PROLON

FOCUS GUIDE

FAN COIL UNIT

Configuration Guide for Prolon Focus Software

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1 - Prolon Fan Coil Unit Controller

This guide will describe in detail the operating sequences and configuration variables used by the Prolon series *Fan Coil Unit controller*.

The *Fan Coil Unit controller* is designed to control a variety of 2-pipe and 4-pipe hydronic heating and cooling units. The on-board microcontroller offers precise digital control to maximize performance. The available control sequences are fully configurable, either locally or remotely, using free software. The FCU uses PI (Proportional-Integral) control loops to optimize HVAC management and offers a variety of functions such as 2-pipe automatic mode change based on water temperature, automatic purge cycles to verify water temperature and prevent stagnation in coils, secondary backup heat source control, and more.

The Prolon *Fan Coil Unit controller* monitors dedicated inputs and uses pre-established control sequences that drive dedicated outputs to control standard fan coil equipment. The sequences offered are highly configurable, allowing for a greater flexibility in the final operation of the controller.

1.1 - Hardware Variations

The Prolon series ***Fan Coil Unit Controller*** is in essence a collection of highly effective ***Fan Coil Unit*** 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 ***Fan Coil Unit Controller*** has been offered on the following hardware platforms. Please see each platform's HARDWARE GUIDE for more information:

M2000 → 9 Analog Inputs / 5 Digital Outputs / 3 Analog Outputs.

C1050 → 3 Analog Inputs / 1 Binary Input / 4 Digital Outputs / 1 Analog Output.

2 - Networking

Prolon's *Fan Coil Unit 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 - Shared Information

When a ***Fan Coil Unit Controller*** is networked with a Prolon Master Controller (such as a Rooftop controller), it will automatically be 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 table summarizes the information shared between ***Fan Coil Unit 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 720 seconds.

	Automatically received from Master	Can be received from NC (Configurable)	Can send to NC (Configurable)
Outside Temperature	X	X	X
Occupancy	X	X	
Two Pipe Water Supply Temperature	X	X	X

Figure 1 - Shared Information

Note that this table applies to the most recent firmware revision of Prolon controllers and may not accurately represent all older firmware revisions.

DESCRIPTION

- **Outside Air Temperature**: The outside air temperature will automatically be shared from the Master Controller to the ***Fan Coil Unit Controllers***. A Network Controller can also be configured to share the outside temperature with a ***Fan Coil Unit Controller*** should a Master Controller not be present. In the case where both are present, the last received outside temperature value will be used. The outside temperature is used for heating and cooling lockouts.

- **Occupancy**: The occupancy status will automatically be shared from the Master Controller to the ***Fan Coil Unit Controllers***. A Network Controller can also be configured to share the occupancy status with the ***Fan Coil Unit 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. The Occupancy status can be used to activate the pumps.

- **Two Pipe Water Supply Temperature**: The two pipe water supply temperature will automatically be shared by the Master Controller to the ***Fan Coil Unit Controllers***, if available. A Network Controller can also be configured to share the two pipe water supply temperature with a ***Fan Coil Unit Controller*** should a Master Controller not be present. In the case where both are present, the last received water supply temperature value will be used. The two pipe water supply temp is used to determine Water Coil Mode in a Two Pipe system.

  Any single FCU can be the source of this temperature, which can then be collected by the Network Controller and distributed throughout the network. Other valid source for this reading could be either the Prolon Boiler, Chiller or Flexio controllers.

3 - Adding a Fan Coil Unit Controller to a Focus Project

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

3.1 - Assigning Addresses

The Prolon ***Fan Coil Unit Controller***'s address can be assigned using the physical dipswitch found on the controller directly. The address will be encoded in binary. Please see each platform's HARDWARE GUIDE for more information.

3.1.1 - Address Locking

For hardware platforms with physical addressing dipswitches such as the ***Fan Coil Unit***, 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 can protect against users mistakenly changing the addresses by playing with the wrong dipswitches, but it 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.

3.2.1 - Master Get List

If the ***Fan Coil Unit 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":

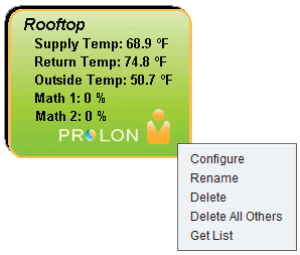

Figure 2 - Master Get List

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

3.2.2 - New Fan Coil Unit Controller Button

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

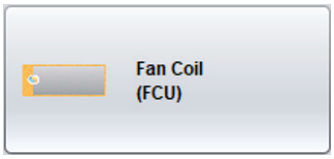

Figure 3 - "New Fan Coil Unit" Button

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

4 - Fan Coil Unit Controller Icon

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

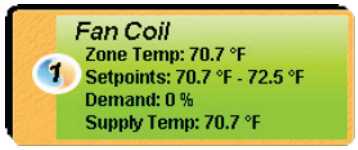

Figure 4 - Typical Fan Coil Unit Controller Icon

4.1 - Icon Data

- **Title**: The name of the ***Fan Coil Unit Controller***. You can change it by right clicking the icon and choosing Rename. By default, it is set to "Fan Coil Unit".
- **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 offline.
- **Demand**: The ***Fan Coil Unit*** 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 ***Fan Coil Unit*** is offline.
- **Supply Temp**: The actual air temperature in the supply duct. Will display "N/A" (not applicable) if no supply temperature sensor is attached.

4.2 - Icon Colors

The icons also change color depending on the ***Fan Coil Unit*** state.

Figure 5 - Grey Icon

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

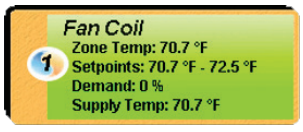

Figure 6 - Green Icon

- **Green**: The icon is green when the controller is communicating, but all ***Fan Coil Unit*** heating or cooling actions are currently off.

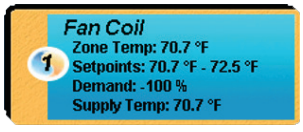

Figure 7 - Blue Icon

- **Blue**: The icon turns blue when the ***Fan Coil Unit*** cooling action is ON and stays blue until the cooling action is OFF.

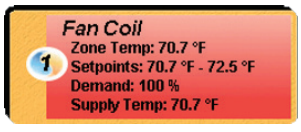

Figure 8 - Red Icon

- **Red**: The icon turns red when the ***Fan Coil Unit*** heating action is ON and stays red until the heating action is OFF.

4.3 - Icon Right Click

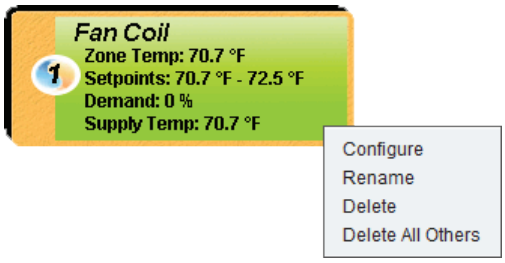

Figure 9 - Icon Right-Click for Fan Coil Unit

- **Configure**: Opens the configuration screen for this ***Fan Coil Unit Controller***.
- **Rename**: Allows you to rename this ***Fan Coil Unit Controller***. Names are limited to 16 characters.
- **Delete**: Removes this ***Fan Coil Unit 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.

