	If set, LN-VSTAT sensor’s setpoint is read-only.	1
SmDispSpaceTemp	LN-VSTAT sensor shows/hides space temperature.	1
WideLearnRange	Relaxed learning for RF modules.	0
UseLearnButton	Button learning for RF modules.	0
ClearOnNextLearn	Clear learned ID list for RF modules on next learn.	0
MidPointSetpoint	Use old effective setpoint calculations.	0
UnitOffWindowCtc	If set, window contact shuts the unit off.	0
NoHtCoMrngWrmup	Disable heating and cooling gin morning warm-up.	0
nviSetpointPers	Enable persistency on nviSetpoint.	0
nviOccManCmdPers	Enable persistency on nciOccManCmd.	0
nviEmergOvrPers	Enable persistency on nciEmergOvr.	0
nviFlowOvrPers	Enable persistency on nviFlowOvr.	0
nviOccCmdPers	Enable persistency on nviOccCmd.	0
nviApplicModPers	Enable persistency on nviApplicMod.	0
nviHotAirPers	Enable persistency on nviHotAir.	0
nviHotWaterPers	Enable persistency on nviHotWater.	0

Configuration Requirements/Restrictions

This CP has no modification restrictions and can be operator modified at any time.

UCPT Reference

UCPTvavOptions (68)

VAV Heating Outdoor Temperature Limits

UCPTvavHeatOutdoorLimits cp_family cpHeatOutdoorLimits

VAV Heating Outdoor Temperature Limits CP defines the outdoor temperature maximum limits where the duct and perimeter heating are allowed.

Valid Range

Table 60: Valid Ranges

Field	Minimum	Maximum	Default
DuctMaxTemp	6°C (43°F)	30°C (86°F)	20°C (68°F)
PerimeterMaxTemp	6°C (43°F)	30°C (86°F)	10°C (50°F)

Configuration Requirements/Restrictions

This CP has no modification restrictions and can be operator modified at any time.

UCPT Reference

UCPTvavHeatOutdoorLimits (114)

Extra Configuration

UCPTextraConfig cp_family cpExtraConfig

Extra Configuration CP is reserved for future use.

Valid Range

The valid range for all fields is -32,768 to 32,767.

Default Value

The default for all fields is 0.

Configuration Requirements/Restrictions

This CP has no modification restrictions and can be operator modified at any time.

UCPT Reference

UCPTextraConfig (87)

Network Variable Type

SCPTnvType cp_family cpNvType

Network Variable Type CP applies to all changeable network variable types. It specifies the network variable type and type details.

Valid Range.

Table 61: Valid Ranges for SCPTnvType

Input Type	Description
type_program_ID	Program ID template of the resource file containing the network variable type definition.
type_scope	Scope of the resource file containing the network variable type definition.
type_index	Index within the specified resource file of the network variable type definition.
type_category	Type category of the network variable type.
type_length	Length of the network variable type.
scaling_factor_a	Scaling multiplier **a** where Scaled Value = a x10b x (Raw Value + c)
scaling_factor_b	Exponent **b** where Scaled Value = a x 10b x (Raw Value + c)
scaling_factor_c	Offset **c** where Scaled Value = a x 10b x (Raw Value + c)

Default Value

The default depends upon the initial network variable type.

Configuration Requirements/Restrictions

This CP has no modification restrictions and can be operator modified at any time.

SCPT Reference

SCPTnvType (254)

Object Major Version

SCPTobjMajVer cp_family cpObjMajVer

Object Major Version CP provides the major version number of the VAV.

Valid Range

Any number from 1 to 255.

Default Value

The major version number at the time of first release is 1.

Configuration Requirements/Restrictions

This CP is a constant (const_flg). It is read-only and cannot be operator modified. It should not be modified by a network tool except upon a download of a new application image, if the object definition had changed.

SCPT Reference

SCPTobjMajVer (167)

Object Minor Version

SCPTobjMinVer cp_family cpObjMinVer

Object Minor Version CP provides the minor version number of the VAV.

Valid Range

Any number from 0 to 255.

Default Value

The minor version number at the time of first release is 0.

Configuration Requirements/Restrictions

This CP is device specific read-only and cannot be operator modified. It can only be read from the device and only when the device is online. It should not be modified by a network tool except upon a download of a new application image.

SCPT Reference

SCPTobjMinVer (168)

Hardware Input Object Network Variable and Configuration Property List

A complete list of the NVs and CPs in the Hardware Input Object.

