PROLON

FOCUS GUIDE

FLEXIO

Configuration Guide for Prolon Focus Software

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1 - Prolon FlexIO Controller

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

The Prolon series FlexIO is a general purpose HVAC controller whose inputs and outputs can be individually configured for use in various applications. Unlike most Prolon controllers, the FlexIO is not aimed at a specific HVAC sequence or piece of equipment, and instead can be used to perform any outlying functions that are not usually covered by existing Prolon devices. Outputs can be configured to respond to a variety of standard HVAC input signal types, ranging from temperatures, pressure, gas and more.

1.1 - Hardware Variations

The Prolon series FlexIO Controller is a general purpose controller whose inputs and outputs can be individually configured for use in various applications. The controller is offered in two hardware models, offering the user the choice of expanded functionality versus targeted pricing.

The sequences are identical between both hardware platforms, and are only differentiated by the physical constraints of the chosen hardware. This guide will underline these differences whenever they apply. Please see each platform's HARDWARE GUIDE for more information:

M2000 → 9 Analog Inputs / 5 Digital Outputs / 3 Analog Outputs / Real-time Clock

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

2 - Networking

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

2.1 - Shared Information

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

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

The Prolon Network Controller is a special case, as it acts as a link between all Master Controllers, so it will be treated in a class on its own.

The following table summarizes the information shared between FlexIO Controllers, Prolon Master Controllers, and the Prolon Network Controller. This information is exchanged approximately every three seconds for Master Controllers, and every ten to thirty seconds for the Network Controller. If the information stops being received, it will be declared invalid after 180 seconds.

	Automatically received from Master	Can be received from NC (Configurable)	Can send to NC (Configurable)
Outside Temperature	X	X	X
Supply Air Temperature	X		
Results of Math Functions (5)	X		
Default Occupancy Status	X	X	
Fan Status	X		
Additional Occupancy States (4 for C1050, 7 for M2000)		X	
Supply Water Temperature	X	X	X

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

DESCRIPTION

- **Outside Air Temperature**: The outside air temperature will automatically be shared from the Master Controller to the FlexIO Controllers. A Network Controller can also be configured to share the outside temperature with a FlexIO Controller should a Master Controller not be present. In the case where both are present, the last received outside temperature value will be used. The outside temperature can be used for automatic output overrides.

- **Supply Air Temperature**: The supply air temperature will automatically be shared from the Master Controller to the FlexIO Controllers.

- **Results of Math Functions**: A Master Controller is continuously calculating the overall demand of the building using configurable mathematical operations, in a process called Flexi-Zone. The results of these functions can be redistributed to FlexIO Controllers to control their outputs. This effectively allows a FlexIO controller to control an output based on that of the average demands of other controllers in the building.

- **Fan status**: The supply fan status will automatically be shared from the Master Controller to the FlexIO Controllers.

- **Default Occupancy Status**: The occupancy status will automatically be shared from the Master Controller to the FlexIO Controllers. A Network Controller can also be configured to share the occupancy status with FlexIO Controller should a Master Controller not be present. In the case where both are present, the occupancy status received from the Network Controller will take priority.

- **Additional Occupancy States**: The Network Controller can share additional occupancy states to the FlexIO Controller. In addition to the default occupancy status above, the FlexIO can, in total, retain up to one occupancy state for each available output:

  - M2000: 8 Occupancy states
  - C1050: 5 Occupancy states

  Any single occupancy state can be used to govern the over all occupancy status of the FlexIO Controller, and/or can be used to control individual outputs. This feature can be used for versatile lighting control or other schedule-based control sequences.

- **Supply Water Temperature**: The supply water temperature will automatically be shared from the Master Controller to the FlexIO Controllers. A Network Controller can also be configured to retrieve or share the supply water temperature with a FlexIO Controller should a Master Controller not be present. In the case where both are present and transmitting a reading to the FlexIO, the last received supply water temperature value will be used.

3 - Adding a FlexIO Controller to a Focus Project

Prolon Focus is a free visualization and configuration software for all Prolon controllers. Once the FlexIO 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 FlexIO 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 - Master Get List

If the FlexIO 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":

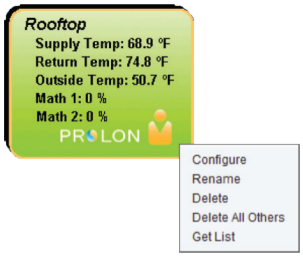

Figure 1 - Master Get List

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

3.2.2 - New FlexIO Controller Button

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

Figure 2 - New FlexIO Button

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

4 - FlexIO Controller Icon

Each FlexIO Controller added to your system has its own icon. Each icon can display data about the FlexIO Controller device it represents, and this data is updated regularly.

The data displayed on the icon is selectable. The icon's color can be also configured to change based on any output that the user selects. These icon settings can be modified in the Icon Setup Screen *(p.14)*.

Figure 3 - FlexIO Icon

You can open the configuration screen for a FlexIO Controller by double-clicking on its icon. If the FlexIO Controller is off-line, all data values will show "N/A" (not applicable).

4.1 - Icon Right-Click

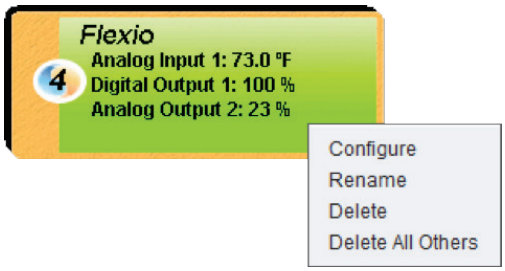

Figure 4 - FlexIO Right-Click

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

To view the configuration of a FlexIO 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 FlexIO Controller Home Screen to transfer you to its corresponding page.

