

MLM FAN COIL UNIT USER MANUAL



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1. Installation and Commissioning

The Fan Coil Controller can be fitted to a standard MLM 24 installation and can interface with the MLM Tool V8.16 u4 for commissioning and diagnostics.

i. Hardware installation

The Fan Coil Controller manages the operation of either a two-pipe and four-pipe Fan Coil Units with, or without electric heating. Various variants exist that allow the use of EC fans, 3-speed fans, AC valves, and electric heating in various configurations. The Fan Coil Controller incorporates a 220V AC to 12V DC SMPS removing the need for a separate power supply or transformer.

Two dry contact inputs are supplied allowing a PIR and/or door or window reed switch to override the operation of the Fan Coil Controller. In addition, a loosely regulated 12V supply is available allowing devices such as PIRs to be directly powered from the Fan Coil Controller. The wiring diagram for the Fan Coil Controller can be seen under Section ii. in Figure 1.

ii. Wiring

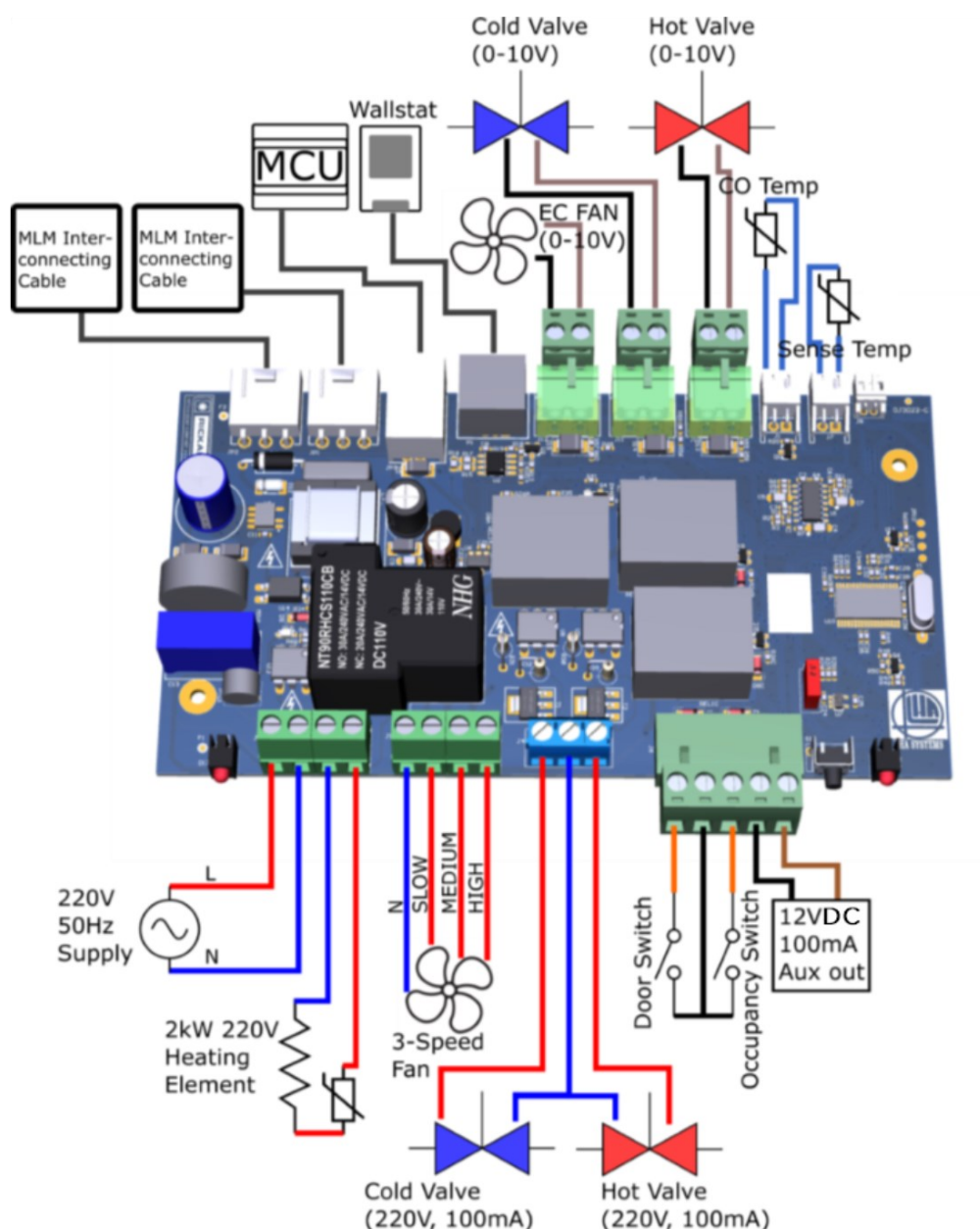


Figure 1: Fan Coil Controller Wiring Diagram

iii. Hardware wiring configuration

Upon completion of the wiring of the Fan Coil Controller, the controller requires hardware configuring. This allows the controller to know what is physically connected to itself as there are numerous possible wiring configurations the Fan Coil Controller will accept.

Ensure the Fan Coil Controller is powered and operating, with the MLM Tool connected as seen in Figure 2 under the 'PHYSICAL' tab. If a Fan Coil Wallstat is connected to the controller, verify that that is also connected by expanding the '+' in Figure 2 resulting in Figure 3.