5 - Configuration of a Fan Coil Unit Controller

To view the configuration of a *Fan Coil Unit 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 *Fan Coil Unit Controller* Home Screen to transfer you to its corresponding page. ***(For more details, see Section 5.1.4 - Icon Quick Jumps)***

5.1 - Fan Coil Unit Controller Home Screen

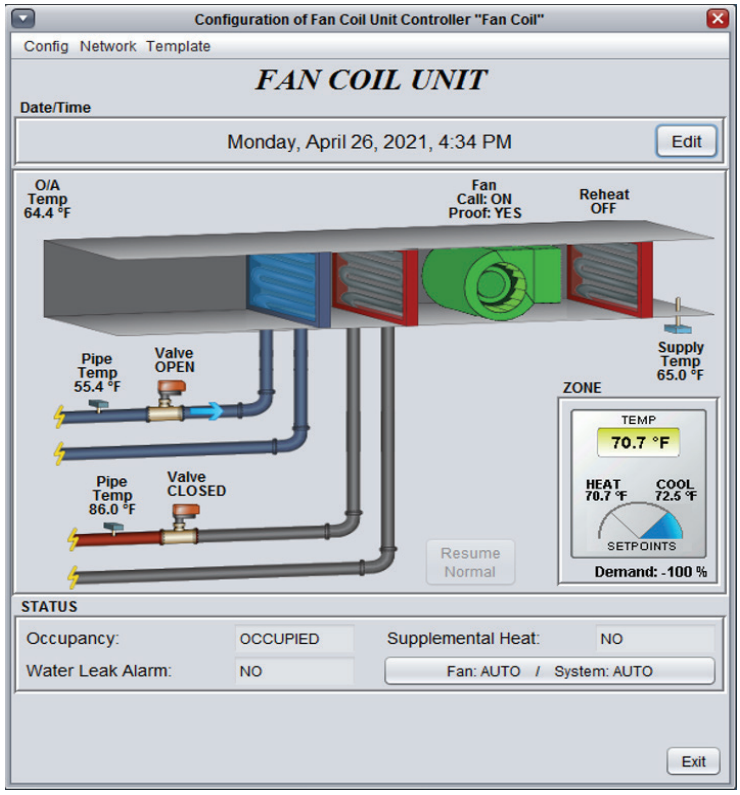

Figure 10 - Fan Coil Unit Controller Home Screen

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

Note that this screen will vary greatly depending on the sequences and display choices that are selected. The following section lists all possible parameters that can be displayed on the screen, but some are mutually exclusive of others due to hardware constraints or sequence logic. The list below outlines the requirements for each element.

5.1.1 - Displayed Information - Inputs

- **Date/Time**: The current date and time from the real time clock included in the Prolon ***Fan Coil Unit Controller***. This can be edited with the Edit button. (Unavailable for the C1050 hardware platform). The time can be displayed in either 12h or 24h format by changing the setting in 'Time Format', under the User Profile (top right portion of the screen).

- **Supply Temp**: The current supply air temperature. Will be "N/A" if no sensor is attached.

- **O/A Temp**: The current outside air temperature. Will display "N/A" if no outside air temperature sensor is attached, or if none is provided from the network.

- **Zone Temp, Setpoints & Demand**: The current zone air temperature, accompanied by the active heating and cooling setpoints, and the resulting zone demand.

- **Pipe Temp**: The current pipe temperature for both 2-pipe and 4-pipe configurations. Will display "N/A" if no pipe temperature sensor is attached.

  NOTE: For 2-pipe systems, if the pipe sensor becomes disconnected or **invalid**, the Water Coil mode (see below) will remain in its last known state until corrected. This strategy gives the occupant the best chance at remaining comfortable until seasonal maintenance occurs.

- **Change Over Contact**: The state of the contact used to indicate 2-pipe supply water temperature. Only visible in 2-pipe mode if Valve Change Over Type is set to "Contact".

- **Water Leak Alarm or General Alarm Contact State**: Indicates the state of the Alarm Contact Input.

- **Water Coil Mode**: Indicates the mode of the 2-pipe water coil, determined by comparing the 2-pipe water supply temperature to the zone temperature, or simply by observing the change-over contact, as applicable. Not displayed in 4-pipe systems.
  - ▹ **HEATING**: The supply water is hotter than the zone, so heating can be provided by the water coils whenever the valve opens.
  - ▹ **COOLING**: The supply water is colder than the zone, so cooling can be provided by the water coils when ever the valve opens.
  - ▹ **NEUTRAL**: The supply water temperature is similar to the zone temperature and therefore cannot provide any heating or cooling. The valve will remain closed but can periodically run a purge cycle to clear any stagnant water and get an updated reading.
  - ▹ **INVALID**: The supply water sensor is either broken or disconnected and no reading is available.

- **Purge State**: Indicates if the FCU controller is currently running its optional purge cycle.

- **Occupancy**: The occupancy status of the ***Fan Coil Unit Controller***. The occupancy state can be determined by a number of factors. They are listed here in order of priority:
  - ▹ The occupancy status received from a Prolon Network Controller takes first priority.
  - ▹ The occupancy status received from a Prolon Master Controller, such as a Rooftop or Heatpump is then used.
  - ▹ Finally, the occupancy status determined by the real time clock onboard the ***Fan Coil Unit Controller***, combined with a programmed schedule will be used (only available on M2000). For the C1050 hardware platform, which does not have an onboard real time clock, it will simply default to occupied mode unless indicated otherwise from the network.

5.1.2 - Displayed Information - Outputs

- **Fan**: The status of the call for fan is displayed above a green fan icon in the middle of the screen. Accompanied by a proof of fan status (may be hidden depending on the settings). When the fan is on and there is a proof of fan signal, the icon animates by rotating the fan blades. When the fan is off or when proof of fan is missing, the fan blades are stopped.
- **Valve(s)**: The current status of the valve(s) for both 2-pipe and 4-pipe configurations. Can be displayed as either a 2-way or a 3-way valve.
- **Reheat**: The current status of the reheat coil.
- **Supplemental Heat**: Indicates if reheat is active due to a demand for supplemental heat.

5.1.3 - Date/Time

The Prolon ***Fan Coil Unit Controller*** has an internal real time clock (unavailable on the C1050 hardware platform). The current date and time are displayed at the top of the Home Screen. To edit the time, click on the "Edit" button.

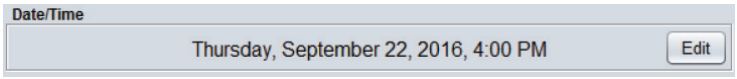

Figure 11 - Edit Time Button

A window appears allowing you to edit the time. Your computer's time is shown at the top of the window. You can copy your computer's time directly into the time of the ***Fan Coil Unit Controller*** using the "Copy" button, or simply edit the time yourself by directly typing it in the corresponding text box. A drop-down list of time zones is also made available.

The use of daylight savings time can also be configured here. When set to automatic control, daylight savings will be enabled and disabled on Sunday at 2AM on the specified weeks.

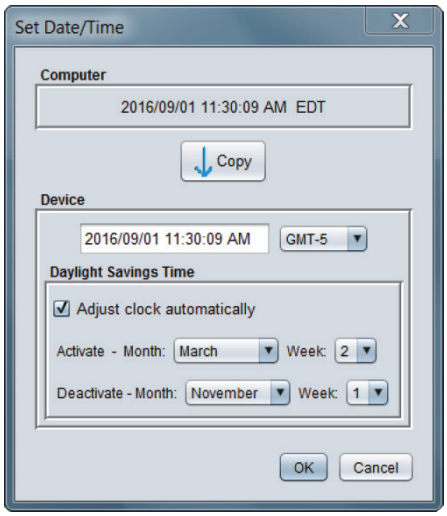

Figure 12 - Edit Time Dialog Box

5.1.4 - Icon Quick Jumps

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

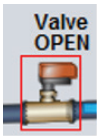

Figure 13 - Icon Quick Jump Example (Valve)

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

ITEMS	QUICK JUMP
Fan	Fan Configuration
Valve	Valve Configuration
Reheat Coil	Reheat Setup
Zone Temp and Setpoints	Temperature Configuration
Supply Temp	Limits
Pipe Temp	Calibration
Occupancy	Weekly Routines (Unavailable for C1050)
Change Over Contact	Valve Configuration

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

5.1.5 - Icon Manual Override

Certain components of the ***Fan Coil Unit 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. ***Note***: Overrides are unavailable in Offline mode.

