



FOCUS GUIDE

HEATPUMP CONTROLLER

Configuration Guide for Prolon Focus Software

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1 - Prolon Heatpump Controller

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

The Prolon series *Heatpump Controller* is designed to control a variety of different heatpump units such as air-to-air or water-to-air systems. 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 controller uses PI (*Proportional-Integral*) control loops to optimize HVAC management and offers a variety of sequences to control the fan, cooling compressors, heating equipment and much more. It can also act as *Master* controller when connected to a Prolon network.

The Prolon series *Heatpump Controller* is in essence a collection of highly effective Heatpump control sequences designed by Prolon, based on the feedback of our trusted clients and contractors with years of field experience. The sequences offered are highly configurable, allowing for a greater flexibility in the final operation of the controller, but they are not programmable.

1.1 - Hardware Variations

The Prolon series *Heatpump Controller* is in essence a collection of highly effective Heatpump 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 *Heatpump 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

C1000 (VC1000F) → 3 Analog Inputs / 1 Binary Input / 4 Digital Output / 1 Analog Output

The following sequences are unavailable for the C1000: Static Pressure, CO₂

M1000 (Discontinued) → 9 Analog Inputs / 5 Digital Outputs / 3 Analog Outputs



2 - Networking

Prolon networks are divided into *Master* and *Follower* devices. *Master* devices are in charge of sharing information with *Follower* devices. The Prolon *Heatpump Controller* is available as either a *Master* or a *Follower*, regardless of the hardware platform:

- The *Zoning* sequence (*Master*) is best suited for heatpumps that are serving multiple zones, and whose decisions are based on the collective demand of these zones
- The *Single-Zone* sequence (*Follower*) is only suitable for heatpumps that are entirely driven by a single temperature sensor

Regardless of the chosen sequence, the Prolon *Heatpump Controller* can be integrated into a Prolon network with other 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 (*Zoning Heatpump Controller*)

The Prolon *Zoning Heatpump Controller* will automatically detect and start sharing information with the *Follower* controllers that it finds. Typical examples of shared information include the occupancy status, supply air temperature, zone demand, and more.

Please refer to the Focus Guide of each respective controller for a detailed list of the information that a Prolon *Zoning Heatpump Controller* will exchange, as each controller requests and provides different kinds of information. Data is exchanged approximately every three seconds.

The Prolon *Zoning Heatpump Controller* can also receive the following information from the Prolon Network Controller:

- **Occupancy Status:** The occupancy status received from the Network Controller will take priority over the occupancy state calculated by the *Zoning Heatpump Controller*'s own internal schedule.
- **Outside Air Temperature:** The Network Controller can collect and distribute the outside air temperature to any controller on a Prolon network.

If a physical input on the *Zoning Heatpump Controller* is assigned to occupancy or occupancy override, this physical input's status will take priority over information received from the network.

If there is already an outside temperature sensor physically connected to the input on the *Zoning Heatpump Controller*, then the physical input will take priority over the one received over the network.

Note that this data will only be shared if the Network Controller is configured to do so. Data is exchanged with a Prolon Network Controller every ten to thirty seconds. If the information stops being received, it will be declared *invalid* after 720 seconds.



2.2 - Shared Information (*Single-Zone Heatpump Controller*)

When integrated into a system with a Proton **Master** Controller, the Proton **Single-Zone Heatpump Controller** will automatically be detected and start sharing information. A Proton Network Controller can also be configured to share information. Here is a list of all currently exchanged information:

- **Occupancy Status:** The occupancy status can only be received from the Network Controller, and it will take priority over the occupancy state calculated by the **Single-Zone Heatpump Controller's** own internal schedule.

If a physical input on the **Single-Zone Heatpump Controller** is assigned to occupancy or occupancy override, this physical input's status will take priority over information received from the network.
- **Outside Air Temperature:** The outside air temperature will automatically be shared from a **Master** Controller to the **Single-Zone Heatpump Controller**. A Network Controller can also be configured to share the outside temperature should a **Master** Controller not be present. In the case where both are present, the last received outside temperature value will be used. If there is already an outside temperature sensor physically connected to the input on the **Single-Zone Heatpump Controller**, then the physical input will take priority over the one received over the network.

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.

The **Single-Zone Heatpump Controller** does not have any information of its own to contribute to a **Master** Controller.



3 - Adding a Heatpump Controller to a Focus Project

Prolon Focus is a free visualization and configuration software for all Prolon controllers. Once the *Heatpump 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 ***Heatpump 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, 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.

3.2.1 - Zoning Heatpump Controller

A Prolon ***Zoning Heatpump Controller*** can be simply added onto the screen by clicking on the "New Zoning Heatpump" button, found in the **Devices Drag and Drop** list on the left side of the Focus screen (System View only):

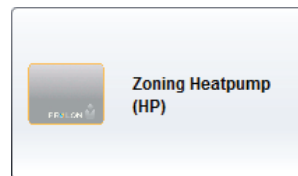


Figure 1 - New Zoning Heatpump Button

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



3.2.2 - Single-Zone Heatpump

There are two methods to add a **Single-Zone Heatpump Controller** to a project, and the appropriate method is determined by the presence of a Prolon **Master** Controller in the network.

3.2.2.1 - Master Get List

If the **Single-Zone Heatpump 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":

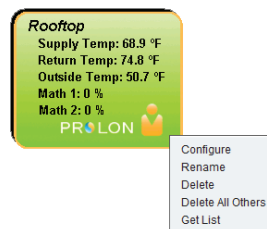


Figure 2 - Master "Get List"

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

3.2.2.2 - New Single-Zone Heatpump Button

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

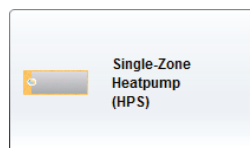


Figure 3 - New Single-Zone Heatpump Button

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 **Single-Zone Heatpump Controllers** in sequence by right clicking the button and selecting the "Create Multiple" option. This option will facilitate the creation of multiple **Single-Zone Heatpump Controllers** in sequential order.



4 - Heatpump Controller Icon

Each *Heatpump Controller* added to your system has its own icon. Each icon displays data about the *Heatpump Controller* it represents, and this data is updated regularly. You can open the configuration screen for a *Heatpump Controller* by double-clicking on its icon or right-clicking it and choosing the “Configure” option. If the Controller is offline, all data will be displayed as “N/A” (not applicable).

4.1 - Zoning Heatpump Controller Icon

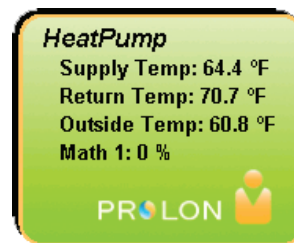


Figure 4 - Zoning Heatpump Icon

4.1.1 - Icon Data

- **Name:** The name of the *Zoning Heatpump Controller*. You can change it by right clicking the icon and choosing “Rename”. By default it is set to “Heatpump”.
- **Supply Temp:** The current air temperature in the supply duct. Will display “N/A” (not applicable) if no supply temperature sensor is attached or if the network does not supply a reading.
- **Return Temp:** The current temperature of the return air. Will display “N/A” if no return air temperature sensor is attached.
- **Outside Temp:** The current outside air temperature. Will display “N/A” if no outside air temperature sensor is attached or if the network does not supply a reading.
- **Math Values:** The values of the selected math functions. The displayed math functions can be changed and even renamed in the Display Configuration page ([p.23](#)). Only the first two selected functions will be displayed.
- **Status Icon:** A person-shaped icon is always visible next to the ProLon logo, indicating if the controller is currently occupied or unoccupied. If the icon is orange, then the *Zoning Heatpump Controller* is in occupied mode. If the icon is grey, the *Zoning* Controller is in unoccupied mode. The icon will be grey when working offline.



4.2 - Single-Zone Heatpump Controller Icon

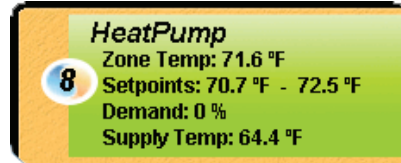


Figure 5 - Single-Zone Heatpump Icon

4.2.1 - Icon Data

- **Name:** The name of the *Single-Zone Heatpump Controller*. You can change it by right clicking the icon and choosing "Rename". By default it is set to "Heatpump".
- **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 *Single-Zone Heatpump Controller* is offline.
- **Demand:** The *Single-Zone Heatpump 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 *Heatpump Controller* 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 or if the network does not provide a reading.

4.3 - Icon Colors

The Heatpump icon changes color depending on the status and current actions being taken by the controller. Although it is the icons of the *Zoning Heatpump Controller* shown below, this information equally applies to the *Single-Zone Heatpump Controller* as well.

- **Grey:** The Heatpump icon is grey when offline or if data is not being received.
- **Green:** The Heatpump icon is green when no heating or cooling actions are being taken.
- **Red:** The Heatpump icon is red when heating actions are being taken.
- **Blue:** The Heatpump icon is blue when cooling actions are being taken.

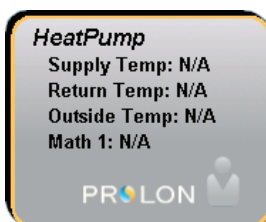


Figure 6 - Grey Icon

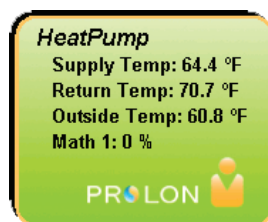


Figure 7 - Green Icon

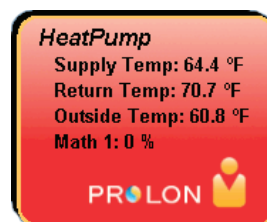


Figure 8 - Red Icon

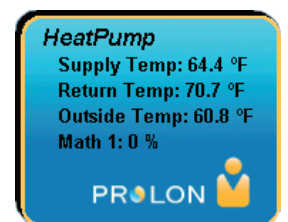


Figure 9 - Blue Icon



4.4 - Icon Right-Click

At any time you can right-click the Heatpump icon to access a list of useful functions.

4.4.1 - Zoning Heatpump Controller

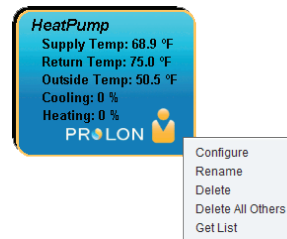


Figure 10 - Icon Right-Click for Zoning Heatpump

- **Configure:** This opens the configuration screen for the **Zoning Heatpump Controller** (same as double-clicking the icon).
- **Rename:** Lets you rename the **Zoning Heatpump Controller**. Names are limited to 16 characters.
- **Delete:** Removes the **Zoning Heatpump Controller** from your network.
- **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.
- **Get List:** Causes the **Zoning Heatpump Controller** to automatically retrieve the list of controllers connected to its system. A new icon is created for all controllers that are found. This function is unavailable offline.

4.4.2 - Single-Zone Heatpump Controller

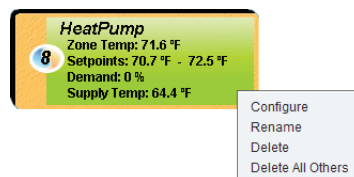


Figure 11 - Icon Right-Click for Single-Zone Heatpump

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

To view the configuration of a *Heatpump 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 *Heatpump Controller* Home screen to transfer you to its corresponding configuration page. ([See Icon Quick Jumps for more details, p.19](#)).