5.1 - FlexIO Controller Home Screen

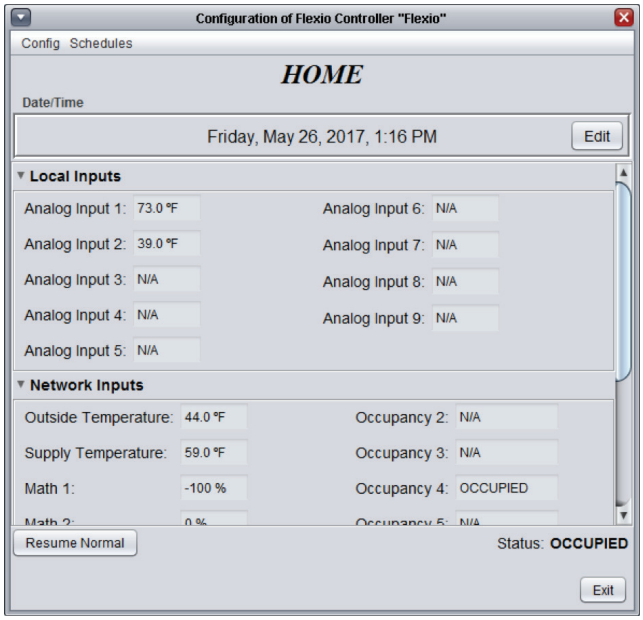

Figure 5 - FlexIO Home Screen

This screen shows the status of all inputs and outputs of the FlexIO Controller. All values will be "N/A" (Not Applicable) when offline.

Note that this screen will vary depending on the sequences and display choices that are selected.

There are three sections in the FlexIO Controller Home Screen: Local Inputs, Network Inputs and finally, Outputs. Each section can be minimized on screen.

5.1.1 - Local Inputs

The Local Inputs section displays the readings from all physical inputs that are currently enabled on the FlexIO Controller. They are initially given default names which you may edit as desired. They also display in the unit/measurement of your choice ***(see Inputs Setup screen p.15 for more details)***.

Note that if an Input's mode is set to "Off", it will not be displayed on the Home Screen.

5.1.2 - Network Inputs

The Network Inputs section displays the readings from all data received over the network, from sources such as a Network Master or Network Controller. ***See Shared Information section on p.6 for more details.*** When a particular reading has not been provided over the network, it will be displayed as N/A.

5.1.3 - Outputs

The Outputs section displays the status of all physical outputs that are currently enabled on the FlexIO Controller. By default, all outputs are initially disabled. The name and configuration of each output is editable ***(see Output Setup p.21 for more details)***.

Note that if an Output's source is set to "Off", it will not be displayed on the Home Screen.

5.1.4 - Date/Time *(M2000 Only)*

The Prolon FlexIO Controller has an internal real time clock (unavailable on the C1050 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 6 - Date/Time Display

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 FlexIO 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.

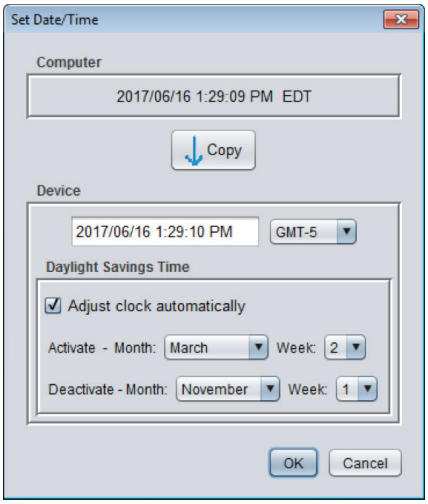

Figure 7 - Edit Date/Time

5.1.5 - Status

This reading displays the occupancy status of the FlexIO Controller. The occupancy state is determined by the Occupancy Source variable, found on *p.21*.

5.1.6 - Quick Jumps

On the Home Screen, you can simply double-click the name of any local input or output to be instantly directed to the configuration of the clicked item. A red contour will surround the name if this feature is available.

5.1.7 - Manual Override

On the Home Screen, you can manually override any available output by right-clicking its name. A pop-up menu will appear if this feature is available.

Note: Overrides are unavailable in Offline mode.

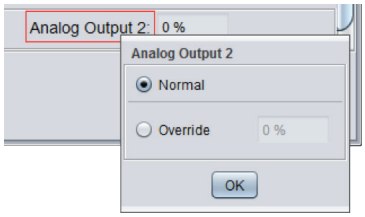

Figure 8 - Override Pop-up

- **Override**: Selecting the "Override" button will allow the user to manually override the selected output until the normal mode is resumed.

  When an override is applied to an output, the associated text will be displayed in bold and start to blink.

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

  All overrides are cancelled when the FlexIO Controller is reset or loses power.

- **Normal**: Selecting the "Normal" button will revert the selected output back to its normal automatic behavior. The override will be disabled.

5.1.8 - Resume Normal Button

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

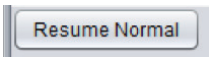

Figure 9 - Resume Normal Button

5.2 - Icon Setup

5.2.1 - Info

This screen is used to select and configure how the FlexIO's main icon will be displayed in Focus.

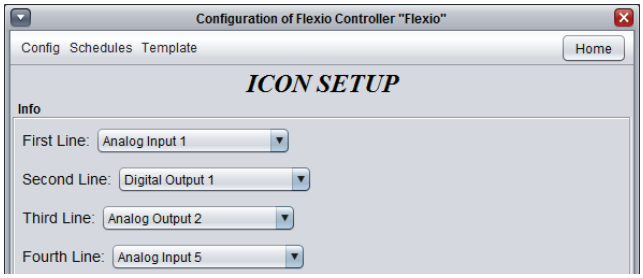

Figure 10 - Icon Info Setup

This section lets you select which data is to be shown on the FlexIO's icon. The icon can display up to four different pieces of information. The information shown can be any of the following:

- the reading from any enabled Local Input
- the active occupancy
- any network input
- the status of any enabled Output

5.2.2 - Color

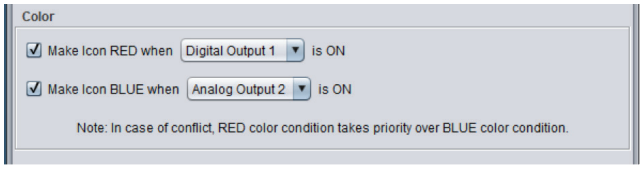

Figure 11 - Icon Color Setup

This section defines the conditions under which the FlexIO's main icon will turn red or blue. The conditions are based on the status of the physical outputs. Icon colors can be useful by making the user aware of important changes to the outputs from just a quick glance.

In the event where both red and blue conditions are satisfied, the red color will be shown. If neither condition is satisfied, the icon will be green. Finally, if there is no communication to the FlexIO controller, or in offline mode, the icon will be grey.