Overview

The network interface definition is based on the LONMARK® sensor profile (#1). This object configures and reads a physical input.

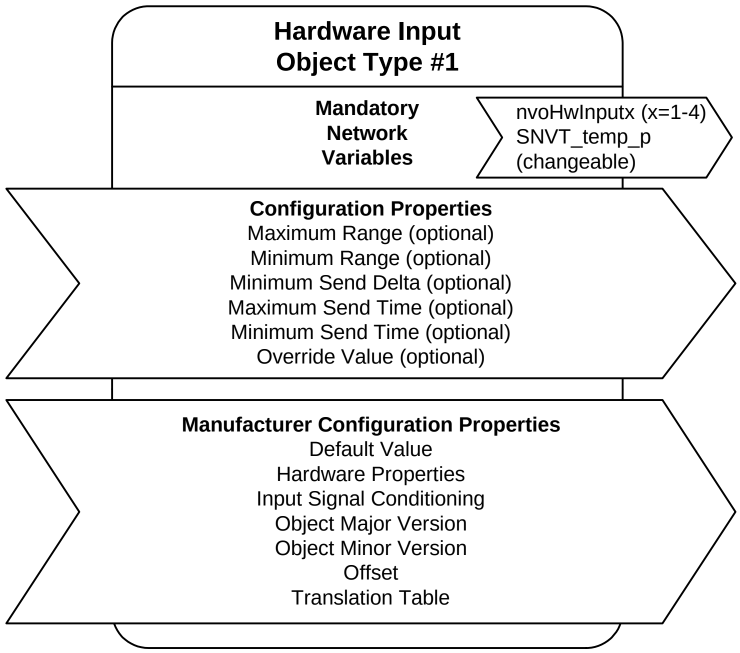

Figure 51: Hardware Input Object Overview

Table 62: Hardware Input Object Output NV Quick Reference

NV Name	NV Type	Size, byte	Description
nvoHwInput	SNVT_temp_p	4	Hardware Input Value Output

Table 63: Hardware Input Object CP Quick Reference

CP Type Name and Index	NV Type Name and Index	Size, byte	Description
SCPTmaxSendTime (49)	SNVT_time_sec (107)	2	Maximum Send Time (output heartbeat)
SCPTobjMajVer (167)	unsigned short	1	Object Major Version (constant)
SCPTobjMinVer (168)	unsigned short	1	Object Minor Version (device specific constant)
SCPTminSendTime (52)	SNVT_time_sec (107)	2	Minimum Send Time
SCPTsndDelta (27)	inherited	4	Send on Delta
SCPTnvType (254)	SNVT_nv_type (166)	19	Network Variable Type
SCPTmaxNVLength (34)	unsigned short	1	Maximum Network Variable Length (read-only)
SCPTovrValue (33)	inherited	4	Override Value
SCPTminRnge (23)	inherited	4	Minimum Input Range
SCPTmaxRnge (20)	inherited	4	Maximum Input Range
UCPTdefaultValue (55)	inherited	4	Default Value
UCPT validInputSignalTypes (69)	structure	2	Valid Input Signal Types (read-only)
UCPTinputSignalType (53)	input_signal_types_t	1	Input Signal Type
UCPT inputSignalInterpretation (65)	signal_interpretation_t	1	Input Signal Interpretation
UCPToffset (113)	float	4	Input Adjust Offset
UCPTthermistorType (54)	UNVT_gen_type (7)	1	Thermistor Type
UCPThwInOptions (97)	structure	1	Input Options
UCPTtransTable (62)	structure	128	Translation Table

Note: All configuration properties apply to the object and are implemented as read-write memory.

Mandatory Network Variables

Hardware Input Value Output

nvoHwInput

Hardware Input Value output indicates the hardware input value translated and formatted according to the configuration and network variable type.

Type: changeable_type SNVT_temp_f

Valid Range

The valid range depends on the minimum and maximum ranges configured.

Default Value

The invalid value depends on the configured default value. It is also used at start-up or in case of a sensor failure.

When Transmitted

The variable transmits immediately when its value has changed significantly (configurable by SCPTminDeltaTemp). It also transmits as a heartbeat output on a regular basis as dictated by the Maximum Send Time CP SCPTmaxSendTime.

Update Rate

This value updates no faster than the Minimum Send Time CP SCPTminSendTime.