5.1 - Heatpump Controller Home screen

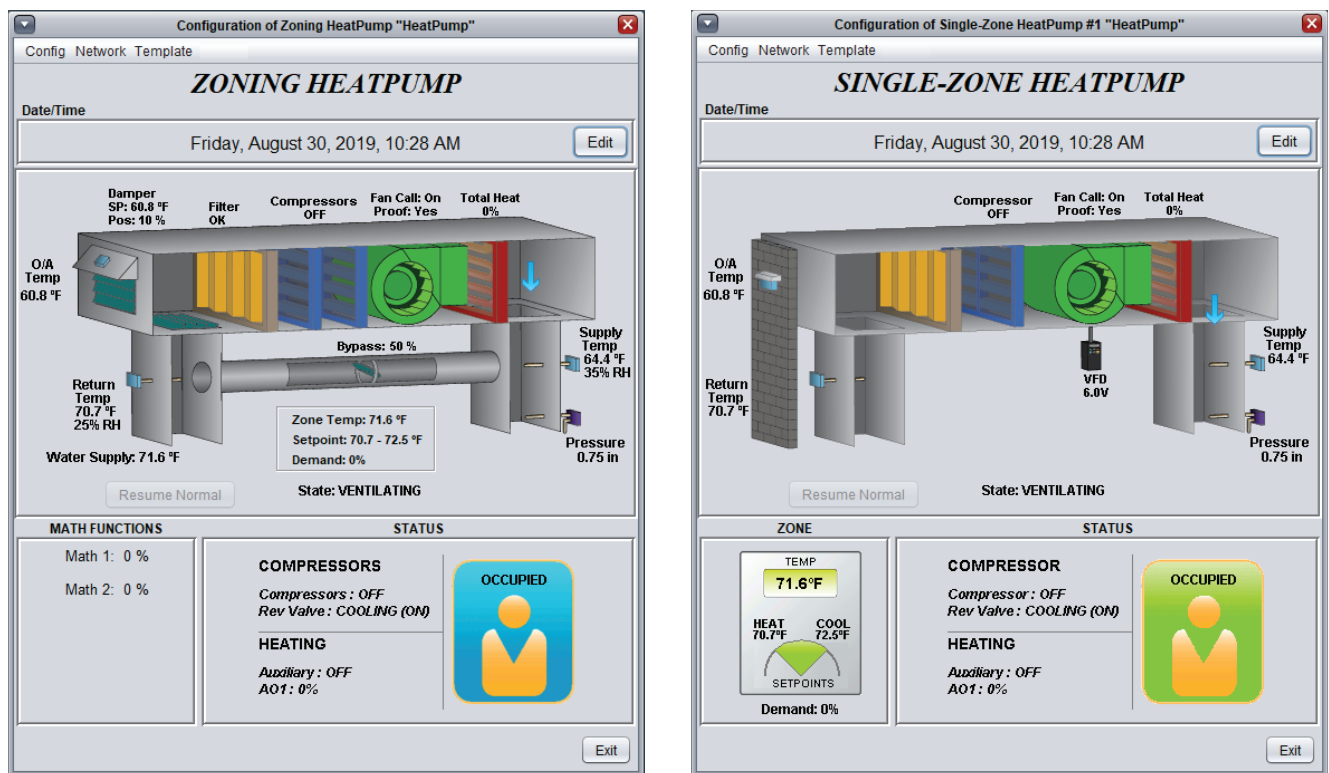


Figure 12 - Heatpump Home Screens

This screen shows the status of all inputs and outputs of the ProLon *Heatpump Controller*, as well as the active setpoints. All values will be "N/A" (Not Applicable) if 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 Heatpump Controller*. This can be edited with the Edit button. (Unavailable for the C1000 hardware platform).
 - **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.
 - **Return Temp:** The current return air temperature. Will display “N/A” if no return air temperature sensor is attached.
 - **Return Air Relative Humidity:** The relative humidity reading in the return air. This reading will only be available if:
 - ▷ A Prolon Humidity Controller is added to the Focus project in this system
 - ▷ The *Heatpump Controller* is a **Master** Controller
 - **Supply Temp:** The current supply air temperature. Will display “N/A” if no supply temperature sensor is attached or if none is provided from the network.
 - **Supply Air Relative Humidity:** The relative humidity reading in the return air. This reading will only be available if:
 - ▷ A Prolon *Humidity* Controller is added to the Focus project in this system
 - ▷ The Prolon *Humidity* Controller is configured to use a relative humidity sensor in the supply
 - ▷ The *Heatpump Controller* is a **Master** Controller
 - **Filter:** The current status of the filter (OK / Dirty). Will only be displayed if Input 4 Mode is set to “Filter Sensor” ([see p.24](#)). Unavailable for the C1000 hardware platform.
 - **Pressure:** The current static air pressure in the supply duct, measured in inches of water. Unavailable for the C1000 hardware platform.
 - **Zone Temp, Setpoints & Demand:** The current zone air temperature, accompanied by the active heating and cooling setpoints, and the resulting zone demand. This information will be displayed differently for **Zoning** or **Single-Zone Heatpump Controllers**:
 - ▷ For **Zoning Heatpump Controllers**, it is displayed in the center of the screen, and can only be provided by an analog wall temperature sensor that is physically connected to the controller (unavailable for the C1000 hardware platform).
 - ▷ For **Single-Zone Heatpump Controllers**, it is displayed in the Zone section on the bottom left of the screen, as part of a larger, wall sensor design. This information can be provided by a digital communicating wall sensor or by an analog wall sensor that is physically connected to the controller (unavailable for the C1000 hardware platform). In the case where analog and digital wall sensors are connected at the same time, the analog sensor will take priority.
- The *Heatpump 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**.
- For **Zoning Heatpump Controllers**, this demand (if available) will then be integrated into the overall building demand in a process called Flexi-Zone. The result of this process allows the **Zoning** unit to activate heating or cooling equipment based on an average demand of the entire building, instead of being driven by a single wall sensor.
- **CO₂:** The carbon dioxide levels read by the CO₂ sensor, displayed in PPM (parts per million). Unavailable for the C1000 hardware platform.
 - **Water Supply:** This displays the water supply intake temperature for display purposes only. It has no bearing on the sequences performed by the controller. Only available when configured for Water-To-Air mode.
 - **Occupancy:** The occupancy status of the *Heatpump Controller*. The occupancy state can be determined by a number of factors. They are listed here in order of ascending priority:
 - ▷ Occupancy is first determined by the real time clock onboard the *Heatpump Controller* along with the programmed schedule (M2000 only).



- ▷ An occupancy status received from the Proton Network Controller then takes precedence over the internal real time clock of the **Heatpump Controller**.
- ▷ Finally, if there is a physical occupancy input (C1000 only), or a physical occupancy override input (M2000 only), closing this contact will take definite control over the desired occupancy state of the Heatpump.

Note that during unoccupied mode, the **Zoning Heatpump Controller** may display as occupied if one of its zones has been locally overridden back to occupied mode. This does not mean it is sending a command for occupancy to the rest of the zones.

- **Heatpump State:** This displays the current actions being undertaken by the **Heatpump Controller**. The following table summarize all possible states:

Mode	Description
Offline	Focus is working offline or the controller is not responding
Fan OFF	The controller is not taking any action
Ventilating	Only the fan is ON
Preheating	The controller is preheating the supply air
Cooling	The compressor is being used in cooling mode
Heatpump	The compressor is being used in heating mode
Auxiliary Heat	Auxiliary Heat is ON because it is too cold outside to use the compressor to heat (Air-To-Air mode only).
Emergency Auxiliary	Auxiliary heat is ON because the compressor is unable to satisfy the heating demand on its own.
Safety Sequence	The compressor and auxiliary heat are working at the same time because the auxiliary heat is unable to satisfy the heating demand on its own. (Air-To-Air mode only).
-- ALARM --	The analog input assigned as an alarm input has detected an alarm condition. The Alarm condition prevents the compressor from being used.



5.1.2 - Displayed Information - Outputs

- **Damper:** The position of the outside air damper, in percentage. The icon will animate to approximate the relative opening of the damper. Will also display the target supply air setpoint when the economizer supply air sequence is enabled.
- **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 (can be hidden for the C1000 hardware platform). When the fan is on and there is a proof of fan signal, the icon animates by rotating the fan blades, and arrows appear indicating airflow. When the fan is off or when proof of fan is missing, the fan blades are stopped and there are no more airflow arrows.
- **Compressor:** The status of the compressor(s) is displayed above an icon in the center of the page, representing compressor coils. This information can also be seen in the status box at the bottom of the screen.

Each coil represents a stage of the compressor. The first stage is the coil on the right and the second stage is the coil on the left. The internal color of the compressor indicates the compressor activity; blue when it is cooling, red when it is heating, and grey when it is off.

- **Reversing Valve:** The status of the reversing valve is displayed in text format in the bottom center of the screen. It is also represented by the contour color of the compressors. The reversing valve is in cooling mode when the contour is blue, and it is in heating mode when the contour is red.

- **Heating:** The overall status of the heating outputs is displayed above an icon on the right side of the screen, representing a heating coil. The icon's color represents the intensity of the heating action being taken.

The value displayed above the icon is the total heat. The total heat is calculated using an average of all outputs currently attributed to heating.

The state of each individual heating output is displayed below in the Status section.

- **Bypass:** The current position of the bypass damper, in percentage (unavailable for the C1000 hardware platform). The icon will animate to approximate the relative opening of the damper, taking into account the chosen opening direction. Will only be displayed if the Pressure Control Mode is set "Bypass Damper" ([see p.39](#)).
- **VFD:** The current voltage applied to the variable frequency drive (unavailable for the C1000 hardware platform). Will only be displayed if Pressure Control Mode is set to "Variable Frequency Drive" ([see p.40](#)).
- **Math Functions:** Display the current calculated values of each math function, as defined in the Math Function screen ([see p.51](#)). A **Zoning Heatpump Controller** is continuously calculating the results of the five math functions which commonly represent the overall cooling or heating demand of the building, in a process called Flexi-Zone.

5.1.3 - Date/Time

The *Proton Heatpump Controller* has an internal real time clock (unavailable on the C1000 hardware platform). The current date and time is displayed at the top of the Home screen. To edit the time, click on the "Edit" button.

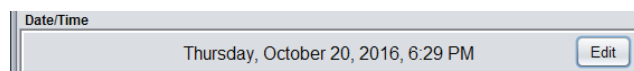


Figure 13 - Edit Time Button



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 **Heatpump 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.

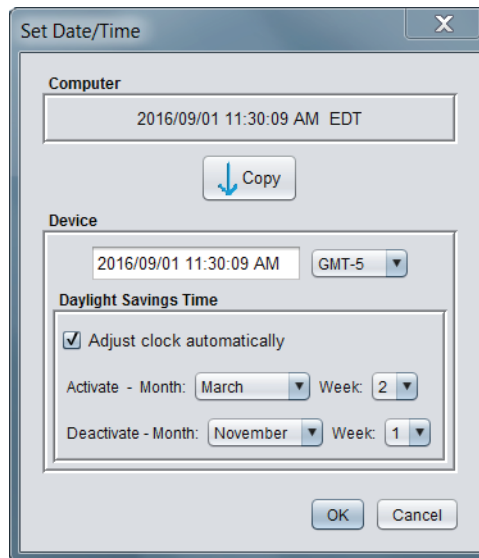


Figure 14 - Edit Time Dialog Box

5.1.4 - Icon Quick Jump

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 option is available, with the exception of the Occupancy section.