5.3 - Inputs Setup

The screen is used to setup how the physical analog inputs make measurements. The analog inputs can operate on a wide range of signals types and measurement units. Any input can be used in any mode, however some physical configuration may be required on the controller itself (jumper setup). Please see each hardware platform's respective guide for more information.

5.3.1 - Temperature

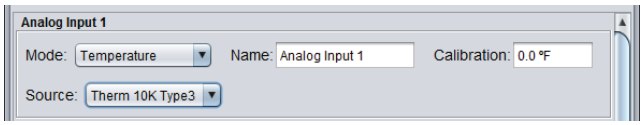

Figure 12 - Temperature Input Mode

This mode can be used to take the measurement of temperature. The input source can be set to:

- 10K type 3 thermistor, valid for reading temperatures -58 to 212°F (-50 to 100°C).
- Various voltage ranges (0-5, 1-5 or 0.5-4.5 VDC)
- Various current ranges (4-20mA or 0-20mA)

For the voltage and current sources, you have the liberty of specifying the minimum and maximum temperature values that the sensor provides. The temperature readings can be calibrated using the calibration field.

5.3.2 - Contact Mode

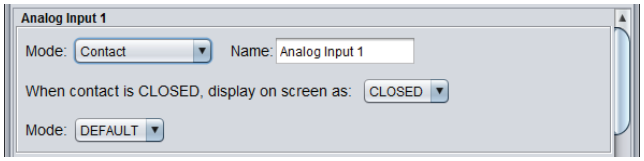

Figure 13A - Contact Input Mode

In Contact mode, the input will determine whether or not it has been shorted to common (contact closed) or if it is still floating (contact open). You can instruct Focus to display a closed contact status with any of the following labels: CLOSED, ON, OFF, YES, NO. When the contact is open, the logical opposite will be displayed.

There are 3 modes for the Contact input

- **DEFAULT**: The input will remain in a closed contact state only so long as the input remains shorted to common.
- **HOLD**: The input will remain in a closed contact state for the specified delay, starting from the moment the input is initially shorted to common. The delay does not restart if the input is shorted again in the middle of the delay period. This is useful in cases where a momentary push button is required to activate outputs for a specified amount of time.

NOTE: When the hold delay expires, the input state will flip to OPEN, even if the contact is still physically closed. The contact needs to physically open again to reset the sequence.

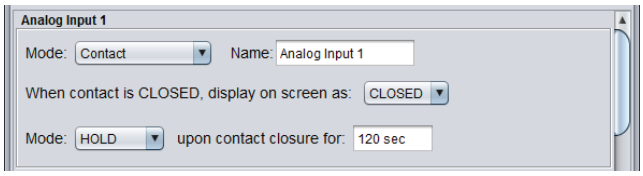

Figure 13B - Contact Input Mode "HOLD"

- **TOGGLE**: The input acts as a toggle switch. A momentary short to common will close the contact and it will remain so until a second momentary short to common occurs, at which point the contact switches to an open state. This is useful in cases where a momentary push button is required to act as a "Start/Stop" button.

- **With Failsafe delay**: This option allows the contact input to revert back to an open state after a specified amount of time. This is useful in cases where a "Start/Stop" button is required, but the "Stop" action is required to be taken after a specified amount of time, hence acting as a safety protection.

NOTE: When the failsafe delay expires, the input state will flip to OPEN, even if the contact is still physically closed. The contact needs to physically open again to reset the sequence.

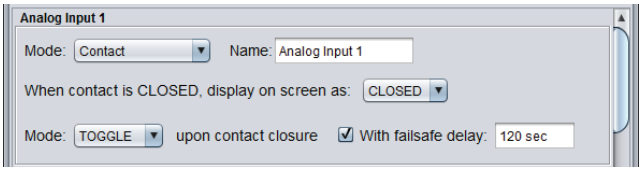

Figure 13C - Contact Input Mode "TOGGLE"

5.3.3 - Pressure

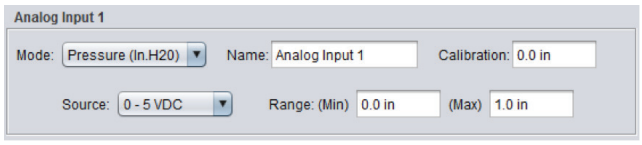

Figure 14 - Pressure Input Mode

There are three pressure measurement modes, one for Inches of Water, one for PSI (pounds per square inch), and one for Pa (Pascals). Choose the one that matches your sensor.

The input source can be set to various voltages ranges (0-5, 1-5 or 0.5-4.5 VDC) or various currents (4-20mA, 0-20mA). You then have the liberty of specifying the minimum and maximum pressure values that the sensor provides (negative pressure readings are allowed).

Finally, a calibration field is available to make adjustments to the reading as necessary.

5.3.4 - Gas Mode

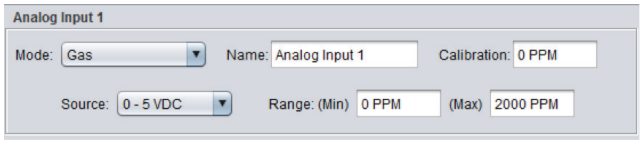

Figure 15 - Gas Input Mode

There are two gas concentration measurement modes, one for parts per million (PPM), and one for parts per billion (PPB). The input source can be set to various voltages ranges (0-5, 1-5 or 0.5-4.5 VDC) or various currents (4-20mA, 0-20mA). You then have the liberty of specifying the minimum and maximum PPM/PPB values that the sensor provides.

Finally, a calibration field is available to make adjustments to the reading as necessary.

5.3.5 - Humidity

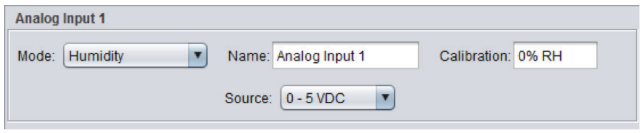

Figure 16 - Humidity Input Mode

This mode is used to measure the relative humidity percentage. The input source can be set to various voltages ranges (0-5, 1-5 or 0.5-4.5 VDC) or various currents (4-20mA, 0-20mA).

