PROLON

FOCUS GUIDE

VAV ZONE CONTROLLER

Configuration Guide for Prolon Focus Software

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REV. 7.3.1
PL-FOC-VAV-C/F-EN

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1 - Prolon VAV Zone Controller

This guide will describe in detail the operating sequences and configuration variables used by the Prolon series *VAV Zone Controllers*.

The Prolon series *VAV Zone Controllers* are designed for variable air volume zoning systems. The built-in microprocessor offers precise digital control to maximize performance. The outputs and control sequences are all fully configurable, either locally or remotely, using free software or from the digital room sensor. Models equipped with on-board brushless actuators (Halomo) provide electronic feedback on damper position. When in a network, the *VAV Zone Controllers* can share information such as the occupancy state, the demand, the supply temperature and more.

1.1 - Hardware Variations

The Prolon series ***VAV Zone Controller*** is in essence a collection of highly effective VAV control sequences designed by Prolon, based on the feedback of our trusted clients and contractors with years of field experience. These sequences are then programmed into various hardware models, offering the user the choice of expanded functionality versus targeted pricing.

The sequences are identical between the various hardware platforms, and are only differentiated by the physical constraints of the chosen hardware. This guide will underline these differences whenever they apply.

The Prolon ***VAV Zone Controller*** has been offered on the following hardware platforms. Please see each platform's HARDWARE GUIDE for more information:

C1000	• 3 Analog Inputs • 1 Binary Input • 4 Digital Outputs • 1 Analog Output • 1 Flow Sensor Input (Optional) • No Onboard actuator
VC1000F (Discontinued)	• 3 Analog Inputs • 1 Binary Input • 4 Digital Outputs • 1 Analog Output • 1 Flow Sensor Input (Optional) • Onboard actuator
VC2000	• 1 Analog Input • 1 Digital Output • 1 Analog Output • 1 Flow Sensor Input (Optional) • Onboard Actuator
VC1000 LT (Discontinued)	• 3 Analog Inputs • 1 Binary Input • 1 Digital Output • 1 Analog Output • Onboard actuator

2 - Networking

Prolon's *VAV Zone Controllers* can work completely independently, but can also be integrated into a network with other types of Prolon controllers, where they will share and exchange information for a more effective overall system. Prolon's default method of network communication is Modbus RTU over RS485.

2.1 - Default Communication

When a ***VAV Zone Controller*** is networked with a Prolon Master Controller (such as a rooftop controller), it will be automatically detected and start sharing information. Here is the list of current Prolon Master Controllers:

- Rooftop Controller (RTU)
- Heatpump Controller (HP)
- Make Up Air Controller (MUA)
- Hydronics Controller (HYD)

The Prolon Network Controller is a special case, as it acts as a link between all Master Controllers, so it will be treated in a class on its own. The following tables summarize the information shared between ***VAV Zone Controllers***, Prolon Master Controllers, and the Prolon Network Controller. This information is exchanged approximately every three seconds for Master Controllers, and every ten to thirty seconds for the Network Controller. If the information stops being received, it will be declared invalid after a configurable amount of time ***(see Other Configuration, p.38)***.

Note that these tables apply to the most recent firmware revision of Prolon controllers, and may not accurately represent all older firmware revisions.

2.1.1 - Network Information Received

	Automatically received from Master	Can be received from Master (Configurable)	Can receive from Network Controller (Configurable)
Supply Air Temperature	X		
Outside Air Temperature	X		X
Occupancy	X		X
Morning Warmup Override		X	
Outside Temperature Override		X	
Results of Math Functions	X		
Temporary Damper / Flow Override		X	
Dehumidification Damper Minimum Position		X	

Figure 1 - Information received from the network

DESCRIPTION:

- **Supply Air Temperature**: The supply air temperature will automatically be shared from the Master Controller to the ***VAV Zone Controllers***.
- **Outside Air Temperature**: The outside air temperature will automatically be shared from the Master Controller to the ***VAV Zone Controllers***. A Network Controller can also be configured to share the outside temperature with a ***VAV Zone Controller*** should a Master Controller not be present. In the case where both are present, the last received outside temperature value will be used.
- **Occupancy**: The occupancy status will automatically be shared from the Master Controller to the VAV Zone Controllers. A Network Controller can also be configured to share the occupancy status with a VAV Zone Controller should a Master Controller not be present. In the case where both are present, the occupancy status received from the Network Controller will take priority. If occupancy input on the ***VAV Zone Controller*** is shorted to common (contact closed), the controller will remain unoccupied regardless of what is reveived from the network.
- **Morning Warm-Up Override**: When a Master Controller becomes occupied, it can be configured to command ***VAV Zone Controllers*** to deactivate their heating outputs. This is typically useful for Gas Heating applications.
- **Outside Temp Override**: A Master Controller can be configured to command ***VAV Zone Controllers*** to activate or deactivate their outputs based on outside temperature conditions.
- **Results of Math Functions**: A Master Controller is continuously calculating the overall demand of the building using configurable mathematical operations, in a process called Flexi-Zone. The results of these functions can be redistributed to ***VAV Zone Controllers*** to control their outputs. This effectively allows a single Zone controller to control an output not only based on its own demand, but on that of the average demands of other controllers in the building.
- **Temporary Damper / Flow Override**: Prolon Master Controllers have a special setting which allows users to temporarily command all ***VAV Zone Controllers*** to move their damper to a particular position or to target a particular CFM. This is useful during the air balancing procedure.
- **Dehumidification Damper Minimum**: Upon a call for dehumidification, Prolon Master Controllers can command ***VAV Zone Controllers*** to use an alternate damper minimum position, to ensure that the dehumidified air is adequately forced into the zones.

2.1.2 - Network Information Sent

	Automatically sent to Master	Can send to Master (Configurable)
Zone Demand	X	
Group Codes & Weights	X	
Local Occupancy Override	X	
Supply Air Temperature		X
Radiant Request	X	

Figure 2 - Information sent to the network

DESCRIPTION:

- **Zone Demand**: Each ***VAV Zone Controller*** continuously calculates the demand for its zone. This demand takes the form of a number varying from -100% to +100%, where a negative percentage indicates a cooling demand, and a positive number indicates a heating demand. A demand of zero indicates that the controller is within its zone temperature setpoints and is satisfied. This demand is periodically sent to the Master controller who, along with the demands of other controllers, will use it to generate an overall building demand in a process called Flexi-Zone. The result of this process allows the Master unit to activate heating or cooling equipment based on an average demand instead of being driven by a single thermostat.
- **Group Codes & Weights**: As part of the Flexi-Zone system, each ***VAV Zone Controller*** can be assigned to different groups and can have different voting weights within these groups. With this information, a Prolon Master can control building equipment with the demands generated by zones in quasi-infinite variations. ***See Group Codes for more details.***
- **Local Occupancy Override**: During unoccupied mode, a user can override a particula zone back into occupied mode using that zone's associated wall sensor (by pressing a button or by other means). The ***VAV Zone Controller*** will communicate this override status back to the Master Controller so that the Master can decide to activate the fan or other equipment.
- **Supply Air Temperature**: Generally, a Master Controller has a supply air temperature sensor connected to it and then provides this supply air temperature reading to the ***VAV Zone Controllers***. However, in some special cases or on retrofit jobs, the supply air temperature sensor may already be connected to a VAV Zone Controller. In this case, the reading can be collected from this Zone Controller and sent to the Master, ready for subsequent distribution to the remaining Zone Controllers.
- **Radiant Request**: When a ***VAV Zone Controller*** has its radiant floor sequence active, it will be constantly calculating a Radiant Floor Duty Cycle for its output. This duty cycle is transmitted to the Master to alert it that there is a demand for hot water.

2.1.3 - COM Settings

Prolon ***VAV Zone Controllers*** offer configurable COM settings so that they can be integrated into various systems. The default RS485 COM settings for all Prolon controllers are:

- Baud Rate: 57600 bps
- Parity: None
- Stop bits: 1
- Data bits: 8

2.2 - BACnet and Lon

The Prolon ***VAV Zone Controllers*** are also capable of BACnet MS/TP communication over RS485, as well as Lon communication (for certain hardware platforms), where they can be integrated into networks with products from other manufacturers. However, DIFFERENT FRONT END software will be required in that case, since the Prolon Focus software only supports Prolon brand controllers communicating using Modbus.

Please see each platform's HARDWARE GUIDE for more information on how to set it up for alternate communication protocols.

3 - Adding a VAV Zone Controller to a Focus Project

Prolon Focus is a free visualization and configuration software for all Prolon controllers. Once the *VAV Zone Controller* has been physically wired to a Prolon network, it's time to add this controller to your Focus project.

3.1 - Assigning Address

All controllers in a Prolon Modbus network need to be addressed, and these addresses must be unique on a given network. Valid addresses range from 1 to 127.

3.1.1 - VC2000 Hardware

If the ***VAV Zone Controller*** is on the VC2000 hardware platform, it may need to have an address assigned to it before proceeding. Prolon VC2000 ***VAV Zone Controllers*** leave the factory with no default address and no physical addressing dipswitch, so they cannot be communicated with until an address is assigned to them.

To know if the VC2000 ***VAV Zone Controller*** has an address or not, look at the VC2000's Status Light. If it is ON, then it has no address yet and needs to be assigned. If the light is OFF, then it DOES have an address, and you can proceed to the next section.

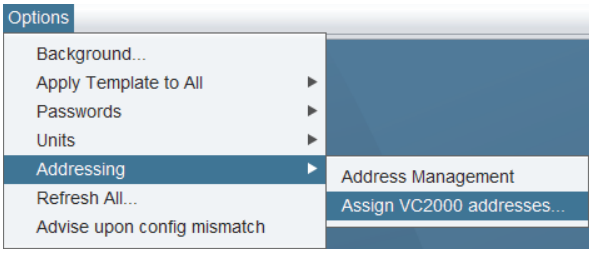
The address can be assigned by one of two ways:

- Using a Prolon wall sensor with digital display, such as a T1000 or T500.
- Using the Prolon Focus software. See the following section: Focus Address Assignment Procedure

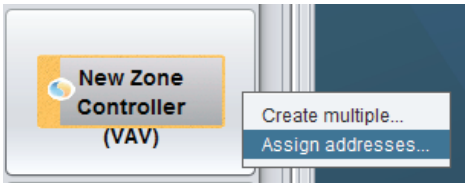
3.1.1.1 - Focus Addresses Assignment Procedure

The Prolon Focus Address Assignment Procedure allows you to assign addresses to VC2000 ***VAV Zone Controllers***. Up to 127 addresses can be assigned during the procedure, but they must be in sequential order. If the controllers you wish to add are not in sequential order, then you can just repeat the procedure for all controllers out of sequence. If the Focus software detects that the addresses you are attempting to assign already exist on the network, it will skip over these addresses and assign the next available address (see example below).

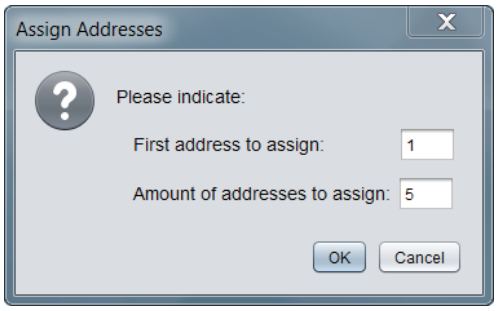
1. The Address Assignment Procedure can be started either by going through the Options Menu:



Or by right-clicking on the "New Zone Controller" icon:

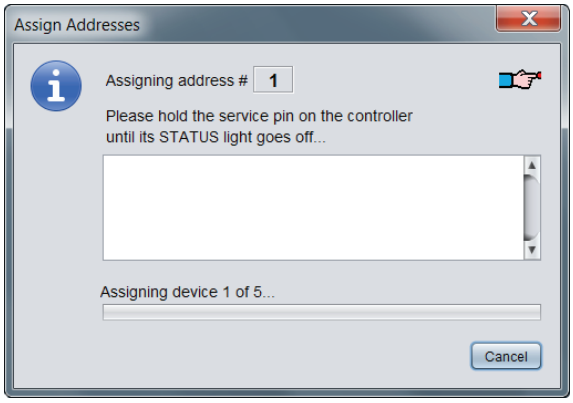


2. Focus will then ask you to provide the first address to assign, followed by the total amount of addresses to assign:



In the example image above, addresses 1 through 5 will be assigned to five VC2000s. If address 3 has already been assigned to another controller somewhere on the network, then addresses 1 through 6 will be assigned instead, skipping over address 3. Addresses can be reassigned later using the Focus's Address Management feature.