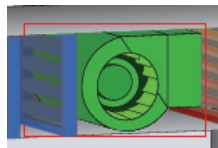


Figure 15 - Icon Quick Jump Example for the Fan

The following is a list of the clickable objects and their corresponding destination:



Items	Quick Jump
Outside Temp Sensor	Limits
Return Temp Sensor	Limits
Supply Temp Sensor	Limits
CO ₂ Sensor	CO ₂ Configuration (unavailable for C1000)
Static Pressure Sensor	Pressure Configuration (unavailable for C1000)
Zone Temp and Setpoints	Temperature Configuration
Outside Air Damper	Economizer Configuration
Bypass Damper	Pressure Configuration (unavailable for C1000)
VFD	Pressure Configuration (unavailable for C1000)
Compressors	Heatpump Configuration
Fan	Fan Configuration
Auxiliary Heating	Heating Configuration
Math Functions	Math Functions (unavailable for Single-Zone)
Occupancy Status	Weekly Routines (unavailable for C1000)

Please note that if the advanced password is enabled, only the Weekly Schedules and Temperature Configuration will be accessible.

Please review the Proton Focus User Guide for more information about passwords.

5.1.5 - Icon Manual Override

Certain components of the **Heatpump Controller** can be overridden. To perform an override, right-click the icon 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).

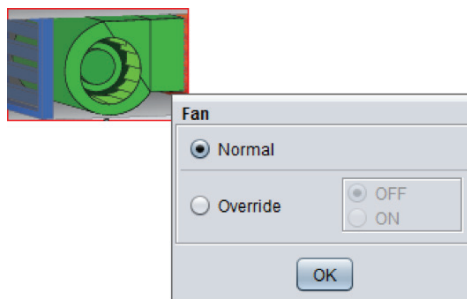


Figure 16 - Manual Override Example



- **Normal:** Selecting the “Normal” button will revert the selected item to its normal behaviour. Any override still applied to this object will be disabled.
- **Override:** Selecting the “Override” button will allow the user to manually override the selected object until Normal mode is resumed.

All Compressor Stages
Outside Air Damper
Auxiliary Heat
Fan
Bypass Damper
VFD
Occupancy

The following is a list of all items that can be overridden: Please note that all overrides still respect the temperature limits, minimum time delays and fan activity. There is an option to allow for absolute control over the overrides, and in essence to ignore these limits. [See Enable Absolute Overrides on p.25 for more details.](#) Fan and Occupancy can be overridden at all times.

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 adjacent picture, the fan is overridden.

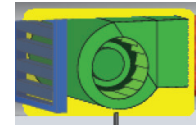


Figure 17 - Override Example for the Fan

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 **cancelled** when the **Heatpump Controller** is reset or loses power.

5.1.6 - "Resume Normal" Button

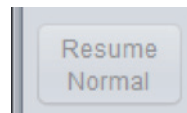


Figure 18 - "Resume Normal" Button

This button allows the **Heatpump Controller** to return to its fully automated behaviour. All overrides previously applied to the device will be disabled. Absolute overrides, if applicable, will also be deactivated ([see p.25](#)). However, before any action is taken, a dialog box will appear to confirm your choice.



5.1.7 - Mode Set Button

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

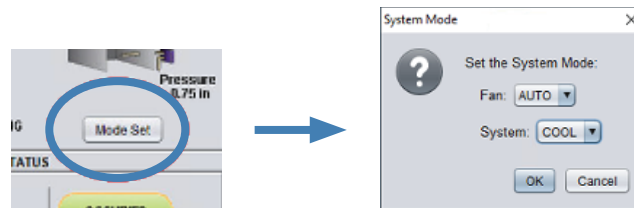


Figure 19 - HP System Mode Override

- **Fan:**
 - ▷ **AUTO:** The fan will run as per defined in the Fan Configuration Menu
 - ▷ **ON:** Override the fan to ON
 - ▷ **OFF:** Override the fan to OFF
- **System*:**
 - ▷ **AUTO:** The unit will respond to both heating and cooling calls with automatic changeover.
 - ▷ **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

**NOTE: the System Mode (AUTO, HEAT, COOL, OFF) does not affect the fan operation.*

Unlike most overrides, the System Mode is stored in memory and will be restored after a power loss or reset.



5.2 - Display Configuration

Figure 20 - Display Configuration Screen

This screen lets you customize the graphical display of the home screen. Only a few settings here can actually affect the operation of the controller: they will be detailed below.

Sensors

This section allows you to select which sensors are displayed in the home page. **Note** that just because a sensor is chosen not to be displayed, its readings will still be taken into account for safety limits or other sequences. So if the intention is to truly ignore a sensor reading, the sensor must be physically disconnected from the controller.

Analog Input 1

You can select the mode of operation for the general purpose analog input #1. Depending on the chosen mode, this particular setting can in fact influence the sequence of operation of the controller:

- **Outside Temp Sensor:** The input is used to monitor the outside air temperature. This temperature is used in various sequences, including limits, use of economizer, low balance point, and more.
- **Water Intake Sensor:** The input is used to display the water supply intake temperature on the home page. It has no effect on the sequence of operation of the controller. (Water-To-Air Mode only).
- **Alarm Input:** The input is used to detect an alarm condition for the Heatpump, such as an accumulation of water. The alarm condition prevents the compressor from being used. This option is only available here for C1000 **Heatpump Controllers**, because M2000 **Heatpump Controllers** already have an input dedicated to this function.



Analog Input 4 (M2000 Only)

You can select the mode of operation for the general purpose analog input #4 (M2000 Only). Depending on the chosen mode, this particular setting can in fact influence the sequence of operation of the controller:

- **Filter Sensor:** In this mode, a message indicating if the filter is clean or dirty will appear above the filter icon. This setting does not affect the sequence of operation of the controller.
- **Water Intake Sensor:** The input is used to display the water supply intake temperature on the home page. It has no effect on the sequence of operation of the controller. (Water-To-Air Mode only).
- **Schedule Override:** When set as a Schedule Override input, the controller will return to occupied mode for the duration that the contact is closed. This takes priority over the schedule determined by the internal real time clock or even the schedule received from the Network Controller. It also immediately activates the exhaust fan (if applicable) if the exhaust fan is set for occupancy mode.

This input has no effect if the controller was already occupied.

Digital Input Mode (C1000 Only)

You can select the mode of operation for the general purpose digital input (C1000 Only). This setting influences the sequence of operation of the controller

- **Occupancy:** In this mode, an open contact signifies that the controller should be occupied, unless indicated otherwise from a Network Controller or other device.
- **Fan Proof:** In this mode, a closed contact indicates proof of fan operation.

A closed contact signifies that the controller should instead be unoccupied, but in this case it will actually ignore the status sent by the Network Controller.

Alarm Input Normally Closed

This option defines the logic of the input dedicated to the compressor alarm. When this alarm is triggered, the compressor is prevented from operating.

Show Auxiliary Heat

This option shows or hides the heating icon on the Home page, and any associated text. This is sometimes useful in Water-To-Air heatpumps that are mostly used for cooling, where auxiliary heating is not needed. This setting does not affect the sequence of operation of the controller.

Filter

This option shows or hides the yellow air filter icon on the Home page, and any associated text. This setting does not affect the sequence of operation of the controller.

Pressure Control Mode

This option lets you display either a bypass damper or a variable frequency drive to control the static pressure (unavailable on the C1000 hardware platform). If no pressure control system is in place, it can be set to "None".

Math Functions

This section selects the Math Functions that are to be displayed on the Home page AND ON THE ZONING HEATPUMP ICON of the controller. Math functions can represent the calculated average demand of the entire building ([see p.51 for more details](#)). Each Math function's name can be customized (up to 16 characters long). These settings do not affect the sequence of operation of the controller. Math functions are not used with the **Single-Zone** Controllers.



Enable Absolute Overrides

This option activates absolute override mode. By default, manual overrides are blocked if the safety of the system is at risk, for example, by cancelling a manual cooling override if the fan stops or if it is too cold in the supply. Absolute overrides bypass all limits and restrictions and therefore should only be used for testing. This setting will be lost if the controller should lose power or is reset. PROCEED AT YOUR OWN RISK.

5.3 - Fan Configuration

	OCCUPIED MODE	UNOCCUPIED MODE	OVERRIDE MODE
Fan OFF	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Fan AUTOMATIC	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>
Fan ON	<input checked="" type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>

AUTOMATIC

Demand Source

Fan ON if heating demand is greater than: 10 % Math 2

Fan ON if cooling demand is greater than: 10 % Math 1

Minimum fan cycle time: 15 min

Refresh Apply Exit

Figure 21 - Fan Configuration Screen

This screen is used for the setup of the main supply fan. Proof of operation of the main supply fan is required before any cooling or heating actions can take place.

The fan operation is primarily occupancy based, but can also activate:

- On demand from the zones
- Due to very high or very low outside temperature
- Due to humidification or dehumidification request
- Due to high CO₂ levels



5.3.1 - Occupancy Based Operation

Main supply fan operation is first determined by the occupancy status:

- **Occupied mode:** The *Heatpump Controller* will perform the selected action when it is occupied, as determined by its own internal schedule or from the one received from the network controller. This includes the physical inputs configured for occupancy (C1000).
- **Unoccupied mode:** The *Heatpump Controller* will perform the selected action when it is unoccupied, as determined by its own internal schedule or from the one received from the network controller. This includes the physical inputs configured for occupancy (C1000).
- **Override mode:** The *Heatpump Controller* will perform the selected action when it is in Override mode. The *Heatpump Controller* will enter Override mode when the local Override button is pushed on the wall thermostat of any of its *Follower* controllers, or its own. The Override button will cause the Controller to remain in this mode for a configurable delay, or until it returns to normal Occupied mode.

Once the occupancy status has been determined, the fan will simply go ON or OFF as selected. If Automatic mode is chosen, then additional demand-based information will be required (see below).

5.3.2 - Automatic

The actions taken in this mode are based on zone demand.

- **Fan ON if heating demand is greater than:** Select this if you want the fan to turn on based on a heating demand. For *Zoning Heatpump Controllers*, a math function representing the collective heating demand of the zones in the system will be used for this purpose ([see Math Functions p.51](#)). The fan will be ON when the heating demand is greater than the configured setpoint.
- **Fan ON if cooling demand is greater than:** Select this if you want the fan to turn on based on a cooling demand. For *Zoning Heatpump Controllers*, a math function representing the collective cooling demand of the zones in the system will be used for this purpose ([see Math Functions p.51](#)). The fan will be ON when the cooling demand is greater than the configured setpoint.

Default	10 %
---------	------

Default	10 %
---------	------

- **Minimum fan cycle time:** This is the minimum amount of time that the fan will stay ON once activated. Even if the demand drops below the setpoint, the fan remains ON until the time delay is met. After this time, the fan will turn OFF as soon as the demand drops under the setpoint.

Default	15 minutes
---------	------------



5.4 - Heatpump Configuration

This screen is used to setup the **general operation** of the heatpump's compressors, as well as to define their use in **cooling** mode. More details about the compressor's operation in **heating** mode can be found in the Heating configuration page [\(p.30\)](#).

Fan activity must be confirmed before any compressor operation Limits Configuration [\(p.43\)](#) for more details.

5.4.1 - Compressor

- **Stages:** The number of compressor stages that are used for the heatpump in both heating and cooling modes.

COMPRESSOR

Stages: 2

Min ON Time: 2 min

Min OFF Time: 5 min

Figure 22 - Compressor Setup

- **Minimum OFF Time:** Once a compressor stage is deactivated, this is the minimum amount of time it will remain OFF. It is also the minimum time required to elapse before the next stage can be deactivated (Interstage Deactivation Delay). This applies to both heating and cooling modes.

Default	5 minutes
---------	-----------

- **Minimum ON Time:** Once a compressor stage is activated, this is the minimum amount of time it will remain ON. It is also the minimum time required to elapse before the next stage can be engaged (Interstage Activation Delay). This applies to both heating and cooling modes.