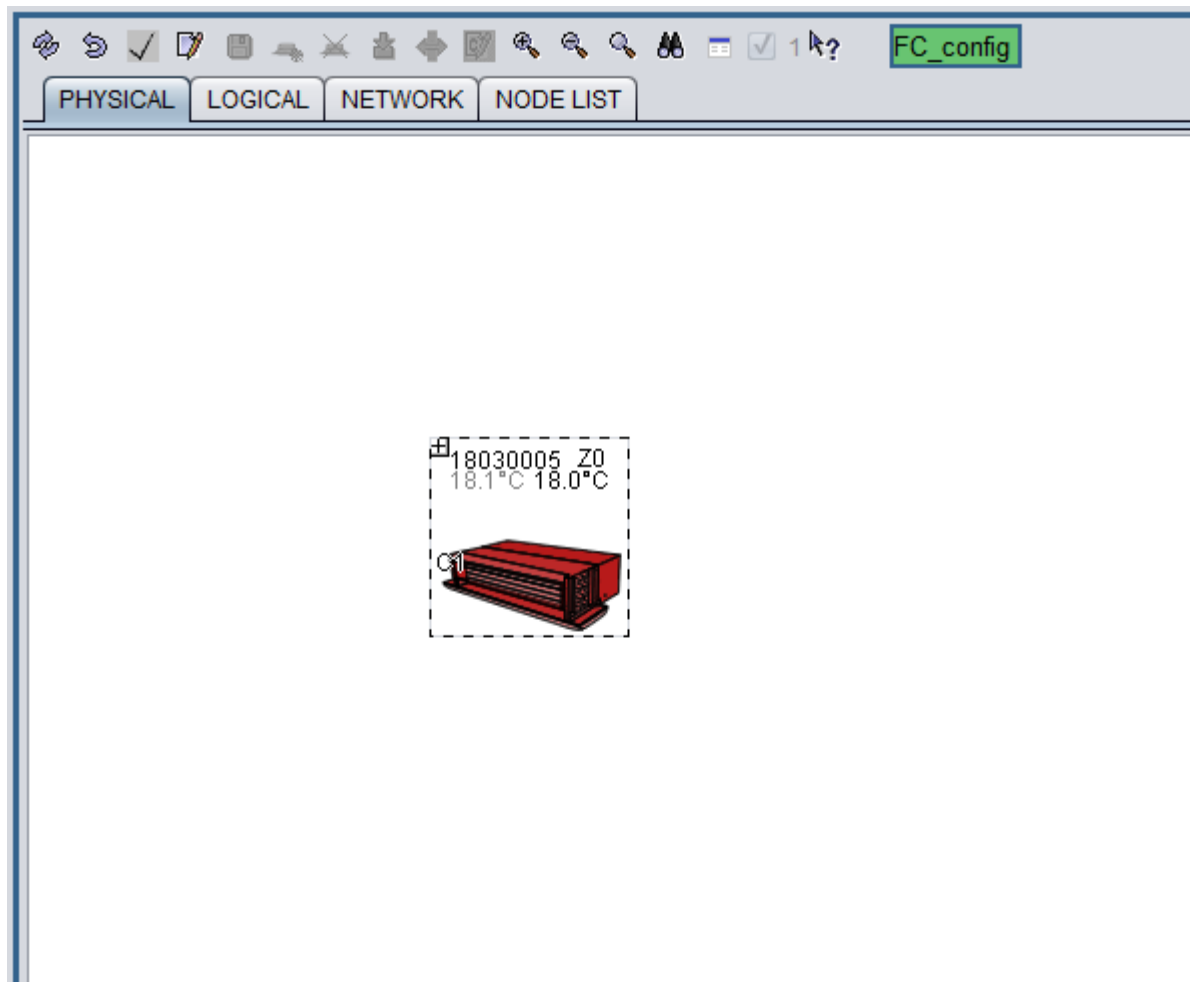


Figure 2: Verifying the Fan Coil is visible on the MLM Tool

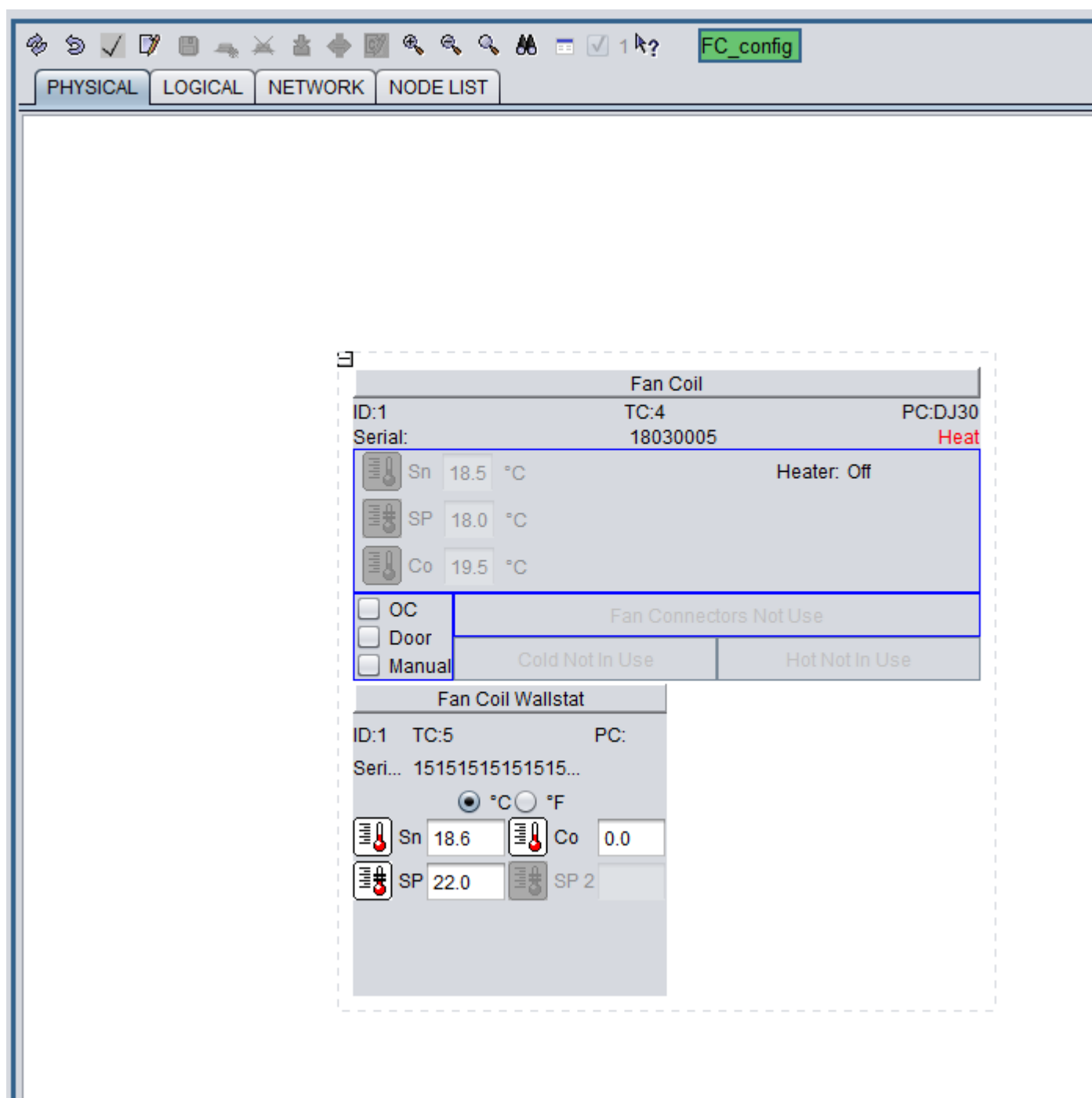


Figure 3: Verifying the Fan Coil Wallstat is visible on the MLM Tool

Selecting the Fan Coil Controller's display block brings up the Node Editor list for the controller on the right of the screen as seen in Figure 4. Under the 'Setup' folder navigate to 'Wired Connectors [77]'.

Tick the appropriate boxes indicating the physical wiring connected to the Fan Coil Unit, and 'Write' the configuration to the controller. The graphical representation of the fan coil should change to represent the types of hardware connected to the unit. Analogue control elements are shown as a percentage, while Discrete control elements will indicate on or off.

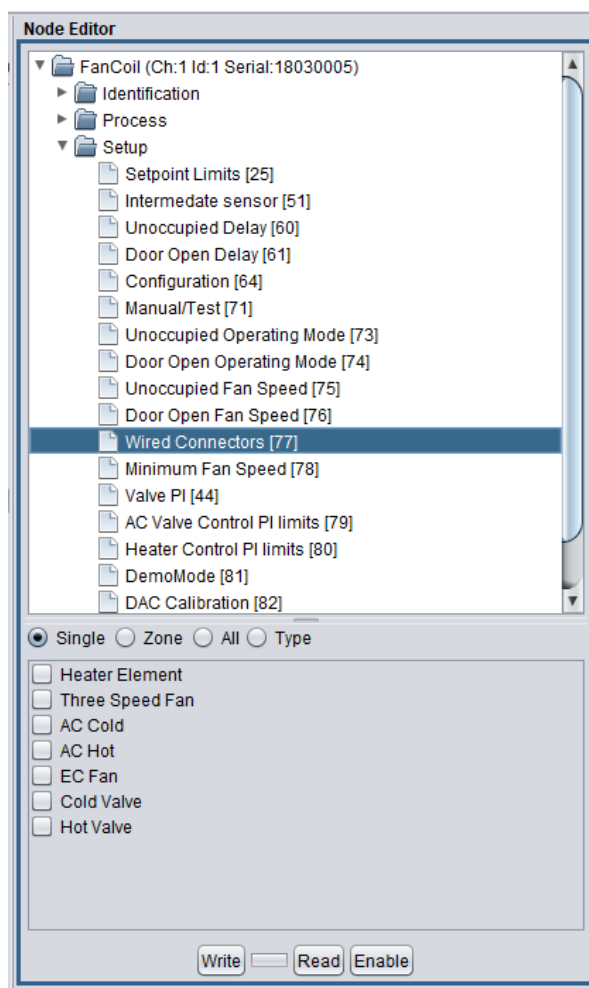


Figure 4: Fan Coil Controller Node Editor - Wiring

Once the physical connections are chosen the Fan Coil Controller needs to be configured for use with a two or four-pipe water system and the normal states of the dry-contact inputs needs to be configured. In two-pipe mode the cold-water valve outputs are used.

The Unoccupied Input and/or Door Input Normally Open configuration bits should be enabled if the dry-contact switch is normally open, and closes when triggered, else these configuration bits should be disabled. If no switch is present these bits should be enabled, as disabling them will trigger an occupancy or door triggered event.

The Occupancy and Door dry-contact inputs trigger operational mode changes in the Fan Coil Controller. These operational modes include "Off", "Fan Only", and "Auto Control", where "Auto Control" is the normal operating mode of the Fan Coil Controller.

These operational mode changes can be configured under "Unoccupied Operating Mode [73]" and "Door Open Operating Mode [74]" SDOs. If "Fan Only" Operation is chosen for the operation modes their associated fan speed can be set under "Unoccupied/Door Fan Speed [75/76]". See Figure 6.