3. Next, Focus will begin broadcasting an addressing command to all controllers for the first address:



Only the controller whose SERVICE button is held down will receive the assigned address, so you must physically go to the appropriate controller and hold down the SERVICE button until the Status Light goes off (indicates that the address has been assigned). It should not take more than five seconds to receive the address once you begin holding the button.

If a VC2000 does not seem to receive its address even after holding down the button for five seconds, it may indicate network communication trouble or incorrect wiring for this or other controllers. Please refer to the Prolon Networking Guide for more information.

4. You may now proceed to the next VC2000 in line and hold down its service button (you do NOT need to return to the screen between each VC2000). Controllers will be added onto the screen automatically as you assign addresses.

NOTE: the address assignment order does not have to be identical to the order in which the controllers are wired (i.e. one could assign addresses in the order they choose)

5. Once you have assigned all addresses, you can return to the computer. A brief log of the actions performed will be displayed on the screen. The procedure is now complete.

3.1.2 - Other Hardware

For the other hardware platforms, the ***VAV Zone Controller***'s address can be assigned using the physical dipswitch found directly on the controller. The address will be encoded in binary. Please see each platform's HARDWARE GUIDE for more information.

3.1.2.1 - Address Locking

For hardware platforms with physical dipswitches, be aware that Prolon Focus offers a feature that allows a user to lock the address of a controller to a specific value, regardless of what is present on the addressing dipswitch. This allows for protection against unwitting users from changing the addresses by playing with the dipswitches, but can also lead to confusion. Please see Address Management in the Prolon Focus User Guide for more information.

3.2 - Adding the Controller to the Screen

Once the controller has been physically wired to a Prolon network and it has an assigned address, it is time to add it to your Prolon Focus project screen.

If you used the Focus Address Assignment Procedure above for VC2000 controllers, your icons should already be on screen, and you can proceed to the next section.

3.2.1 - Master Get List

If the ***VAV Zone Controller*** is placed under a Master Controller in the network hierarchy, it can be added to your screen simply by performing a GET LIST on the Master. The Master Controller will take charge and scan its network for controllers, and all those that are found will automatically be added to the screen. To perform a GET LIST, right-click on your Master icon and select "Get List":

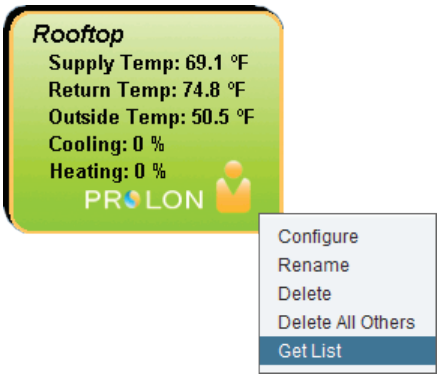


Figure 3 - Master Get List

Note that this step is crucial, as no communication will reach your ***VAV Zone Controller*** if it has not been added the Master's List. If no Master controller is assigned to the ***VAV Zone Controller***, then this step can be ignored, and the new Zone Controller button can be used instead (see below).

3.2.2 - New Zone Controller Button

In the event where there is no Master Controller assigned to the ***VAV Zone Controller*** in the network hierarchy, then a ***VAV Zone Controller*** can be simply added onto the screen by clicking or dragging on the "New Zone Controller" button, found in the Devices Drag and Drop list on the left side of the Focus screen (System View only):

Figure 4 - New Zone Controller button

Focus will ask for the address of the controller, attempt to locate it, and add it on the screen if successful.

Alternatively, you can add multiple ***VAV Zone Controllers*** in sequence by right clicking the button and selecting the "Create Multiple" option. This option will facilitate the creation of multiple ***VAV Zone Controllers*** in sequential order.

4 - VAV Zone Controller Icon

Each *VAV Zone Controller* added to your system has its own icon. Each icon displays data about the *VAV Zone Controller* it represents, and this data is updated regularly. You can open the configuration screen for a *VAV Zone Controller* by double-clicking on its icon. If the *VAV Zone Controller* is offline, all data values will show "N/A" (not applicable) and the icon will be grey.

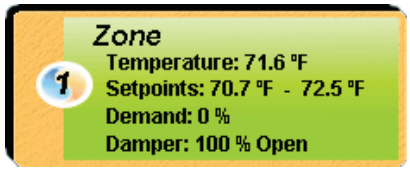


Figure 5 - Typical VAV Zone Controller icon

Please note that if the VAV Zone Controller is Pressure Independent, the airflow in the duct will be shown in the icon. Otherwise, the damper position will be displayed.

4.1 - Icon Data

- **Name**: The name of the ***VAV Zone Controller***. You can change it by right clicking the icon and choosing "Rename". By default it is set to "Zone".
- **Address Number**: This can be seen in the blue and orange circle (yin/yang) at the left side of the icon.
- **Temperature**: The current zone air temperature. Will display "N/A" if there is no temperature sensor attached or if offline.
- **Setpoints**: The active heating and cooling setpoints, respectively. Will display "N/A" if the VAV Zone Controller is offline.
- **Demand**: The ***VAV Zone Controller*** continuously calculates the demand for its zone. This demand takes the form of a number varying from -100% to +100%, where a negative percentage indicates a cooling demand, and a positive number indicates a heating demand. A demand of zero indicates that the controller is within its zone temperature setpoints and is satisfied. Will display "N/A" if the ***VAV Zone Controller*** is offline.
- **Damper**: The position of the damper in percentage. Will be replaced by "Flow" (airflow in the duct) if the ***VAV Zone Controller*** is pressure independent. Will display "Reinitializing…" when performing its damper calibration process ***(see Damper Opening p.17)***. Will display "N/A" if the ***VAV Zone Controller*** is offline.
- **Flow**: The airflow in the duct controlled by this VAV Zone Controller in CFM (cubic feet per minute). Will be replaced by "Damper" (damper position) if the VAV Zone Controller is pressure dependent.

4.2 - Icon Colors

The icons change color depending on their status and demand.

- **Grey**: The icon is grey if working offline or if the communication with that ***VAV Zone Controller*** is lost. All data will be seen as "N/A".

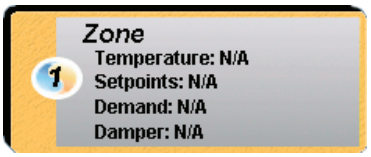


Figure 6 - Grey icon

- **Green**: The icon is green when the demand is within the deadband (between 5% cooling and 5% heating).

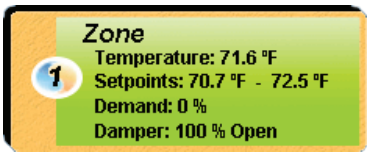


Figure 7 - Green icon

- **Red**: The icon turns red when the demand is greater than 10% HEATING, and stays red until the demand returns to 0%.

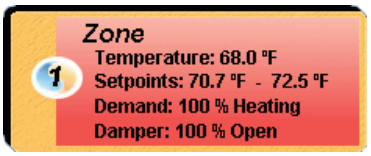


Figure 8 - Red icon

- **Blue**: The icon turns blue when the demand is greater then 10% COOLING, and stays blue until the demand returns to 0%.

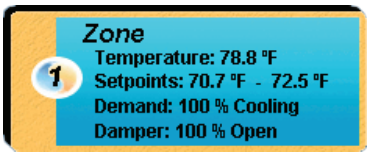


Figure 9 - Blue icon

4.3 - Icon Right-Click

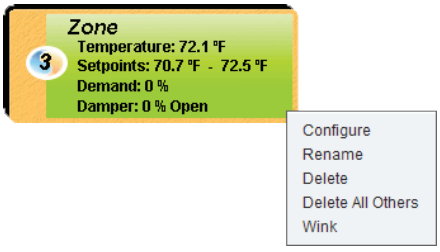


Figure 10 - Icon Right Click menu

- **Configure**: Opens the configuration screen for the ***VAV Zone Controller***.
- **Rename**: Allows you to rename this VAV Zone Controller. Names are limited to 16 characters.
- **Delete**: Removes this ***VAV Zone Controller*** from your Focus Project.
- **Delete All Others**: Removes all other Icons from the current system. This is useful for debugging purposes, for example when trying to exclusively establish communication with this controller, and the presence of the other controllers in your project is causing communications to slow down.
- **Wink**: This option, only available for the VC2000 hardware platform, will cause the Heartbeat and Status LEDs on the controller to alternate every second, for a total duration of two minutes. This is useful method to visually identify your VC2000, in the case where its address is missing from the label, or if you suspect it has been mislabeled.

5 - Configuration of a VAV Zone Controller

To view the configuration of a *VAV Zone Controller* in detail, double-click on its icon to see its configuration screen. Use the menus in the top left corner to navigate between the different sections, or simply double-click any item in the *VAV Zone Controller* Home screen to send you to its corresponding configuration page. *(See Icon Quick Jumps for more details, p.19)*.

5.1 - Config Menu

5.1.1 - VAV Zone Controller Home Screen

This screen shows the status of all inputs and outputs of the ***VAV Zone Controller***, as well as the active setpoints. All values will be "N/A" (Not Applicable) when offline.

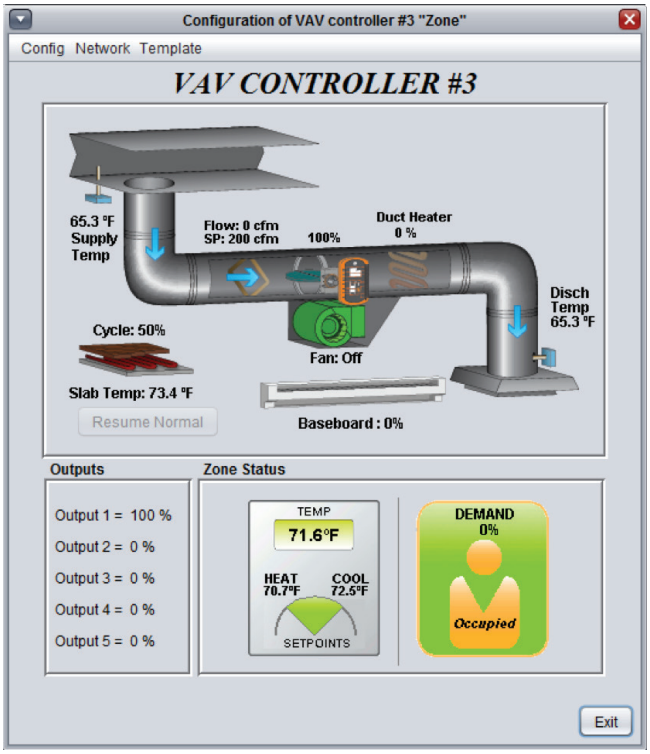


Figure 11 - VAV Zone Controller home screen

5.1.1.1 - Readable Values

- **Supply Temp**: The supply temperature in degrees Fahrenheit or Celsius. Will be "N/A" if no sensor is attached and if no supply temperature is received from the network.

- **Slab Temp**: The slab temperature in degrees Fahrenheit or Celsius. Will display N/A if no sensor is attached. This icon is absent when no output has been designa ted as a radiant floor *(see Radiant Floor Special Function p.32)*.

- **Radiant Floor Cycle**: Shows the percentage of the duty cycle for which the radiant floor output is active. This icon is absent when no output has been designated as a radiant floor *(see Radiant Floor Special Function p.32)*.

- **Flow**: The airflow in CFM (cubic feet per minute). Will not be visible if the damper control source is set to Demand *(See Damper Configuration p.26)*.

- **Flow SP**: The current target flow setpoint. The VAV Controller is actively trying to obtain this much airflow in the duct.

- **Damper opening**: The position of the damper (in percentage) can be seen near the icon of the damper. The damper icon rotates according to its position and will move clockwise or counter-clockwise depending on the chosen setting.

  Will display "Reinitializing…" when the VAV Zone Controller is performing its damper calibration process. The damper calibration process occurs upon power-up, or whenever the controller transitions to unoccupied mode. During this process, it will fully open and fully close the damper in an attempt to detect the limits of its range of movement. If the controller does not exit the calibration process, please verify that the damper can move freely and that there is sufficient voltage supplied to the controller.