Default	2 minutes
---------	-----------

5.4.2 - Cooling

The compressors can be activated based on a demand for cooling. For a **Zoning Heatpump Controller**, a math function representing the collective cooling demand of all the zones in the system is used for this purpose [\(see Math Functions, p.51\)](#). Once the cooling demand is **satisfied**, cooling will stop.

Staged cooling is defined by a **Setpoint** and **Differential** band for each individual stage:



COOLING			
Demand Source:	Math 1		
Stage 1 - SP:	35 %	Diff:	20 %
Stage 2 - SP:	60 %	Diff:	40 %

Figure 23 - Staged Cooling Setup Based on Demand

Each stage of mechanical cooling has an activation and deactivation point. These points are centered on the **Setpoint** of the stage, and separated by the **Differential** of the stage, as shown in the following graph:

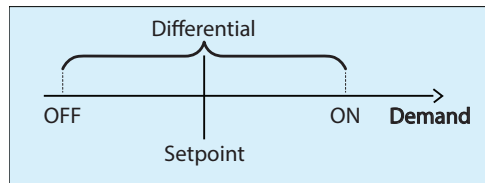


Figure 24 - Staged Cooling Control Based on Demand

5.4.3 - Heatpump

This section defines the physical setup of the heatpump, as well as certain special activation conditions.

HEATPUMP	
<input type="checkbox"/> Reversing Valve powered in heating (B Mode)	<input type="checkbox"/> Add-On
Low Balance Point: 17.6 °F	<input type="checkbox"/> Safety Sequence after: 30 min
Type: Water to Air	

Figure 25 - Heatpump Setup

- **Reversing Valve powered in heating (B Mode):** This option determines the logic of the reversing valve output. By default, when the compressor is supposed to operate in cooling mode, the reversing valve output will be powered. Selecting this checkbox will instead make the **Heatpump Controller** power the output in heating mode (“B” mode).
- **Add-On:** When selected, this option specifies that the compressor is installed **downstream** of the auxiliary heat module. This will prevent the compressor from being used at the same time as auxiliary heat. The status of this parameter is reflected on the home screen graphic (Air-To-Air mode only).
- **Low Balance Point:** This value defines the outside temperature **above** which the compressor can still be used in heating mode (Air-To-Air mode only). When the outside temperature is below this value, the heatpump is disabled and auxiliary heat takes over. The heatpump will be re-enabled again when the outside temperature goes 3.6°F (2°C) higher than the balance point. In Water-To-Air mode, the heatpump is always authorized, regardless of outside temperature.



- **Safety Sequence after:** The safety sequence is designed to help protect the system when auxiliary heat is active but does not seem to be working. In Air-to-Air mode, auxiliary heat is used when it is too cold outside to efficiently use the compressors. However, if it is determined that the auxiliary heat does not seem to be working correctly, the compressor is re-enabled despite the temperature outside. The purpose is to generate at least some minimal level of heating to protect the integrity of the building.

Specifically, the sequence is activated when the heating demand is greater than 95% AND the supply temperature remains below 77°F (25°C) **continuously** for the specified amount of time, despite auxiliary heat being active. As soon as either condition is corrected, the system returns back to normal operation.

This sequence is not available in water-to-air mode since the compressor is authorized regardless of outside temperature.

- **Type:** Defines the heatpump type. Air-To-Air Heatpumps use the outside air as an energy transfer medium. Their operating efficiency changes due to the variations of outside temperature that can occur over the course of a year. For example, when it is very cold outside, auxiliary electrical or gas heating may be required to maintain a comfortable indoor temperature.

Water-to-Air heatpumps instead use water pulled from deep below the ground which remain relatively stable and can therefore operate efficiently year round.

5.4.4 - Emergency Auxiliary Heat

Emergency auxiliary heat is a sequence used to heat the building when the compressors do not seem to be operating correctly. The auxiliary heating outputs, typically connected to electrical or gas powered heating equipment, will be activated. The compressor will remain on during this period as long as the compressor is not on "Add-On" type.

EMERGENCY AUXILIARY HEAT

Start when - Demand greater than 90 %

AND - Supply temp less than 77.0 °F

Only use Auxiliary Heating

Figure 26 - Emergency Auxiliary Heat Configuration

Specifically, the sequence is enabled when the heatpump has been ON for at least twenty minutes, yet the following two conditions persisted throughout the last twenty minutes:

- ▷ Heating demand greater than a specified amount (default 90%)
- ▷ Supply Air temperature below a specified amount (default 77°F / 25°C)

Once enabled, emergency auxiliary heat will remain active until the heating demand drops below the specified value. The compressor then operates alone again, and may have more success now that the building has been given some heating inertia. If not, the emergency auxiliary heat may activate again after another twenty minutes if the conditions above return.

- **Only Use Auxiliary Heating:** Selecting this option disables the heatpump in heating mode, and only auxiliary heat will be used to answer calls for heat, regardless of the outside temperature.

Note: Check this box if you want to override the auxiliary heat output from the home page.



5.5 - Heating Configuration

This screen is used to setup the heating configuration of the **Heatpump Controller**. Fan activity must be confirmed before any heating will take place. Temperature limits and other time delays can also affect heating activation. [Please see the Limits Configuration \(p.43\) for more details.](#)

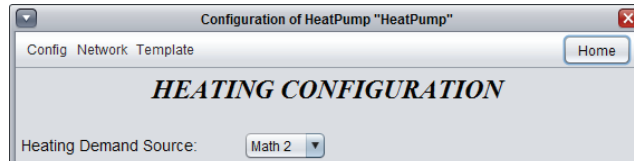


Figure 27 - Heating Configuration Screen

The heating equipment will be activated based on a demand for heating. In the case of a **Zoning Heatpump Controller**, a math function representing the collective heating demand of the zones in the system will be used for this purpose ([see Math Functions p.51](#)). Once the demand is **satisfied**, heating will stop.

5.5.1 - Heating Configuration

The **Heatpump controller** uses demand-based, staged heating to operate the compressors. Staged heating is defined by a **Setpoint** and **Differential** band for each individual stage:

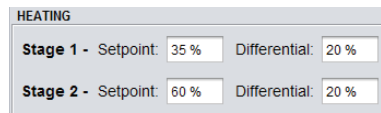


Figure 28 - Staged Heating Setup Based on Demand

Each stage of heating has an activation and deactivation point. These points are centered on the **Setpoint** of the stage, and separated by the **Differential** of the stage, as shown in the following graph:

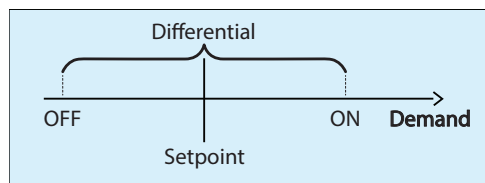


Figure 29 - Staged Heating Control Based on Demand

For Air-To-Air heatpumps, when **auxiliary heat** is used below the low balance point ([see p.29](#)) the same Stage 1 heat setpoint and differential band will determine its activation. **Auxiliary heat** will also turn on in emergency heat situations, as described in [section 5.4.4](#).

Note that on Proton **Heatpump Controllers** there is only one stage of digital auxiliary heat. In some hardware variation setups, an analog stage of auxiliary heat is also available, which is described in the next section. Please see each platform's **HARDWARE GUIDE** for more information.



5.5.2 - Analog Output 1

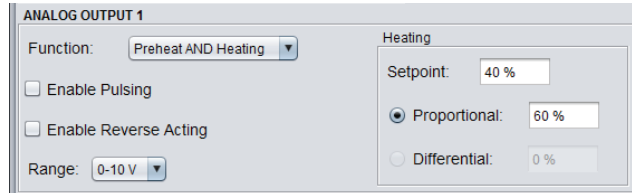


Figure 30 - Analog Output Heat Setup

(Output 5 for C1000 hardware platform)

The function of the Analog Output on the **Heatpump Controller** can be selected via the dropdown box in this section. It can be used for standard Heating, **Preheating** or both. In the case that both are selected, the highest value will be used.

The sequence behind preheating is described in the **Preheating** section below.

The heating sequence for this output can either be ON/OFF or modulating. For Air-To-Air Heatpumps, standard heating will **only be allowed** below the low balance point ([see p.28](#)) or during the emergency heat sequence.

For Water-To-Air heatpumps, standard heating will only be allowed during the emergency heat sequence, as compressors should normally be sufficient for heating year-round.

- **Heating Stage (Differential):** The output is used as an ON/OFF heating stage, with activation and deactivation points based on the heating demand. These points are centered on the **Setpoint**, and separated by the **Differential** of the stage, as shown in the following graph:

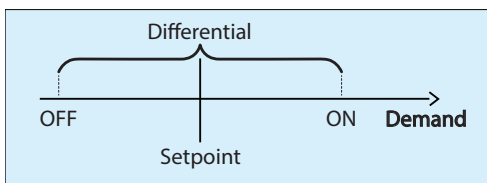


Figure 31 - Differential Heating Control Based on Demand

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

Note: This option is not available if the function of the Analog Output is Preheat AND Heating, due to the fact that **Preheating** is inherently modulating.

- **Heating Stage (Proportional):** The output is a modulating heating stage whose action changes proportionally with the demand. You can select if the output will use pulse width modulation, or simply ramp the voltage up and down using voltage modulation.

The output's value, on a scale of 0-100%, is calculated as follows:

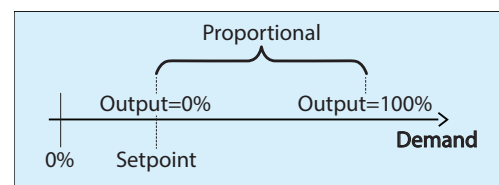


Figure 32 - Proportional Heating Control based on Demand

The output is at 0% when the demand is below the setpoint, and increases proportionally with the demand until it finally reaches 100% when the demand reaches the sum of the setpoint and 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 (Math 1) = 45% heating

Then the calculated output value is:

- ▷ $(45-25) / 50 = 40\%$



This output percentage is then converted into a pulse width or into a modulating voltage depending on whether or not the **Enable Pulsing** checkbox is selected. Pulse width modulation is designed for solid-state relay-equipped electric duct heaters.

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.

- **Enable Reverse Acting:** The output voltage will be inversely proportional to the calculated output value. For example, in a range of 0-10VDC, if the modulating output is calculated to be at 30%, it will output 7 volts at the terminals.
- **Range:** This option selects the voltage range provided by the **Heatpump Controller** at the terminals of the Analog Output. The range always corresponds to a full 0-100% output scale. For example, in the 2-10V range, a 0% output corresponds to 2V, and a 50% output corresponds to 6V.

5.5.3 - Preheating

PREHEATING			
Setpoint :	70.7 °F	Low Limit:	55.4 °F
Proportional :	36.0 °F	Integral :	15 min

Figure 33 - Preheating Setup

The goal of **Preheating** is to maintain the desired supply air temperature **Setpoint**.

Preheating with the Analog Output is enabled when:

- ▷ The Analog Output is set to **Preheating**, or **Preheat and Heat** (see p.31).
- ▷ The outside temperature is below the **Enable Preheat Setpoint** (see p.45) or if the outside air temperature is **invalid**.
- ▷ The demand for cooling is less than 10% and all cooling equipment is deactivated. If preheating is deactivated due to a cooling demand of 10%, then the cooling demand must return to 0% before preheating will be enabled again.
- ▷ There is a valid supply air temperature reading

The value of the Analog Output for the **Preheating** sequence is calculated based on a PI (**Proportional / Integral**) control loop. The **Proportional** component of the loop is determined as follows:

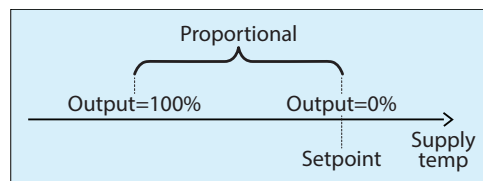


Figure 34 - Preheat Proportional Band

As the supply temperature drifts below the setpoint, the **Proportional** component ramps up to compensate.