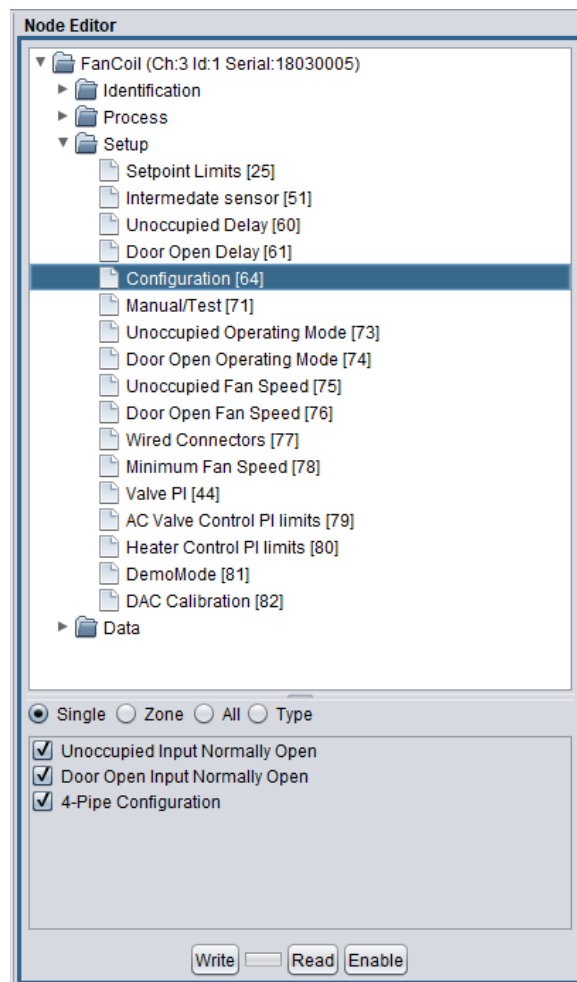


Figure 5: Fan Coil Controller Node Editor – Configuration

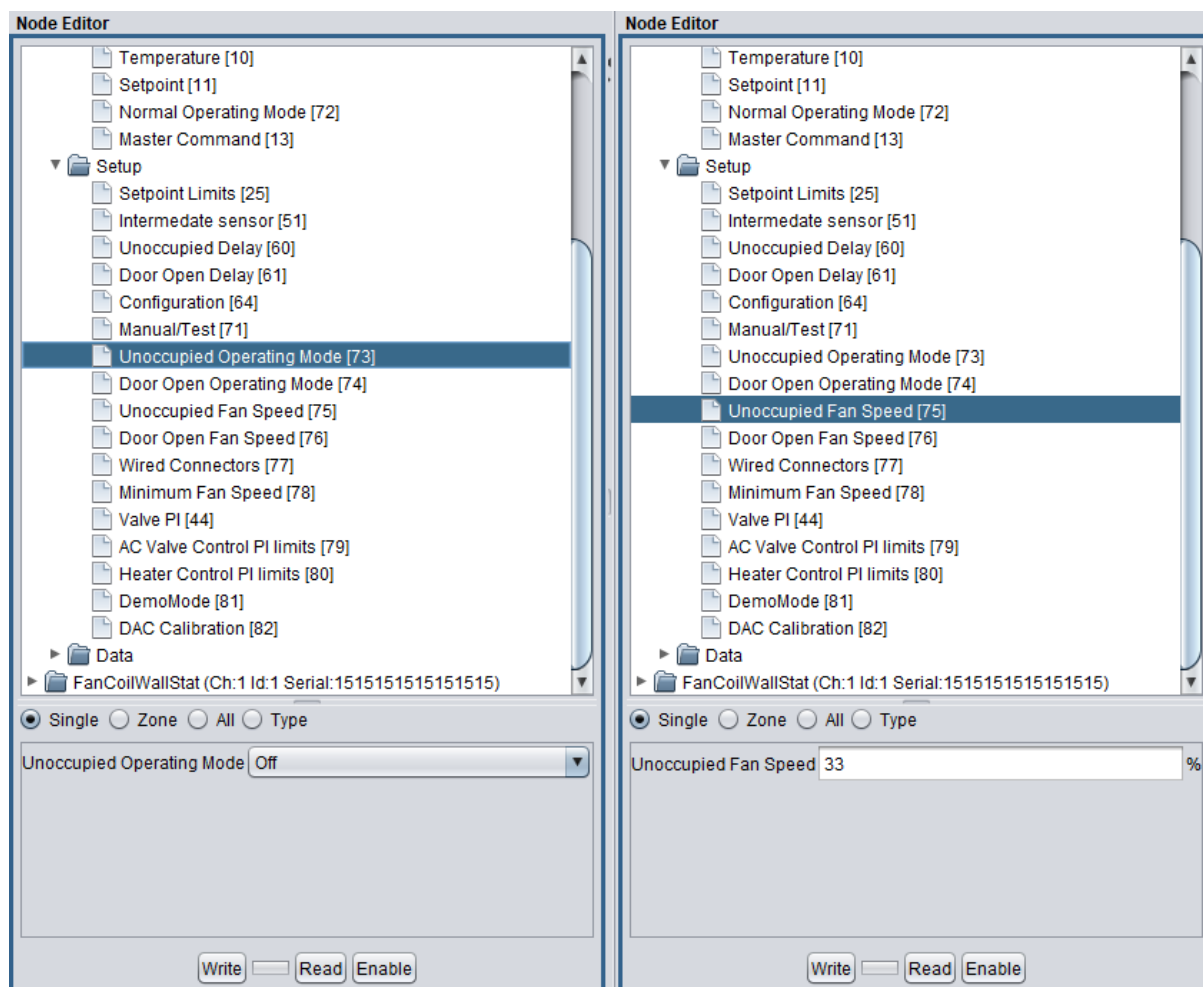


Figure 6: Configuring dry-contact inputs

The dry-contact inputs can be configured to trigger only if held in an active state for a period. This is useful if the occupants of the room are not constantly observed by the PIR connected to the occupancy input, or if the door/window was opened and closed to let someone else into the room. This delay is adjusted via "Unoccupied Delay [60]" and "Door Open Delay [61]".

iv. Hardware Installation Testing

The installation of the Fan Coil Controller can be tested using "Manual/Test [71]" as seen in Figure 7. Be certain all electrical connections are proper, and that the installation is safe before testing. To test the Fan Coil's outputs, enable Manual Control/Override and set values for whichever output you desire to test. The cold and hot valve percentages operate the analogue valve outputs, while the fan speed percentage adjusts the EC Fan speed and the 3-speed fan outputs simultaneously. The 3-speed fan speeds are mapped as seen in Table 3.

Table 3: Relationship between EC Fan and 3-Speed Fan in Manual Override

Percentage Fan Speed	3-Speed Fan Speed
0%	Off
1% - 33%	Slow
34% - 66%	Medium
67% - 100%	High

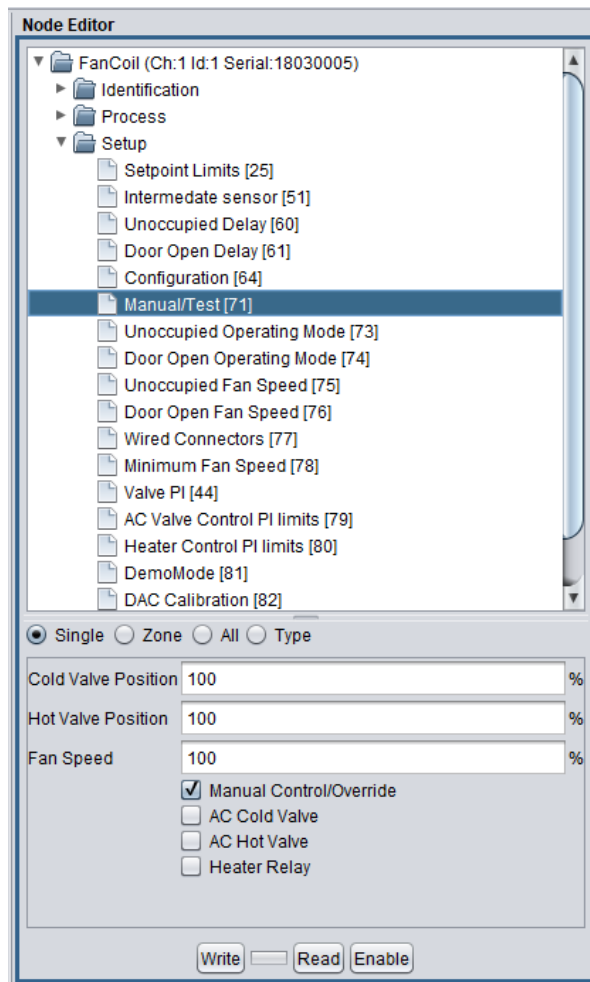


Figure 7: Fan Coil Controller Manual Control

The state of the dry-contact inputs can be tested via "State Status [69]" under the Data folder as seen in Figure 8. Click "Read" to determine the current state of the Occupancy and Door dry-contact input.

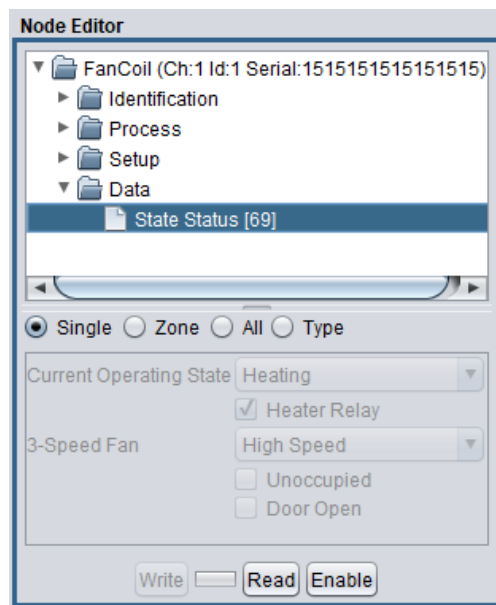


Figure 8: Fan Coil States Status

v. Operation Configuration

There are various operational controls that can be configured by the user. These include the minimum fan speed, turn-on and turn-off limits for the discretely controlled outputs, the PI loop control variables, and master command.

a. Minimum fan speed

This setting limits the minimum fan speed during auto control operation. This allows air to be circulated even if the system is not heating nor cooling (idle), thereby improving the accuracy of the temperature measurement of the space. The fan speed is supplied as a percentage and can be correlated to the 3-speed fan speeds with the use of Table 3.

b. Turn-on and turn-off PI control limits

The discrete control elements, the AC valves and electric heater, approximate the PI control output via a hysteretic set of limits. In simple terms, if the control system's output (be it heating or cooling) increases above a predetermined limit the configured AC valves and/or electric heater will be turned on. These controls will then be kept powered until a lower limit is reached. This form of control is meant to approximate the desired control output over time, while giving a fair compromise between the longevity of the heater relay and the response time.

The default on and off control percentages can be altered if required. Setting the on and off control percentages far apart results in a slower response. This slower response results in far greater temperature drift around the setpoint while reducing the cycle count over time of the heater relay and AC valves. Alternatively, setting the on and off percentages closer will allow for less drift around the setpoint, but at the expense of the longevity of the heater relay. Figure 9 illustrates an example of the "Heater Control PI limit". The AC valve limits function similarly with both the hot and cold AC valves acting symmetrically (using the same limits).

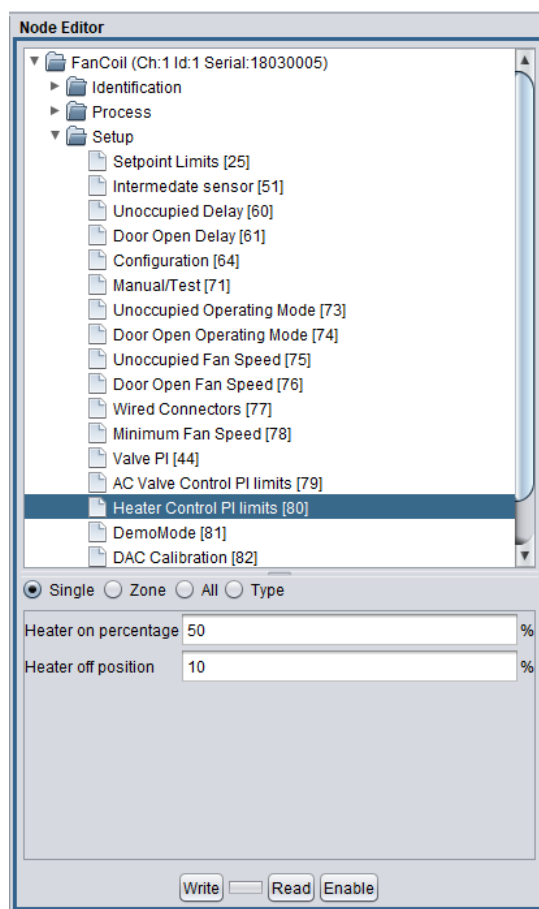


Figure 9: Heater Control PI limits

c. PI loop control variables

The proportional (gain) and integral (reset rate) of the internal PI control loop can be altered via "Valve PI [44]".

d. Master Command

The Master Command under the Process folder allows the Fan Coil, or the Fan Coil Wallstat, to be configured as the provider of space-temperature measurement (Sense), change-over temperature measurement, and setpoint control. This command can also be used to configure the Wallstat to display temperatures in Fahrenheit. The dialogue can be seen in Figure 10. An example of this is enabling Sense on the Fan Coil and disabling Sense on the Fan Coil Wallstat results in the space-temperature being measured from the Fan Coil. While enabling Setpoint on the Fan Coil Wallstat and disabling it on the Fan Coil results in the Fan Coil being able to alter the Setpoint temperature.