  Will display "STALLED" if the damper is no longer able to move in the desired direction, after having previously been able to do so during the damper calibration process.

- **Discharge Temp**: The discharge temperature in degrees Fahrenheit or Celsius. Will be "N/A" if no sensor is attached. Will not be visible if the analog input is not appropriately configured *(see Input Function p.38)*.

- **Duct Heater**: The current level of the output that has been designated as a duct heater. The icon's color represents the intensity of the heating action being taken. This icon is absent when no output is designated as a duct heater *(see Duct Heater Special Function p.32)*.

- **Baseboard**: The current level of the output that has been designated as a baseboard. The icon's color represents the intensity of the heating action being taken. This icon is absent when no output is designated as a baseboard. *(see Display Configuration on p.22)*.

- **Fan**: The current status of the fan powered box. The icon's animated rotation indicates that the fan is on. This icon is absent when no output is designated as a fan powered box *(see Fan Powered Box Special Function p.32)*.

- **CO_2**: The current CO_2 levels expressed in parts per million (PPM). Will only be visible if the analog input is set for CO_2 mode *(see Other Configuration at p.38 for more information)*.

ZONE STATUS

- **Zone Temperature**: The actual temperature read from the temperature sensor input, or as provided by the digital wall sensor. Will be "N/A" if no sensor is attached.

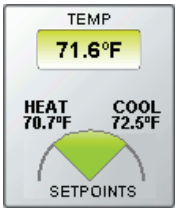


Figure 12 - Wall sensor display

- **Active Heating Setpoint**: This is the heating setpoint currently used by the ***VAV Zone Controller***. In occupied mode, it is provided by a potentiometer physically attached to the board, or by the digital wall sensor. If no setpoint is supplied, the default heating setpoint is used. In unoccupied mode, the heating setpoint is reduced by the unoccupied heating offset ***(see p.38)***.

- **Active Cooling Setpoint**: This is the cooling setpoint currently used by the ***VAV Zone Controller***. In occupied mode, it corresponds to the sum of the active heating setpoint and the occupied deadband. In unoccupied mode, the cooling setpoint is increased by the unoccupied cooling offset ***(see p.38)***.

- **Occupied/Unoccupied**: The current occupancy status of the ***VAV Zone Controller***, accompanied with a representative icon. In occupied mode, the icon is orange. In unoccupied mode, the icon is grey. When offline, it displays "N/A".

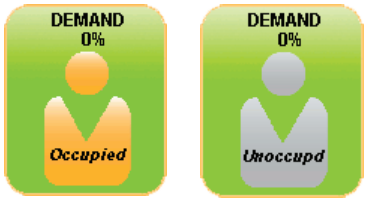


Figure 13 - Occupancy display

- **Demand**: The ***VAV Zone Controller*** continuously calculates the demand for its zone. This demand takes the form of a number varying from -100% to +100%, where a negative percentage indicates a cooling demand, and a positive number indicates a heating demand. A demand of zero indicates that the controller is within its zone temperature setpoints and is satisfied. The status icon will be red when there is a demand for heating, blue when there is a demand for cooling, and green when the demand is near the deadband.

OUTPUTS

The current value of each output, in percentage. The quantity of outputs displayed varies according to the hardware platform:

- ▹ VC2000 and VC1000LT (discontinued) controllers each have 1 digital output (ON-OFF or pulsed), and 1 analog output (0-10VDC, 2-10VDC, or 0-5VDC).

- ▹ C1000 and VC1000F (discontinued) controllers have 4 digital outputs (ON-OFF or pulsed) and 1 analog output (0-10VDC, 2-10VDC, or 0-5VDC).

Outputs will display "N/A" if they are set to "OFF". You can rename the outputs by right clicking on them and selecting "Rename".

5.1.1.2 - Icon Quick Jump

Certain items in the Home screen will direct you to their corresponding configuration screen when double-clicked. A red contour will surround the object if this feature is available.

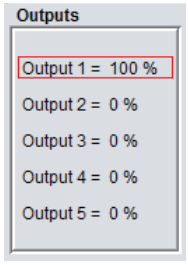


Figure 14 - Icon Quick Jump example

The following is a list of the featured items and their corresponding destination:

Items	Quick Jump
Damper	Damper Configuration
Thermostat	Temperature Configuration
Occupancy Status	Timing Configuration
Digital Output	Configuration of Digital Output
Analog Output	Configuration of Analog Output
Output 1 (C1000 only)	Configuration of Digital Output 1
Output 2 (C1000 only)	Configuration of Digital Output 2
Output 3 (C1000 only)	Configuration of Digital Output 3
Output 4 (C1000 only)	Configuration of Digital Output 4
Output 5 (C1000 only)	Configuration of Analog Output 5
Supply Temperature Sensor	Temperature Calibration
Flow Sensor*	Pressure Independent Configuration
Duct Heater*	Configuration of the output that has been designated as a the duct heater
Fan*	Configuration of the output that has been designated as a the fan powered box
Baseboard*	Configuration of the output that has been designated as a the baseboard
Radiant Floor*	Radiant Floor Configuration

** Visible only when the appropriate features are enabled*

Please note that if the advanced password is enabled, you will not be able to double-click on any objects, except the thermostat.

5.1.1.3 - Icon Manual Override

Certain components of the ***VAV Zone Controller*** can be overridden. To use this feature, right-click on the item of the component you wish to override. A pop-up menu will appear if this feature is available.

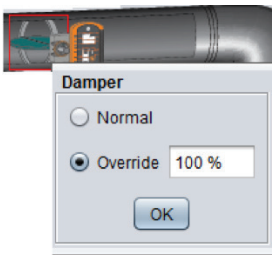


Figure 15 - Manual override of the damper

- **Normal**: Selecting the "Normal" button will revert the selected item back to its normal automatic behavior. Any override applied to this object will be disabled.
- **Override**: Selecting the "Override" button will allow the user to manually override the selected object until the normal mode is resumed.

  The following is a list of all items that can be overridden:

  - **Damper**: The minimum damper opening is ignored.
  - **Occupancy Status**: Generally, all zones will assume the same occupancy status as the master controller. If the master is unoccupied, setting a slave to "occupied" will also force the master to be occupied. All others slaves will remain unoccupied.
  - **Outputs**: An output that is configured to control a damper cannot be overridden. However, the damper can always be overridden by right-clicking on the damper itself ***(See Output Configuration, p.29)***.
  - **Radiant Floor**: This directly overrides the associated output, and not the radiant floor duty cycle.
  - **Duct Heater**
  - **Baseboard**
  - **Fan**

When an override is applied to an object, a yellow contour appears around its icon and any associated text starts to flash. For example, in the figure below, the damper has been overridden to 35%.

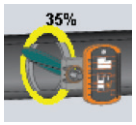


Figure 16 - The damper is overridden

Please note that if the advanced password is enabled, or if you are offline, you will not be able to override any objects.

All overrides are removed when the ***VAV Zone Controller*** is reset or loses power.

5.1.1.4 - Resume Normal Button

This button allows the ***VAV Zone Controller*** to return to its fully automated behavior. All overrides previously applied to the ***VAV Zone Controller*** will be disabled. However, before any action is taken, a dialog box will appear to confirm your choice.

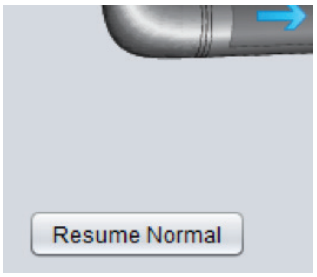


Figure 17 - "Resume Normal" button

5.1.1.5 - Renaming an Output

Each output can be renamed by right clicking on the its text and selecting the "Rename" option from the dropdown menu. A maximum of 16 characters can be used.

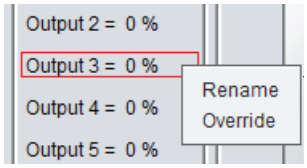


Figure 18 - Renaming an output

5.1.2 - Display Configuration

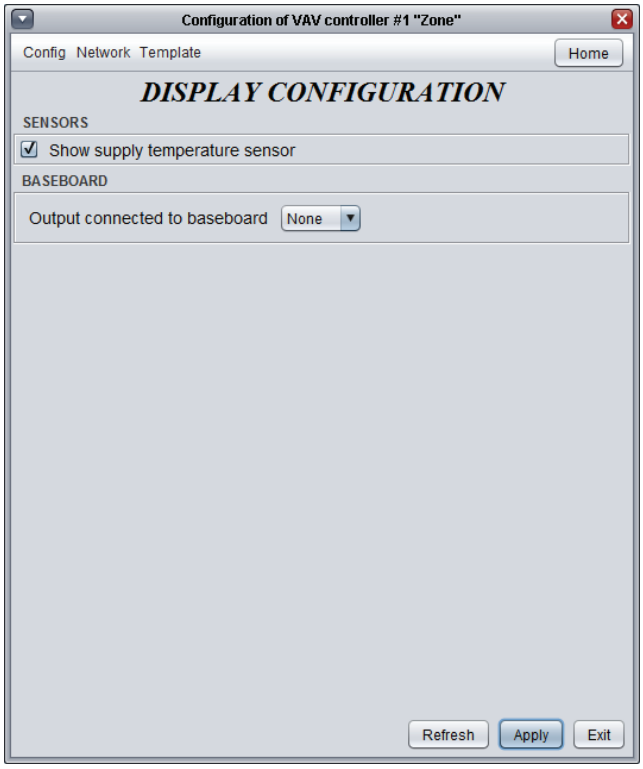


Figure 19 - Display configuration screen

This screen lets you customize the graphical display of the home screen, as well as assign certain functions to inputs and outputs.

- **Sensors**: This option instructs Focus whether or not to display the supply temperature sensor on the visualization page. This does not affect the operational sequence of the controller (decisions will still be made based on supply air temperature if it is available to the controller).
- **Baseboard**: Using the dropdown menu, you can indicate to Focus which output, among those available, is controlling a baseboard. A baseboard icon will then appear on the graphical display of the home screen, whose color represents the intensity of the heating action of that output.

5.1.3 - Temperature Configuration

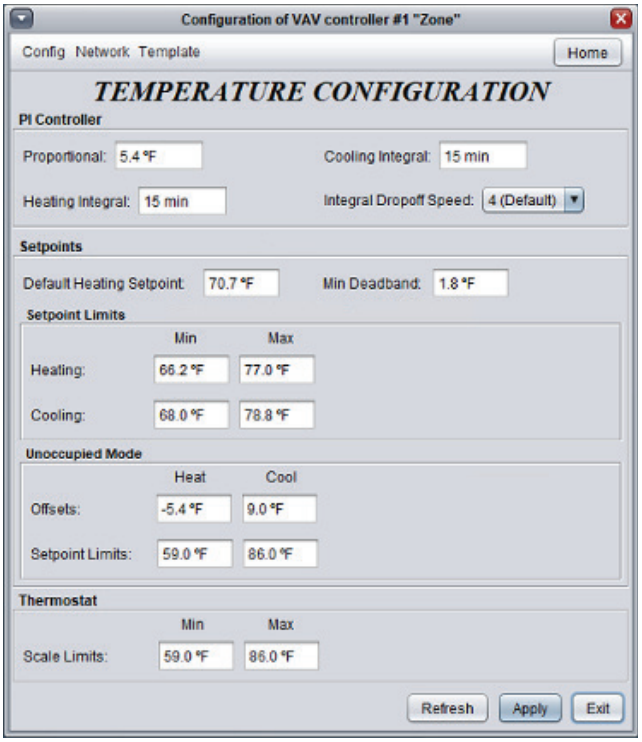


Figure 20 - Temperature configuration screen

5.1.3.1 - PI Controller

The ***VAV Zone Controller*** continuously calculates the demand for its zone. This demand takes the form of a number varying from -100% to +100%, where a negative percentage indicates a cooling demand, and a positive number indicates a heating demand. A demand of zero indicates that the controller in within its zone temperature setpoints and is satisfied.