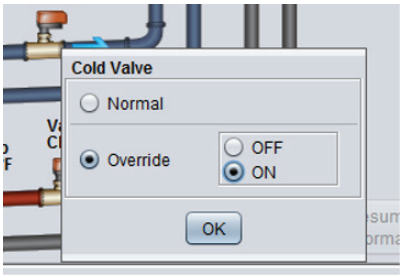

Figure 14 - Manual Override of the Valve

- **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:

Valve
Reheat Coil
Fan
Occupancy

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 valve has been overridden.

Figure 15 - Override Example - Valve

Please note that if the advanced password is enabled, or if you are offline, you will not be able to override any objects (please review the Prolon Focus User Guide for more information about passwords).

All overrides are cancelled when the ***Fan Coil Unit Controller*** is reset or loses power.

- **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.

5.1.6 - "Resume Normal" Button

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

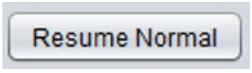

Figure 16 - "Resume Normal" Button

5.1.6 - Mode Set Button

This button allows you to manually override the operating mode of the ***Fan Coil Unit Controller***. A popup will appear with the available options.

Note: Unlike most overrides, the Fan and System Operating Mode overrides configured here are stored in memory and will be kept after a power loss or reset.

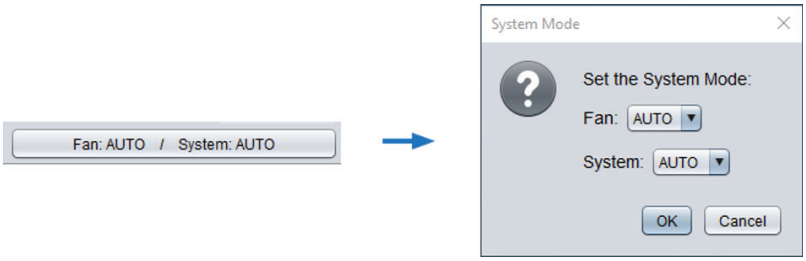

Figure 17 - Mode Set Button

- **Fan**: The Fan will activate as indicated (ON/OFF/AUTO). In Auto mode, the Fan will run as defined in the Fan Configuration Screen.
- **System**: Overrides the unit's System Mode. ***Note*** that this does not affect operation of the Fan.
  - AUTO: The unit will respond to both heating and cooling calls
  - HEAT: The unit will respond to heating calls only
  - COOL: The unit will respond to cooling calls only
  - OFF: The unit will NOT respond to either heating or cooling calls

5.2 - Hardware Setup

This section defines the hardware setup of the ***Fan Coil Unit controller*** and subsequently customizes the graphics and icons of the Home page. Some options are for display only and have no effect on the sequences running in the controller.

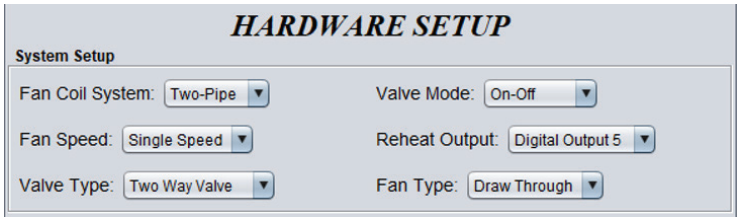

Figure 18 - System Setup

- **Fan Coil System**: Select either the Two-Pipe or Four-Pipe configuration. This choice will be primordial to the overall operation of the controller.
- **Fan Speed**: Select either Single, Two or Three-Speed fan. See Fan Configuration for more details.
- **Valve Type**: Select either Two-Way Valve or Three-Way Valve. This is for display purposes only and does not influence the operation of the controller.
- **Valve Mode**: This determines whether Digital Outputs or Analog Outputs will be used to control the valves.

Digital Outputs work in ON-OFF mode, while Analog outputs can modulate. ***Note*** that on the C1050 in a Four Pipe setup, since there is only one analog output available, only heating will be available for modulation, and cooling will be ON-OFF. See the Hardware guide for more information.

- **Reheat Output**: Selects which output will control a supplemental heating output (not tied to the valve operation). This is typical for an electric heating strip configuration.
- **Fan Type**: select either Draw Through or Push Through. This is for display purposes only and does not influence the operation of the controller.

5.2.1 - C1050 Digital Input

This section sets the Mode of the C1050's Digital Input.

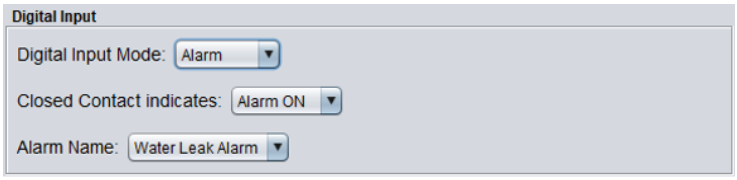

Figure 19 - C1050 Digital Input

- **None**: The input is deactivated.
- **Fan Proof**: Select this if there is a fan proving device. This may optionally affect the reheat sequence but will have no effect on the valve operation.
- **Alarm**: Select this if there is an alarm condition associated with the ***Fan Coil unit***. Upon activating the alarm condition, the valve(s) will close. The fan and reheat outputs are not affected by this and will continue their normal operation. You may select the name of this alarm from the associated dropdown list (Water Leak Alarm or General Alarm). The Alarm Name is for display purposes only and does not influence the sequence.

5.2.2 - C1050 Analog Input 2

When a C1050 ***Fan Coil Unit Controller*** is in Four Pipe Mode, its Analog Input 2 is available to take readings of either the Hot or Cold water supplies.

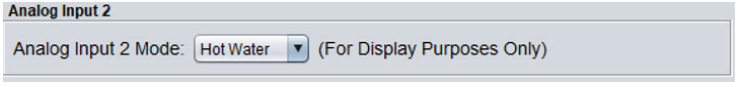

Figure 20 - C1050 Analog Input 2

This reading is for display and logging purposes only and will not affect the operation of the valves.

5.2.3 - M2000 Analog Input 2

The M2000 has an Analog Input dedicated to the Hot Water temperature sensor in a Four-Pipe system.

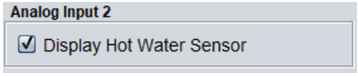

Figure 21 - M2000 AI2 – Four Pipe Hot Water Input

Note that this reading has no effect on the sequence and is for display or datalogging purposes only. This checkbox can hide it from the Visualization page in case it is not in use.

5.2.4 - M2000 Analog Input 4

The M2000 has an Analog Input dedicated to the Cold Water temperature sensor in a Four-Pipe system.

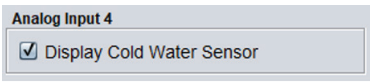

Figure 22 - M2000 AI4 – Four Pipe Cold Water Input

Note that this reading has no effect on the sequence and is for display or datalogging purposes only. This checkbox can hide it from the Visualization page in case it is not in use.

5.2.5 - M2000 Analog Input 7

The M2000 has an Analog Input dedicated to a Fan proving signal.