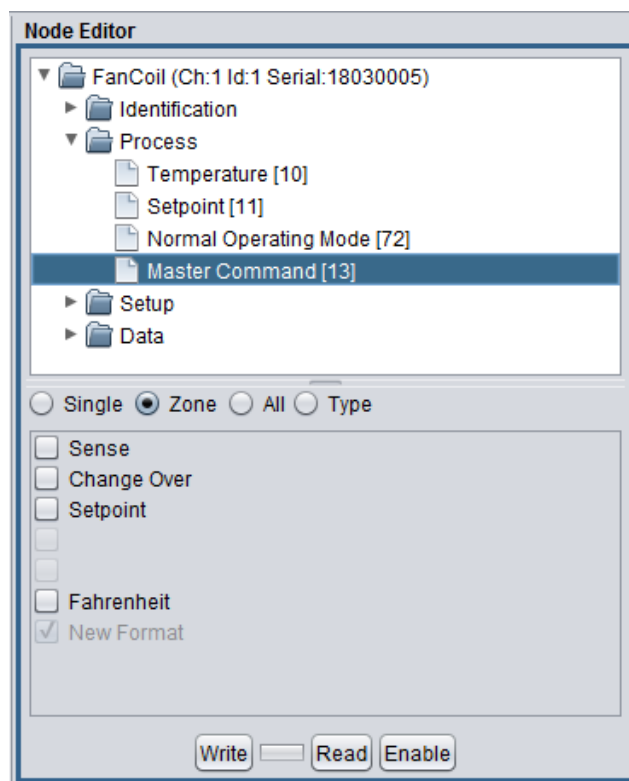


Figure 10: Master Command

e. Setpoint and setpoint limits

The upper and lower setpoint limits can be configured via the "Setup Limits [25]" under the Setup Folder as seen in Figure 11. This limits the setpoint within a specific range. This can be useful if a Fan Coil Wallstat is configured to set the setpoint for the Fan Coil. This inhibits the user from setting a temperature too high or too low.

The "Setpoint [11]" under the Process Folder can be used to configure the setpoint. This may have no effect if the setpoint is retrieved from another device and is dependant on the configuration in the "Master Command [13]".

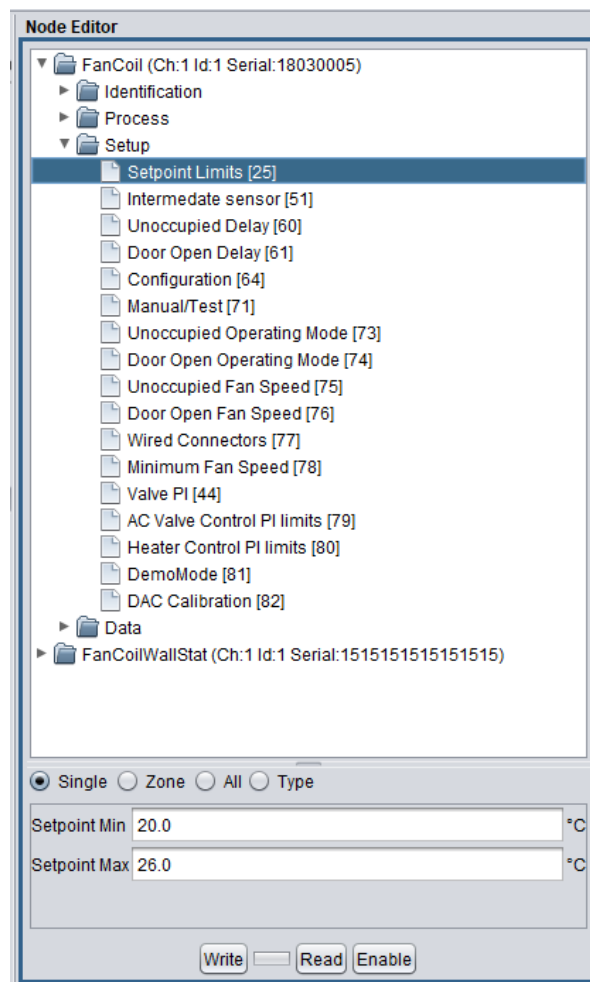


Figure 11: Setpoint limits

2. Fan Coil Operating Modes

The Fan Coil Controller utilises multiple control modes of operation. These modes include:

Heating: In this mode the fan coil is attempting to heat the room/space.

Cooling: In this mode the fan coil is attempting to cool the room/space.

Idle: In this mode the fan coil is not attempting to adjust the room/space temperature or fan speed whatsoever.

Fan Only: In this mode the fan coil does no temperature control, but only operates the fan.

The fan is held at a fixed speed set by the Wallstat.

Override: This mode is activated by the door/window input, the occupancy input or by placing the Fan Coil Controller into manual control.

Button: This mode is essentially a display mode and does not alter the operation of the Fan Coil Controller. Pressing the button, the Fan Coil Controller brings up this display mode in the MLM Tool Application. This mode is useful in identifying a Fan Coil Unit on the MLM Tool.

3. Fan Coil Wallstat

The Fan Coil Wallstat can alter the operational mode of the Fan Coil Controller, adjust the fan speed, set the set-point, display the space-temperature and cause the Fan Coil Controller to power off.

The Fan Coil Wallstat utilises four user control buttons, these being, power, display cycle, increment and decrement. These buttons functions are represented by the symbols on the Wallstats face near the buttons they are associated with as seen in Figure 12. The bottom left button is used as a power button, this turns the Fan Coil Controller on or off. The top left button is used to cycle the displays. The right buttons are used to increment/decrement a specific value on the current display. Utilising these buttons while on the Space-temperature display causes the screen to jump to the Setpoint display.

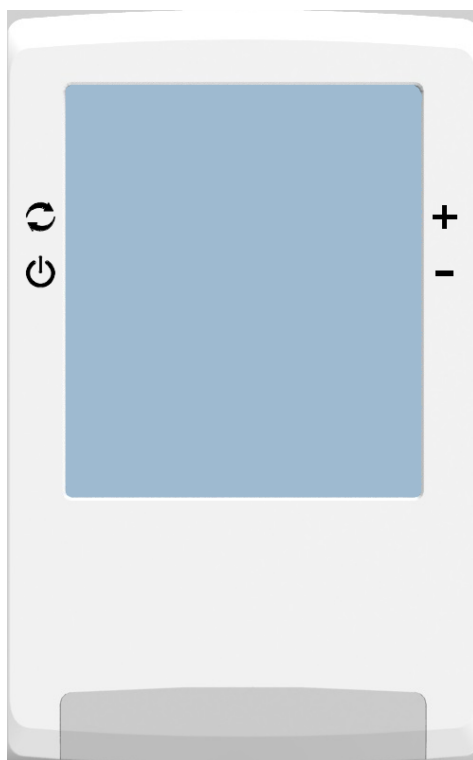


Figure 12: Wallstat buttons

i. Fan Coil Wallstat Button Symbols



The button denoted by this symbol cycles between the various displays and controls.



The button denoted by this symbol powers down the Fan Coil and Fan Coil Wallstat.



The button denoted by this symbol increments the setting on the display.



The button denoted by this symbol decrements the setting on the display.

ii. Fan Coil Wallstat Display Symbols

The Fan Coil Wallstat indicates the current operation of the Fan Coil via various symbols displayed on its LCD. These symbols are listed below.



Fan Coil currently in cooling mode.



Fan Coil currently in heating mode.



Fan Coil Electric heating currently operating (if available).



Fan Coil Occupancy. (Door is closed, and someone is present in the room)



This symbol indicates that the Fan Coil Wallstat is currently displaying the measured space/room temperature.



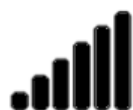
This symbol indicates that the fan is currently operating if visible and non-flashing. The speed is depicted by the bars near this symbol. This symbol indicates that the user is in the fan control display when it is flashing.



This symbol is used in conjunction with the Fan symbol, and indicates that the fan is operating at a slow speed.



This symbol is used in conjunction with the Fan symbol, and indicates that the fan is operating at a medium speed.



This symbol is used in conjunction with the Fan symbol, and indicates that the fan is operating at a high speed.



This symbol indicates that the temperature set point is currently displayed.

iii. Fan Coil Wallstat modes of operation

The Fan Coil Wallstat has three major modes of operation, these include:

- **Off**
- **Automatic control**, this allows the fan coil controller to control its valves, heater and fan to reach the setpoint temperature.
- **Manual Fan Only control**, this turns off all temperature control, the fan speed can be set to low, medium or high speed.

Pressing the power button, turning the Fan Coil Wallstat off, achieves the "Off" mode of operation. Pressing any button from this state turns the Fan Coil Controller and Wallstat "On". In an "On" state the Fan Coil's mode of operation can be switched between automatic control or fan only control. This is done from the fan control display. The displays are discussed in Section 7.4.

iv. Displays

The Fan Coil Wallstat can indicate three possible displays. The space/room temperature, the fan speed control, and the set point display. Figure 13 illustrates a typical space/room temperature display where the current space temperature is 22.2°C, the fan speed is high, and the unit is currently in cooling mode. The block around the thermometer symbol indicates that the Wallstat is in the space/room temperature display. Pressing the display cycle button from this display causes the Fan Coil Wallstat to switch to the fan speed control display.

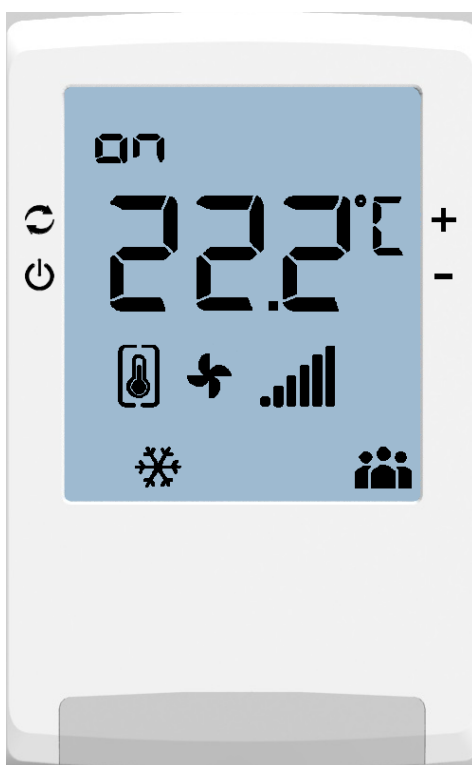


Figure 13: Space/room temperature display

The fan speed control can be seen in Figure 14, this display is indicated by the block around the fan symbol. The control is adjusted by pressing the '+' or '-', which increases or decreases through the selected operation modes. Values 1 to 3 command the Fan Coil to only operate its fan with the speeds slow to high respectively. The value of 'A' is automatic control, under this control the fan coil attempts to bring the space/room temperature to the setpoint temperature through the control of the valves and/or electric heating in conjunction with the fan speed. To accept a selection, wait until the Fan Coil Wallstat beeps and the flashing value digit remains constant. Leaving the Wallstat in this display will result in the Wallstat jumping back to the space/room temperature display. Pressing the screen cycle button in the fan operation display will cause the Fan Coil Wallstat to cycle to the setpoint display.