In PI loop control, as is used by the Prolon ***VAV Zone Controller***, the demand is calculated by adding the proportional component of the demand to the integral component. These components are determined as follows:

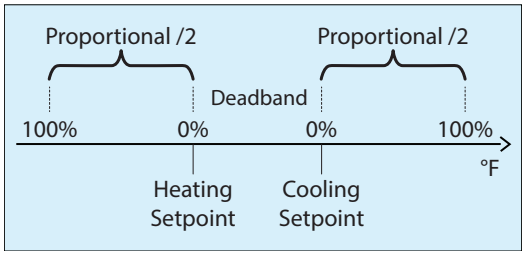


Figure 21 - Proportional component of demand

- **Proportional**: Defines the proportional band used by the ***VAV Zone Controller*** to calculate the proportional component of the demand. Please refer to Figure 21. Setting this value to zero removes proportional control,and consequentially, integral control. Demand will always be zero.

Default	5.4 °F / 3 °C

- **Cooling Integral**: Defines the amount of time required for the cooling integral component of the demand to equalize the proportional component. Setting this value to zero removes the cooling integral component of the demand.

Default	15 minutes

- **Heating Integral**: Defines the amount of time required for the heating integral component of the demand to equalize the proportional component. Setting this value to zero removes the heating integral component of the demand.

Default	15 minutes

- **Integral Dropoff Speed**: This setting defines how quickly the accumulated heating or cooling integral component of the PI calculation will be eliminated once the zone temperature returns within the setpoint deadband. The setting is provided on a scale of 1 to 5, with 1 being the slowest. Slowing down this setting can be useful in zones which have a strong constant heating or cooling load, which may make it advantageous to keep the zone demand ON even though the setpoints have been met.

Default	4

5.1.3.2 - Setpoints

- **Default Heating Setpoint**: When there is no external source of heating setpoint, such as a connected digital or analog wall sensor, this is the value that will be used as the heating setpoint. Otherwise it is ignored.

Default	70.7 °F / 21.5 °C

- **Occupied Deadband**: The deadband between the occupied heating setpoint and the occupied cooling setpoint. The cooling setpoint is calculated by adding this deadband to the heating setpoint.

Default	1.8 °F / 1 °C

- **Setpoints Limits**: These are the limits that are applied to the raw setpoints determined above (received for example, from the digital or analog wall sensor) to effectively limit the range of setpoints available for this zone. This will result in the 'active' heating and cooling setpoints for occupied mode.
  - ▹ Minimum Heating Setpoint

Default	66.2 °F / 19 °C

  - ▹ Maximum Heating Setpoint

Default	77 °F / 25 °C

  - ▹ Minimum Cooling Setpoints

Default	68 °F / 20 °C

  - ▹ Maximum Cooling Setpoints

Default	78.8 °F / 26 °C

5.1.3.3 - Unoccupied Mode

- **Offsets**: The setpoints calculated for occupied mode (after applying the setpoint limits) are offset by these amounts during unoccupied mode:
  - ▹ Heating

Default	-5.4 °F / -3 °C

  - ▹ Cooling

Default	9 °F / 5 °C

- **Setpoint Limits**: Once the unoccupied setpoints are calculated, they are then limited by the following values:
  - ▹ Heating

Default	56 °F / 15 °C

  - ▹ Cooling

Default	86 °F / 30 °C

5.1.3.4 - Thermostat

- **Scale Limits**: These are the minimum and maximum values of the scales on the wall sensor connected to this controller. This only applies to wall sensors with scale markings, such as the T200 or PL-RS wall sensors. Change this only to match the scale of the given wall sensor.
  - ▹ Minimum:

Default	59 °F / 15 °C

  - ▹ Maximum:

Default	86 °F / 30 °C

5.1.4 - Damper Configuration

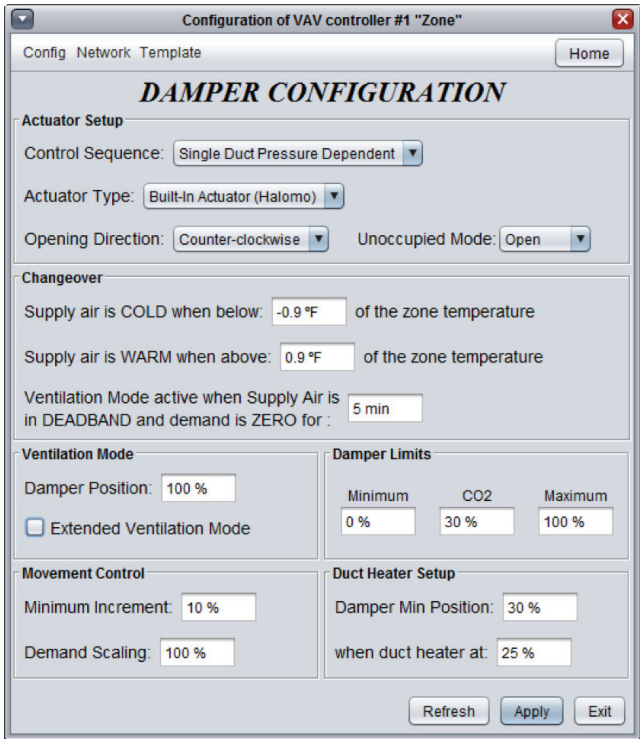


Figure 22 - Damper configuration screen

5.1.4.1 - Actuator Setup

IMPORTANT: Any changes to the settings in this section require a controller reinitilization, either by momentarily cutting power to the controller or by resetting it through software.

- **Control Sequence**:
  - ▹ **Single Duct Pressure Dependent**: The damper targets a specific position based on the demand of the zone and on the availability of favorable supply air. The target position is directly proportional to the demand.
  - ▹ **Single Duct Pressure Independent**: The damper targets a specific air flow based on the demand of the zone and on the availability of favorable supply air. The target air flow is directly proportional to the demand and is scaled based on the min and max air flow setpoints.
  - ▹ **Multizone**: This sequence, also known as dual-duct, modulates the damper to mix hot and cold supply air coming from two separate duct systems to maintain a comfortable zone temperature. The signal used to drive the actuator by the ***VAV controller*** corresponds to the damper position inside the HOT supply duct: the damper modulates open on a call for heat and closes on a call for cooling. **It is understood that the end-user will provide a mechanical setup that drives the cooling side damper in opposition to the heating side damper.** When there is no demand and the zone is satisfied, the damper maintains a midway reset position that is configurable ***(see section 5.1.4.5)***.

Note that the target position of the damper is NOT affected by the actual air temperatures in either supply duct, nor by the discharge air temperature.

- **Actuator Type:**
  - ▹ **Built-In Actuator (Halomo)**: Damper positioning is determined automatically using the onboard Halomo motor feedback (not available on the C1000 Hardware platform).
  - ▹ **Remote Actuator**: Damper position is estimated using the **Stroke Time** configuration setting. Note that an output must have its source set to "Damper" to enable damper control and visualisation.
- **Opening Direction**: The opening direction of the damper. This can also be changed through a procedure performed physically at the controller. Please see each platform's HARDWARE GUIDE for more information.
- **Unoccupied Mode:**
  - ▹ **Open**: The damper will fully open in unoccupied mode, unless there is a demand other than 0% AND the supply air is unfavorable, at which point it will close to its minimum. This is the default setting.
  - ▹ **Demand**: When inside the deadband, the damper will remain at its minimum position. If the zone temperature approaches within 0.9 °F / 0.5 °C of the edge of the deadband AND the supply temperature is favorable, the damper will fully open, until the zone temperature moves back into the deadband, away from the edge by 1.8 °F / 1 °C.
  - ▹ **Min Pos**: The damper will remain at its minimum position, unless there is a demand AND the supply air is favorable, at which point it will fully open.
  - ▹ **Normal**: The damper operates the same as in occupied mode.

5.1.4.2 - Changeover

This section determines the points at which the incoming supply air temperature is considered hotter, colder or ambient compared to the current room temperature:

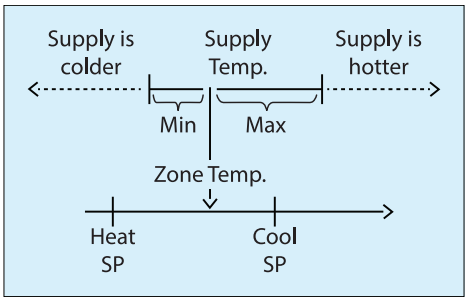


Figure 23 - Supply temperature deadband

The ***VAV Zone Controller*** uses this information to decide whether or not the supply air is favorable for the zone. If it is favorable, the damper will open proportionally to the demand of the zone. If it is unfavorable (or in the deadband), the damper will remain at its minimum.

Note that if the supply temperature reading is invalid, the controller automatically assumes that the incoming supply air is ***colder***. Physically shorting the supply temperature input to common will instead make it assume that the incoming supply air is ***hotter***. The Min and Max positions are always tied to the active zone temperature and move along with it.

Note that the Min does not necessarily have to be set below the zone temp, nor the Max above the zone temp. Both the Min and Max can be set higher, lower or split around the zone temp to get any desired ventilation or changeover effect.

This section also defines how long the supply air must remain in the deadband before ventilation mode can be activated. ***See section 5.1.4.3 for more details about Ventilation Mode***.

5.1.4.3 - Ventilation Mode

The Prolon ***VAV Controller*** has a special operating mode called Ventilation Mode. This mode is activated when the supply air temperature is within the deadband ***(see section 5.1.4.2)*** and the zone temperature is also within its heating and cooling setpoints (zone satisfied). In this mode, the damper opens up to take advantage of the alignment in temperatures to ventilate the zone.

In a pressure dependent setup, you can set the position that the damper goes to when Ventilation Mode is activated. In a pressure ***independent*** setup, you instead set the target air flow based on your defined minimum and maximum air flow setpoints.

- **Disabling Ventilation Mode**: Ventilation Mode can be disabled by setting the Min and Max values in section 5.1.4.2 to the ***same value***.
- **Extended Ventilation Mode**: Selecting the Extended Ventilation Mode option removes the condition that the zone must be satisfied before Ventilation Mode can occur. In other words, Ventilation Mode relies entirely on the supply air temperature being within your prescribed deadband.

5.1.4.4 - Damper Limits

- **Minimum**: The minimum damper opening position at all times.
- **CO_2**: Alternate minimum damper position when the CO_2 levels become too high. Only visible when the analog input has been set to "CO_2" ***(see Other Configuration for more information)***.
- **Standby**: Alternate minimum damper position when the standby sequence is enabled ***(see Standby Mode)***.
- **Maximum**: This value indicates the maximum allowable opening position of the damper. It is generally used for air balancing of the system (pressure dependent only).

5.1.4.5 - Movement Control

- **Minimum Increment**: This is the amount by which the desired damper position must change before the damper will actually move (pressure dependent only).
- **Demand Scaling**: Indicates the value that the zone demand must reach to scale open the damper to its maximum value (pressure dependent only).
- **Reset Position (Multizone only)**: Indicates the rest position of the damper when there is no demand for heating or cooling. Heating or cooling demands will scale the damper position starting from this center point.

5.1.4.6 - Duct Heater Setup

When an output is designated as a duct heater, an alternate minimum damper position (pressure dependent) or flow setpoint (pressure independent) can be used whenever the duct heater output is activated.

You must specify the output threshold value at which the damper will flip between using its standard minimum position to this alternate minimum. Once the alternate minimum is activated, the output value must decrease to 5% under the threshold before the normal minimum will be used again.

5.1.5 - Outputs Configuration

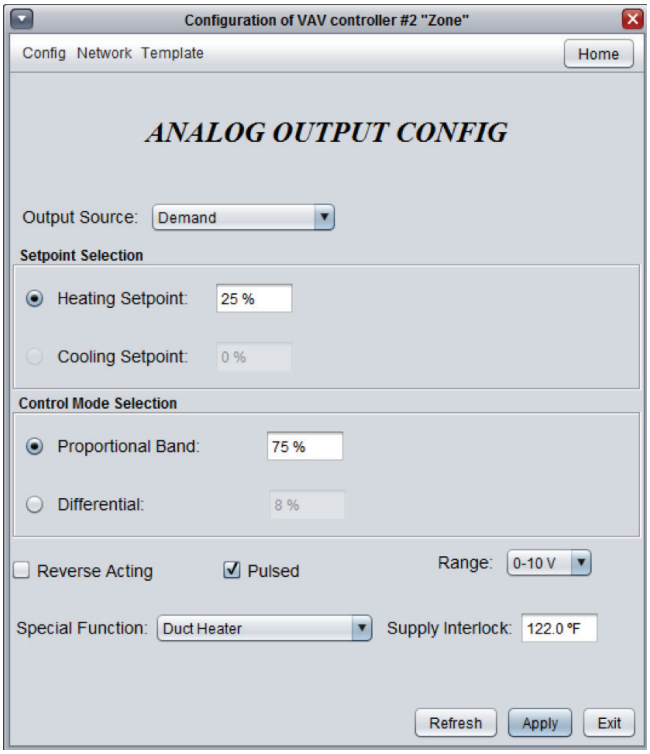


Figure 24 - Configuration of Output screen

The Prolon ***VAV Zone Controller*** is sold under several possible hardware variations that affect the type and quantities of available outputs. ***Please refer to "Hardware Variations" in section 1.1 for more details***, as well as the respective Hardware Guides to see wiring and electrical details for each output.