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.

- **Low Limit:** The Low Limit is a lower, alternate preheating setpoint which is used to maintain a safe air temperature in the supply duct during very cold winter periods. Unlike the normal preheat setpoint, it is authorized to be used even if there is a strong cooling demand; however, cooling equipment must still be deactivated first.

Essentially, it is used during winter periods where a cooling demand is present (due to strong sunlight or other reasons), and there is an outside air damper in the system. When the supply air temperature gets too low, the outside air damper will naturally close to its minimum position, but sometimes this is not sufficient to maintain safe temperatures in the supply. This is where this alternate preheat low limit comes into play to protect the building.

5.6 - Economizer Configuration

This screen is used to setup and control the economizer sequence. When the **Use Economizer** checkbox is checked, the **Heatpump Controller** will use a dedicated analog output to drive an outside air damper for free-cooling purposes.

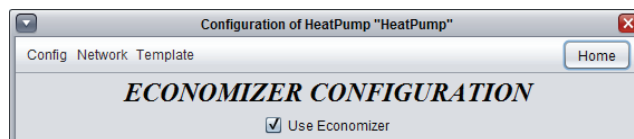


Figure 35 - Economizer Configuration Screen

In the case where CO₂ control is enabled ([see p.37](#)), the widest opening position requested from either sequence will be used to drive the outside air damper. If the **Use Economizer** checkbox is not checked, the outside air damper can still be used for CO₂ control if required.

Note that if no proof of operation of the main supply fan is obtained, the damper fully closes.

5.6.1 - Outdoor Temp Change Over

The economizer's operation is enabled based on the outside air temperature.

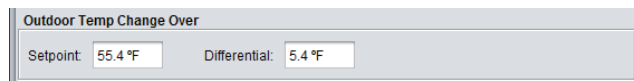


Figure 36 - Economizer Outdoor Change Over Setup

The activation and deactivation of the economizer is determined by a **Setpoint**, with a **Differential** band centered around the setpoint, as follows:

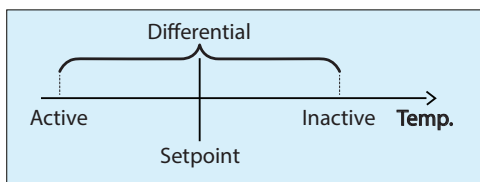


Figure 37 - Economizer Change Over Differential

Below the activation point, the economizer sequence is the first to respond to demands for cooling, taking advantage of the cold outside air. Mechanical cooling can be completely prohibited in this mode, or simply have its activation points pushed back, as determined in the section below [\(5.6.5\)](#).

Above the deactivation point, it is too warm to use the economizer sequence, so the damper will remain at its minimum position, unless there is a call for fresh air due to the CO₂ sequence.

If there is no valid outside air temperature reading, only mechanical cooling will be used, and the economizer will remain at its minimum position.

5.6.2 - Economizer Control

This section determines the operation behind the economizer sequence. The economizer's operation can either be based on damper position or on the supply air temperature.

5.6.2.1 - Damper Position

When the economizer control is set to Damper Position, the controller will drive the outside air damper based on the cooling demand (for **Zoning Heatpump Controllers**, the source of the cooling demand is selected in the Compressor Configuration, [see p.27](#)).

Figure 38 - Economizer Damper Position Setup

Below the **Setpoint**, the damper will remain at its minimum position. As the cooling demand increases past the setpoint, the Damper will open proportionally, until the point where the cooling demand reaches the (**Setpoint + Proportional**), at which point it will be fully open:

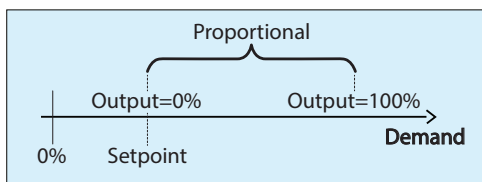


Figure 39 - Economizer Damper Proportional Band

At any point during the operation of the economizer sequence, if the supply air temperature should drop below the prescribed low limit, the damper will move in an attempt to maintain this limit. However, it will not close beyond its minimum position.

Note that if the temperature reading becomes *invalid*, for safety reasons the controller must assume that it is too cold and will close to its minimum, letting mechanical cooling take over.

5.6.2.2 - Supply Temp

When the economizer control mode is set to Supply Temp, the controller will modulate the outside air damper so as to target a specific supply air temperature setpoint. This target supply air setpoint is determined by the overall cooling demand (for **Zoning Heatpump Controllers**, the source of the cooling demand is selected in the Compressor Configuration, [see p.27](#)).

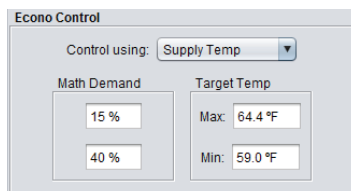


Figure 40 - Economizer Supply Temp Setup

When the cooling demand is below the lowest point on the demand scale (20% in the image above), the economizer sequence is disabled and the damper maintains its minimum position.

As the cooling demand increases into the demand scale's range, the economizer sequence becomes enabled. The target supply temperature will drop proportionally as the cooling demand increases, until it hits the lowest point in the scale, at which point the target supply temperature will stop decreasing.

If the supply air temperature reading becomes *invalid*, the economizer sequence is disabled and the damper will remain at its minimum.



5.6.3 - Damper Setup

The Damper Setup section describes certain basic behaviours of the damper that applies to all economizer sequences.

Damper Setup

Damper Speed: 1

Damper Differential: 1 %

Output Range: 2-10 V

Figure 41 - Economizer Damper Setup

- **Damper Speed:** The speed at which the output voltage will change to reach the desired temperature setpoint (where applicable). Slow this down for increased stability: 1 is slow, 5 is fast. (1 is the default).
- **Damper Differential:** The minimum increment by which the outside air damper can move. Increasing this value can reduce wear and tear on the actuator, but in turn decreases the controller's ability to maintain an accurate temperature setpoint.
- **Output range:** The voltage range that the economizer output will use, which can be either:
 - ▷ 0-10 VDC
 - ▷ 2-10 VDC

5.6.4 - Limits

This section defines the minimum outside air damper position, and when it is to be used.

Limits

Min Damp Position: 20 %

Enable Morning Ventilation Period: 60 min

Figure 42 - Limits Setup

5.6.5 - Mechanical Cooling Setup

This section describes if and how mechanical cooling will be used when the economizer sequence is active.

Mechanical Cooling Setup

Permit Mechanical Cooling with Economizer

Alternative Setpoint of Mechanical Cooling (Stage 1) when Economizer enabled: 75 %

Alternative Differential (Stage 1): 20 %

Figure 43 - Mechanical Cooling Setup



The option to **Permit Mechanical Cooling with Economizer** authorizes the first (and ONLY the first) mechanical cooling stage to function, even when the economizer is active. When this occurs, the mechanical cooling stage will use the alternate setpoint and differential from this section, and not those indicated in the compressor configuration screen.

If this option is NOT selected, then mechanical cooling will not be permitted when the economizer is enabled.

5.7 - CO₂ Control Configuration

This screen is used to control the CO₂ sequence. When the **Enable CO₂ Control** checkbox is checked, the **Heatpump Controller** will use a dedicated analog output to drive an outside air damper for air quality purposes (the same dedicated analog output used in the economizer sequence).

In the case where Economizer control is enabled ([see p.33](#)), the widest opening position requested from either sequence will be used to drive the outside air damper. If the **Use Economizer** checkbox is not checked, the outside air damper can still be used for CO₂ control if required.



Figure 44 - CO₂ Configuration Screen

Note that this screen is unavailable for the C1000 hardware platform.

5.7.1 - Setup

The **Heatpump Controller** will drive the outside air damper based on the detected levels of CO₂:

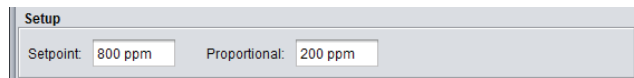


Figure 45 - CO₂ Setup

Below the **Setpoint**, the damper will remain at its minimum position, as defined in the Economizer configuration ([p.34](#)). If no economizer sequence is used, the minimum is then zero. As the CO₂ level increases past the setpoint, the Damper will open proportionally, until the point where the CO₂ reaches the (**Setpoint + Proportional**), at which point it will be fully open:

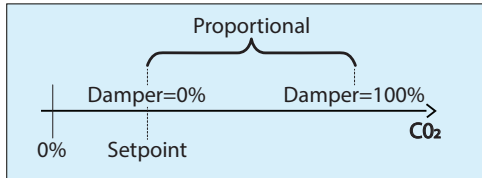


Figure 46 - CO₂ Proportional Band

If the main supply fan is off when the CO₂ level increases past the setpoint, the controller will call for the main supply fan to turn on before opening the damper.

5.7.2 - Limits

There are two sequences that can limit the opening of the damper position during a call for more fresh air.

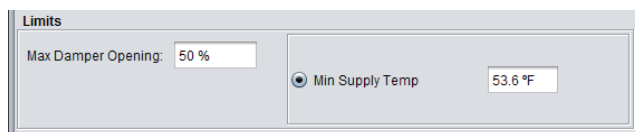


Figure 47 - CO₂ Limits Setup

The **Maximum Damper Opening** position blocks the damper from opening past that point, even when there is a strong CO₂ concentration. It is used to avoid artificially creating a heating demand in the building, with the tradeoff being a slower response time for air quality. It is important to note that this maximum does not affect the economizer sequence, only the CO₂ control sequence.

The outside air damper position can also be limited by **supply air temperature**. When the temperature goes below the limit, the outside air damper will begin to close until the limit is **satisfied**. If there is no valid temperature reading, the damper will remain at the minimum position for system safety concerns.

Both limiting sequences are both applicable at all times. In other words, if the max damper position has been attained and then the supply air gets too cold, the damper will then close until the limit is **satisfied**.

5.8 - Pressure Configuration

This screen is used to setup and control the static pressure of the system. The **Heatpump Controller** can either control a bypass damper or a variable frequency drive to maintain static pressure. **Note** that this screen is unavailable on the C1000 hardware platform.

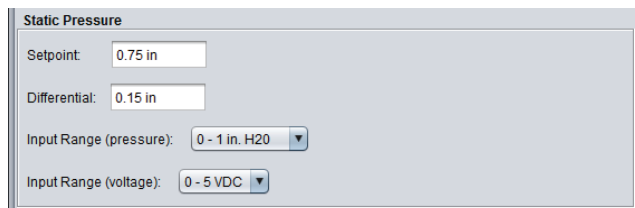


Figure 48 - Static Pressure Setup



The **Heatpump Controller** has an analog output dedicated to pressure control and will slowly make adjustments to the output voltage so as to obtain the static pressure **Setpoint**.

In an effort to preserve the lifespan of the equipment, a **Differential** band is used to define a range, centered on the setpoint, in which the static pressure is acceptable. The pressure must deviate from the setpoint by half the differential before the controller will attempt to compensate for the change. This section also defines the parameters of the static pressure sensor:

- **Input Range (pressure):** These are the available static pressure sensor ranges that the **Heatpump Controller** can work with. Options range from 1 to 2.5 inches of water.
- **Input Range (voltage):** These are the available sensor voltage ranges that the **Heatpump Controller** can work with. The two options are 0-5VDC and 1-5 VDC.