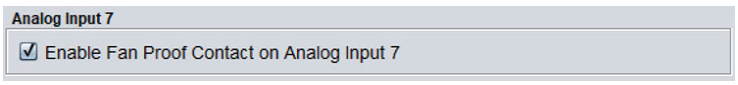

Figure 23 - M2000 AI7 – Fan Proof Input

The proof of fan signal has no effect on valve operation. It may optionally affect the Reheat sequence, depending on the configuration ***(see Reheat Configuration)***.

5.2.6 - M2000 Analog Input 8

The M2000 has an Analog Input dedicated to an Alarm signal.

Figure 24 - M2000 AI8 - Alarm Input

Upon activating the alarm condition, the valve(s) will close. The fan and reheat outputs are not affected by this and will continue their normal operation. You may select the name of this alarm from the associated dropdown list (Water Leak Alarm or General Alarm). The Alarm Name is for display purposes only and does not influence the sequence.

5.2.7 - Signal Control

Depending on the setup, the outputs may have various signal control options.

Figure 25 - Signal Control

These are:

- **Range**: Select the appropriate voltage range for the analog voltage signal (Analog Outputs only).
- **Pulsed**: Instead of using voltage modulation, the analog outputs will use pulse-width modulation, with a one second pulse width period. (Analog Outputs only).
- **Reverse acting**: This option reverses the electrical signal sent by the associated output. For example: ON=0VAC / OFF=24VAC for digital outputs.

5.3 - Temperature Setup

5.3.1 - PI Controller

The ***Fan Coil Unit 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 ***Fan Coil Unit Controller***, the demand is calculated by adding the proportional component of the demand to the integral component. These components are determined as follows:

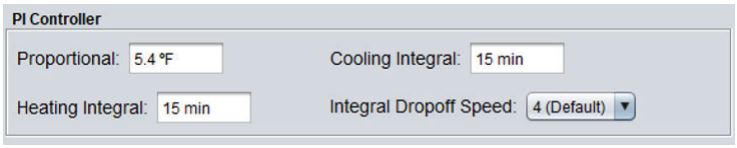

Figure 26 - Zone PI Controller

- **Proportional**: Defines the proportional band used by the ***Fan Coil Unit Controller*** to calculate the propor tional component of the demand. Please refer to Figure 26. Setting this value to zero removes proportional control, and consequentially, integral control. Demand will always be zero.

- **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.

- **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.

- **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.

5.3.2 - Setpoints

Figure 27 - Zone 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.

- **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.

5.3.3 - Setpoints Limits

These limits are applied to the default heat and cool setpoints configured above, effectively limiting the available setpoint range for this zone. This results in the final 'active' heating and cooling setpoints for occupied mode.

Figure 28 - Zone Setpoint Limits

If a setpoint hits its corresponding limit, the other setpoint remains offset by the Min Deadband defined above. For example, say the Default Heating Setpoint is 80 °F with a 2 °F deadband. The Default Cooling Setpoint is therefore 82 °F. Now if the Max Heating Limit is 77 °F, then the final 'active' heat setpoint is 77 °F in heat and the final 'active' cooling setpoint becomes 77+2 = 79 °F.

5.3.4 - Unoccupied Mode

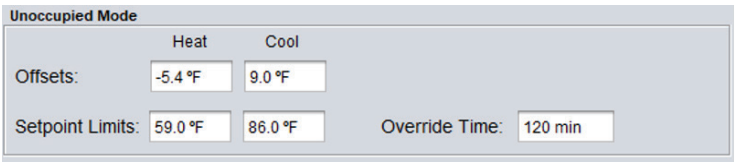

Figure 29 - Unoccupied Mode Zone Setpoints

- **Offsets**: The setpoints calculated for occupied mode (after applying the setpoint limits) are offset by these amounts during unoccupied mode.
- **Setpoint Limits**: Once the unoccupied setpoints are calculated, they are then limited by the following values.
- **Override Time**: This is the amount of time spent in occupied mode once the device is overridden from unoccupied mode after activating the override sequence on the thermostat.

5.4 - Fan Setup

This screen is used to configure the automatic operation of the Fan, whether it be in Single Speed or Two Speed mode.

Proof of Fan is not required for valve operation, however the valves do require a Fan Call before they can open. Reheat can optionally be interlinked with Proof of Fan ***(see Reheat Configuration)***.

The Fan sequence is primarily occupancy-based but can also activate on a heating or cooling call.

5.4.1 - Low/Single Speed

This section applies equally to all fan modes, regardless of speed.

5.4.1.1 - Automatic Mode

You can define how the fan should operate based on three different occupancy states: Occupied, Unoccupied and Overridden. “Overridden” is defined as the state where the FCU is initially in Unoccupied mode, but then is temporarily overridden from the wall thermostat by an occupant. It is NOT related to any overrides that can be performed from the Visualization page.

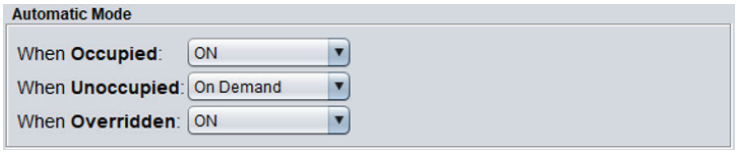

Figure 30 - Fan Automatic Mode Setup

For each occupancy state, you can configure the fan to be unconditionally ON or OFF, or alternatively to run based “On Demand”.

5.4.1.2 - On Demand

In “On Demand” mode, you can define fan activation setpoints based on the zone demand. The zone demand is calculated by the controller’s PI Loop ***(see section 5.3.1)***.

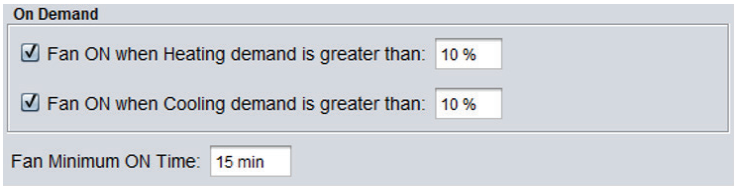

Figure 31 - Fan On Demand Mode

When the demand hits a setpoint, the Fan will start up and run at least for the Fan Minimum On Time. It will then continue until the demand drops back under the setpoint.

Note that this section is only available if at least one of the Occupancy States is set to “On Demand”.

5.4.2 - Second Fan Speed

The setup for the Second Fan Speed differs slightly depending on whether the valves are configured for ON-OFF or modulating operation. In either case, the First Fan Speed must already be in call before the Second Speed will be enabled.

5.4.2.1 - On-Off Valves

If the Valves are set for ON-OFF operation, then the Second Fan Speed simply activates when a valve is open and deactivates when it closes.

Figure 32 - Second Speed Fan with ON-OFF Valves

5.4.2.2 - Modulating valves

If the Valves are set for MODULATING operation, then the Second Fan Speed activates based on the valve position.

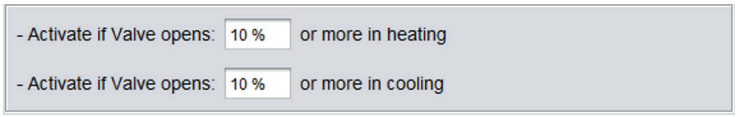

Figure 33 - Second Speed Fan with Modulating Valves

Note that a differential band is built into the sequence to prevent short cycling the fan. The differential is subtractive to the setpoint and has a fixed value of 10%. In other words, if the activation setpoint is 15% in heating, then the valve must close to a 5% heating position before the Second Fan Speed will turn off.