A calibration field is also available to make adjustments to the reading as necessary.

5.3.6 - Volts

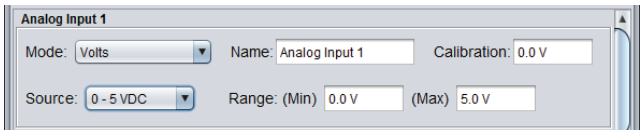

Figure 17 - Volts Input Mode

This mode is used to measure any voltage. The input source can be set to various voltages ranges (0-5, 1-5 or 0.5-4.5 VDC) or various currents (4-20mA, 0-20mA). You then have the liberty of specifying the minimum and maximum voltage or current values that the sensor provides.

A calibration field is also available to make adjustments to the reading as necessary.

5.3.7 - Current *(A and mA)*

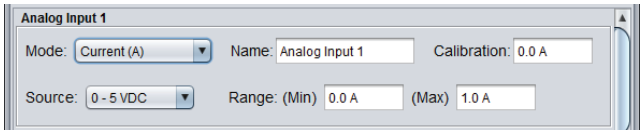

Figure 18 - Current Input Mode

There are two current measurement modes, one for amps, and one for milliamps. The input source can be set to various voltages ranges (0-5, 1-5 or 0.5-4.5 VDC) or various currents (4-20mA, 0-20mA). You then have the liberty of specifying the minimum and maximum voltage or current values that the sensor provides.

A calibration field is also available to make adjustments to the reading as necessary.

5.3.8 - Frequency *(Hz)*

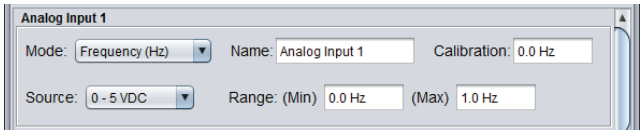

Figure 19 - Frequency Input Mode

This mode is used to measure any frequency (Hz). The input source can be set to various voltages ranges (0-5, 1-5 or 0.5-4.5 VDC) or various currents (4-20mA, 0-20mA). You then have the liberty of specifying the minimum and maximum voltage or current values that the sensor provides.

A calibration field is also available to make adjustments to the reading as necessary.

5.3.9 - Power *(kW)*

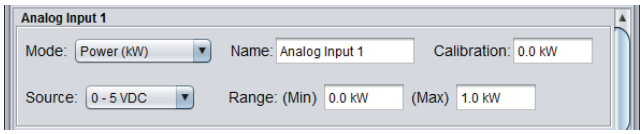

Figure 20 - Power Input Mode

This mode is used to measure power (kW). The input source can be set to various voltages ranges (0-5, 1-5 or 0.5-4.5 VDC) or various currents (4-20mA, 0-20mA). You then have the liberty of specifying the minimum and maximum voltage or current values that the sensor provides.

A calibration field is also available to make adjustments to the reading as necessary.

5.3.10 - Flow *(CFM, GPM and L/s)*

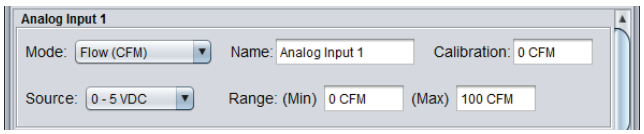

Figure 21 - Flow Input Mode

There are three flow measurement modes, one for CFM (cubic feet per minute), one for GPM (gallons per minute), and one for L/s (liters per second). The input source can be set to various voltages ranges (0-5, 1-5 or 0.5-4.5 VDC) or various currents (4-20mA, 0-20mA). You then have the liberty of specifying the minimum and maximum voltage or current values that the sensor provides.

A calibration field is also available to make adjustments to the reading as necessary.

5.3.11 - Velocity *(FPM and m/s)*

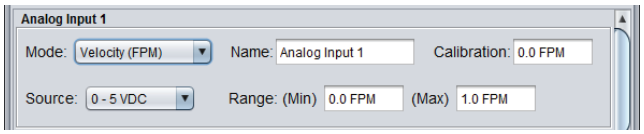

Figure 22 - Velocity Input Mode

There are two velocity measurement modes, one for FPM (feet per minute) and one m/s (meters per second). The input source can be set to various voltages ranges (0-5, 1-5 or 0.5-4.5 VDC) or various currents (4-20mA, 0-20mA). You then have the liberty of specifying the minimum and maximum voltage or current values that the sensor provides.

A calibration field is also available to make adjustments to the reading as necessary.

5.3.12 - Speed *(RPM)*

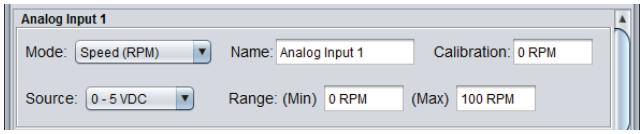

Figure 23 - Speed Input Mode

This mode is used to measure speed (RPM). The input source can be set to various voltages ranges (0-5, 1-5 or 0.5-4.5 VDC) or various currents (4-20mA, 0-20mA). You then have the liberty of specifying the minimum and maximum voltage or current values that the sensor provides.

A calibration field is also available to make adjustments to the reading as necessary.

5.3.13 - Level *(in, ft, m and mm)*

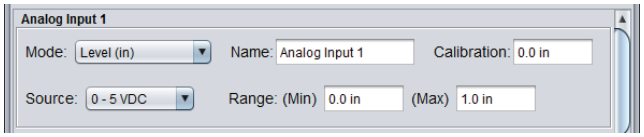

Figure 24 - Level Input Mode

There are four level measurement modes, one for inches (in), one for feet (ft), one for meters (m) and one for millimeters (mm). The input source can be set to various voltages ranges (0-5, 1-5 or 0.5-4.5 VDC) or various currents (4-20mA, 0-20mA). You then have the liberty of specifying the minimum and maximum voltage or current values that the sensor provides.

A calibration field is also available to make adjustments to the reading as necessary.