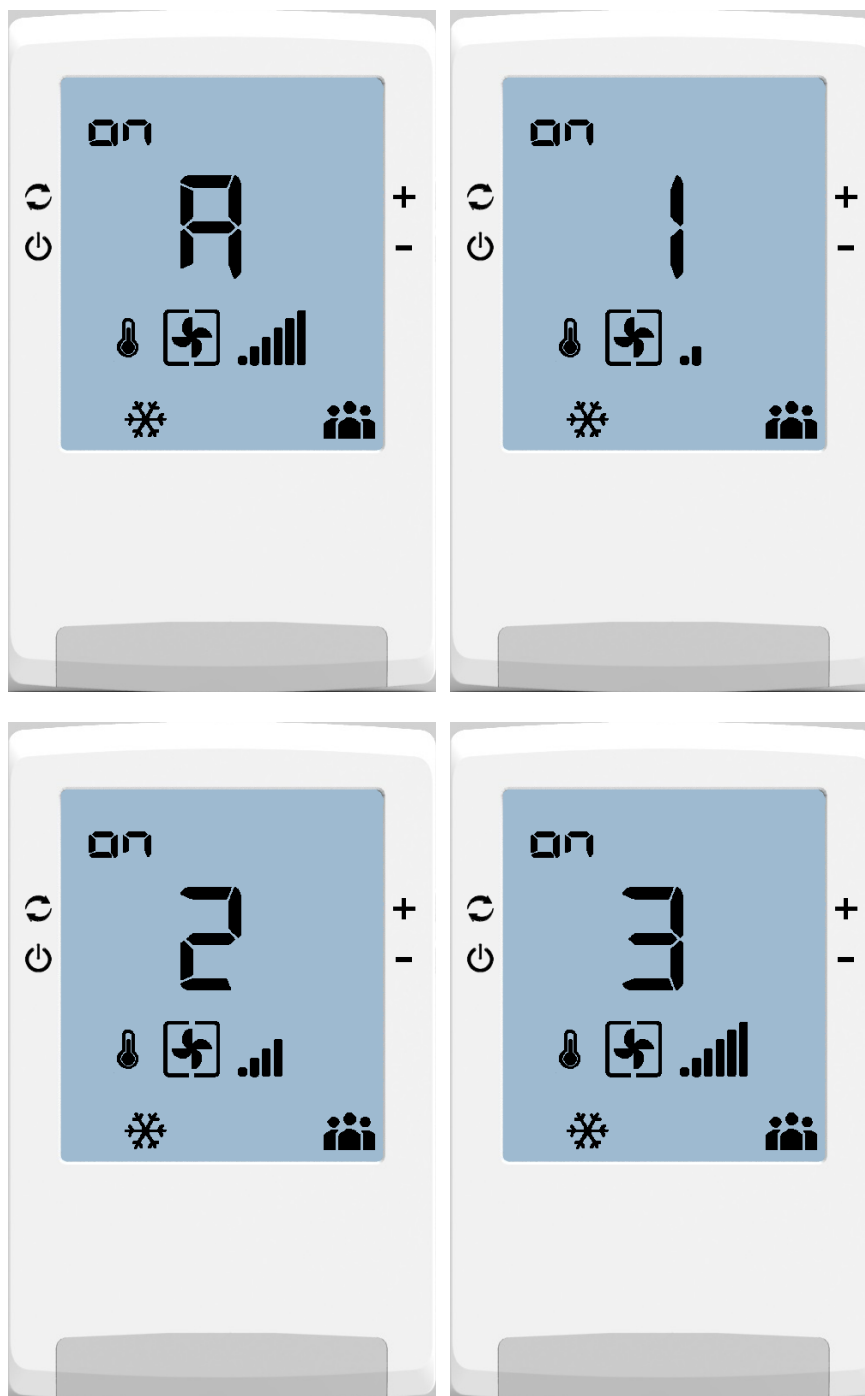


Figure 14: Fan Operating mode display

An example of the setpoint display can be seen in Figure 15, this display is indicated by the flashing of the "SP" symbol. The "+" and "-" buttons are used to adjust the setpoint temperature up and down respectively. To accept a setpoint temperature wait for the Fan Coil Wallstat to beep, and the temperature value to stop flashing.

If the Fan Coil Wallstat is left unattended for some time in this display, the display will automatically jump back to the space/room temperature display. Alternatively, the display cycle button can be pressed while in the setpoint display, and the Fan Coil Wallstat will return to the space/room temperature display.



Figure 15: Setpoint display

Pressing the power button on any of these screens results in the Fan Coil unit powering down and the Fan Coil Wallstat display going blank except for the words "Off" as seen in Figure 16. Pressing any button in this "Off" state restores power to the Fan Coil and Fan Coil Wallstat.

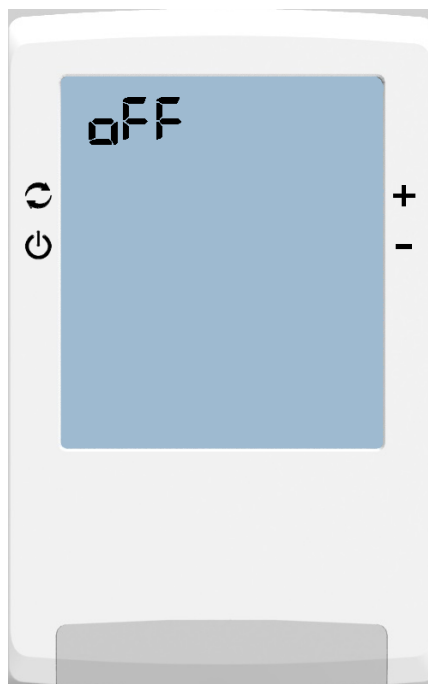
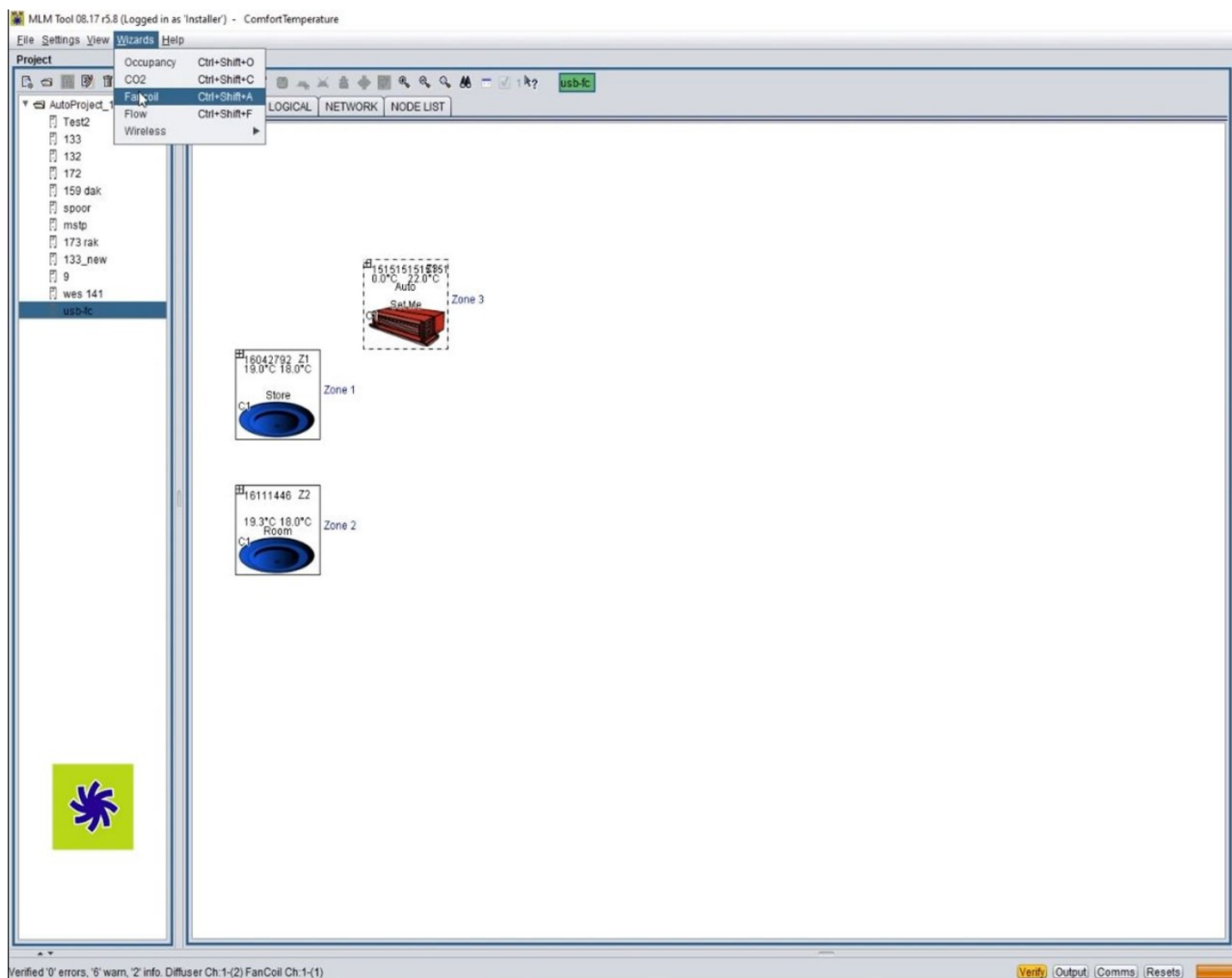