5.8.1 - Bypass Damper Settings

When the **Pressure Control Mode** in the Display Configuration menu ([see p.23](#)) is set to **Bypass Damper**, this section is used to setup its operation.

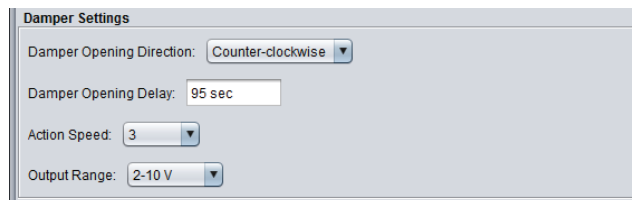


Figure 49 - Bypass Damper Setup

- **Damper Opening Direction:** Sets the direction in which the damper opens (clockwise or counter clockwise)
- **Damper Opening Delay:** This is the amount of time that it takes for the actuator to fully open the damper, starting from a closed position. The actuator's manufacturer specifies this value.
Note that this setting is only useful so as to accurately represent the damper's current position on screen, but is not used in the control sequence.
- **Damper Speed:** The speed at which the output voltage will change to reach the desired pressure setting. Slow this down for increased stability: 1 is slow, 5 is fast. (3 is the default).
- **Output Range:** The **Heatpump Controller's** analog output can work over 3 different voltage ranges:
 - ▷ 0-10V
 - ▷ 2-10V
 - ▷ 2.4-7.5V

Default	95 sec
---------	--------



5.8.2 - Variable Frequency Drive Settings

When the **Pressure Control Mode** in the Display Configuration menu ([see p.23](#)) is set to **Variable Frequency Drive**, this section is used to setup its operation.

The screenshot shows a 'Drive Settings' window with the following fields:

- Action Speed: 3 (dropdown menu)
- Output Range: 2-10 V (dropdown menu)
- Voltage section:
 - Minimum: 3.0 V (text input)
 - Maximum: 10.0 V (text input)
- Hertz section:
 - Display in Hertz (checkbox)
 - Min: 20 Hz (text input)
 - Max: 60 Hz (text input)

Figure 50 - Variable Frequency Drive Setup

- **Action Speed:** The speed at which the controller will react to reach the desired pressure. Slow this down for increased stability: 1 is slow, 5 is fast. (3 is the default).
- **Output Range:** The variable frequency drive output can work over 3 different voltage ranges
 - ▷ 0-10V
 - ▷ 2-10V
 - ▷ 2.4-7.5V
- **Minimum:** Minimum voltage maintained at all times by the **Heatpump Controller** for the Variable Frequency Drive output.
- **Maximum:** Maximum voltage allowed at the terminals of the Variable Frequency Drive on the **Heatpump Controller**.
- **Display in Hertz:** This feature allows you to display the VFD action occurring on the Visualisation page in Hertz instead of in Volts. Hertz units will also be used when applying overrides to the VFD. The minimum and maximum Hertz settings correspond directly to the minimum and maximum voltage. This feature is for display purposes only and does not affect controller operation.

5.9 - Zone Temperature Configuration

If a zone temperature sensor is connected to the **Heatpump Controller**, it will calculate a demand for the attached 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**.

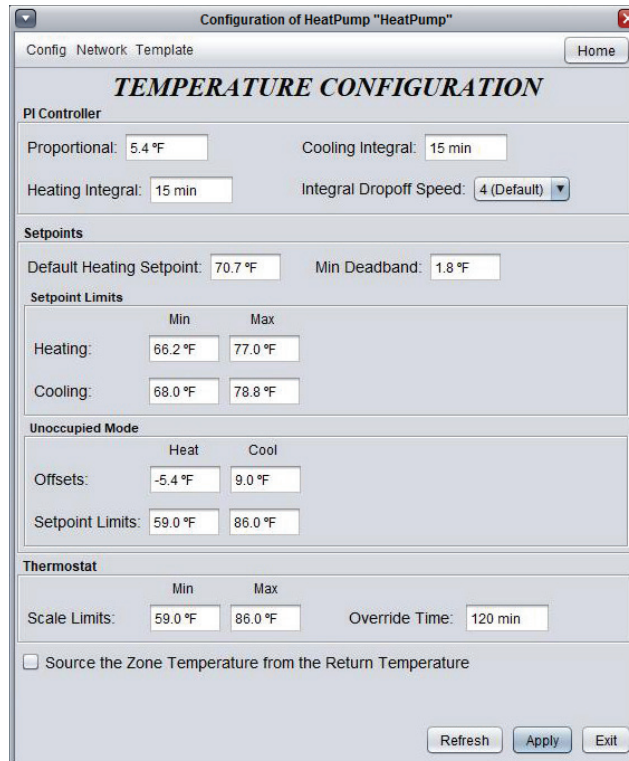


Figure 51 - Zone Temperature Configuration Screen

Source the Zone Temperature from the Return Temperature: Activating this function will replace any zone temperature reading with the current return temperature reading. This can be used to drive the zone demand from the return temperature when there is no temperature sensor in the space. Note that the return temperature reading still continues to serve as the return temperature and can still trigger any associated limits or safeties.

5.9.1 - PI Controller

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

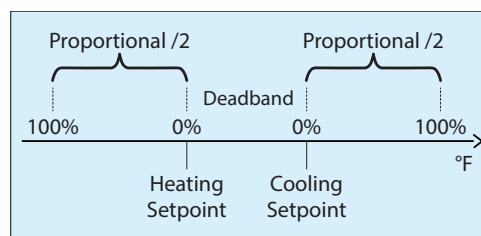


Figure 52 - PI Loop Proportional Band

- **Proportional:** Defines the proportional band used by the *Heatpump Controller* to calculate the proportional component of the demand. 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 min
---------	--------

- **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 min
---------	--------

- **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
---------	---

5.9.2 - 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 Setpoint

Default	68 °F / 20 °C
---------	---------------

- ▷ Maximum Cooling Setpoint

Default	78.8 °F / 26 °C
---------	-----------------



5.9.3 - 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	-5.4 °F / -3 °C
---------	-----------------

▷ Cooling

Default	9 °F / 5 °C
---------	-------------

5.9.4 - 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
---------	---------------

- **Override Time:** This is the amount of time spent in occupied mode once the device is overridden from unoccupied mode using the override button on the thermostat.

Default	120 min
---------	---------

5.10 - Limits Configuration

The Proton **Heatpump Controller** can regulate or subdue the action of many sequences based on various temperature limits.



5.10.1 - Return Air Temperature

Both Cooling and Heating can be limited by the return air temperature:

LIMITS		
RETURN AIR TEMPERATURE		
Stop Cooling when lower than:	57.2 °F (1st Stage)	68.0 °F (2nd Stage)
Stop Heating when higher than:	95.0 °F	

Figure 53 - Return Air Temperature Limits

These limits have a built-in differential bands to prevent short cycling of the equipment should the return temperature fluctuate closely around these limits.

- When the **cooling** limits are tripped, the return temperature must rise back above the limit, plus an additional 3.6°F (2°C) before cooling will be enabled again.
- When the **heating** limits are tripped, the return temperature must drop back below the limit, minus an additional 9°F (5°C) before heating will be enabled again.

Note that the Return Limit for the First Stage of Cooling also applies to the Economizer sequence, causing the outside air damper to return to its minimum position when tripped.

If the Return Air Temperature reading is *invalid*, it is assumed that these limits are *satisfied*.

5.10.2 - Outside Air Temperature

Both Cooling and Heating can be limited by the outside air temperature. The **Preheating** sequence is also enabled based on outside temperature:

OUTSIDE AIR TEMPERATURE		
Stop Cooling when lower than:	-40.0 °F (1st Stage)	53.6 °F (2nd Stage)
Stop Heating when higher than:	86.0 °F	
Enable Preheating if lower than:	53.6 °F	
Restart Fan when lower than:	-40.0 °F	or higher than: 104.0 °F

Figure 54 - Outside Temperature Limits

These limits have a built-in differential bands to prevent short cycling of the equipment should the outside temperature fluctuate closely around these limits.

- When the cooling limits are tripped, the outside temperature must rise back above the limit, plus an additional 3.6°F (2°C) before cooling will be enabled again.
- When the heating limits are tripped, the outside temperature must drop back below the limit, minus an additional 3.6°F (2°C) before heating will be enabled again.



- When preheating is enabled, the outside temperature must rise back above the limit, plus an additional 3.6°F (2°C) before preheating will be disabled.
- The **Fan Restart Sequence** does not have any associated differential band due the fact that the Fan sequence has a built in minimum run time to prevent short cycling.

If the Outside Air Temperature reading is *invalid*, it is assumed that these limits are *satisfied*. **Preheating** is also permitted when the reading is *invalid*.

5.10.3 - Supply Air Temperature

Both Cooling and Heating can be limited by the supply air temperature:

The screenshot shows a control panel titled "SUPPLY AIR TEMPERATURE" with the following settings:

- Stop Cooling stages in succession when lower than: 48.2 °F
- Modulating Heat Limit of Analog Output 1: 104.0 °F (if modulating)
- Stop Heating when higher than: 122.0 °F
- Stop Fan when lower than: 39.2 °F
- Restart at: 53.6 °F

Figure 55 - Supply Air Temperature Limits

These limits have a built-in differential bands to prevent short cycling of the equipment should the supply air temperature fluctuate closely around these limits.

- When the cooling limit is tripped, the supply temperature must rise back above the limit, plus an additional 5.4°F (3°C) before cooling will be enabled again. Cooling stages will turn off while still respecting the Interstage Deactivation Delay ([see Minimum Off Time p.27](#)).
- For the non-modulating heating limit, the supply temperature must drop back below the limit, minus an additional 9°F (5°C) before any heating will be enabled again.

The **Fan Stop Limit** prevents the fan from supplying very cold air into the building, for example if the outside air damper is stuck open and heating is not working. **Note** that this limit will be ignored for a short period of time following a normal activation of the fan. This is simply to give a chance to the heating equipment to heat up the air first.

The Fan Stop Limit is ignored for five minutes after the first activation of the fan. This limit will not be ignored a second time if it is the very reason the fan stopped in the first place.



5.11 - Priority Configuration

The priority configuration page is used to determine how the **Zoning Heatpump Controller** will react when it has equally strong cooling and heating demands coming from its zone controllers.

Please note that since the **Single-Zone Heatpump Controller** cannot communicate with any zone controllers, it will never have conflicting demands, and this screen is therefore unnecessary and unavailable.

Configuration of HeatPump "HeatPump"

Config Network Template Home

PRIORITY

Deadband Between Heating and Cooling: 20 %

PRIORITY MODE

Auto

Outside Temp. : 46.4 °F Differential : 7.2 °F

Manual

Cooling Heating

Refresh Apply Exit

Figure 56 - Priority configuration screen

The first parameter is used to keep heating and cooling actions sufficiently spaced apart in the first place:

- **Deadband between Heating and Cooling:** This specifies a deadband, centered on 0%, in which no heating and no cooling actions will be taken, regardless of the setpoints used in the cooling or heating configuration pages. This value is applied to each math function.



5.11.1 - Priority Mode

A **Zoning Heatpump controller** activates heating or cooling based on the collective demands coming from its zones. The calculation method can actually differ for heating versus cooling ([see Math Configuration p.51](#)), possibly resulting in simultaneous demands strong enough to activate the equipment in both modes. A decision must then be made by the **Zoning Heatpump controller** about which to activate.