- **Output Source**: Establishes the rules behind the outputs operation.
  - ▹ **Demand**: The output behavior is based on this VAV Zone Controllers own demand. ***Please see section 5.1.3.1*** for more information on zone demand.
  - ▹ **Damper**: The output is used to control a damper. Only Outputs 1&2 (C1000 only) or the analog output can be configured for damper control.

    If Output 1 is set to damper control, Output 2 will automatically be set to damper control, and vice-versa. For counterclockwise opening (default), Output 2 is used to open the damper, and Output 1 is

used to close the damper. If Output 5 is set to damper control, then its value will scale to match the desired damper position (0-100%).

- **Occupancy**: The output will be at turn ON when occupied and OFF when unoccupied.
- **Occ / Night Heat**: The output will turn ON when occupied and OFF when unoccupied. In unoccupied mode the output will also turn ON when there is a heating demand greater than 25%, and will stay ON until the demand goes back to 0%.
- **Occ / Night Heat & Cool**: The output will turn ON when occupied and turn OFF when unoccupied. In unoccupied mode the output will also turn ON when there is a heating or cooling demand greater than 25%, and will stay ON until the demand goes back to 0%.
- **Fan Status**: The output will turn ON when the network master controller indicates that both a call for fan and proof of fan have been obtained. Otherwise, the output is OFF.
- **Math 1 to 5**: The output's behavior is based on the chosen math function. In a standard Prolon Modbus network, these math functions are obtained from the network master and are traditionally the resulting average demands of different controllers on the network.

  In BACnet or Lon, setting an output to use math functions will automatically activate this VAV Zone Controller's own math calculations (even if this was not enabled in the Math Functions configuration screen). ***See the Math Functions configuration screen on p.44 for more details.***
- **Off**: The output remains inactive and will be displayed as N/A on the Home screen.

5.1.5.1 - Setpoint Selection

If the Output Source above is set to 'Demand' or 'Math', then this determines if the output will activate under heating or cooling conditions. This also specifies the setpoint for the output, but the final operational sequence will depend on the Control Mode Selection below.

5.1.5.2 - Control Mode Selection

Proportional Band
Selecting Proportional Band control will incrementally increase or decrease the output's value as the zone's demand increases or decreases. This mode provides better control than traditional differential style outputs (ON/OFF), but can only be used with equipment that can accept a modulating signal.

For digital outputs, the output will use pulse width modulation, where the pulse width increase or decreases over time. The total pulse width period is one second.

For analog outputs, you can select if the output should also pulse with a one second pulse width modulation, or simply ramp the voltage up and down with voltage modulation.

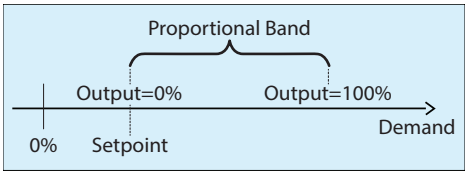


Figure 25 - Proportional deadband diagram

The output's value, on a scale of 0-100%, is calculated as follows: The output is at 0% when the demand is below the set-point, and increases proportionally with the demand until it finally reaches 100% when the demand reaches the setpoint + proportional band. The sum of the setpoint and the demand cannot be greater than 100%. Here is an example:

Given the :

- ▹ Setpoint = 25%
- ▹ Proportional band =50%
- ▹ Demand = 45%

Then the calculated output value is: (45-25) / 50 = 40%

This output percentage is then converted into a pulse width for pulsing outputs, or into a voltage for voltage modulating analog outputs.

For example, a 25% output percentage for a pulsing output will result in the output being ON for 0.25 seconds, and then OFF for the remaining 0.75 seconds. These pulses will simply repeat over and over. For modulating 0-10VDC outputs, a 25% output will provide 2.5VDC at the output terminals.

Differential

In Differential (ON/OFF) mode, the output only has 2 states, ON or OFF. From the OFF state, the output turns ON when the demand passes (setpoint + differential/2) and remains ON until the demand goes back down below (setpoint – differential/2) *(see figure 25)*. The setpoint must always be greater than the differential. The sum of the setpoint and the differential must be less than 100%.

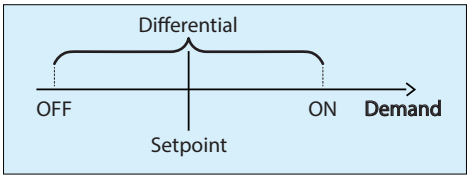


Figure 26 - Differential diagram

5.1.5.3 - Output Default Values

Output	Source	Setpoint	Control Mode
Output 1 (C1000)	Occupancy	N/A	N/A
Output 2 (C1000)	Demand	Heating: 1%	Proportional Band: 99%
Output 3 (C1000)	Demand	Heating: 25%	Proportional Band: 75%
Digital Output	Demand	Heating: 50%	Differential: 40%
Analog Output	Demand	Heating: 25%	Proportional Band: 75% (Pulsed)

5.1.5.4 - Other Options

- **Reverse Acting**: The voltage that appears at the terminals of the output will be inverted compared to the value calculated above. For pulsing outputs, where the calculated output percentage is 25%, it means that the output will be OFF for 0.25 seconds and ON for 0.75 seconds. For analog outputs, where the calculated output percentage is 25%, it means that the voltage at the terminals of a 0-10VDC output will be 7.5 VDC.

- **Pulsed**: This option is only available for the Analog Output, and determines if it will use a one second pulse width modulation instead of normal voltage modulation.

- **Voltage**: This option is only available for the Analog Output. It specifies the voltage range to be used:
  - ▹ 0-10V
  - ▹ 2-10V
  - ▹ 0-5V

- **Special Function**: These are special settings you can attribute to this output.
  - ▹ **Duct Heater**: Indicates that this output controls a duct heater and that alternate damper minimum positions or air flow setpoints will be used when this output turns ON.

    The alternate damper minimum position (pressure dependent mode) or alternate minimum ventilation setpoint (pressure independent mode) are enabled when the calculated output percentage goes above the Duct Heater Setpoint ***(see section 5.1.4.6 for more details)***.

    The Duct Heater function also comes with a Supply Interlock high limit, which completely deactivates the output whenever the incoming supply air temperature is too warm.

  - ▹ **Radiant Floor**: Indicates that this output controls a radiant floor system. The control mode must be set to proportional in this mode. The calculated output percentage will not be directly applied to the output's terminals in the mode, but instead be used to help select the target radiant floor temperature setpoint. ***See the Radiant Floor Configuration screen for more details.***
  - ▹ **Fan Powered Box *(Series)***: Indicates that this output controls a fan powered box, where the fan is placed in the direct path of the main air coming from the air handling unit. In this mode, the output source must be set to one of the following:
    - > Occupancy (default)
    - > Occ / Night Heat
    - > Occ / Night Heat & Cool
    - > Fan Status

    A checkbox is also made available in this mode to optionally require that the damper is forced fully closed before starting the fan. This is to protect the fan's motor, as it is possible that the air coming downstream from the air handling unit has caused the fan blades to spin on their own, and starting the fan from this state can cause damage to the motor.

  - ▹ **Fan Powered Box *(Parallel)***: Indicates that this output controls a fan powered box, where the fan is placed alongside the VAV box, in parallel of the main air coming from the air handling unit, and not in the direct path of this air. In this mode, the output source must be set to either 'Demand' or 'Math'.

5.1.6 - Radiant Floor Configuration

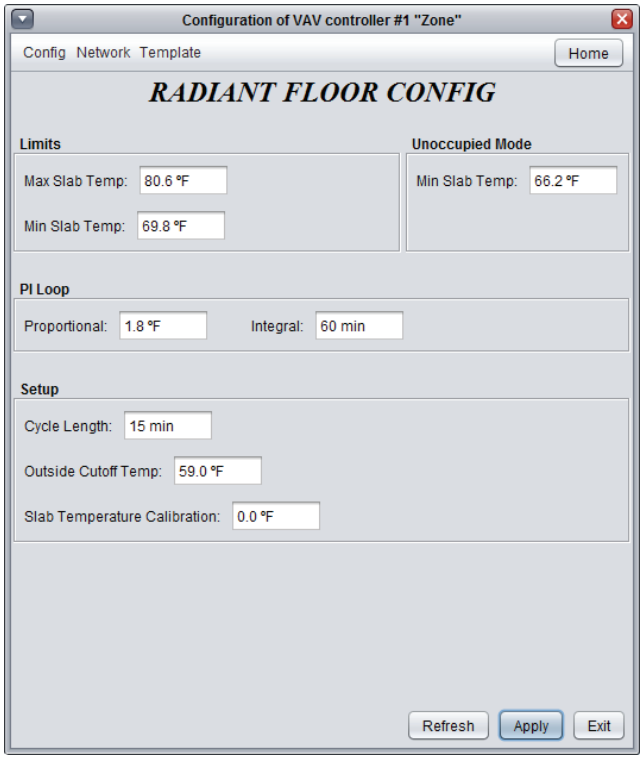


Figure 27 - Radiant Floor configuration screen

This screen can only be accessed when an output has been set to the 'Radiant Floor' special function *(see Output Configuration screen, p.29)*.

5.1.6.1 - Limits

The slab target temperature is determined using a scale based on the minimum and maximum slab setpoints limits. The calculated percentage of the output assigned to the Radiant Floor is then used to select the target based on this scale.

(See p.30 for more information on how the output percentage is calculated in proportional mode).

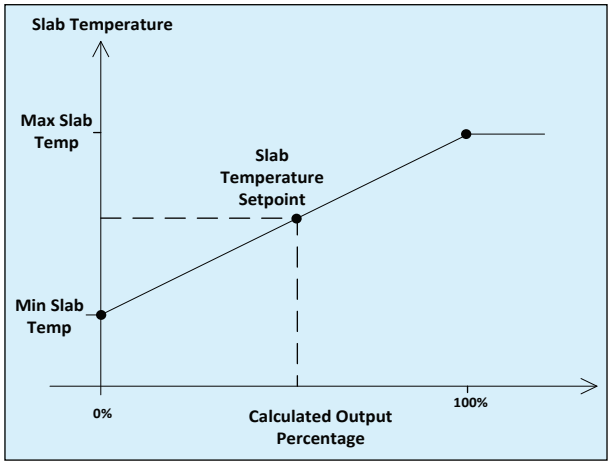


Figure 28 - Slab target scale

Example:
An output is set as a radiant floor output. Its heating setpoint is 30%, with a proportional band of 60%. The minimum slab temperature is set to 69.8 °F / 21 °C, and the maximum slab temperature is set to 80.6 °F / 27 °C.

At a given moment, the demand of the zone is 45%. The Calculated Output Percentage is therefore (45-30) / 60 = 25%.

Therefore, the Slab Temperature Setpoint will be 25% of the way between the min and max slab limits:
(80.6-69.8) x 0.25 + 69.8 = 72.5°F.

- **Max Slab Temp.:**

Default	80.6 °F / 27 °C

- **Min Slab Temp.:**

Default	69.8 °F / 21 °C

5.1.6.2 - Unoccupied Mode

- **Min Slab Temp:** In unoccupied mode, the minimum slab scale limit above is instead replaced by this value. Operation is otherwise identical.

Default	66.2 °F / 19 °C

5.1.6.3 - PI Loop

The controller heats the radiant floor using pulse width modulation. The percentage of the cycle that the output is activated is determined by a proportional / integral (PI) loop.