5.3.14 - Percentage *(%)*

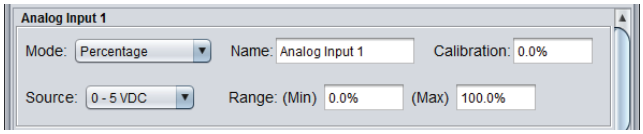

Figure 25 - Percentage Input Mode

This mode is used to measure a percentage (%). The input source can be set to various voltages ranges (0-5, 1-5 or 0.5-4.5 VDC) or various currents (4-20mA, 0-20mA). You then have the liberty of specifying the minimum and maximum voltage or current values that the sensor provides.

A calibration field is also available to make adjustments to the reading as necessary.

5.3.15 - No Unit

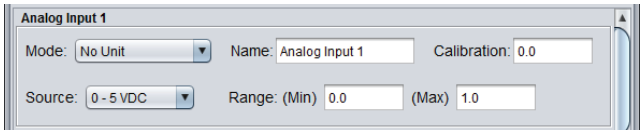

Figure 26 - No Unit Input Mode

This mode is used to measure a signal without any unit. The input source can be set to various voltages ranges (0-5, 1-5 or 0.5-4.5 VDC) or various currents (4-20mA, 0-20mA). You then have the liberty of specifying the minimum and maximum voltage or current values that the sensor provides.

A calibration field is also available to make adjustments to the reading as necessary.

5.3.16 - Outside Temperature Source

The FlexIO controller makes use of the outside temperature reading to perform automatic overrides on the outputs. However, it is first necessary to specify to the FlexIO *which* input is the source of the outside temperature reading, or if it should use a network-provided reading instead.

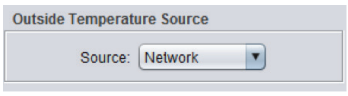

Figure 27 - Outside Temperature Source Selection

This list will be populated with any analog inputs that are set to **Temperature** mode, as well as one extra entry for the network provided outside temperature reading.

5.3.17 - Occupancy Source

The FlexIO controller makes use of the occupancy status to perform automatic overrides on the outputs. However, it is first necessary to specify to the FlexIO *which* input is the source of the occupancy status, or if it should use a network provided status, or finally if it should use its own internal schedule to determine occupancy.

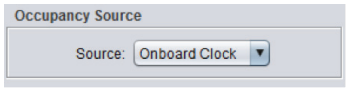

Figure 28 - Occuppancy Source Selection

This list will be populated with any inputs that are set to **Contact** mode, as well as with entries for each of the network provided occupancy statuses, and finally one more for the onboard clock.

5.4 - Output Setup Screens

These screens setup how the physical outputs are used. The outputs can operate in many different modes, based on wide range of source data.

Both FlexIO hardware platforms offer digital outputs, analog outputs and virtual outputs. The Digital Outputs are 24VAC triac outputs that can operate in ON/OFF or pulse modes. The Analog Outputs, which can also operate in ON/OFF or pulse mode, additionally offer 0-10 VDC voltage modulation as well as customizable voltage range modulation. The Virtual Outputs do not physically exist and are only used for the logical purposes related to output binding.

5.4.1 - Source

The first step in setting up an output in a FlexIO controller is to set its source data. The source data is the basis on which the output will react. The source can be any of the Local Inputs, the Outputs, the Network Variables, the Occupancy status, or can be used as a Backup *(see p.25 for details)*.

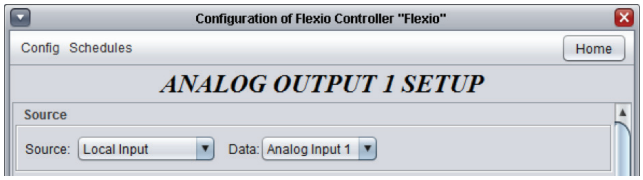

Figure 29 - Output Sources Selection

The Local Inputs correspond to the same ones described in Inputs Setup from *Section 5.3*. Any Output, virtual or not, can be used as a source to drive the action of another Output. The Network Variables are those received from a network master device (when available), and corresponds to the same information in the *Shared Information section of p.6*.

The Occupancy status is determined from the Occupancy Source drop down list, found in the *Inputs Setup section on p.15*.

Finally, the Backup option is explained in detail in the *5.4.8 section on p.25*.

5.4.2 - Setup

This section defines how the output should respond to the chosen source.

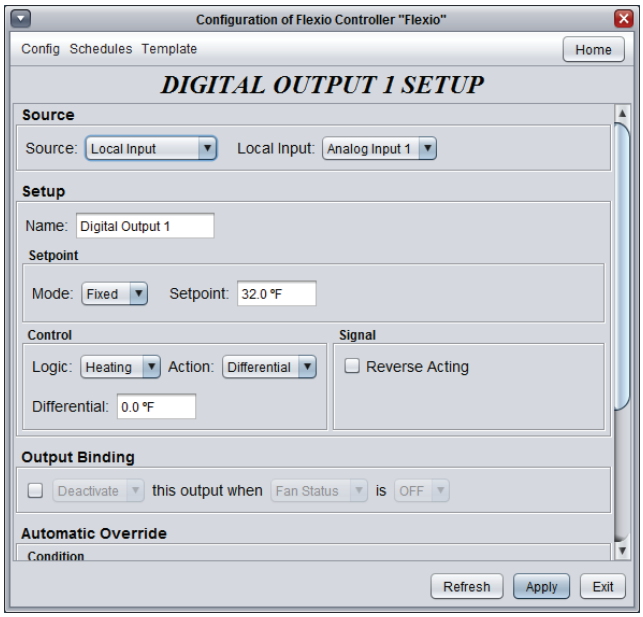

Figure 30A - Output Setup (Fixed Setpoint Mode)

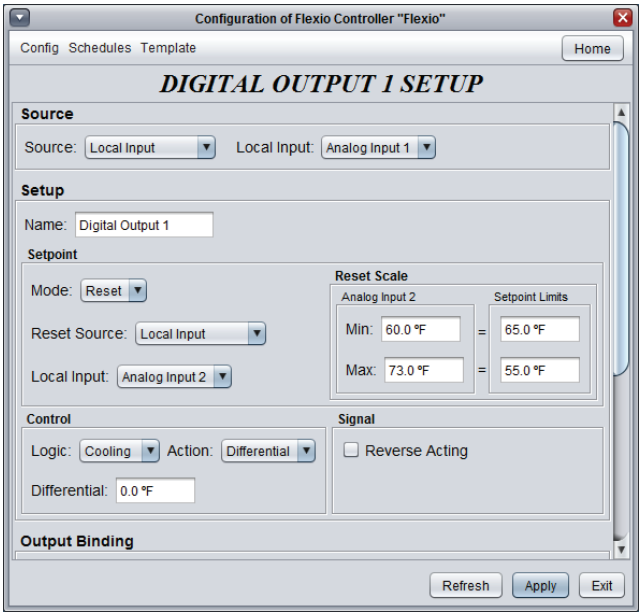

Figure 30B - Output Setup (Reset Setpoint Mode)

Mode
FlexIO outputs can be configured for two setpoint modes:

- **Fixed**: the configured output will maintain the defined fixed setpoint
- **Reset**: the configured output will maintain a setpoint defined by the reset scale. Additional parameters must be setup

Reset Source
Select the source variable which will act as the determining factor of the actual setpoint. The sources can be a Local Input, an Output, a Network Variable, or Occupancy.