5.4.3 - Third Fan Speed

The activity of the Third Fan Speed based on the zone demand calculated by the controller's PI Loop (see section 5.3.1):

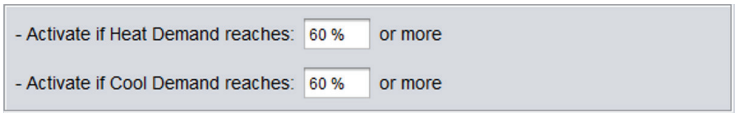

Figure 34 - Third Speed Fan

A differential band is built into the sequence to prevent short cycling the fan. The differential is subtractive to the setpoint and has a fixed value of 10%. In other words, if the activation setpoint is 60% in heating, then the heat demand must drop to 50% before the Third Fan Speed will turn off.

Note that the First and Second Fan speeds need to be active before the Third Speed will be permitted.

5.5 - Valve Configuration

This screen is used to configure the operation of the Valves in Two Pipe and Four Pipe setups. ***Note*** that in either setup, Fan Call is required for a valve to open, but Fan Proof is not.

- **Two Pipe Setup**: In this setup, an output drives a single valve that responds to both heating and cooling calls. However, the valve is only permitted to open if the Water Coil Mode is favorable to the desired action (hot water for heating, chilled water for cooling).

  If the water supply temperature is not sufficiently hot or cold, it is declared Neutral, and the valve remains closed. A periodic purge sequence may be enabled to update the Water Coil Mode ***(see Purge section)***.

  Note that if either the supply water temperature OR the zone temperature readings are invalid, then the Water Coil Mode cannot be determined, and the valves will remain closed.

- **Four Pipe Setup**: In this setup, two outputs each control their own valve, one for heating and another for cooling, to satisfy the zone demand. Both valves are permitted to open at any time as they are not dependent on a variable pipe temperature. (It is always assumed that the hot water valve has hot water available, and that the cold water valve has cold water available).

5.5.1 - Setpoint

Valve response is based on the zone demand calculated by the controller's PI Loop ***(see section 5.3.1)***. Separate setpoints and control bands are available for heating and cooling, and control modes will differ based on the selected Valve Type (On-Off or Modulating).

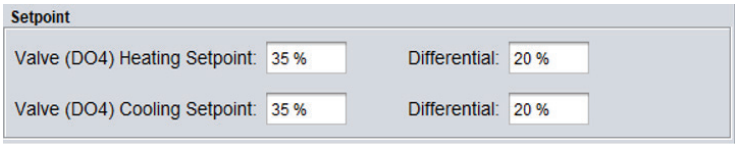

Figure 35 - Valve Setpoint Configuration

5.5.1.1 - On-off valves

On-Off valves use Differential control, with distinct activation and deactivation points based on the zone demand. These points are centered on the Setpoint and separated by the Differential Band, as shown in the following graph:

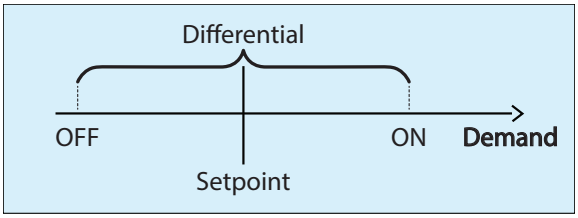

Figure 36 - Valve Differential Control

This Differential band ensures that the activation and deactivation points are sufficiently spread apart, so as to avoid short-cycling the equipment.

5.5.1.2 - Modulating valves

Modulating valves use Proportional control, where the action increases proportionally to the zone demand. While the demand remains below the Setpoint, the valve remains closed. Once the demand ramps up past the Setpoint, the valve will open proportionally. Once the demand hits the sum of the Setpoint and Proportional band, the valve will be fully open:

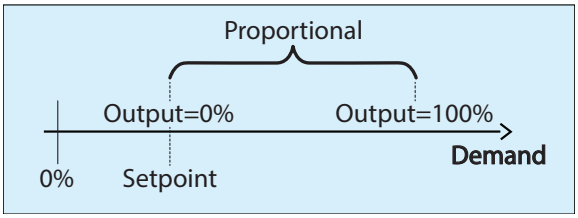

Figure 37 - Valve Proportional Control

Note that analog outputs for modulating valves use standard voltage modulation expressed over the range configured *in section 5.2.7*.

5.5.2 - Preheating

The goal of the Preheating sequence is to maintain the designated preheat supply air setpoint. This sequence is available for **modulating valves only**.

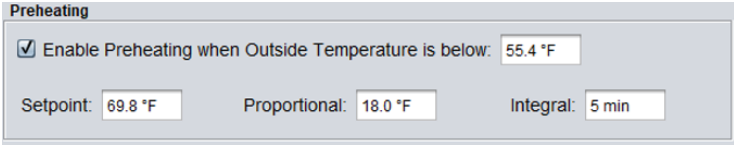

Figure 38 - Preheating Configuration

Preheating is enabled when:

- The outside air temperature is below the preheat limit, or if the outside air temperature is invalid.
- There is a valid supply air temperature reading.
- The cooling demand is less than 10% and all cooling outputs are deactivated. If preheating does get deactivated due to a cooling demand of 10%, then the cooling demand must return to 0% before preheating will be enabled again.
- The Water Coil Mode must be in Heating (applies to Two-Pipe systems only).

For the Preheating sequence, the value of the modulating valve is calculated based on a PI (Proportional / Integral) control loop. The Proportional component of the loop is determined as follows: As the supply temperature drifts below the setpoint, the Proportional component ramps up to compensate.

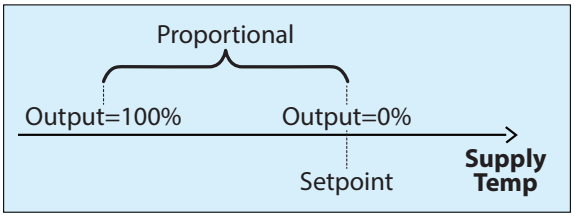

Figure 39 - Preheat Proportional Loop

The Integral component is defined as the amount of time required to add 100% to the Preheat output due to a constant error of 1.8 °F (1 °C). Its purpose is to correct small errors over time.

The Proportional component is then added to the Integral component to calculate the final Preheat output. When properly tuned, this PI loop will maintain a constant supply air Setpoint in the duct.

5.5.3 - Change Over

This section, which applies to **Two-Pipe systems only**, outlines the conditions which determine the Water Coil Mode. The ***Fan Coil Unit Controller*** uses this information to decide whether the water supply temperature is favorable enough to respond to the zone demand. The Change Over can be based off a thermistor reading or a dry contact.

5.5.3.1 - Thermistor

This section defines the water supply temperature ranges that determine whether the Water Coil Mode is in HEATING, COOLING or NEUTRAL mode.

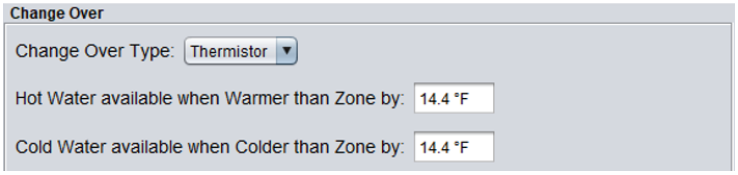

Figure 40 - Thermistor Change Over

These ranges are centered on the current zone temperature:

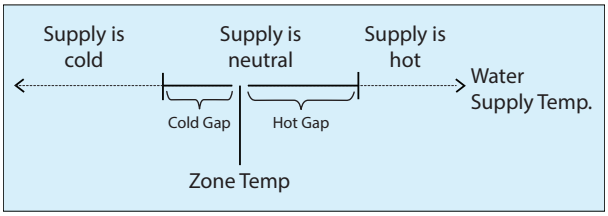

Figure 41 - Thermistor Change Over Ranges

Note that the Water Coil Mode can only become truly NEUTRAL when the water supply temperature falls within the neutral zone **while the valve is open**. If the water supply temperature falls within the neutral zone while the valve is closed, these neutral readings are ignored since they may simply be due to stagnant water. The Water Coil Mode will then remain in the last known state until the valve opens again.