Default Service Type

The default service type is unacknowledged.

Configuration Properties

Send Heartbeat (Optional)

SCPTmaxSendTime cp_family cpMaxSendTime

Send Heartbeat input CP sets the maximum time period that can expire before the VAV automatically updates the appropriate output network variables.

Valid Range

The valid range is any value between 0.0 s and 6,553.4 seconds. Setting SCPTmaxSendTime to 0.0 disables the Send Heartbeat mechanism.

Default Value

The default value is 120.0 seconds, **with some exception.**

Configuration Requirements/Restrictions

This CP has no modification restrictions and can be operator modified at any time.

SCPT Reference

SCPTmaxSendTime (49)

Minimum Send Time (Optional)

SCPTminSendTime cp_family cpMinSendTime

Minimum Send Time CP determines the minimum time period between transmissions of a particular network variable output. This CP provides a way to tailor the maximum transmission rate to the available network bandwidth.

Valid Range

The valid range is any value between 0.0 and 6553.4 seconds. The transmission mechanism has a 1-second precision; therefore, a tenth of second has no effect. Transmission updates occur every second.

Default Value

The default value is 0.0 (no throttling of outbound traffic).

Configuration Requirements/Restrictions

This CP has no modification restrictions and can be operator modified at any time.

SCPT Reference

SCPTminSendTime (52)

Send on Delta (Optional)

SCPTsndDelta cp_family cpSndDelta

Send on Delta CP determines the minimum amount of change of the network variable output for it to be updated over the network. This CP provides a way to tailor the maximum transmission rate to the available network bandwidth.

Valid Range

The valid range is any value between 0.0 and the maximum network variable type range.

Default Value

The default value is 0.0 (transmitted on every change).

Configuration Requirements/Restrictions

This CP has no modification restrictions and can be operator modified at any time.

SCPT Reference

SCPTsndDelta (27)

Minimum Range (Optional)

SCPTminRnge cp_family cpMinRange

Minimum Range CP determines the lower limit of the input range.

Valid Range

The valid range is any value within the defined limits of the SNVT concerned. The value must be lower than the maximum range.

Default Value

The default value is 0.

Configuration Requirements/Restrictions

This CP has no modification restrictions and can be operator modified at any time.

SCPT Reference

SCPTminRnge (23)

Maximum Range (Optional)

SCPTmaxRnge cp_family cpMaxRange

Maximum Range CP determines the higher limit of the input range.

Valid Range

The valid range is any value within the defined limits of the SNVT concerned. The value must be greater than the minimum range.

Default Value

The default value is 0.

Configuration Requirements/Restrictions

This CP has no modification restrictions and can be operator modified at any time.

SCPT Reference

SCPTmaxRnge (20)

Override Value (Optional)

SCPTovrValue cp_family cpOvrValue

Override Value CP determines the value the input adopts when the object is overridden.

Valid Range

The valid range is any value within the defined limits of the SNVT concerned. The value should be set to the type default.

Default Value

The default value is 0.

Configuration Requirements/Restrictions

This CP has no modification restrictions and can be operator modified at any time.

SCPT Reference

SCPTovrValue (33)

Implementation Specific Configuration Properties

Default Value

UCPTdefaultValue cp_family cpDefaultValue

Default Value CP determines the value the input adopts when a hardware input electrical fault occurs.

Valid Range

The valid range is any value within the defined limits of the SNVT concerned. The value should be set to the type's invalid value.

Default Value

The default value is 0.

Configuration Requirements/Restrictions

This CP has no modification restrictions and can be operator modified at any time.

UCPT Reference

UCPTdefaultValue (55)

Valid Input Signal Types

UCPTvalidInputSignalTypes cp_family cpValidInSignalTypes

Valid Input Signal Type CP defines the possible input signal types that can be applied on the specific hardware input.

Valid Range

The valid range for each field is 0 or 1.

Default Value

The default is 1 for Miliamps_4_20mA, Voltage_0_10V, and Resistance fields, 0 for all others.

Configuration Requirements/Restrictions

This CP is a constant (const_flg). It is read-only and cannot be operator modified. It should not be modified by a network tool except upon a download of a new application image, if the object definition had changed.

UCPT Reference

UCPTvalidInputSignalTypes (69)

Input Signal Type

UCPTinputSignalType cp_family cpInputSignalType

Input Signal Type CP defines the input signal type. It can either be in milliamps, voltage, or resistance.