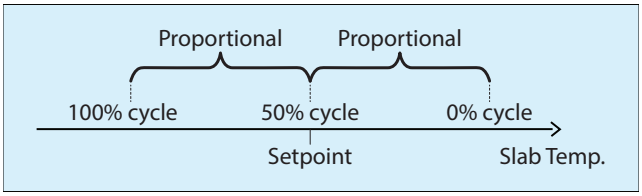


Figure 29 - Radiant Floor proportional band

The output pulses at 50% of the cycle length (defined below) when the slab temperature reaches the setpoint. The proportional band will increase or reduce the length of the pulse depending on the offset from the setpoint. The integral increases the action of the output over time (the longer the slab temperature is incorrect, the more effect the integral component will have).

- **Proportional:**

Default	1.8 °F / 1 °C

- **Integral**: Defined as the amount of time required to cause the pulse width to vary by 100% to compensate for a continual error of 1.8 °F / 1 °C.

Default	69.8 °F / 21 °C

5.1.6.4 - Setup

- **Cycle Length**: The amount of time for a complete ON AND OFF cycle.

Default	15 minutes

- **Outside Cutoff Temp**: Above this temperature, the radiant floor output always remains deactivated. (There is a 3.6°F / 2°C differential to allow for temperature fluctuations).

Default	59 °F / 15 °C

- **Slab Temperature Calibration**: This applies an offset to the slab temperature reading, if required.

Default	0 °F / 0 °C

5.1.7 - Pressure Independent Configuration

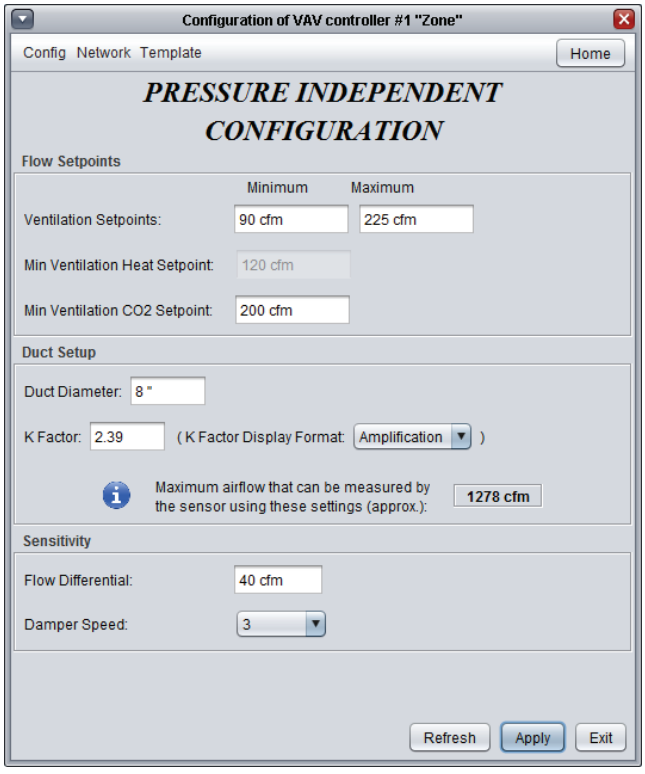


Figure 30 - Pressure Independent configuration screen

This screen can only be accessed when the ***VAV Zone Controller*** is set to pressure independent mode ***(see Damper Control Source, p.26)***. The settings here define how the controller will regulate air flow.

5.1.7.1 - Flow Setpoints

- **Ventilation Setpoints**: The controller uses the calculated demand of the zone to determine a target airflow, whose range is defined by these flow setpoints. ***(Please refer to 'PI Control' on p.23 for more information on how demand is calculated)***.

  Note that the incoming supply air temperature must also be favorable for the air flow target to scale up, otherwise only the minimum flow setpoint will be maintained.

  For example, for a given:
  - ▹ Demand: 45% heating
  - ▹ Min Flow Setpoint: 100 cfm
  - ▹ Max Flow Setpoint: 500 cfm
  - ▹ Supply Air: Favorable (85 ºF)

  Then the target air flow setpoint will be:
  - ▹ ((500-100) x 45%) + 100 = 280 CFM

  Note that if the ***VAV Zone Controller*** enters Ventilation Mode, it will instead target the maximum air flow. ***See the Damper Deadband section (p.27)*** for more details on the determination of favorable supply air, as well as Ventilation Mode.

  In the special case where there is no valid zone temperature provided to the controller, it will instead behave as an air volume controller: Inoccupied mode, it will always target the max flow setpoint, and in unoccupied mode it will target the min flow setpoint.

- **Minimum**:

Default	90 cfm (Cubic feet per minute)

- **Maximum**:

Default	225 cfm (Cubic feet per minute)

- **Min Ventilation CO_2 Setpoint**: Alternate minimum ventilation setpoint, enabled when the CO_2 levels are too high. Only visible when the analog input has been set to "CO_2" ***(see Other Configuration at p.38 for more information)***.

- **Min Ventilation Heat Setpoint**: Alternate minimum ventilation setpoint, enabled when one of the outputs of the controller is designated as a Duct Heater. When that output's current value is greater than the Duct Heater Setpoint ***(see p.27)***, this alternate minimum is used. Otherwise, the normal ventilation minimum is used in the calculation.

Default	120 cfm (Cubic feet per minute)

5.1.7.2 - Duct Setup

- **Duct Diameter**: The diameter of the duct in which the flow sensor is installed.

Default	8 inches

- **K Factor**: Factor defined by the flow cross or Pitot tube being used to sample and deliver the air from the duct to the air flow sensor on the controller. It is specified by the manufacturer of the flow cross and varies with the duct diameter.

Default	2.39

- **K Factor Display Format**: This is a Display-Only setting and is not saved or even considered by the controller. It's only used by the Focus software to display the K Factor using two different methods, for your convenience.

The first is the Amplification method (Prolon standard) where the K Factor is represented as the factor of multiplication produced by the flow cross when it converts the pressure in the duct to the pressure at the air flow sensor. It is typically a number from 1 to 4.

The second is the Flow method (CFM), where the K Factor is represented as the air flow in the duct required for the flow cross to produce a pressure of 1 in of water at the sensor. It can range from hundreds to thousands of CFM.

- **Sensor Type**: The type of flow sensor used on the controller (C1000 / VC1000F only).
  - ▹ Flow sensor: up to 3000 fpm.

5.1.7.3 - Sensitivity

- **Sensor Differential**: The airflow reading must deviate away from the target airflow by half this amount, either above or below, before the damper will attempt to compensate for the change in airflow.

Default	40 cfm (Cubic feet per minute)

- **Damper Speed**: The speed at which the damper will move to reach the desired airflow. Slow this down for increased air flow stability, but slower reaction time. Described as: 1=slow, 5=fast (3 is the default).

5.1.8 - Other Configuration

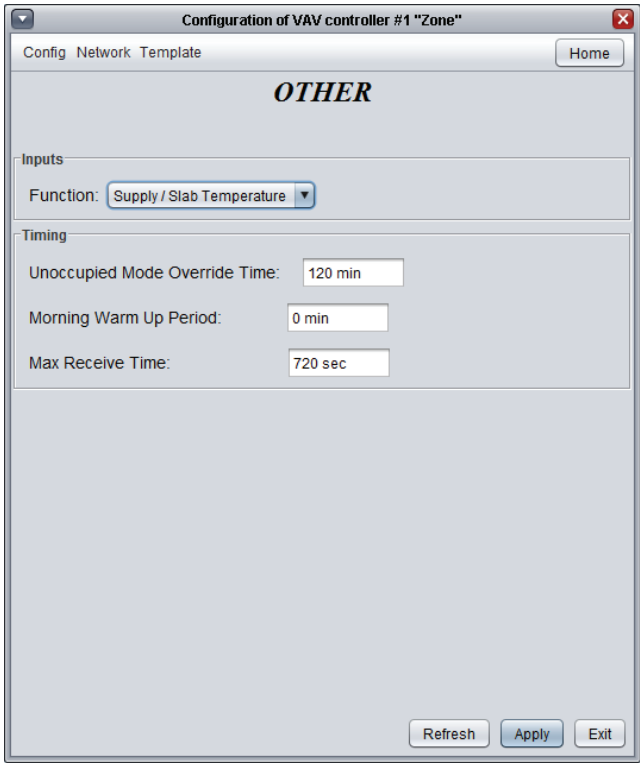


Figure 31 - Other configuration screen

Input

- **Function**: Using the dropdown menu, you can assign various functions to the inputs of the controller. An appropriate icon will then appear on the graphical display of the home screen.
- **Supply/Slab Sensor**: The controller will assign its analog input to measure the supply air temperature. Alternatively, if one of the outputs is designated as a "Radiant Floor", the reading will instead be assigned to the slab temperature. Exception: if a T1000 digital sensor is connected and is already providing the slab temperature reading the controller, than the function of this input will revert back to supply air temperature. In all cases, a 10K Type 3 thermistor must be used.
- **Zone Temperature**: The controller will assign its analog input to measure zone air temperature. A 10K Type 3 thermistor must be used. A zone temperature reading on this input will take precedence over one received from a digital wall sensor, such as T1000, T500 or T200.
- **Occupancy**: The controller will assign its analog input to determine the occupancy status of the controller (dry contact). When the contact is open, the controller remains occupied, unless instructed otherwise from the network (Network Controller or other Master controller). When the contact is closed, the controller remains unoccupied, REGARDLESS of the instructions coming from the network.
- **Discharge Temp**: The controller will assign its analog input to measure the discharge air temperature readings. This is the air temperature downstream from the damper, exiting from the diffuser. A 10K Type 3 thermistor must be used.
- **Standby mode**: The controller will assign its analog input to determine the standby mode status of the controller (dry contact). The purpose of Standby mode is to minimize this zone's impact on the rest of the system. Stand-by mode is activated when the contact is open during occupied mode, at which point the damper will instead use the Standby Minimum Position, and the zone demand and weight transmitted to the master become zero. When the contact is closed, or the schedule is unoccupied, the controller operates normally. Typically a motion sensor is connected to the input in this mode, which closes upon detection of motion.

- **CO_2**: The controller will assign its analog input to measuring CO_2 levels. When they rise above the setpoint, the VC2000 will use alternate damper or flow minimum settings. The CO_2 must drop below the setpoint by at least 100 ppm before the alternate minimums are deactivated and normal operation resumes.

  A 4-20mA (or 1-5VDC) signal corresponding to 0-2000 ppm of CO_2 must be used for this input.

- **Damper Override**: When the input detects a contact closure at its terminals, it will command the damper to move to the position (pressure dependent) or to use the flow (pressure independent) set point you prescribe.

  The following options are available for the C1000:

  There are two configurable inputs for this hardware platform: an analog and a digital input. They follow the same sequences as described above:

  - AI = Supply / Slab Temp, DI=Occupancy
  - AI = Discharge Temp, DI=Occupancy
  - AI = Discharge Temp, DI=Standby Mode

Timing

- **Unoccupied Mode Override Time**: When the VAV Zone Controller is unoccupied, a local wall sensor can be used to temporarily override the controller back to occupied mode (by pressing a button or other means). This defines how long the controller will stay occupied in that case.

Default	120 min

- **Morning Warm-Up Period**: Upon a transition to occupied mode, the ***VAV Zone Controller*** may be commanded by the network master to disable its outputs (typical in Gas Heater applications). This value defines how long the outputs will remain deactivated, unless commanded by the master for an even longer period of time.

Default	0 min

- **Max Receive Time**: The amount of time that data received from the network remains valid. This applies to all Modbus, BACnet and Lon networks. Data will always remain valid if this is set to zero.