The valve must be open for the configurable minimum delay before the supply water temperature can really be qualified as NEUTRAL:

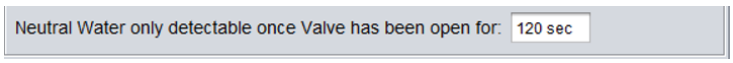

Figure 42 - Neutral Supply Water Delay

This delay ensures that any stagnant water is purged before it can influence the temperature reading. Additionally, for Modulating valves, a minimum valve opening position is required to obtain valid supply readings. See "Activation Threshold" ***in section 5.5.5 for more details***.

If the water supply temperature suddenly becomes invalid during operation, then the Water Coil Mode will remain in the last known state until it is corrected. This strategy gives the occupant the best chance at remaining comfortable until seasonal maintenance occurs.

5.5.3.2 - Contact

This section defines how to interpret a dry contact which is being used to determine the Water Coil Mode.

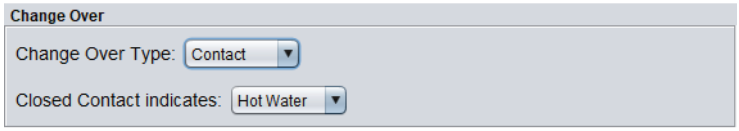

Figure 43 - Contact Change Over

You can define whether a closed contact indicates that the Water Coil Mode is in HEATING or COOLING. There is no NEUTRAL mode in this case.

5.5.4 - Purge

The Purge Cycle is intended to force the valve to open periodically whenever the Water Coil Mode is NEUTRAL. This sequence applies to **Two-Pipe systems using Thermistor Change Over only**. ***Note*** that the FCU Controller will not perform a purge if it is using a water supply temperature reading that has been provided by the network.

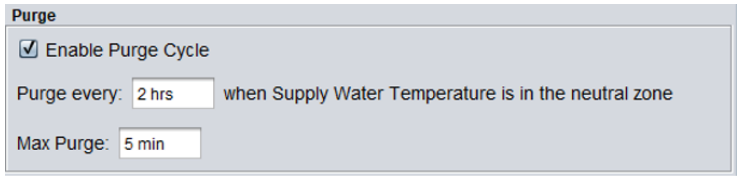

Figure 44 - Purge Sequence

When the Purge Cycle is initiated, it has a maximum delay to detect whether the water supply temperature is now considered hot or cold. If this delay expires and the Water Coil Mode is still determined to be neutral, the valve will close and await the next purge cycle. Any detection of hot or cold supply water will immediately stop the purge cycle and the Water Coil Mode will be updated.

5.5.5 - Movement Control

This section defines the restrictions placed on the valve's movement to reduce wear and to improve water supply temperature detection. This section applies to **modulating valves only**.

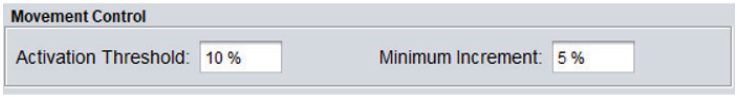

Figure 45 - Movement Control

- **Activation Threshold**: In the case of a **Two-Pipe system**, the valve will not begin opening until its calculated position is at least that of the Activation Threshold. It will also not be able to close to a value less than the Activation Threshold, except to go to 0%.

  This setting is used to enforce a minimum water flow during valve activity to make sure that the water does not become stagnant and induce an unreliable water supply reading. (This setting does not apply to Four-Pipe systems).

  Example: If the valve is closed and has an Activation Threshold of 10%, and its calculated position becomes 8%, it will remain closed. The valve requires a calculated position of 10% or more before it can move away from a closed position. On the other hand, when closing, the valve will never close less than 10%, unless its calculated position is 0%, at which point it will fully close.

- **Minimum Increment**: This setting applies a differential on any valve movement, to prevent wear on the valve. The valve must move by the at least this amount each time, or not at all.

5.6 - Reheat Setup

This screen is used to configure the Reheat sequence, which can be implemented by either a Digital or Analog output.

5.6.1 - Conditions under which reheat output may activate

The reheat sequence is enabled under any of the following conditions:

- When there is a heating demand in a Two Pipe configuration, but no hot water is available.
- When there is a heating demand and the alarm input has been triggered.
- When the Supplemental Heating conditions are met (see below).

5.6.2 - Control

This section defines how the Reheat sequence will operate. The Reheat sequence can run in either Differential or Proportional mode, regardless of whether an Analog or Digital output is being used.

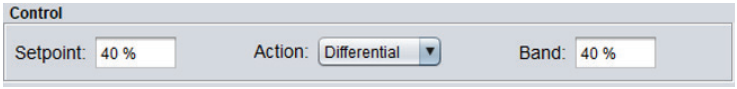

Figure 46 - Reheat Control

5.6.2.1 - Differential

In Differential mode, the Reheat sequence has an activation and deactivation point based on the heat demand calculated by the controller's PI Loop *(see section 5.3.1)*. These points are separated by a Differential Band, centered on a Setpoint, as shown in the following graph:

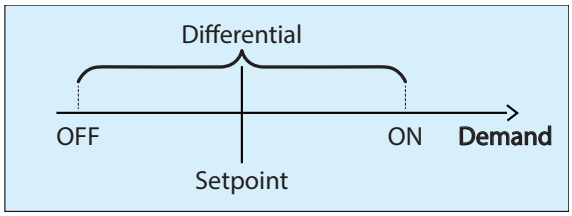

Figure 47 - Reheat Differential Mode

This Differential band ensures that the activation and deactivation points are sufficiently spread apart, so as to avoid short-cycling the equipment.

5.6.2.2 - Proportional

In Proportional mode, the reheat action increases proportionally to the heat demand calculated by the controller's PI Loop *(see section 5.3.1)*:

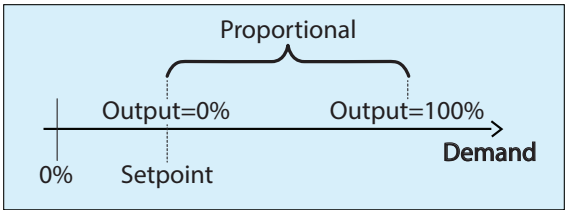

Figure 48 - Reheat Proportional Mode

While the demand remains below the Setpoint, the reheat action remains off. Once the demand ramps up past the Setpoint, the reheat action will increase proportionally. Once the demand hits the sum of the Setpoint and Proportional band, the reheat action will be at its maximum.

Note that in Proportional mode, Digital outputs will necessarily be using Pulse Width Modulation with a one-second pulse width period. Analog outputs have the choice of using that same Pulse Width Modulation, or simply use the standard Voltage Modulation applied over the chosen voltage range ***(see section 5.2.7)***.

5.6.3 - Supplemental Heating

Supplemental Heating is used when the valve (in either two pipe or four pipe systems) does not seem to be able provide enough heat. The Supplemental Heating output, which is typically connected to an electrical heating strip, can then be activated. ***Note***: Valve operation is unaffected by the Supplemental Heating sequence.