Valid Range

Table 64: Valid Ranges for UCPTinputSignalType

Value	Signal Type	Description
0	RESISTANCE	Signal type is resistance.
1	VOLTAGE_0_10V	Signal type is voltage.
2	MILIAMPS_4_20mA	Signal type is milliamps.

Default Value

The default is RESISTANCE.

Configuration Requirements/Restrictions

This CP has no modification restrictions and can be operator modified at any time.

UCPT Reference

UCPTinputSignalType (53)

Input Signal Interpretation

UCPTinputSignalInterpretation cp_family cpInSigInterpret

Input Signal Interpretation CP defines the input signal interpretation that identifies the way the signal is translated.

Valid Range

Table 65: Valid Ranges for UCPTinputSignalInterpretation

Value	Input or Signal Type	Description
0	DISCONNECTED	Input is not used.
1	LINEAR	Signal is interpreted as linear curve.
2	TRANS_TABLE	Signal is interpreted as user-defined curve.
3	DIGITAL	Signal is interpreted as digital.
4	MULTI_LEVEL	Signal is interpreted as multilevel data points.
5	STD_THERMISTOR	Signal is interpreted as a standard thermistor curve.
6	SETPOINT_OFFSET	Input is interpreted as a setpoint adjust curve with a zero deadband.

Default Value

The default is DISCONNECTED.

Configuration Requirements/Restrictions

This CP has no modification restrictions. It can be operator modified at any time.

UCPT Reference

UCPTinputSignalInterpretation (65)

Input Offset

UCPToffset cp_family cpOffset

Input Offset CP determines the offset applied to the input value.

Valid Range

The valid range is any value within the defined limits of the SNVT concerned.

Default Value

The default value is 0.

Configuration Requirements/Restrictions

This CP has no modification restrictions and can be operator modified at any time.

UCPT Reference

UCPToffset (20)

Thermistor Type

UCPTthermistorType cp_family cpThermistorType

Thermistor Type CP determines the standard curve associated with the selected thermistor.

Valid Range

Table 66: Valid Ranges for UCPTthermistorType

Value	Input or Signal Type	Description
0	DEFAULT_TYPE	Uses the default curve (10k type 2.)
1	TYPE_1	Uses the PT100 curve.
2	TYPE_2	Uses the 10k type 2 curve.
3	TYPE_3	Uses the 10k type 3 curve.
6	TYPE_6	Uses the 1k curve.
7	TYPE_7	Uses the 10k type 7 curve (same as type 3).
12	TYPE_12	Uses the 10k type 12 curve (same as type 2).
24	TYPE_24	Uses the 10k type 24 curve (same as type 2).

Default Value

The default is DEFAULT_TYPE.

Configuration Requirements/Restrictions

This CP has no modification restrictions. It can be operator modified at any time.

UCPT Reference

UCPTthermistorType (54)

Hardware Input Options

UCPThwInOptions cp_family cpHwInOptions

Hardware Input Options CP defines all of the true or false and on or off options of the hardware input. See *Valid Range* for details.

Valid Range

All fields can only have a value of either 0 or 1.

Table 67: Valid Range of cpHwInOptions

Field	Default	Description
ReverseAction	0	Reverses the input action.
Reserved2. . .8	0	Reserved for future use.

Configuration Requirements/Restrictions

This CP has no modification restrictions and can be operator modified at any time.

UCPT Reference

UCPThwInOptions (97)

Translation Table

UCPTtransTable cp_family cpTransTable

Translation Table CP defines the 16 points of the user defined curve.

Valid Range

The valid range for each X and Y field is any value within the defined limits of the SNVT concerned.

Default Value

The default is 0 for all X and Y fields.

Configuration Requirements/Restrictions

This CP has no modification restrictions and can be operator modified at any time.

UCPT Reference

UCPTtransTable (62)

Network Variable Type

SCPTnvType cp_family cpNvType

This CP specifies the network variable type and type details.

Table 68: Valid Range of SCPTnvType

Input Type	Description
type_program_ID	Program ID template of the resource file containing the network variable type definition.
type_scope	Scope of the resource file containing the network variable type definition.
type_index	Index within the specified resource file of the network variable type definition.
type_category	Type category of the network variable type.
type_length	Length of the network variable type.
scaling_factor_a	Scaling multiplier **a** where ScaledValue = a x 10^b x (RawValue + c)
scaling_factor_b	Exponent **b** where ScaledValue = a x 10^b x (RawValue + c)
scaling_factor_c	Offset **c** where ScaledValue = a x 10^b x (RawValue + c)

Default Value

The default depends on the initial type of the network variable.