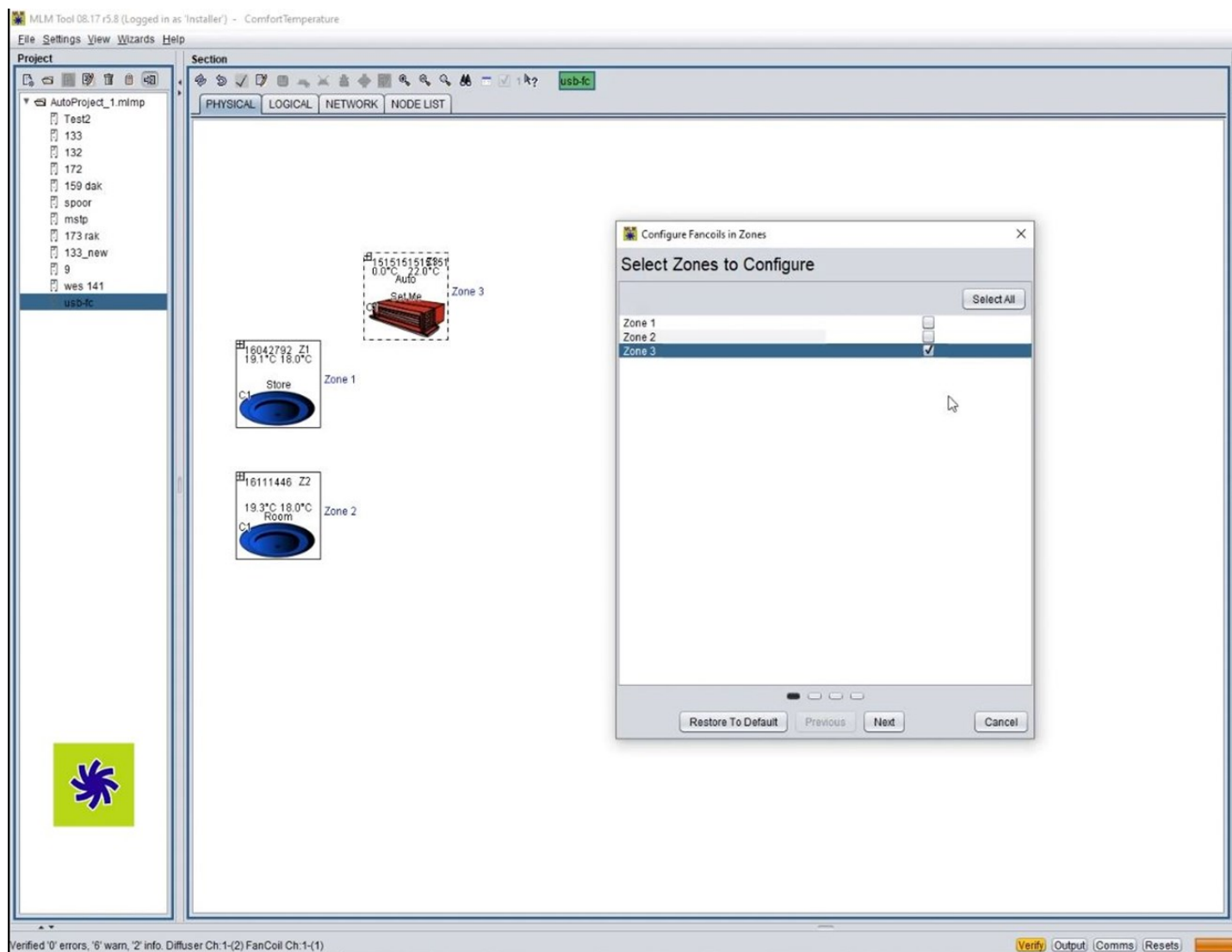
Figure 16: Fan Coil Wallstat powered off

MLM Fan Coil Unit Multi-Zone Zone Setup

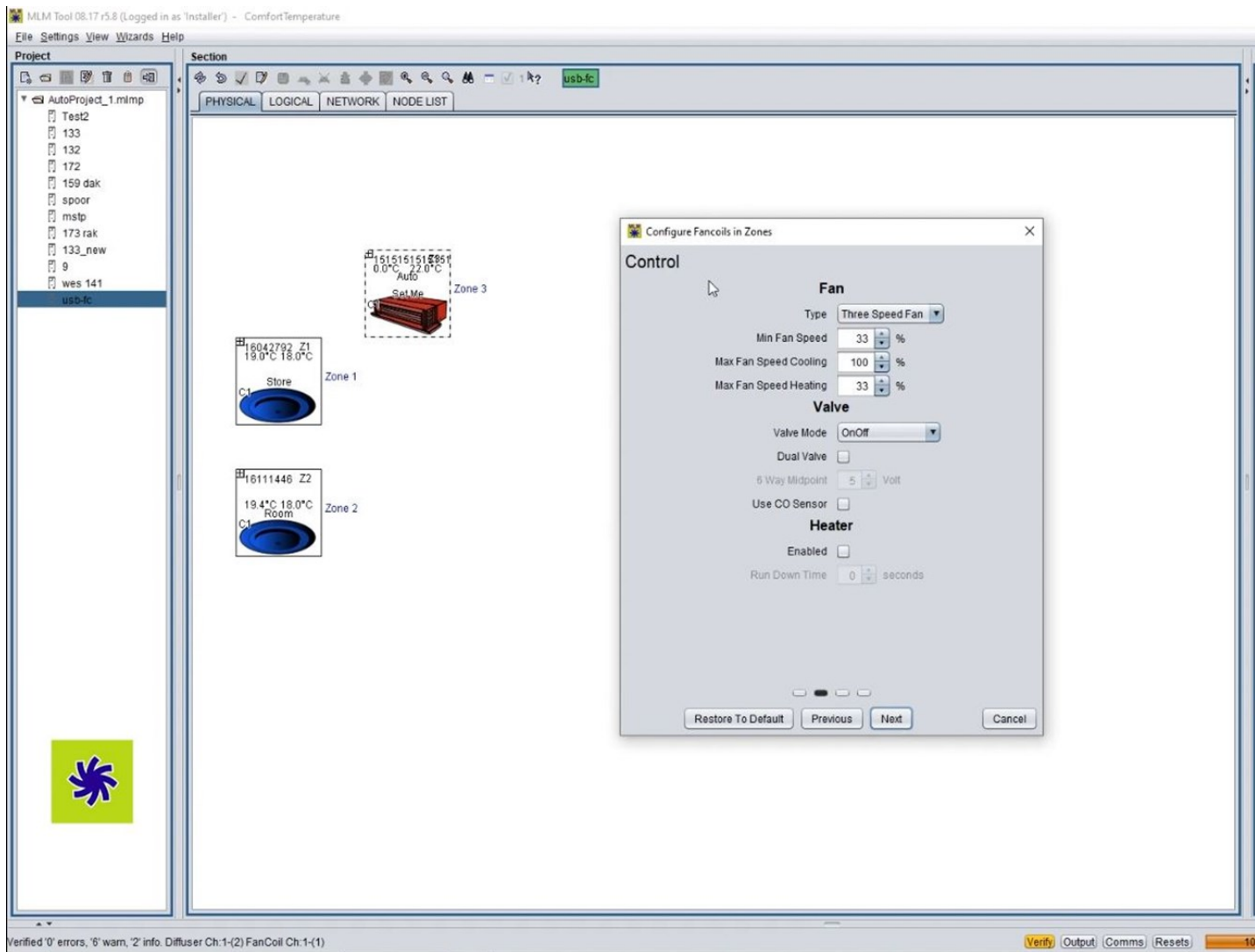
click on the desired FCU and open the FCU Setup Wizard



Select Diffuser zones to work with the FCU



Select the Fan Control Mode

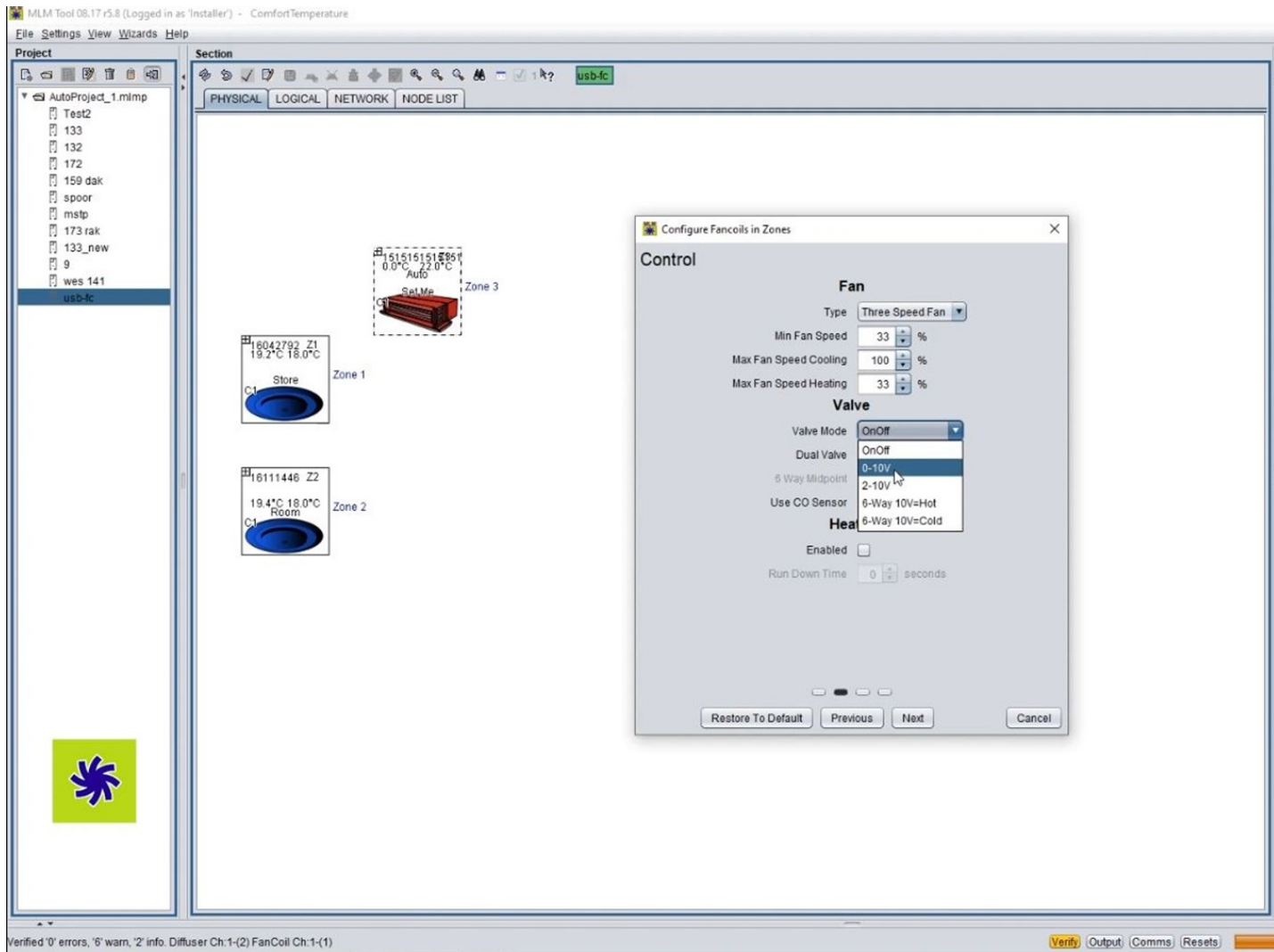


The screenshot displays the MLM Tool v08.17 r5.8 interface. The main window shows a project tree on the left with 'AutoProject_1.mimp' expanded, listing various components like 'Test2', '133', '132', '172', '159 dak', 'spoor', 'mstp', '173 rak', '133_new', '9', and 'wes 141'. The 'usb-fc' component is selected. The main workspace shows a schematic diagram with three zones: Zone 1 (Store), Zone 2 (Room), and Zone 3 (Auto). A 'Set Me' button is visible in Zone 3. A 'Configure Fancoils in Zones' dialog box is open, showing the 'Control' tab. The dialog box contains the following settings:

- Fan**
 - Type: Three Speed Fan
 - Min Fan Speed: 33 %
 - Max Fan Speed Cooling: 100 %
 - Max Fan Speed Heating: 33 %
- Valve**
 - Valve Mode: OnOff
 - Dual Valve: ☐
 - 5 Way Midpoint: 5 Volt
 - Use CO Sensor: ☐
- Heater**
 - Enabled: ☐
 - Run Down Time: 0 seconds

At the bottom of the dialog box, there are buttons for 'Restore To Default', 'Previous', 'Next', and 'Cancel'. The status bar at the bottom of the main window shows 'Verified 0 errors, 6 warn, 2 info. Diffuser Ch:1-(2) FanCoil Ch:1-(1)' and a 'Verify' button.

Select the Valve Control Type



MLM Tool 08.17 r5.8 (Logged in as 'Installer') - ComfortTemperature

File Settings View Wizards Help

Project

- AutoProject_1.mimp
 - Test2
 - 133
 - 132
 - 172
 - 159 dak
 - spoor
 - mstp
 - 173 rak
 - 133_new
 - 9
 - wes 141
 - usb-fc

Section

PHYSICAL LOGICAL NETWORK NODE LIST

Zone 1: 16042792 Z1, 19.2°C 18.0°C, Store, C1

Zone 2: 16111446 Z2, 19.4°C 18.0°C, Room, C1

Zone 3: 15151515 Z3, 0.0°C 22.0°C, Auto, Sal Me, C1

Configure Fancoils in Zones

Control

Fan

Type: Three Speed Fan

Min Fan Speed: 33 %

Max Fan Speed Cooling: 100 %

Max Fan Speed Heating: 33 %

Valve

Valve Mode: OnOff

Dual Valve: OnOff

5 Way Midpoint: 0-10V, 2-10V, 6-Way 10V=Hot, 6-Way 10V=Cold

Use CO Sensor: 6-Way 10V=Hot, 6-Way 10V=Cold

Heat

Enabled: ☐

Run Down Time: 0 seconds

Restore To Default Previous Next Cancel

Verified '0' errors, '6' warn, '2' info. Diffuser Ch:1-(2) FanCoil Ch:1-(1)

Verify Output Comms Resets

Select the Valve Control Type

0108.17 r5.8 (Logged in as 'Installer') - ComfortTemperature

File View Wizards Help

Section

PHYSICAL LOGICAL NETWORK NODE LIST

Project_1.mimp
Test2
133
132
172
159 dak
spoor
mstp
173 rak
133_new
9
wes 141
usb-fc

Zone 1
16042792 Z1
19.2°C 18.0°C
C1
Store

Zone 2
16111446 Z2
19.3°C 18.0°C
C1
Room

Zone 3
5151515151515151
0.0°C 22.0°C
Auto
Set Ma

Configure Fancoils in Zones

Control

Fan

Type: Three Speed Fan

Min Fan Speed: 33 %

Max Fan Speed Cooling: 100 %

Max Fan Speed Heating: 33 %

Valve

Valve Mode: OnOff

Dual Valve: OnOff

6 Way Midpoint: 0-10V

Use CO Sensor: 2-10V

Heating: 6-Way 10V=Hot

Cooling: 6-Way 10V=Cold

Enabled: ☐

Run Down Time: 0 seconds

Restore To Default Previous Next Cancel

Errors: '6' warn, '2' Info. Diffuser Ch:1-(2) FanCoil Ch:1-(1)

Verify Output Comms Resets

Select the Valve Control Type

MLM Tool 08.17 r5.8 (Logged in as 'Installer') - ComfortTemperature

File Settings View Wizards Help

Project

- AutoProject_1.mimp
 - Test2
 - 133
 - 132
 - 172
 - 159 dak
 - spoor
 - mstp
 - 173 rak
 - 133_new
 - 9
 - wes 141
 - usb-fc

Section

PHYSICAL LOGICAL NETWORK NODE LIST

Zone 1

Zone 2

Zone 3

Configure Fancoils in Zones

Control

Fan

Type: Three Speed Fan

Min Fan Speed: 33 %

Max Fan Speed Cooling: 100 %

Max Fan Speed Heating: 33 %

Valve

Valve Mode: 6-Way 10V=Cold

Dual Valve: ☐

6 Way Midpoint: 5 Volt

Use CO Sensor: ☐

Heater

Enabled: ☐

Run Down Time: 0 seconds

Restore To Default Previous Next Cancel

Verified 0 errors, 6 warn, 2 info. Diffuser Ch:1-(2) FanCoil Ch:1-(1)

(Verify) (Output) (Comms) (Resets)

**Choose Dual Valve and Change Over “CO”
if required**

MLM Tool 08.17 r5.8 (Logged in as 'Installer') - ComfortTemperature

File Settings View Wizards Help

Project

- AutoProject_1.mimp
 - Test2
 - 133
 - 132
 - 172
 - 159 dak
 - spoor
 - mstp
 - 173 rak
 - 133_new
 - 9
 - wes 141
 - usb-fc

Section

PHYSICAL LOGICAL NETWORK NODE LIST

Zone 1: 16042792 Z1, 19.2°C 18.0°C, Store, C1

Zone 2: 16111446 Z2, 19.4°C 18.0°C, Room, C1

Zone 3: 15151515 Z3, 0.0°C 2.0°C, Auto Set Ma, C1

Configure Fancoils in Zones

Control

Fan

Type: Three Speed Fan

Min Fan Speed: 33 %

Max Fan Speed Cooling: 100 %

Max Fan Speed Heating: 33 %

Valve

Valve Mode: OnOff

Dual Valve: ☒

6 Way Midpoint: 6.3 Volt

Use CO Sensor: ☒

Heater

Enabled: ☐

Run Down Time: 0 seconds

Restore To Default Previous Next Cancel

Verified '0' errors, '6' warn, '2' info. Diffuser Ch:1-(2) FanCoil Ch:1-(1)

Verify Output Comms Resets

Select Heater and Run Down Time if required

MLM Tool 08.17 r5.8 (Logged in as 'Installer') - ComfortTemperature

File Settings View Wizards Help

Project

- AutoProject_1.mimp
 - Test2
 - 133
 - 132
 - 172
 - 159 dak
 - spoor
 - mstp
 - 173 rak
 - 133_new
 - 9
 - wes 141
 - usb-fc