The decision in this case can either be determined manually, or based on the outside air temperature. When based on the outside temperature, a differential band centered on the outside temperature setpoint is used to avoid alternating back and forth too quickly between priority modes.

Note that these Priority rules only come into play when there is conflicting heating and cooling demands. If only cooling is calling for action, then the **Zoning Heatpump Controller** will cool without hindrance, even when the priority is set to heating. It will, however, stop cooling should the heating demand become strong enough to activate the heating equipment.

Again, this section is only relevant when heating and cooling are being controlled by the different math functions; otherwise the priority has no importance since a math function cannot produce a heating and cooling demand at the same time.

5.12 - Calibration

This screen allows the user to adjust the controller's various input readings, in case a noticeable offset is observed. Positive or negative values can be entered.

The screenshot shows a software window titled "Configuration of HeatPump 'HeatPump'". The window has a menu bar with "Config", "Network", and "Template", and a "Home" button. The main content area is titled "CALIBRATION" and is divided into two sections: "Temperature" and "Other".

Section	Parameter	Value
Temperature	Supply Temperature Calibration	0.0 °F
	Return Temperature Calibration	0.0 °F
	Outside Temperature Calibration	0.0 °F
	Zone Temperature Calibration	0.0 °F
	Zone Setpoint Calibration	0.0 °F
	Water Supply Calibration	0.0 °F
Other	Pressure Offset	0.0 in
	CO ₂ Calibration	0 ppm

At the bottom right of the window are three buttons: "Refresh", "Apply", and "Exit".

Figure 57 - Calibration Screen

The Zone **Setpoint** value will be added to the setpoint reading received from a wall sensor to calculate the actual heat setpoint. It only applies to sensors with physical scales, such as the T200 or PL-RS wall sensors.



5.13 - Device Properties

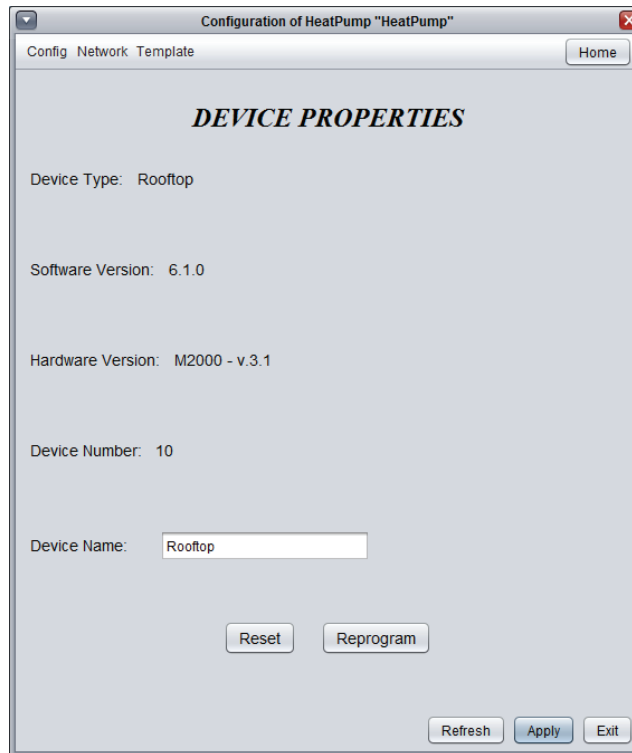


Figure 58 - Device Properties Screen

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” below).
- **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 set 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 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 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 Proton. 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.



6 - Network Menu

A Proton *Master* Controller such as a *Rooftop* or *Zoning Heatpump Controller* manages the Proton *Followers* controllers (VAV Controller, Thermostat, etc.) in its system. It exchanges data with them and this data can be used to calculate math functions, control the occupancy, activate morning warm up functions, and much more. Therefore a proper network configuration is an important element in any zoning system.

6.1 - Device List

This screen displays two different lists of known controllers in the current system, and is mainly used for debugging purposes.

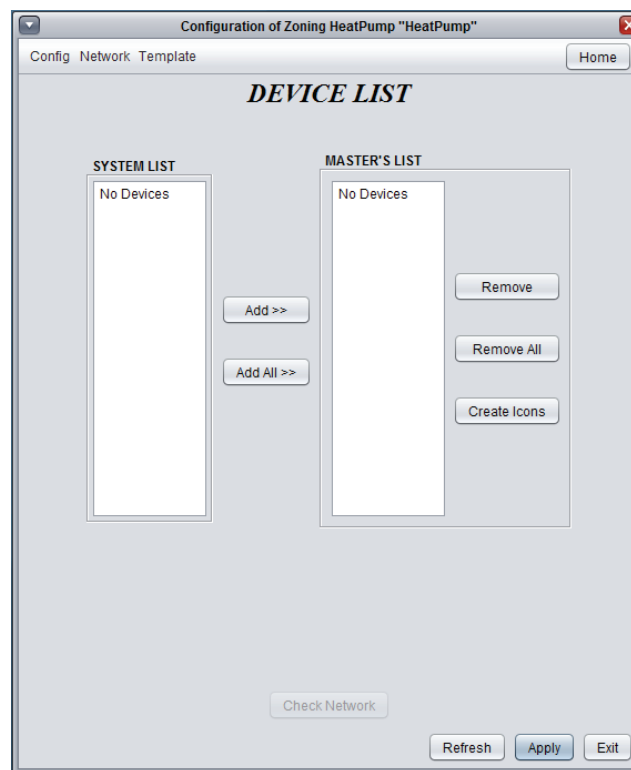


Figure 59 - Device List Configuration Screen

- **System List:** This is simply the list of icons that have been added to the current system in your Focus project. It does not imply that the controllers in this list are functional and communicating. Icons that are currently non-responsive (grey color) will still appear in this list, as long as they appear somewhere on the project screen.
- **Master's List:** This is the list of **Followers** controllers that the **Master** Controller is currently aware of. The master builds this list after a Get List procedure, which occurs periodically or upon user command.

This list can be useful during a job start-up or during troubleshooting, letting you know what controllers the master can detect, highlighting possible sources of problems.



An important note here is that if a follower is not currently on the master's follower list, the master will NOT attempt to communicate with it. This means that the demand of this follower will not be included in any math function calculation, and the follower will not receive the system-shared supply air temperature or occupancy status. In addition, Prolon Focus will NOT be able to communicate with the follower (its icon becomes grey). This is because the master assumes that the follower does not exist and therefore blocks any related network traffic.

When online, updating the master's follower list can be done quickly by simply pressing the "Check Network" button, by right-clicking the master icon and choosing "Get List", or by resetting the **Master** Controller.

Under normal circumstances, both lists should match.

6.1.1 - Buttons

- **Add>>**: Add the selected followers from the system's follower list to the master's follower list. To select a follower, simply click on its name in the list. To select multiple followers, hold CTRL while clicking on their names.
- **Add All>>**: Add all the followers from the system's follower list to the master's follower list.
- **Remove**: Remove the selected followers from the master's follower list. To select a follower to remove, simply click on its name in the list. To select multiple followers, hold CTRL while clicking on their names.
- **Remove All**: Remove all the followers from the master's follower list.
- **Create Icons**: Create Focus icons for each follower in the master's follower list, unless the icon already exists.
- **Check Network**: Causes the master to automatically retrieve the list of followers attached to it. All followers found will be displayed in the "Master's List" box. This function is unavailable offline.



6.2 - Math Functions

This screen is used to configure a Proton **Master's** math functions.

Configuration of HeatPump "HeatPump"

Config Network Template Home

MATH FUNCTIONS

MATH 1
Source: Weighted Average (Cooling Only) Global Group Code

MATH 2
Source: Weighted Average (Heating Only) Global Group Code

MATH 3
Source: Occupancy Global Group Code

MATH 4
Source: Maximum Cooling Global Group Code

MATH 5
Source: Maximum Heating Global Group Code

Poll Rate: List Refresh Rate:

Demand Filter: Unoccupied Mode:

Refresh Apply Exit

Figure 60 - Math functions configuration screen

Besides calculating its own demand, a Proton **Master** will detect and analyze the demand and group codes of all the zone controllers on its network. With the various demands on hand, it calculates the math functions as specified below. The results of these math functions are then applied to the cooling, heating and other functions of the **Master** Controller, as defined by the user.

Note that if the **Master** Controller has its own attached zone temperature sensor, it essentially counts as a individual Zone Controller as well, and will include its own readings in the calculations below.

There are five available math functions to program. For each function, you have the following options:



- **Source:** Each math function can be calculated in one of the following ways:
 - ▷ **Weighted Average:** The weighted average of all the Zone Controllers included in the calculation. The weighted average is calculated by multiplying the demand of each 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 Zone Controllers included in the calculation.
 - ▷ **Max Cooling:** This returns the highest demand of cooling of all the 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 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 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%.
 - ▷ **Radiant Request:** As soon as the radiant cycle percentage of any single one of the participating zones in the math function becomes greater than 0%, the math value goes to 100%. Otherwise it remains at 0%.
- **Global:** When this is selected, ALL Zone Controllers found in the system 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 Zone Controller.
- **Group Code:** When this is selected, ONLY the Zone Controllers belonging to this group are included in the calculation. There are 250 group available, numbered 1 through 250. If weighted average is selected, then the weight will be specified in the Group Codes configuration screen of each Zone Controller. When group codes are not being used, it is automatically set to zero.
- **Poll Rate:** The interval at which this device will retrieve new data from the Zone Controllers on the network. Increase this value to alleviate network traffic.
- **List Refresh Rate:** The interval at which this device will attempt to detect any Zone Controllers on the network. Setting this to zero will disable list refreshing.
- **Demand Filter:** The demand filter is used to limit the rate of change of the math functions. When a math value changes, it is first compared to its previous value. The difference between the two is multiplied by the demand filter and added to the previous value. Example:
 - ▷ Demand Filter = 30%
 - ▷ Previous math value = 50%
 - ▷ Desired math value = 75%
 - ▷ Final math value = $(75-50) \times 30\% + 50 = 57.5\%$Therefore, instead of the math value suddenly jumping from 50% to 75% in the span of 1 second, it will instead jump to 57.5 % and gradually reach the 75% mark.

Note that the demand filter is not applied if the difference between the previous math value and the desired math value is equal or less than 3%.
- **Unoccupied Mode:** This option can 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 followers (cooling and heating), priority is used to decide between them ([see p.47](#)).
 - > “Weighted Average (Cooling Only)” is replaced by “Maximum Cooling”
 - > “Weighted Average (Heating Only)” is replaced by “Maximum Heating”
 - ▷ **Normal:** Math functions will be calculated the same way, regardless of occupancy.



6.3 - Group Codes

Group #	Weight
0	0
0	0
0	0
Global	1

Figure 61 - Group Codes Screen

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

- **Group #:** A group that the **Zoning Heatpump Controller** belongs to. When this is set to zero, the **Zoning Heatpump Controller** does not participate in a group.
- **Weight:** The weight of the **Zoning Heatpump Controller** in the selected group. Used in weighted average calculations. Setting this to zero removes it from the group.
- **Global Weight:** The weight of the **Zoning Heatpump Controller** in the global group. Used in weighted average calculations. Setting this to zero removes it from the global group.