Configuration Requirements/Restrictions

This CP has no modification restrictions and can be operator modified at any time.

SCPT Reference

SCPTnvType (254)

Maximum Network Variable Length

SCPTmaxNVLength cp_family cpMaxNVLength

Maximum Network Variable Length CP defines the maximum network variable length.

Valid Range

The value is always 4 for hardware inputs.

Default Value

The default is 4.

Configuration Requirements/Restrictions

This CP is a constant (const_flg). It is read-only and cannot be operator modified. It should not be modified by a network tool except upon a download of a new application image, if the object definition had changed.

SCPT Reference

SCPTmaxNVLength (255)

Object Major Version

SCPTobjMajVer cp_family cpObjMajVer

Object Major Version CP provides the major version number of the VAV.

Valid Range

Any number from 1 to 255.

Default Value

The major version number at the time of first release is 1.

Configuration Requirements/Restrictions

This CP is a constant (const_flg). It is read-only and cannot be operator modified. It should not be modified by a network tool except upon a download of a new application image, if the object definition had changed.

SCPT Reference

SCPTobjMajVer (167)

Object Minor Version

SCPTobjMinVer cp_family cpObjMinVer

Object Minor Version CP provides the minor version number of the VAV.

Valid Range

Any number from 0 to 255.

Default Value

The minor version number at the time of first release is 0.

Configuration Requirements/Restrictions

This CP is device specific read-only and cannot be operator modified. It can only be read from the device and only when the device is online. It should not be modified by a network tool except upon a download of a new application image.

SCPT Reference

SCPTobjMinVer (168)

Hardware Output Object Network Variable and Configuration Property List

A complete list of the NVs and CPs in the Hardware Output Object.

Overview

The network interface definition is based upon the LONMARK sensor profile #3. The object configures and reads a physical input.

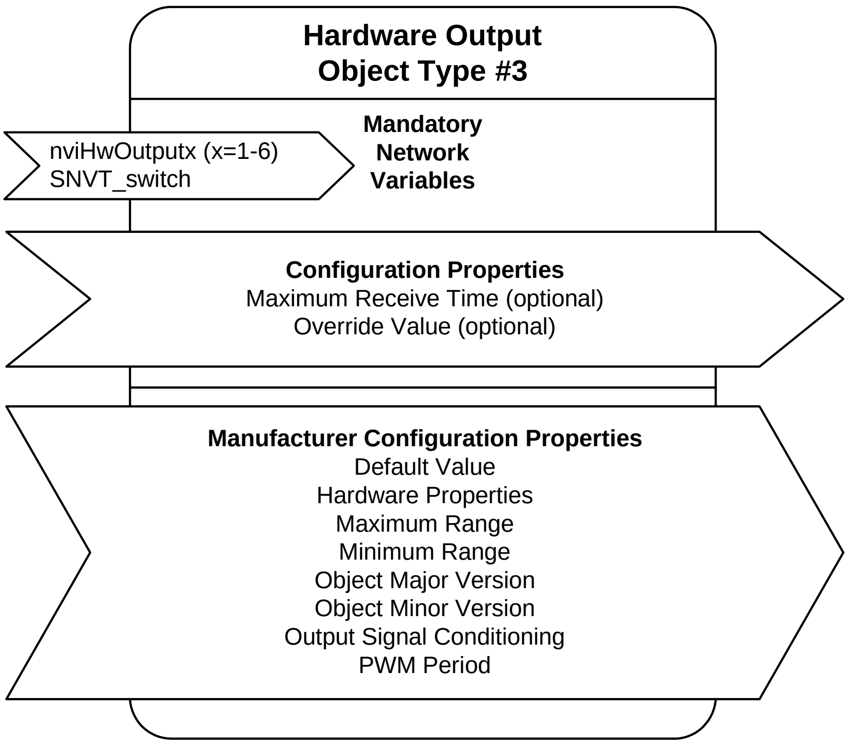

Figure 52: Hardware Output Object Overview

Table 69: Hardware Output Object Input NV Quick Reference

NV Name	NV Type	Size, byte	Description
nviHwOutput	SNVT_switch	2	Hardware Output Command Input