- Once the Reset Source has been selected, the dropdown list displayed below will provide which specific Local Input, Output or Network Variable to use. (Not applicable if Occupancy is set as the Reset Source.)

Reset Scale
Establish the minimum and maximum values for the reset source as well as the minimum and maximum setpoint limits.

NOTE: the reset scale is a LINEAR PROPORTIONAL function, and does not extend beyond the limits you specify.

Logic
FlexIO outputs can respond to their source variable by activating either:

- ▹ when the variable gets too high (direct acting / cooling)
- ▹ when the variable gets too low (reverse acting / heating)

For example, when the source variable is temperaturebased, direct acting corresponds to an output that will turn on when the temperature gets too high, resulting in a cooling action. Alternatively, if the logic is instead set to heating (reverse acting), the output will turn on when the temperature gets too low.

Action
A FlexIO output can either act on its source variable in:

- ▹ Differential Mode (ON/OFF response)
- ▹ PI Loop Mode (modulating response)

- For **Differential** mode, the output simply turns ON of OFF based on the setpoint. A differential band is used to adequately separate the activation and deactivation points, avoiding short cycling the output as the source data fluctuates.
- For **PI Loop** mode, the output will either modulate its voltage (for analog outputs) or use pulse width modulation (for analog or digital outputs) in an effort to precisely maintain the given setpoint. The output level required to do so is determined mathematically using a PI (Proportional / Integral) Loop.

- The **Proportional band** component represents the setpoint offset that should correspond to 100% of the output's action. The integral component represents the amount of time required for the output's action to reach 100% following a constant offset of 1 unit from the setpoint. As the FlexIO outputs can be used to control a variety of signals, careful attention must be payed to the tuning of the PI Loop. PI Loop tuning is beyond the scope of this document.

The Setup section is also used to specify the output signal's characteristics:

- **Reverse Acting**: Invert the voltage logic of the output
- **Pulsed (Analog Outputs only)**: Forces the analog output to use Pulse Width Modulation instead of voltage modulation when in PI Loop Mode
- **Range (Analog Outputs Only)**: Sets the voltage range to be used by the analog output. The selected range always corresponds to 0-100% of the output's action. The output range can also be customizable by using the CUSTOM range option.

5.4.3 - Delay On Make/Break

For outputs using Differential logic or any kind of On/Off action, the following delays can be used to offset the start and stop of the output:

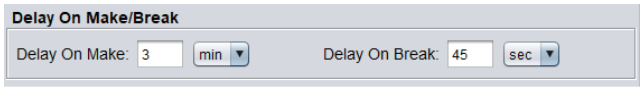

Figure 31 - Delay On Make/Break Setup

- **Delay On Make**: When the output is scheduled to activate based on the standard control logic of section 5.4.2, this setting will delay activation for up to 15 minutes. This could be used to stagger the start of two outputs with similar configurations. For example, to start pump and boiler outputs configured with the same logic, but to provide the pump some time to run before activating the boiler, this delay would be applied to the boiler output.
- **Delay On Break**: When the output is scheduled to deactivate based on the standard control logic of ***section 5.4.2***, this setting will delay the deactivation for up to 15 minutes. This could be used to enforce purge delays of outputs with similar configurations. For example, for pump and boiler outputs configured with the same logic, applying this delay to the pump output ensures that it will keep running for some time after the boiler output deactivates.

Note that these delays are superseded by the Output Binding and Automatic Override sequences presented below.

5.4.4 - Output Binding

The FlexIO controller has a feature that allows you to interlock the operation of one output to the status of up to two other outputs, inputs, or network variables.

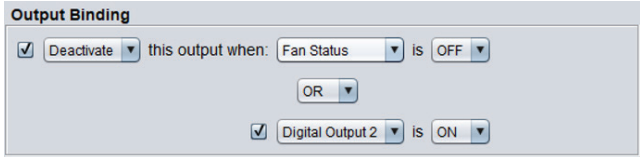

Figure 32 - Output Binding Setup

An output can be forced ON or OFF (Activated/Deactivated) based on:

- The status of another output (ON/OFF)
- The status of any contact-based input

- Fan Status (Network Variable from Master Controller)

Note: If a chosen source output is not ON/OFF and instead acts with modulation (0-100%), then any output value other than 0% for that source output counts as "ON" for the purposes of this binding decision.

Additionally, a second condition can also be used to stack against the first by using AND/OR conditional logic.

Note that output bindings can also be stacked on themselves: Say Output 'A' is bound directly to Output 'B', and Output 'B' itself is bound directly to Output 'C'. In this fashion, Output 'A' will be directly affected by the status of Output 'B', but also indirectly by Output 'C'. This can allow for the creation of sequences of much greater complexity than could be achieved by a single output alone.

5.4.5 - Automatic Override Condition

The FlexIO controller offers an option to automatically override any of its outputs. This override can take effect based on the outside air temperature or the occupancy status.

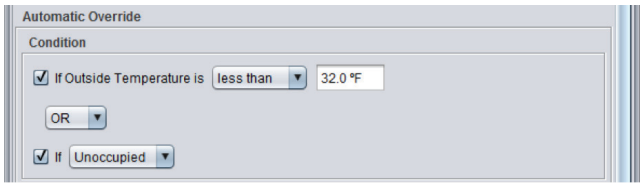

Figure 33 - Automatic Override Condition Setup

The Outside Temperature is determined by the Outside Temperature Source drop down list ***(see p.20)***.