Default	720 sec

5.1.9 - Temperature Calibration

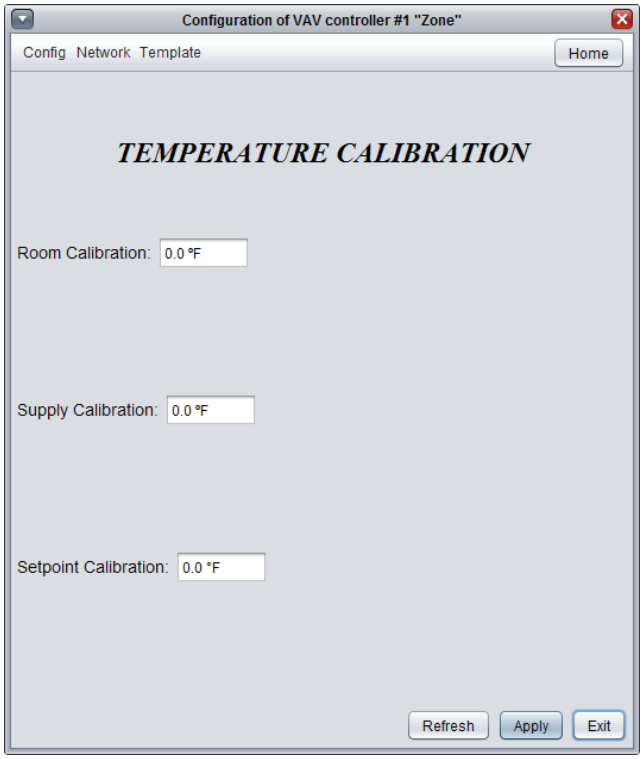


Figure 32 - Temperature Calibration configuration screen

- **Room Calibration**: This value will be added to the temperature received from the room sensor to calculate the active zone temperature.

Default	0 °F / 0 °C

- **Supply Calibration**: This value will be added to the temperature received from the physically attached supply sensor, to calculate the active supply temperature.

  NOTE: This value will NOT BE ADDED if the supply temperature is provided by the network.

Default	0 °F / 0 °C

- **Setpoint Calibration**: This value will be added to the setpoint received from the wall sensor to calculate the actual heat setpoint. Only applies to sensors with physical scales, such as the T200 or PL-RS wall sensors.

Default	0 °F / 0 °C

5.1.10 - Ventilation Calibration

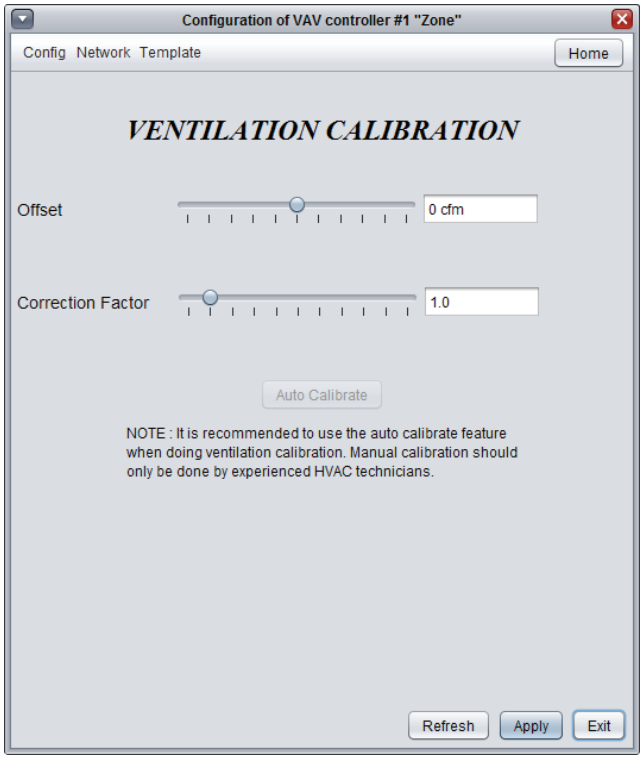
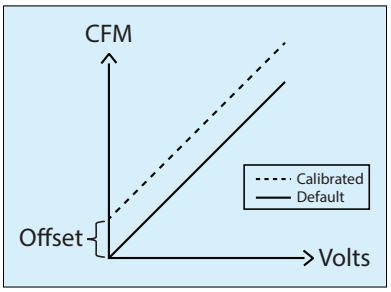


Figure 33 - Ventilation Calibration configuration screen

This screen can only be accessed when the ***VAV Zone Controller*** is set to pressure independent *(see Damper Control Source, p.26)*. It is used to match the air flow sensor's internal reading with that of an air balancing technician.

- **Offset**: This value will be added to the airflow sensor reading to calculate the actual airflow. You can use the slider or simply type in the desired value.

Default	0 cfm (Cubic feet per minute)



- **Correction Factor**: Multiplication factor used to correct the slope of the airflow sensor.

Default	1

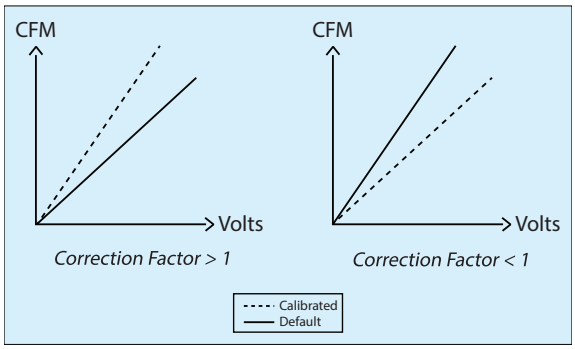


Figure 34 - Correction factor

- **Auto Calibrate**: This calibration procedure is provided by Focus to automatically determine the correction factor and offset that best suits your system. To perform this function, you must be communicating with the controller and have a balometer or other means of measuring air flow. Also, you must have already input to the ***VAV Zone Controller*** the correct K Factor of the flow sensor, the duct diameter and the damper opening delay (if applicable).

  ▹ **Step 1**: Focus overrides the damper position to 100% (or lower in case the reading is near the limits of the sensor). A progress bar appears indicating the current damper position. You can cancel the operation at any time by pressing the "Cancel" button.

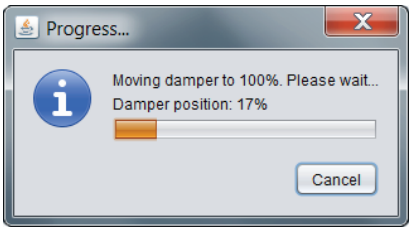


Figure 35 - Damper progress bar

  ▹ **Step 2**: With the damper now open, Focus asks you for the first air flow reading in CFM (cubic feet per minute). The moment you click on the "Next>" button, Focus will also retrieve the internal air flow reading from the ***VAV Zone Controller***. If you type an invalid number, or if Focus cannot read from the ***VAV Zone Controller***, the operation is aborted.

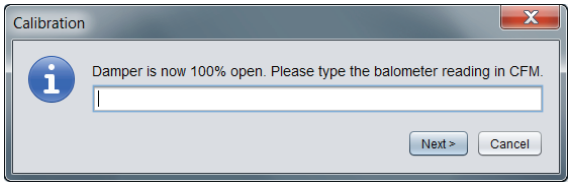


Figure 36 - Airflow dialog box

  ▹ **Step 3**: Focus overrides the damper to 20% (or greater in case the reading is below 60 CFM). A progress bar appears indicating the current damper position. You can cancel the operation at any time by pressing the "Cancel" button.

  ▹ **Step 4**: With the damper now at 20% open, Focus once again asks you for an air flow reading. The moment you click on the "Next>" button, Focus will also retrieve the air flow reading from the VAV Zone Controller.

  ▹ **Step 5**: With two data points now in memory, Focus can calculate the correction factor and offset needed to adjust the controller's internal air flow sensor readings so that they correspond to your air flow readings. A pop-up screen will appear to confirm that the calculation was successful. Please note that these new settings have been calculated but **not applied yet**. To apply the new settings to the VAV Zone Controller, **click the 'Apply' button.**

5.1.11 - Device Properties

Figure 37 - Device properties screen

This screen shows all the intrinsic properties of the device you are configuring. This helps you determine its capabilities without having to visually inspect the device.

- **Device Type**: The type of controller you are configuring.
- **Software version**: The current software in the controller. The greater the software version, the more advanced the device is. Devices can be upgraded by reprogramming them (see "Reprogram" in the next column).
- **Hardware version**: This is the physical hardware platform of the controller. Different hardware has different features. The hardware can only be changed by replacing it physically.
- **Device Number**: The network address of the controller, which is configured by software for the VC2000, and manually using the dipswitches for the other hardware platforms.
- **Device Name**: This field indicates the current name of the controller, which you can modify.Alternatively, you can just right-click on the icon and select the 'Rename' option.
- **Reset Device**: Causes the device to perform a reset. All configuration properties REMAIN SAVED. However, resetting the controller removes all active overrides. This function is useful for recalibrating the damper or for other debugging purposes.
- **Reprogram**: This function is used to upgrade the controller to a new software version. Focus will begin by asking you for the HEX file that contains the software update. Software update HEX files can only be provided by Prolon. At the end of the procedure, Focus will automatically reapply all the parameters you have previously configured into the device.

  Should there be any interruption during the programming procedure (due to intermittent communication or other), the procedure is halted to allow time for the problem to be fixed. When ready, the whole upgrade procedure can be resumed at any time by pressing this button again. It is normal for the icon to turn grey and become unresponsive during this period. Simply continue with the procedure anyways.

5.2 - Network Menu

5.2.1 - Math Functions (for BACnet or LON networks only)

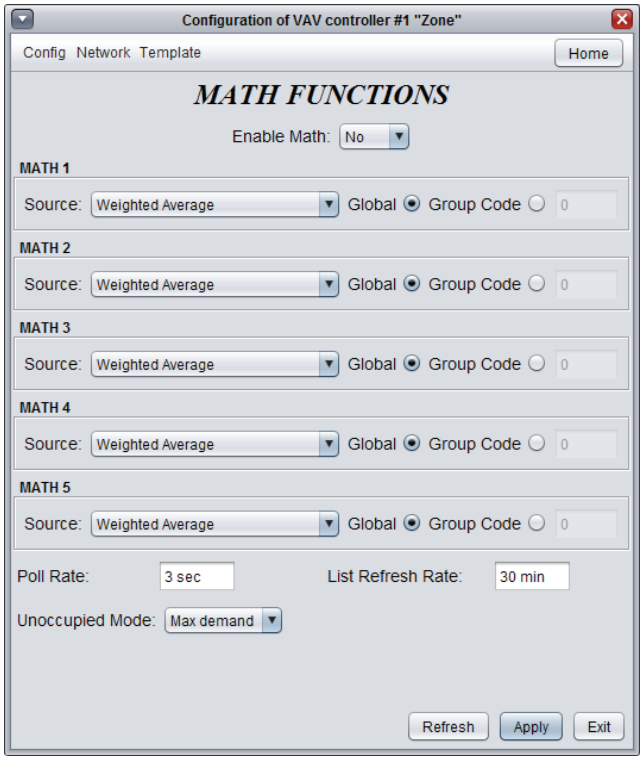


Figure 38 - Math Function configuration screen

This screen is used to configure the math functions of a ***VAV Zone Controller*** when it is in BACnet or LON mode ONLY. If you want to change the math functions available in a standard Prolon Modbus network, this can only be done on the master controller of the system.

Besides calculating its own demand, a ***VAV Zone Controller*** can detect and analyze the demand and group codes of other ***VAV Zone Controllers*** on BACnet or LON network, as long as they are on the same subnet (127 device maximum). The information is then used to calculate the math functions specified below. The resulting math values can then be used to control the outputs of the ***VAV Zone Controller*** and are also accessible to the rest of the network in network variable form.

- **Enable Math**: To avoid creating unnecessary network traffic, the ***VAV Zone Controller***'s math functions are disabled by default. Two methods can be used to activate the math functions. The first is to set an output's control source to a math function, and the second is to activate them manually using this option.
- **Source**: Each math function can be calculated in one of the following ways:
  - ▹ **Weighted Average**: The weighted average of all the ***VAV Zone Controllers*** included in the calculation. The weighted average is calculated by multiplying the demand of each ***VAV Zone Controller*** by its respective weight and adding them together. The result is then divided by the total weight in the calculation. This provides a math function whose final result is more influenced by the zones with greater weight.
  - ▹ **Max Heating**: This returns the highest demand of heating of all the ***VAV Zone Controllers*** included in the calculation.
  - ▹ **Max Cooling**: This returns the highest demand of cooling of all the ***VAV Zone Controllers*** included in the calculation.
  - ▹ **Weighted Average *(heating only)***: This is the same as "Weighted Average", except only zones with a heating demand are included in the calculation. Zones in cooling are worth 0%.
  - ▹ **Weighted Average *(cooling only)***: This is the same as "Weighted Average", except only zones with a cooling demand are included in the calculation. Zones in heating are worth 0%.
  - ▹ **Occupancy**: If there is at least one VAV Zone Controller found in this calculation that is occupied (or overridden to be occupied), this math function will return 100%, otherwise it will be 0%.
  - ▹ **Override**: If there is at least one ***VAV Zone Controller*** found in this calculation that is overridden from unoccupied to occupied mode, this math function will return 100%, otherwise it will be 0%.
- **Global**: When this is selected, ALL ***VAV Zone Controllers*** found on the network are included in the calculation. If "Weighted Average" is selected, then the weight used will be specified in the Group Codes configuration screen, in the Global field of each ***VAV Zone Controller***.
- **Group Code**: When this is selected, ONLY the VAV Zone Controllers belonging to this group are included in the calculation. There are 250 groups available, numbered 1 through 250. If weighted average is selected, then the weight will be specified in the Group Codes configuration screen of each VAV Zone Controller. When group codes are not being used, it is automatically set to zero.