Table 70: Hardware Output Object CP Quick Reference

CP Type Name and Index	NV Type Name and Index	Size, byte	Description
SCPTmaxRcvTime (48)	SNVT_time_sec (107)	2	Maximum Receive Time (input heartbeat)
SCPTobjMajVer (167)	unsigned short	1	Object Major Version (constant)
SCPTobjMinVer (168)	unsigned short	1	Object Minor Version (device specific constant)
SCPTovrValue (33)	inherited	4	Override Value
SCPTminRnge (23)	inherited	4	Minimum Output Range
SCPTmaxRnge (20)	inherited	4	Maximum Output Range
SCPTdefOutput (7)	inherited	4	Default Output
UCPThwOutOptions (102)	structure	1	Output Options
UCPTpwmPeriod (51)	SNVT_time_min (123)	2	PWM Period

Note: All configuration properties apply to the object and are implemented as read-write memory.

Mandatory Network Variables

Hardware Output Command Input

nviHwOutput

Hardware Output Command Input commands the state of the output. It has optional maximum receive time.

Type: SNVT_switch

Valid Range

The valid range for the value field is 0% to 100%, and the valid range for the state field is -1, 0, and 1. The value 0.0, -1 (value = 0, state = -1) is considered 0%. When both fields are set to a value greater than zero, the output is ON or modulating; if not, it is OFF.

Default Value

The default value is the invalid value (0.0, -1). This value is adopted at powerup and in cases where an update is not received within the specified receive heartbeat time. This instance causes the output to use the configured default output.

Configuration Considerations

This network variable input has receive heartbeat checking enabled if it is bound and the configured receive heartbeat time in SCPTmaxRcvTime is greater than zero.

Configuration Properties

Receive Heartbeat (Optional)

SCPTmaxRcvTime cp_family cpMaxRcvTime

Receive Heartbeat CP determines the maximum period of time between updates to a network variable input that has input heartbeat checking. If no update occurs within the time specified, the particular input network variable is reset to its default value.

Valid Range

The valid range is any value between 0.0 and 6,553.4 seconds. Setting SCPTmaxRcvTime to 0.0 disables the Receive Heartbeat mechanism.

Default Value

The default is 0.0 (no input heartbeat checking).

Configuration Requirements/Restrictions

This CP has no modification restrictions and can be operator modified at any time.

SCPT Reference

SCPTmaxRcvTime (48)

Override Value (Optional)

SCPTovrValue cp_family cpOvrValue

Override Value CP determines the state the output adopts when the object is overridden.

Valid Range

The valid range for the value field is 0% to 100% and the valid range for the state field is -1, 0, and 1. The value 0.0, -1 (value = 0, state = -1) is considered 0%. When both fields are set to a value higher than zero, the output is ON or modulating; if not, it is OFF.

Default Value

The default value is 0.

Configuration Requirements/Restrictions

This CP has no modification restrictions and can be operator modified at any time.

SCPT Reference

SCPTovrValue (33)

Default Output

SCPTdefOutput cp_family cpDefOutput

Default output CP determines the state the output adopts after reset and when a heartbeat failure occurs on the network variable input.

Valid Range

The valid range for the value field is 0% to 100%, and the valid range for the state field is -1, 0, and 1. The value 0.0, -1 (value = 0, state = -1) is considered 0%. When both fields are set to a value higher than zero, the output is ON or modulating; if not, it is OFF.

Default Value

The default value is 0.0, 0.

Configuration Requirements/Restrictions

This CP has no modification restrictions and can be operator modified at any time.

SCPT Reference

SCPTdefOutput (7)

Implementation Specific Configuration Properties

Minimum Range

SCPTminRnge cp_family cpMinRange

Minimum Range CP determines the lower limit of the output range.

Valid Range

The valid range for the value field is 0% to 100%, and the valid range for the state field is -1, 0, and 1. The value 0.0, -1 (value = 0, state = -1) is considered 0%. When both fields are set to a value greater than zero, the output is ON or modulating; if not, it is OFF.

Default Value

The default value is 0.

Configuration Requirements/Restrictions

This CP has no modification restrictions and can be operator modified at any time.

SCPT Reference

SCPTminRnge (23)

Maximum Range

SCPTmaxRnge cp_family cpMaxRange

Maximum Range CP determines the higher limit of the output range.