Similarly, the occupancy source is set using the Occupancy Source drop down list ***(see p.21)***.

Either of these conditions alone can trigger the override ('OR' mode), or you can require them both to be satisfied ('AND' mode) before the override can take place.

5.4.6 - Automatic Override Action

Once the automatic override condition is satisfied, the override can take place.

Figure 34 - Automatic Override Action Setup

The FlexIO automatic override can directly set the output to a specific value: ON or OFF in differential action mode, or any percentage from 0-100% in PI Loop mode.

In PI Loop mode, an additional option is available: instead of setting the output directly to a predefined value, you can instead instruct the FlexIO to enforce a minimum value at the output. The output is allowed to increase the signal beyond the prescribed minimum if the need should arise, but cannot reduce it below the minimum, so long as the automatic override conditions remain satisfied.

5.4.7 - Min On/Off Delays

This section configures the minimum ON and OFF delays for outputs using ON/OFF or differential logic (not visible for modulating outputs).

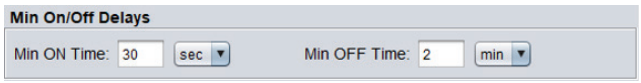

Figure 35 - Min On/Off Delay Setup

They are used to prevent the short cycling of equipment. Note that these delays take priority over any other sequences in the FlexIO Output Configuration page.

5.4.8 - Output Source: BACKUP

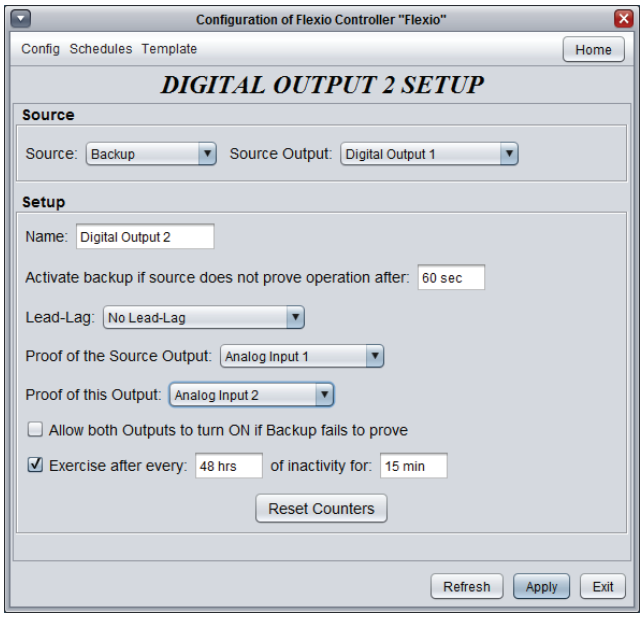

Figure 36 - Backup Output Setup

Setting an output source to "Backup" enables the output to activate when another output turns on yet no proof of operation has been obtained. The outputs can also alternate using Lead/Lag sequences. Common applications include pump control, cooling units in server rooms, etc.

To properly setup a Backup Output, follow these steps:

- **STEP 1**: Setup any output to activate based on a desired set of conditions (occupancy, temperature, pressure, etc…). This is the "Source" output.
- **STEP 2**: Set the source of another output to "Backup" mode, which will activate in case the Source output fails to provide proof of operation. The Backup Output will have the exact same activation conditions as the Source Output and can also run on a Lead/Lag cycle.

Source Output
Select the pre-configured output to which this output will act as a backup.

Activate backup if source does not prove operation after
The purpose of this sequence is to activate the Backup Output when the Source Output does not have proof of operation for a configurable amount of time.

Lead-lag
There are three available lead-lag sequences:

- Alternate after each call: The role of "lead output" alternates each time the output stops operating. The outputs do not exchange roles while an output is still ON.
- Alternate with a fixed run time: The role of "lead output" alternates automatically based on a configurable interval of uninterrupted time spent in the ON state. When the timer expires, the current lead output will stop, and the lag output will immediately take over, becoming the new lead output.
- Equal run time: Every time the outputs stop operating, the role of "lead pump" is re-evaluated, based on the total run time of each output. The output with the lowest run time becomes the lead output. The outputs do not exchange roles while an output is ON.

Please note that the lead-lag sequence can also be disabled.

Proof of the Source Output / Proof of this Output
Select the input serving as proof of operation for each output.

NOTE: only inputs designated as "Contact" may be used for proof of operation purposes.

Allow both Outputs to turn ON if Backup fails to prove
Select this checkbox if, upon failure to prove operation of BOTH lead output AND Backup Output, you wish both outputs (lead and backup) to turn on simultaneously.

If this checkbox remains unchecked, upon failure to prove operation of backup output, only the backup output will remain ON.

Exercise Outputs
This function is used to turn on the outputs periodically to prevent extended periods of inactivity.

Clear Timers
This function is used to clear and restart the run time counters for the lead and lag outputs. Both timers are cleared simultaneously.

5.4.9 - Virtual Outputs

Virtual outputs are setup in an identical manner as the Digital and Analog Outputs. It differs from the Digital and Analog Outputs in that the Virtual Output does not activate any physical outputs on the controller. It is used in cases where the Output Binding feature is needed without having to "sacrifice" a physical output (Digital or Analog).

For example:
Digital Output 1 (DO1) is configured to maintain Analog Input 1 (AI1) at 70ºF. We would like to add a condition: if Analog Input 2 (AI2) rises above 50ºF, Digital Output 1 remains OFF.

How to resolve:
Configure Virtual Output 1 (VO1) as follows: its source will be AI2, and VO1 will follow a cooling/direct acting logic, with a setpoint of 50ºF (i.e. if AI2 rises above 50ºF, then VO1 turns ON).

Configure DO1 to maintain its setpoint as seen above and enable the "Output Binding" feature. Select "Deactivate" this output when "Virtual Output 1" is "ON".