Section

PHYSICAL LOGICAL NETWORK NODE LIST

Zone 1

Zone 2

Zone 3

Configure Fancoils in Zones

Control

Fan

Type: Three Speed Fan

Min Fan Speed: 33 %

Max Fan Speed Cooling: 100 %

Max Fan Speed Heating: 33 %

Valve

Valve Mode: OnOff

Dual Valve: ☒

5 Way Midpoint: 6.3 Volt

Use CO Sensor: ☒

Heater

Enabled: ☒

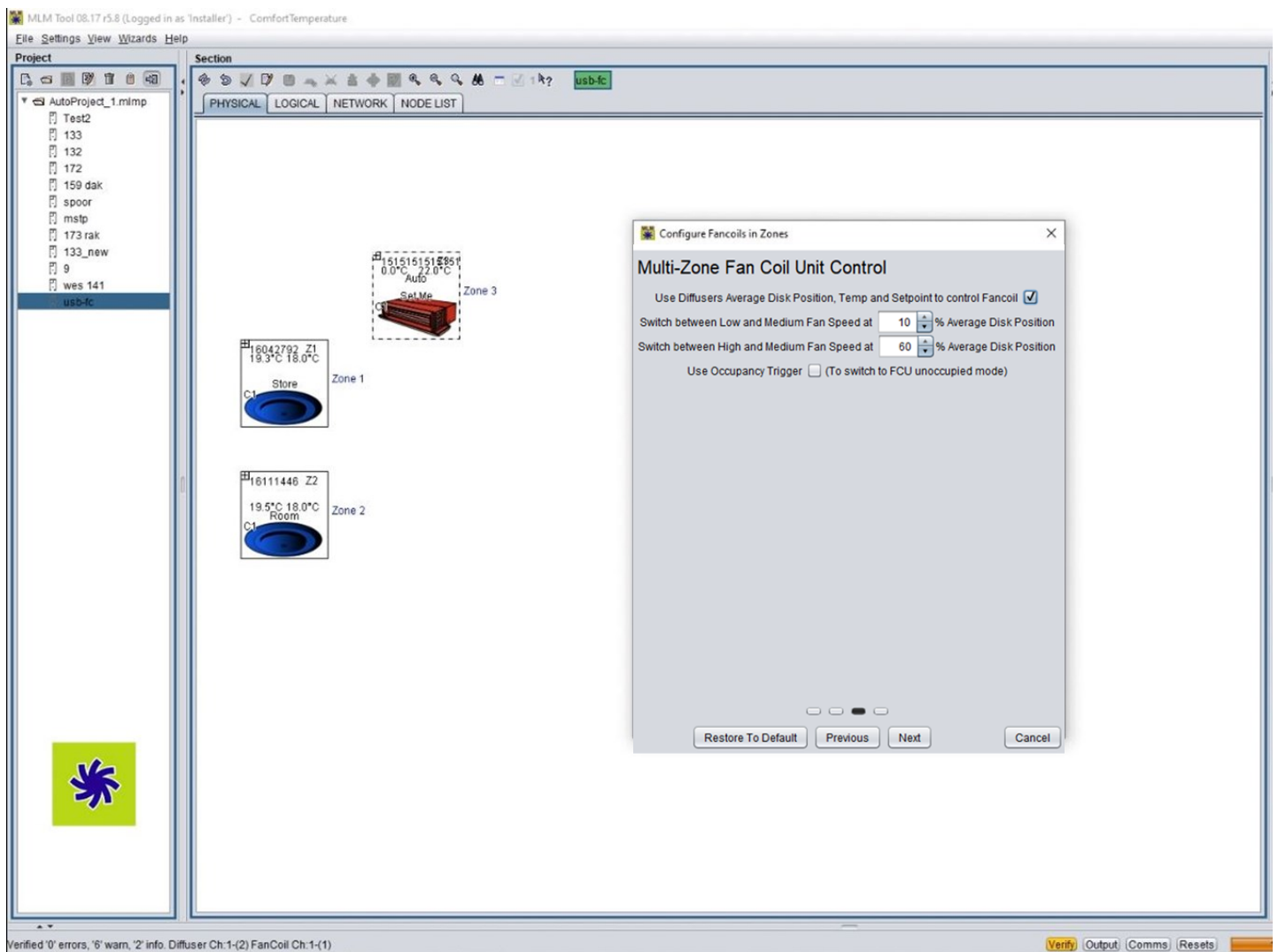
Run Down Time: 0 seconds

Restore To Default Previous Next Cancel

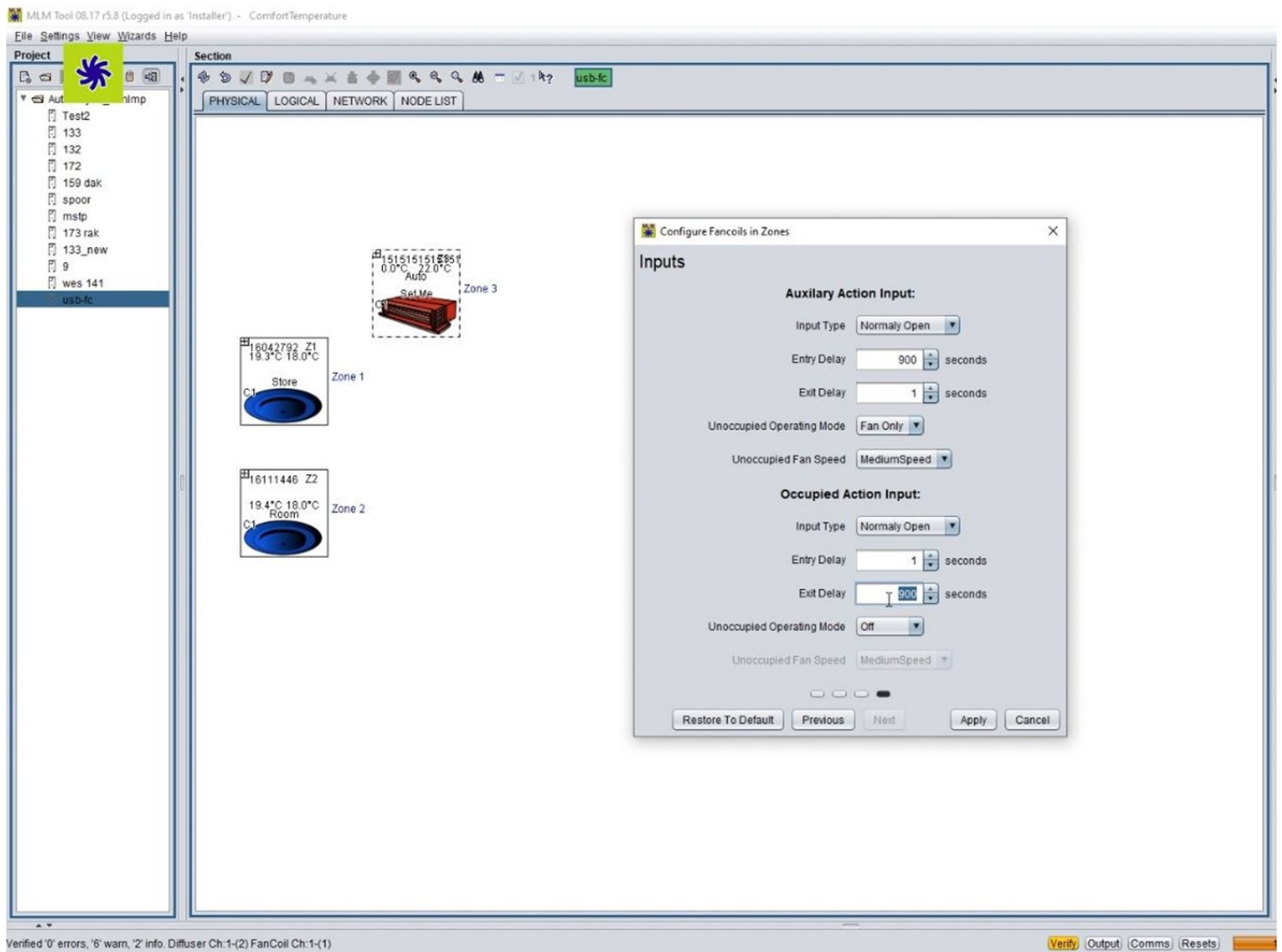
Verified 0 errors, 0 warn, 0 info. Diffuser Ch:1-(2) FanCoil Ch:1-(1)

Verify Output Comms Resets

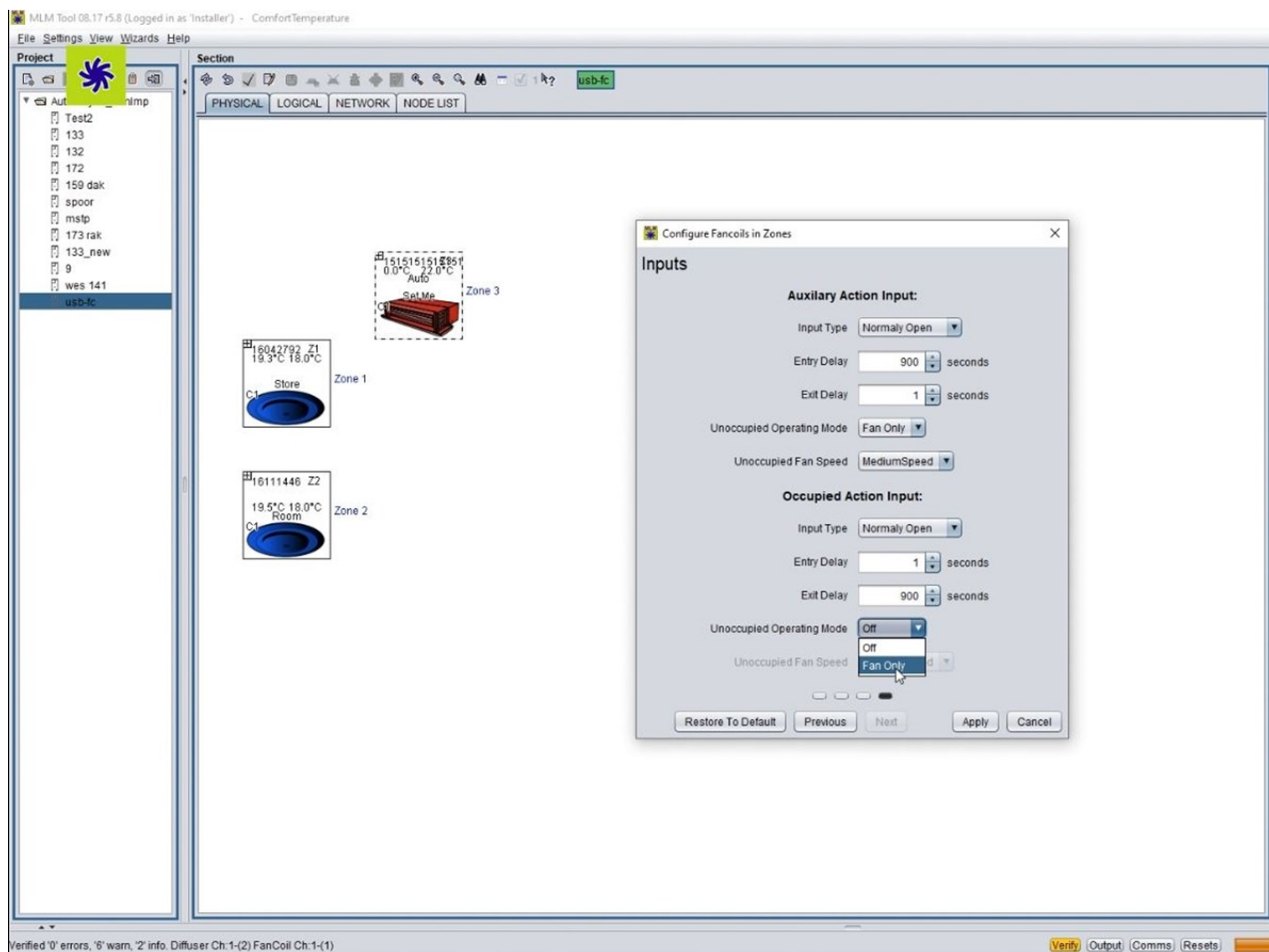
Select how you want the FCU to be controlled



Select how the FCU will respond to switch inputs by others and diffuser fitted occupancy sensors



Select how the FCU will respond to Unoccupied Operating Mode and apply your selections



4. Glossary of terms

AC	Alternating-current
BMS	Building Management System
DC	Direct-current
LCD	Liquid Crystal Display
MLM	Multi Loop Modular
PI	Proportional-Integral
PIR	Passive Infrared
SMPS	Switch-mode Power Supply
SP	Set Point