Valid Range

The valid range for the value field is 0% to 100%, and the valid range for the state field is -1, 0, and 1. The value 0.0, -1 (value = 0, state = -1) is considered 0%. When both fields are set to a value greater than zero, the output is ON or modulating; if not, it is OFF.

Default Value

The default value is 0.

Configuration Requirements/Restrictions

This CP has no modification restrictions and can be operator modified at any time.

SCPT Reference

SCPTmaxRnge (20)

Valid Output Signal Types

UCPTvalidOutputSignalTypes cp_family cpValidOutSigTypes

Valid Output Signal Types CP defines the possible output signal types that the hardware output can generate.

Valid Range

The valid range for each field is 0 or 1.

Default Value

The default is 1 for Analog_4_20mA, Analog_0_10V, PWM, and Digital fields; 0 for all others.

Configuration Requirements/Restrictions

This CP is a constant (const_flg). It is read-only and cannot be operator modified. It should not be modified by a network tool except upon a download of a new application image, if the object definition had changed.

UCPT Reference

UCPTvalidOutputSignalTypes (60)

Output Signal Type

UCPToutputSignalType cp_family cpOutputSignalType

Output Signal Type CP defines the output signal type. It can either be in milliamps, voltage, or resistance.

Valid Range

Table 71: Valid Ranges for UCPToutputSignalType

Value	Signal Type	Description
0	DIGITAL	Signal type is digital.
1	PWM	Signal type is pulse width modulation.
2	ANALOG_0_10V	Signal type is voltage.
3	ANALOG_4_20MA	Signal type is current.

Default Value

The default is DIGITAL.

Configuration Requirements/Restrictions

This CP has no modification restrictions. It can be operator modified at any time.

UCPT Reference

UCPToutputSignalType (58)

Hardware Output Options

UCPThwOutOptions cp_family cpHwOutOptions

Hardware Output Options CP defines all of the true or false and on or off options of the hardware output.

Valid Range

All fields can only have a value of either 0 or 1.

Table 72: Valid Range of cpHwOutOptions

Input Type	Default	Description
ReverseAction	0	Reverses the input action.
Persistent	0	Makes the network variable persistent.
Reserved3. . . 8	0	Reserved for future use.

Configuration Requirements/Restrictions

This CP has no modification restrictions and can be operator modified at any time.

UCPT Reference

UCPThwOutOptions (102)

PWM Period

UCPTpwmPeriod cp_family cpPWMperiod

PWM Period CP defines the pulse width modulation time period.

Valid Range

The valid range is any value between 0 to 6,553.5 seconds.

Default Value

The default is 10 seconds.

Configuration Requirements/Restrictions

This CP has no modification restrictions and can be operator modified at any time.

UCPT Reference

UCPTpwmPeriod (51)

Object Major Version

SCPTobjMajVer cp_family cpObjMajVer

Object Major Version CP provides the major version number of the VAV.

Valid Range

Any number from 1 to 255.

Default Value

The major version number at the time of first release is 1.

Configuration Requirements/Restrictions

This CP is a constant (const_flg). It is read-only and cannot be operator modified. It should not be modified by a network tool except upon a download of a new application image, if the object definition had changed.

SCPT Reference

SCPTobjMajVer (167)

Object Minor Version

SCPTobjMinVer cp_family cpObjMinVer

Object Minor Version CP provides the minor version number of the VAV.

Valid Range

Any number from 0 to 255.

Default Value

The minor version number at the time of first release is 0.

Configuration Requirements/Restrictions

This CP is device specific read-only and cannot be operator modified. It can only be read from the device and only when the device is online. It should not be modified by a network tool except upon a download of a new application image.

SCPT Reference

SCPTobjMinVer (168)

Appendix A: Air Physics Guide

This section provides a brief overview of air physics calculations and explains the relation between air velocity, dynamic pressure, differential pressure, Pitot factors, and various coefficients.

Air Physics

The following equations have been numbered for an easier demonstration of creating new equations through substitution and combination.

The equation (1) for air velocity is:

$$V = 4005 \bullet \sqrt{p_v}$$

Where *V* is the air velocity in feet per minute (fpm), and P_v is the dynamic pressure (or velocity pressure) in inches of water.

The equation (2) for airflow is:

$$Q = V \bullet A$$

Where *Q* is the airflow in cubic feet per minute (cfm), and *A* is the duct area in square feet (ft^2).