Default	0 (Deactivated)

- **Poll Rate**: The interval at which this device will retrieve new data from the ***VAV Zone Controllers*** on the network. Increase this value to alleviate network traffic.

Default	3 Seconds

- **List Refresh Rate**: The interval at which this device will attempt to detect any ***VAV Zone Controllers*** on the network. It can only find ***VAV Zone Controllers*** that are on the same subnet (127 total). Setting this to zero will disable list refreshing.

Default	30 Minutes

- **Unoccupied Mode**: This option lets you decide to modify the math calculation strategies during unoccupied mode.
  - ▹ **Max demand**: During unoccupied mode, "Averaging" type math functions will be replaced by "Max demand" type functions:
    - > "Weighted Average" is replaced by "Max Demand". In the case where there are conflicting demands between different slaves (cooling and heating), heating has priority.
    - > "Weighted Average (Cooling Only)" is replaced by "Maximum Cooling"
    - > Weighted Average (Heating Only)" is replaced by "Maximum Heating"
  - ▹ Normal: Math functions will always be calculated the same way, regardless of occupancy.

5.2.2 - Group Codes

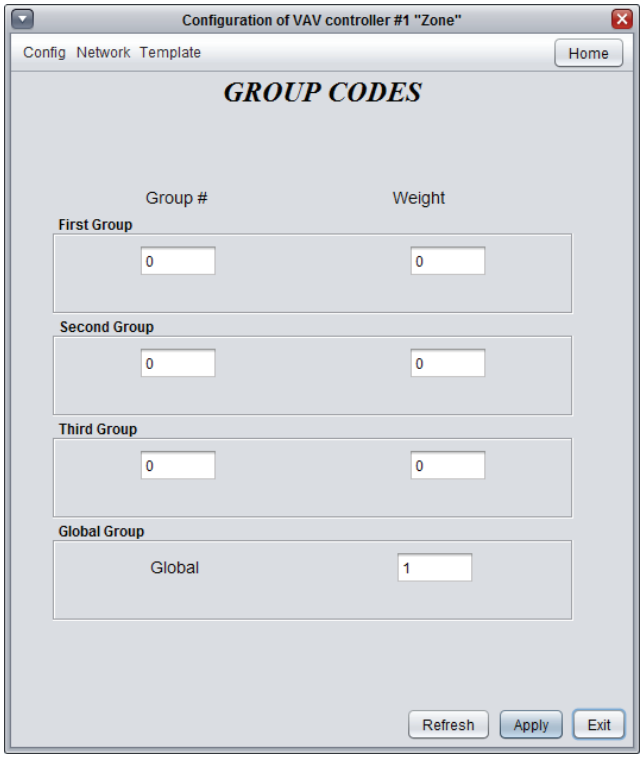


Figure 39 - Group Codes screen

This screen lets you configure which math groups the ***VAV Zone Controller*** should belong to, as well as the voting weight it should have in each group. This information is used by the network master as part of Prolon's Flexi-Zone math calculation system. A ***VAV Zone Controller*** can belong to three different groups at a time, as well as the global group.

- **Group #**: A group that the ***VAV Zone Controller*** belongs too. When this is set to zero, the ***VAV Zone Controller*** does not participate in a group.

Default	0

- **Weight**: The weight of the ***VAV Zone Controller*** in the selected group. Used in weighted average calculations. Setting this to zero removes it from the group.

Default	0

- **Global Weight**: The weight of the ***VAV Zone Controller*** in the global group. Used in weighted average calculations. Setting this to zero removes it from the global group.

Default	1

5.2.3 - Lon Configuration

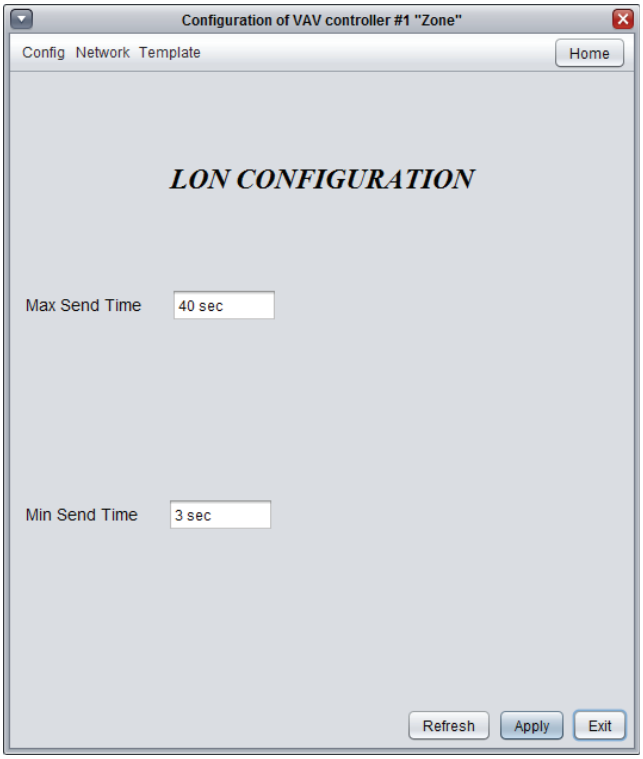


Figure 40 - LON configuration screen

This screen lets you configure the parameters that are exclusive to the LON protocol. This screen cannot be accessed if the LON plug-in card is not connected to the ***VAV Zone Controller*** board.

- **Max Send Time**: The maximum amount of time that can elapse between two sequential transmissions of the same NVO. Even if the NVO has not changed, it will still be sent when this delay expires. (SCPTmaxSendTime)

Default	40 Seconds

- **Min Send Time**: The minimum amount of time that must elapse between two sequential transmissions of the same NVO. Even if the NVO changes frequently, it can only be sent once this delay expires. (SCPTminSendTime)

Default	3 Seconds

5.2.4 - BACnet Configuration

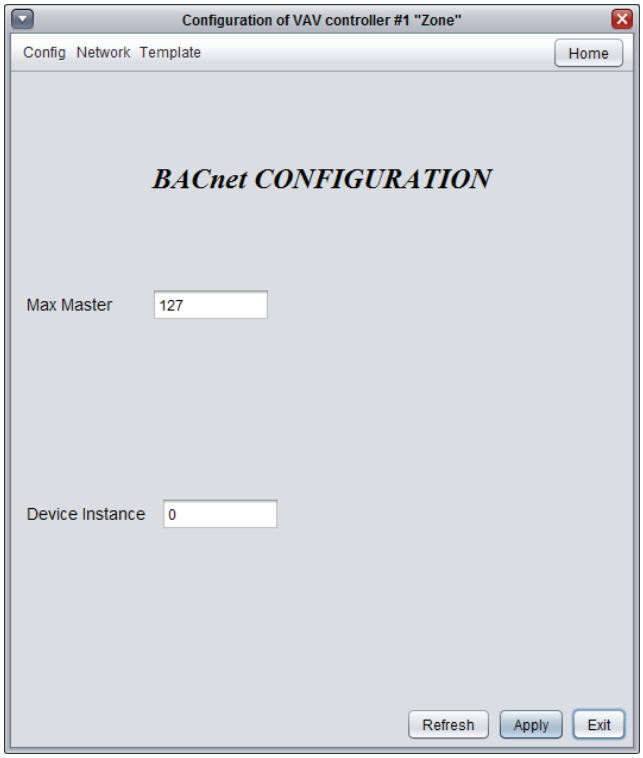


Figure 41 - BACnet configuration screen

This screen lets you configure the parameters that are exclusive to the BACnet protocol. This screen cannot be accessed if the ***VAV Zone Controller*** is not configured to use BACnet. See each platform's hardware guide for more information on how to activate BACnet mode.

- **Max Master**: The maximum address up to which this device will search for other BACnet masters (Prolon or other) while performing the "Poll For Masters" operation.

Default	127

- **Device Instance**: The unique BACnet identification number of this device on the network. By setting this value to 4194303 (BACnet invalid), the VAV Zone Controller will instead use its own RS485 network address as the BACnet Device Instance ***(see Assigning Addresses, p.10 for more details).***

Default	4194303

5.2.5 - COM Port Settings

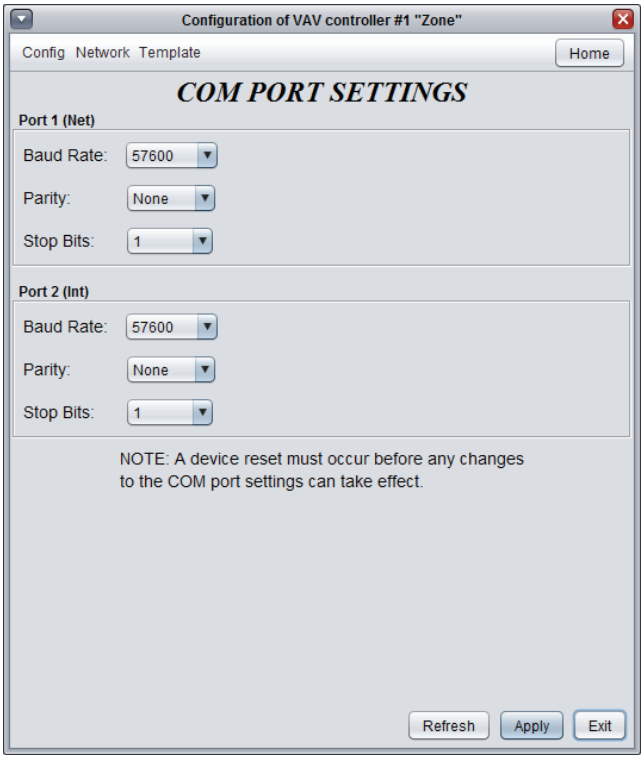


Figure 42 - COM Port configuration screen

Changes to the settings in this section will only take effect once the ***VAV Zone Controller*** is reset or has power cycled. Each port on the ***VAV Zone Controller*** has the same options. Please refer to each platform's hardware guide for more details on the COM ports.

- **Baud Rate**: This sets the baud rate value for the COM port. The default baud rate used by a VAV Zone Controller is 57600bps but may be set to any of these standard values:
  - 9600 bps
  - 19200 bps
  - 38400 bps
  - 57600 bps
  - 76800 bps
  - 115200 bps
- **Parity**: This sets the parity for communication on the COM port. The default parity used by a VAV Zone Controller is "None" but may be set to any of these standard values:
  - None
  - Odd
  - Even
- **Stop Bits**: Sets the number of stop bits used by the COM port. By default, it is set to 1, but can also be set to 2.

5.3 - Template Menu

5.3.1 - Save as Template

The template function gives you the ability to save the configuration of a particular ***VAV Zone Controller*** for future use, which can then be applied to any other ***VAV Zone Controller***, regardless of hardware platform. Each configurable property of the ***VAV Zone Controller*** is saved into this template file, except for its name. This function is very useful if you have many ***VAV Zone Controllers*** with the same or very similar configurations. You will be able to quickly copy and paste the configuration from ***VAV Zone Controller*** to ***VAV Zone Controller***.

5.3.2 - Load Template

After saving a ***VAV Zone Controller*** configuration in a template, you can load this template into another ***VAV Zone Controller*** by selecting this menu item in the configuration screen of the ***VAV Zone Controller*** you wish to change. All configuration properties found in the template are then copied into the configuration screen for your viewing or possible modification. Once you are satisfied with the set of properties, click the "Apply" button.

NOTE: The template configuration will not be applied to the ***VAV Zone Controller*** until you click on the "Apply" button. If you do not wish to use the configuration properties of a loaded template, click on the "Refresh" or "Exit" buttons.

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