5.5 - COM Port Settings

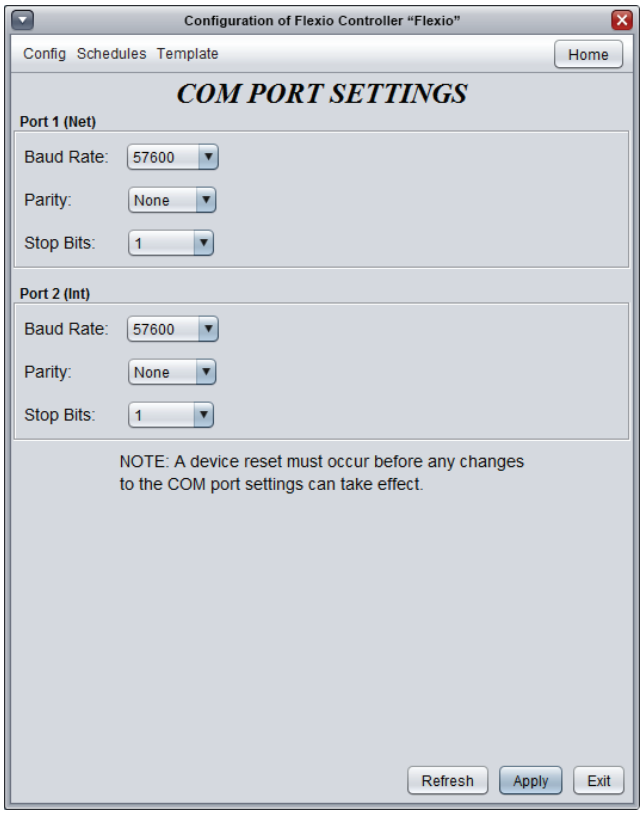

Figure 37 - COM Port Configuration Screen

Changes to the settings in this section will only take effect once the FlexIO is reset or has power cycled. Each port on the FlexIO 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 the FlexIO 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 the FlexIO is "None" but may be set to any of these standard values:
  - None
  - Odd
  - Even
- **Stop Bits**: Sets the number of stop bits used by the COM port. By default, it is set to 1, but can also be set to 2.

5.6 - Device Properties

Figure 38 - 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").
- **Hardware version**: This is the physical nature of the controller. Different hardware has different features. The hardware can only be changed by replacing it physically.
- **Device Number**: The network address of the controller, which is configured manually using the dipswitches, or even 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 Prolon. At the end of the procedure, Focus will automatically reapply all the parameters you have previously configured into the device.

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

5.7 - Weekly Schedule

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

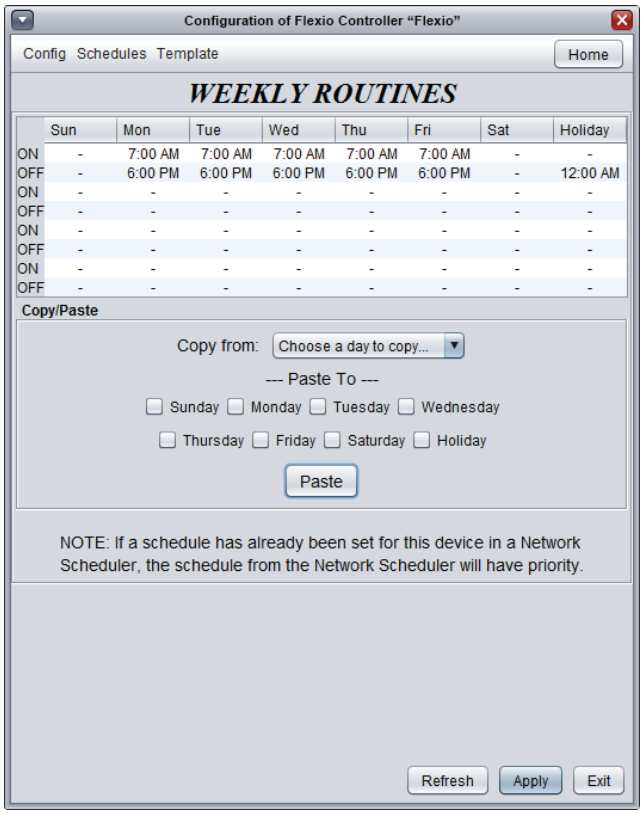

Figure 39 - Weekly Routines Screen

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

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

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

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

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

5.8 - Holiday Calendar

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 calendar has no pre-defined holiday marked, allowing for complete customization of the holiday calendar upon initial configuration. The holiday calendar does not automatically recognize floating holidays (Labor Day, Memorial Day, etc.) and thus must be adjusted annually.

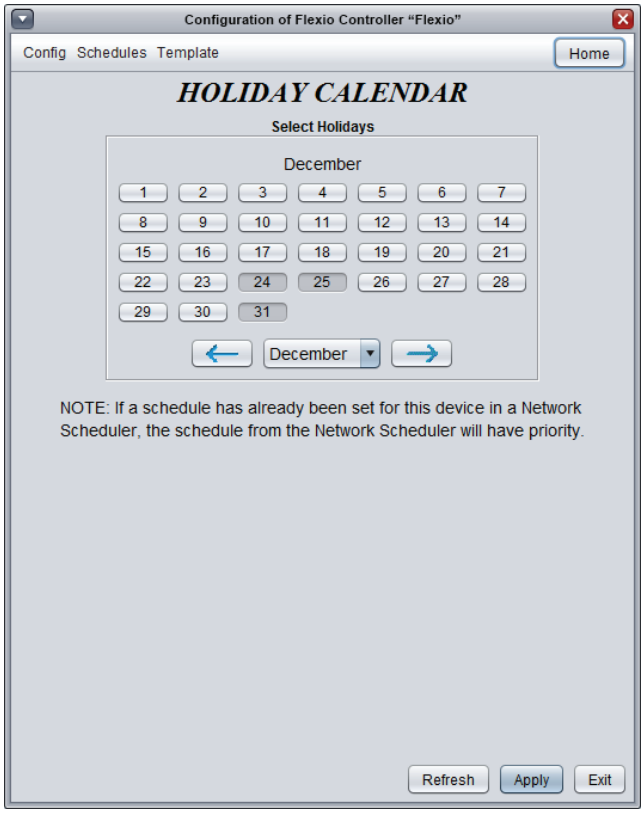

Figure 40 - Holiday Calendar Screen

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.

5.9 - Template Menu

5.9.1 - Save as Template

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

5.9.2 - Load Template...

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