By combining the equation for air velocity (1) and airflow (2), where the equation for air velocity has been substituted for *V* in $Q = V \cdot A$, you create equation (3):

$$Q = 4005 \bullet \sqrt{p_v} \bullet A$$

Normally, the dynamic pressure is measured with a Pitot tube connected to a differential pressure sensor (or to a manometer). The relation between the differential and dynamic pressure is equation (4):

$$p_d = PF \bullet p_v$$

or

$$p_v = \frac{p_d}{PF}$$

Where P_d is the differential pressure and *PF* is the Pitot factor.

Substitute the equation for P_v into *Q* to create equation (5):

$$Q = 4005 \bullet \sqrt{\frac{p_d}{PF}} \bullet A$$

Some manufacturers give a flow coefficient (or K factor) instead of the Pitot factor for their VAV boxes (with Pitot tubes included). In this case, the airflow is the following equation (6):

$$Q = K_{cfm} \bullet \sqrt{p_d}$$

or

$$K_{cfm} = \frac{Q}{\sqrt{p_d}}$$

Where K_{cfm} is the flow coefficient.

Combining equation (5) and (6) to create equation (7):

$$K_{cfm} = \frac{4005 \bullet A}{\sqrt{PF}}$$

or

$$PF = \left(\frac{4005 \bullet A}{K_{cfm}} \right)^2$$

Equation (7) is useful when an instrument that reads the airflow using equation (5) is connected to a VAV box whose specifications only gives a flow coefficient.

Some other manufacturers give a velocity coefficient for their VAV boxes (with Pitot tubes included). In this case, the airflow equation is equation (8):

$$Q = K_{fpm} \bullet \sqrt{p_d} \bullet A$$

or

$$K_{fpm} = \frac{Q}{\sqrt{p_d} \bullet A}$$

Where K_{fpm} is the velocity coefficient.

By combining equation (5) and (8), you create equation (9):

$$K_{fpm} = \frac{4005}{\sqrt{PF}}$$

or

$$PF = \left(\frac{4005}{K_{fpm}} \right)^2$$

Equation (9) is useful when an instrument that reads the airflow using equation (5) is connected to a VAV box whose specifications only give a velocity coefficient.

Appendix B: Tuning the PID Loop

This section describes how to tune the PID loop in a systematic manner to prevent the system from oscillating.

Tuning the PID Loop

To tune a PID loop when you are using the standard PID configuration screen (proportional band, integral time, and deadband), do the following steps:

A. Tune the Proportional Band

1. Set the integral time to 0 seconds.
2. Slowly decrease the proportional band until you observe a constant rate of oscillation.
3. Increase the proportional band by 50% (multiply the proportional band by 1.5). Initiate a cold start (stop, then restart the system) and make sure that the system has minimal overshoot, minimal offset, and is not oscillating. Adjust the proportional band (increasing or decreasing) as required.
4. The proportional band is now tuned.

B. Tune the Integral Time

1. Set the integral time to a large value to slow system response.
2. Divide the integral time in half and observe the system response.
3. Initiate a cold start and make sure that the system has minimal overshoot, minimal offset, and is not oscillating. Adjust the integral time (increasing or decreasing) as required.
4. The PID loop for the controller is now fully tuned.

Tuning the PID Loop - Advanced Settings

To tune a PID loop when you are using the advanced PID configuration screen, do the following steps:

A. Tune the Proportional Gain

1. Set the integral time to 0 seconds.
2. Slowly increase the proportional gain until you observe a constant rate of oscillation.
3. Decrease the proportional gain by 33% (multiply the proportional gain by 0.666). Initiate a cold start (stop, then restart the system) and make sure that the system has minimal overshoot, minimal offset, and is not oscillating. Adjust the proportional gain (increasing or decreasing) as required.
4. The proportional gain is now tuned.
5. Set the integral and derivative gains to the same value that you selected for the proportional gain.

B. Tune the Integral Time

1. Set the integral time to a large value to slow system response.
2. Divide the integral time in half and observe the system response.
3. Initiate a cold start and make sure that the system has minimal overshoot, minimal offset, and is not oscillating. Adjust the integral time (increasing or decreasing) as required.
4. The integral time is now tuned.

C. Tune the Derivative Time

1. Set the derivative time to 0. HVAC systems have a slow response time due to the nature of the equipment. Because of this slow response, the derivative time is generally not used.
2. The PID loop for the controller is now fully tuned.

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