Specifically, the sequence is enabled when ALL the following CONDITIONS are met SIMULTANEOUSLY:

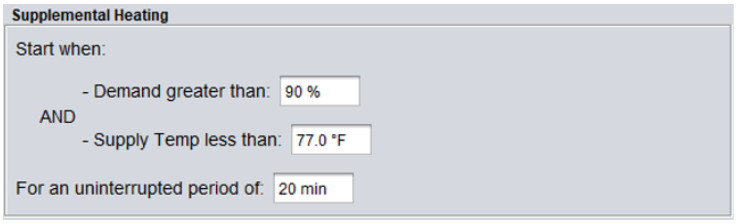

Figure 49 - Supplemental Heating Sequence

- The Heat demand calculated by the controller's PI Loop is greater than the supplemental heat setpoint
- The Supply Air Temperature is below the supplemental heat low limit
- The above two conditions have been met continuously (uninterrupted) for the defined period
- There is a valid Proof of Fan (optional)

Note that if either the demand or supply limit conditions get interrupted, then the timer for the supplemental heat period must restart from the beginning.

Once activated, Supplemental Heating will follow the actions defined in the standard Reheat sequence above ***(see section 5.6.2)***. ***Note*** that if Reheat is using Proportional action, then the output signal will be filtered upon activation and progressively climb to the intended value instead of instantly jumping to it. This avoids making sudden jarring calls to the equipment and possibly overshooting the setpoint. The filter will limit the rate of increase to 1% of the signal of the signal output every second. Once the signal reaches its intended value, the filter is deactivated.

Once the Supplemental Heating sequence finishes, the valve will continue to respond to heating calls alone and will hopefully have more success. If not, the Supplemental Heating can activate if the conditions above are met again.

5.6.4 - Ignore Proof of Fan

This option disables the proof of fan condition tied to both the Reheat and Supplemental Heating sequences.

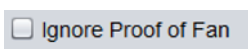

Figure 50 - Reheat Ignore Fan Proof Option

Note that if there are no inputs even assigned to a fan proving signal, then this option will be hidden, and proof of fan will not be required for the Reheat or Supplemental Heat sequences.

5.7 - Calibration Configuration

This page is used to offset the various input readings provided to the controller by the attached sensors.

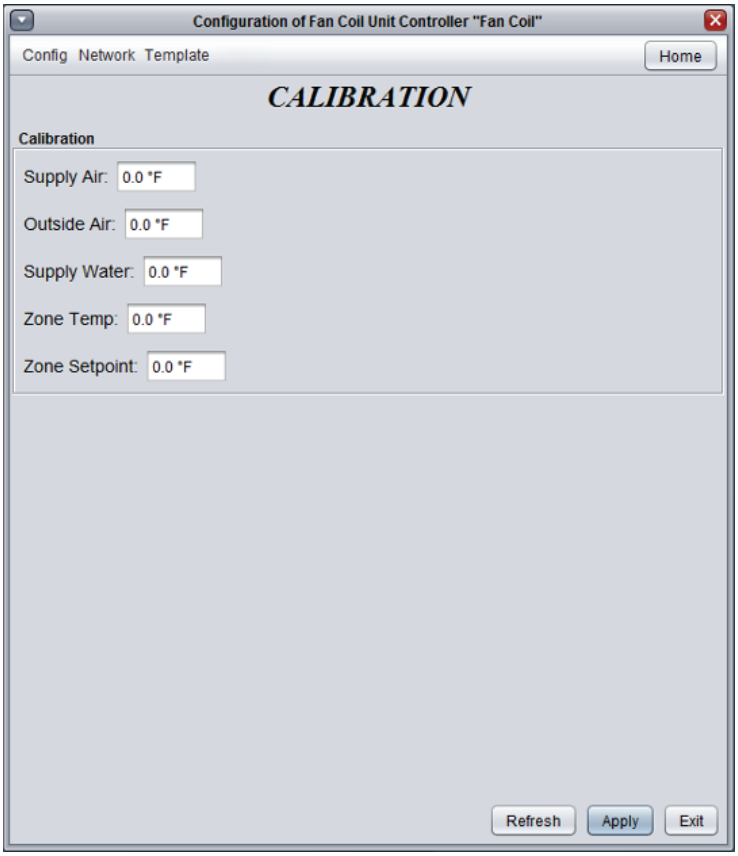

Figure 51 - Calibration Configuration

The options here may vary depending on the selected hardware and configuration.

5.8 - Limits Configuration

The Limits section is used to establish temperature safeguards that can either taper off any modulating heating activity or simply cut out any heat or cool activity altogether. These limits apply to both valve and reheat activity.

5.8.1 - Supply Air

The Supply Air Temperature can be used to limit heating. If the heating action is modulating (pulse width or voltage modulation), the FCU controller will reduce its heating action so as not to rise above the limit.

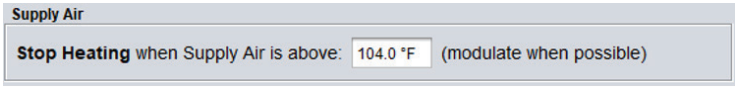

Figure 52 - Supply Air Limits

For on-off heating, the heating action will stop when the supply air temperature reaches the limit and becomes re-enabled again 5°C (9°F) lower than the limit.

If the supply air temperature reading is invalid, this limit is ignored.

5.8.2 - Outside Air

The outside air can be used to cut out heating or cooling action. The action is cut off completely, regardless of if it is on-off or modulating action.

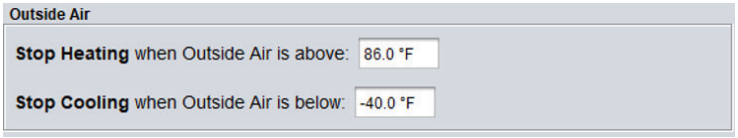

Figure 53 - Outside Air Limits

Once a limit is triggered, the outside air temperature must return by 1°C (1.8°F) inside the limit for control to be re-enabled again.

If the outside air temperature reading is invalid, these limits are ignored.

5.9 - COM Port Configuration

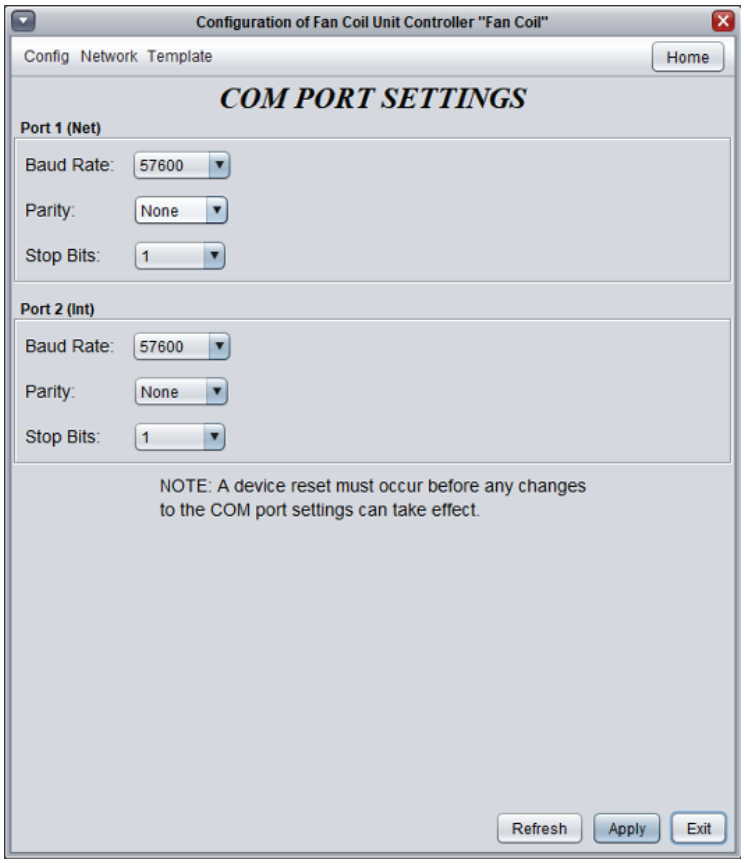

Figure 54 - COM Port Configuration

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

Note: It is strongly recommended that you do not change any of these settings away from their defaults unless you have specific knowledge of how these settings work or have been directed to by Prolon Technical Support. Changing these settings can cause loss of communication with this controller and may disrupt communication on the network if not done properly.