6.4 - COM Port Settings

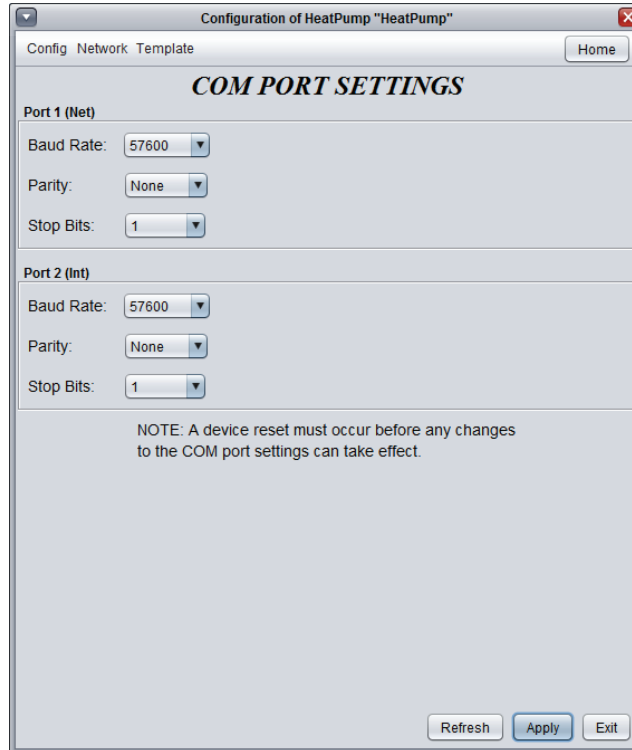


Figure 62 - COM Port Configuration Screen

Changes to the settings in this section will only take effect once the **Heatpump Controller** is reset or has power cycled. Each port on the **Heatpump 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 **Heatpump 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 **Heatpump 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.



6.5 - Weekly Schedule

	Sun	Mon	Tue	Wed	Thu	Fri	Sat	Holiday
ON	-	7:00 AM	7:00 AM	7:00 AM	7:00 AM	7:00 AM	-	-
OFF	-	-	-	-	-	-	-	12:00 AM
ON	-	-	-	-	-	-	-	-
OFF	-	-	-	-	-	-	-	-
ON	-	-	-	-	-	-	-	-
OFF	-	-	-	-	-	-	-	-
ON	-	-	-	-	-	-	-	-
OFF	-	6:00 PM	6:00 PM	6:00 PM	6:00 PM	6:00 PM	-	-

Copy/Paste

Copy from: Choose a day to copy...
--- Paste To ---
 Sunday Monday Tuesday Wednesday
 Thursday Friday Saturday Holiday
Paste

NOTE: If a schedule has already been set for this device in a Network Scheduler, the schedule from the Network Scheduler will have priority.

Refresh Apply Exit

Figure 63 - Weekly Routines Screen

This screen is used to configure weekly occupancy schedules.

- **Weekly Schedule Grid:** The Weekly Schedule Grid defines the weekly occupancy routine of the Heatpump.
- **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.

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).

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



6.6 - Holiday Calendar

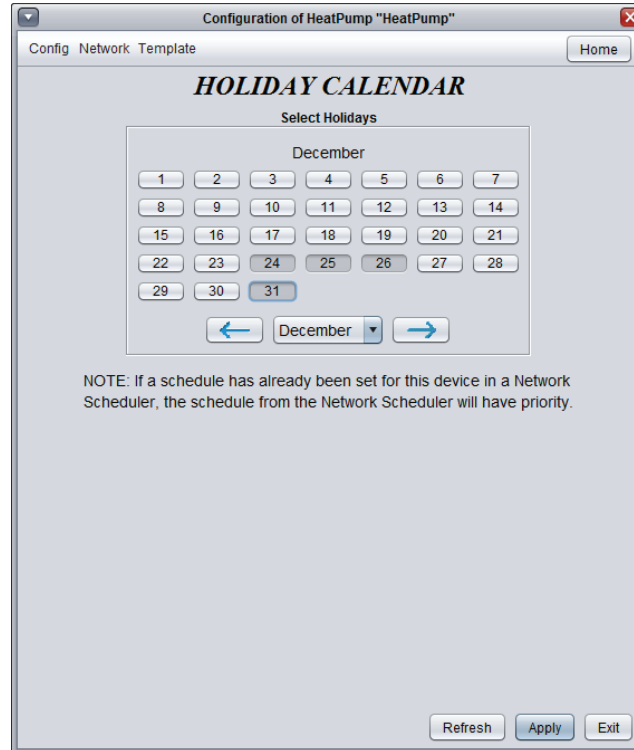


Figure 64 - Holiday Calendar Screen

This screen is used to define which dates count as holidays, so that the normal daily schedule can be replaced by an alternate, special holiday schedule. The holiday calendar does not automatically recognize floating holidays (Labor Day, Memorial Day, etc.) and thus must be adjusted annually.

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 flip through the different months by clicking on the arrows at the bottom or by simply choosing the desired month from the drop down list of months.



6.7 - BACnet Configuration

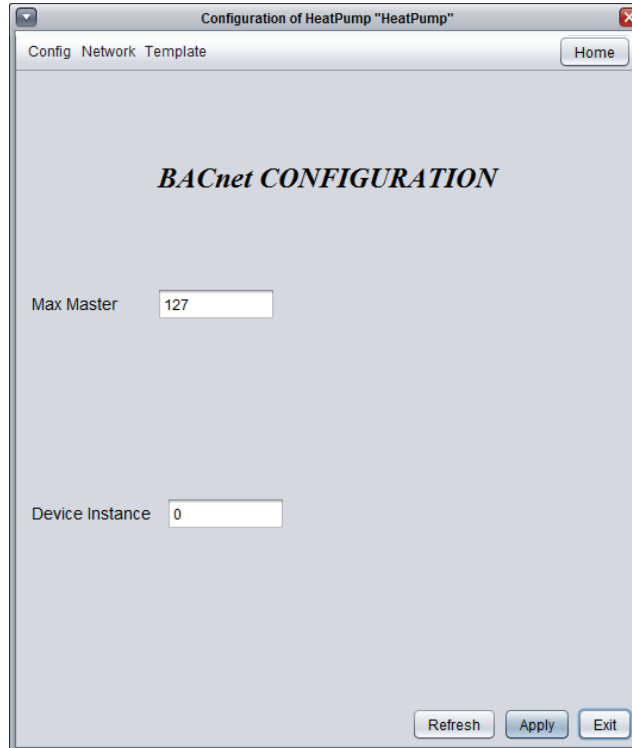


Figure 65 - BACnet configuration screen

The Proton **Zoning Heatpump Controller** can communicate over BACnet MS/TP. This screen is used to configure the parameters that are exclusive to the BACnet protocol.

This screen cannot be accessed if the **Zoning Heatpump 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 (Proton or other) while performing the "Poll For Masters" operation.
- **Device Instance:** The unique BACnet identification number of this device on the network. By setting this value to 4194303 (BACnet *invalid*), the **Zoning Heatpump Controller** will instead use its own RS485 network address as the BACnet Device Instance ([see Assigning Addresses, p.10 for more details](#)).



6.8 - Other

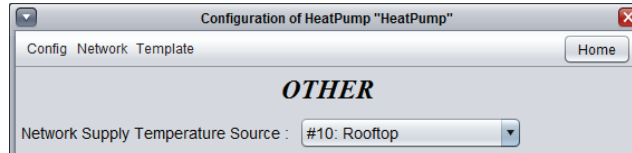


Figure 66 - Network Supply Temperature Source

This screen contains various settings and sequences that require the participation of zone controllers in the system.

Network Supply Temperature Source

This option is used to define which controller is the source of the supply air temperature reading for the system. The **Zoning Heatpump Controller** retrieves this reading from the device and distributes it to all other controllers.

Any controller that already has its own supply temperature sensor will use the reading from its own attached sensor and ignore the one received from the **Zoning Heatpump Controller**. By default, this is set to distribute the **Zoning Heatpump Controller's** supply air temperature reading.

6.8.1 - Morning Warm Up Sequence

The Morning Warm Up Sequence is used to temporarily disable the outputs on selected zone controllers upon a transition to Occupied Mode. This is an interesting way to obtain considerable energy savings by relegating morning heating demands to the **Master** Controller, instead of using terminal heating on top of the **Master's** own heating.

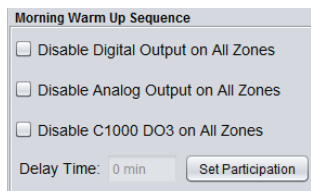


Figure 67 - Morning Warm Up Sequence

Upon a transition from unoccupied to occupied (but not including those which occur due to manual overrides), the **Master** Controller commands all participating zones controllers to disable the selected outputs for the amount of time specified. Participating zones in this sequence are selected via the Set Participation button.

For C1000 VAV Controllers, the Digital output corresponds to Output 4, and the Analog Output corresponds to Output 5.



6.8.2 - Cooling Priority Zones

When a zone is specified as a cooling priority zone, the **Master** will use the cooling demand of that zone to drive the cooling sequence, as long as the demand of that zone is greater than the math output normally assigned to cooling.

Cooling Priority Zones

Zone 1: #3: Zone

Zone 2: None

Zone 3: None

Allow Second Compressor Stage

Figure 68 - Cooling Priority Zones

A maximum of three high-priority cooling zones may be selected. This feature can be very useful for conference rooms, which under most circumstances are empty and without cooling demand. But once that room fills with occupants, it can effectively drive the cooling in the **Master** Controller.

Note that this sequence takes priority over heating, even if heating normally has priority ([see p.48](#)).

WARNING: This sequence should only be used by experienced building automation specialists.

6.8.3 - Outside Temperature Override

This function commands the selected zone controllers to set their outputs to a minimum specified value under certain outside temperature conditions. These overrides can be activated when the outside temperature is either greater or less than a given setpoint:

Outside Temperature Overrides

If temp is less than -4.0 °F

If temp is greater than 80.0 °F

set Digital Output to 40 % (minim)

set Digital Output to 0 % (minim)

set Analog Output to 0 % (minim)

set Analog Output to 0 % (minim)

set C1000 DO3 to: 0 % (minim)

set C1000 DO3 to: 0 % (minim)

Set Participation

Set Participation

Figure 69 - Outside Temperature Override

This can be useful to force particular zone controllers to activate their heating outputs in anticipation of a strong heating demand due to cold outside temperatures, for example, during unoccupied mode. Participating zones in this sequence are selected via the Set Participation button.

For modulating or pulsing outputs, the override only acts as a minimum in this case: the overridden output can still increase its action if called to.

For ON/OFF differential outputs, only an override of 100% will activate that output. Otherwise it will remain off.



Alternatively, in the special case where the **override is set to zero**, the output will instead remain deactivated for the duration of the override. This can be useful to ensure that heating outputs stay off during warmer seasons.

For C1000 VAV Controllers, the Digital output corresponds to Output 4, and the Analog Output corresponds to Output 5.

6.8.4 - Zone Damper Override

This function commands all VAV zones to the desired position.

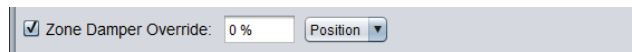


Figure 70 - Zone Damper Override

This function is useful during air balancing procedures. The available modes are:

- **Position:** Dampers simply go to the desired position.
- **Flow:** For pressure independent zone controllers, the damper will move to target a flow reading determined by the override percentage, using its minimum and maximum air flow setpoints as a scale.
- **Min:** Dampers go to their minimum position if pressure dependent, or their minimum flow setpoint if pressure independent. The override value is not used.
- **Max:** Dampers go to their maximum position if pressure dependent, or their maximum flow setpoint if pressure independent. The override value is not used.

For example, if the minimum flow setpoint for a VAV Zone Controller is 100 CFM, and the maximum flow setpoint is 200 CFM, and the override is set to 75%, then the VAV controller will target 175 CFM.

This parameter will be lost if the master loses power or is reset.



6.9 - Template Menu

6.9.1 - Save as Template

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

6.9.2 - Load Template...

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