- **Baud Rate**: This sets the baud rate value for the COM port. The default baud rate used by the ***Fan Coil Unit Controller*** is 57600bps but may be set to any of these standard values:
  - 9600
  - 19200
  - 38400
  - 57600
  - 76800
  - 115200
- **Parity**: This sets the parity for communication on the COM port. The default parity used by the ***Fan Coil Unit Controller*** is "None" but may be set to any of these standard values:
  - None
  - Odd
  - Pair
- **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.

5.10 - Device Configuration

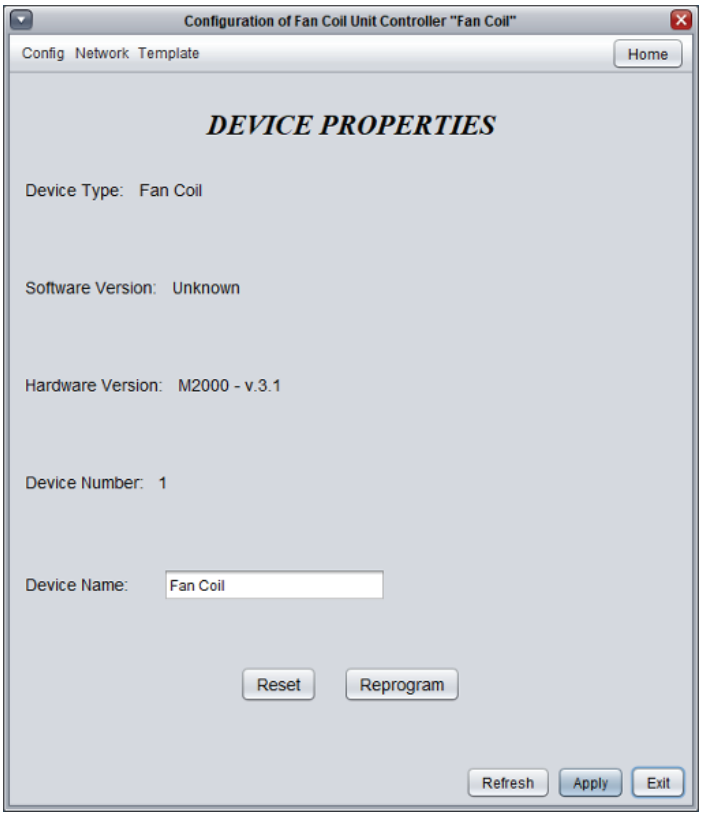

Figure 55 - Device Configuration

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" below).
- **Hardware version**: This is the physical nature 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 manually using the dipswitches, or through software.
- **Device Name**: This field indicates the current name of the controller, which you can modify. Alternatively, you can right-click on the icon and select the rename option.
- **Reset Device**: Causes the device to reset as if it had been powered off and back on. All configuration properties REMAIN SAVED. However, resetting the controller removes all active overrides. This function is useful for 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 anyway.

5.11 - Schedule Configuration

This screen is used to configure weekly occupancy schedules (M2000 hardware platform only).

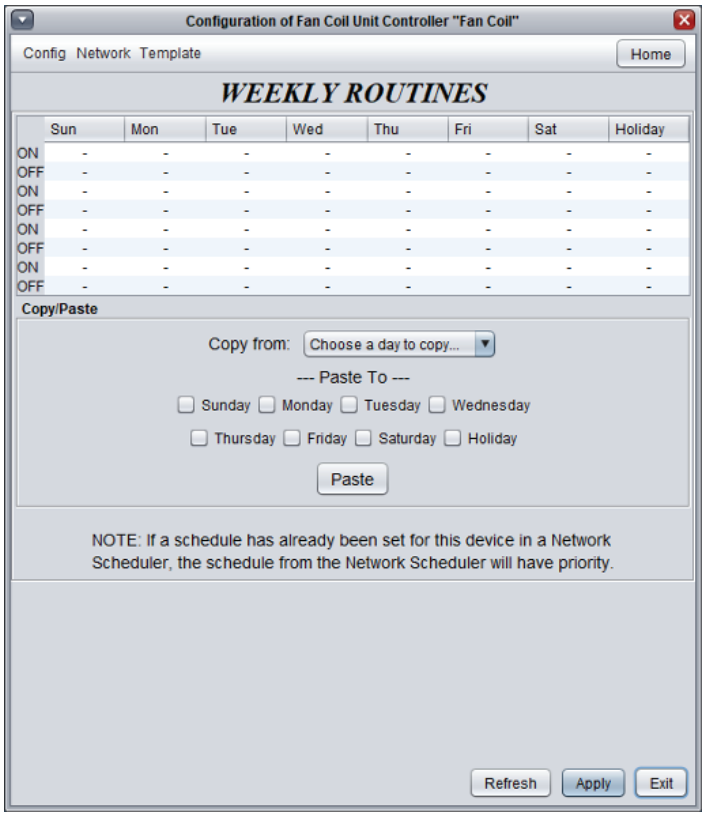

Figure 56 - Schedule Configuration

- **Weekly Schedule Grid**: The Weekly Schedule Grid defines the weekly occupancy routine of the controller. Double-click a cell on the grid to edit it.

  The occupancy status only changes when a valid time is encountered on the weekly schedule grid. For example in the routine above, on Monday the device will be set to "Occupied" at 7:00 AM. At 6:00 PM, the device will be set to "Unoccupied" and remain so until the next valid time is encountered (7:00 AM the next day), where it becomes occupied again. The "Holiday" column will replace a normal weekday anytime the current date has been set as a holiday (see the next section).

  The time can be displayed in either 12h or 24h format by changing the setting in the 'Options' menu, under 'Units', then 'Time Format'.

  Note that if a Network Controller is present on the network and it has been configured to send a schedule to the ***Fan Coil Unit Controller,*** the schedule sent by the Network Scheduler will take precedence over the one set here.

- **Copy/Paste**: The Copy/Paste function makes it easy to copy a particular day's schedule and apply it to other days of the week. Simply choose a day to copy from the drop down list, select one or more days to paste to then click the "Paste" button.

5.12 - Calendar Configuration

This screen is used to define which dates are holidays so that the normal daily schedule can be replaced by an alternate holiday schedule. The calendar has no pre-defined holidays marked, allowing for complete customization of the holiday calendar upon initial configuration. The holiday calendar does not recognize floating holidays (Labor Day, Memorial Day, etc.) and thus must be adjusted annually.

Figure 57 - Calendar Configuration

Calendar Dates

On the selected days, the holiday occupancy routine defined in the Weekly Routines screen will replace the normal occupancy schedule of that day. After the day is over, the next day follows the standard schedule again.

To select or unselect a date, simply click on it. You can change months by clicking on the arrows at the bottom or by simply choosing the desired month from the drop down list of months.

5.13 - Template Menu

5.13.1 - Save as Template

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

5.13.2 - Load Template...

After saving a ***Fan Unit Controller*** configuration in a template, you can load this template into another ***Fan Unit Controller*** by selecting this menu item in the configuration screen of the ***Fan Unit 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 ***Fan Unit 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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