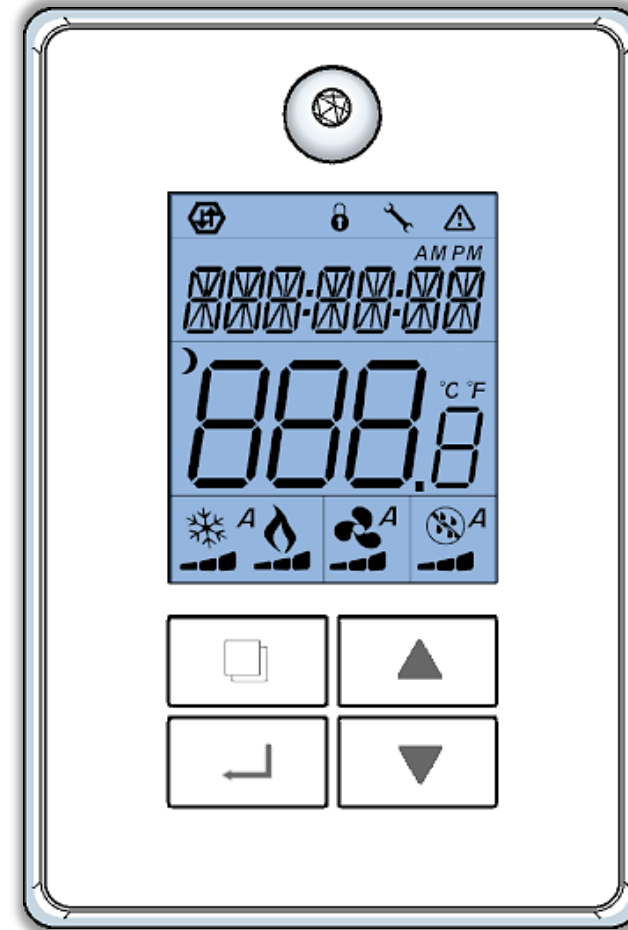


# BW437-RTU-LX (Roof Top Unit) Wall Controller Quick Guide



Smart Technology. Smart Equipment. Smart Solutions.  
Smarter Buildings.



# BW437-RTU Quick Guide

## Disclaimer

Please read this manual before proceeding to install this controller or any other Onyx LX device.

This manual applies to Onyx LX UI software version 4.0 and higher and using firmware version 1.058 and higher.

**All firmware updates must be done utilizing Supplied USB-COM adapter or USB to MSTP converter cable.**

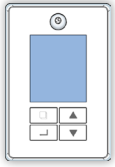
Installations shall be made by a properly certified technician and respect all local mandatory codes and regulations.

Electronic controls are static sensitive devices: discharge yourself properly before manipulating and installing a controller.

Any short circuit or incorrect wiring may permanently damage the controller or the controlled equipment.







Double check all wiring before applying power.

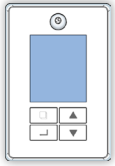
If a control failure could lead to personal injury and/or loss of property, it becomes the responsibility of the installer to add safety devices and/or alarm system to protect against failures.



# BW437-RTU-LX Quick Guide Symbol Definitions

The following table lists the symbols used in this document to denote certain conditions:

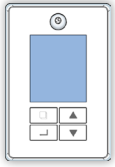
Symbol	Definition
	ATTENTION: Identifies information that requires special consideration
	TIP: Identifies advice or hints for the user, often in terms of performing a task
	REFERENCE _ INTERNAL: Identifies an additional source of information within the bookset.
<b>CAUTION</b>	Indicates a situation which, if not avoided, may result in equipment or work (data) on the system being damaged or lost, or may result in the inability to properly operate the process.
	Indicates a situation where users must observe precautions for handling electrostatic sensitive devices.
	CAUTION: Indicates a potentially hazardous situation which, if not avoided, may result in minor or moderate injury. It may also be used to alert against unsafe practices.
	WARNING: Indicates a potentially hazardous situation which, if not avoided, could result in serious injury or death.



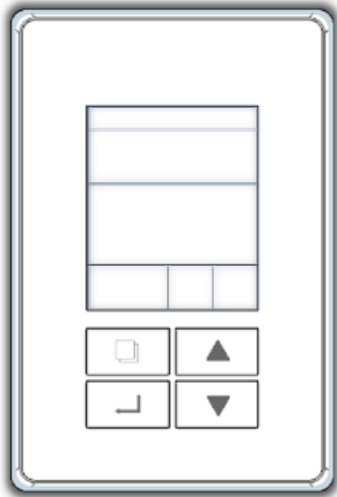
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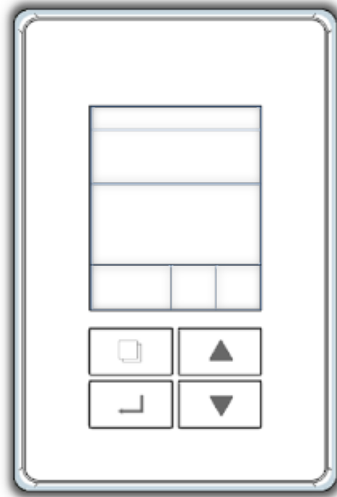
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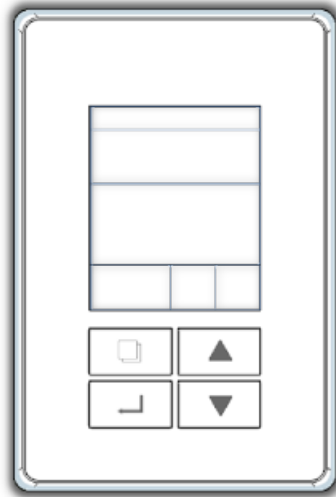
# BW437-RTU-LX Quick Guide Models Available



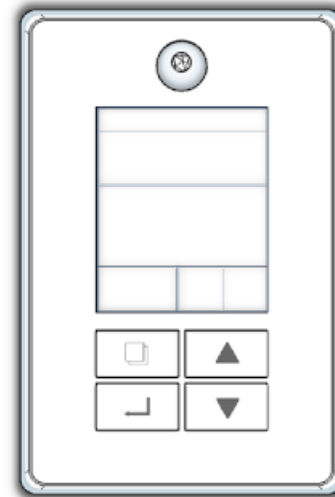
BW437-RTU-LX  
Base Model



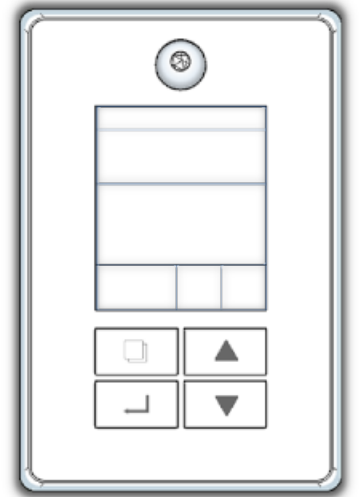
BW437H-RTU-LX  
Base Model  
Model *w/Humidity Sensor*



BW437HC-RTU-LX  
Base Model  
Model *w/Humidity Sensor w/CO2 Sensor*



BW437MH-RTU-LX  
Base Model  
Model *w/PIR Motion Sensor w/Humidity Sensor*



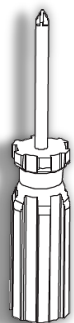
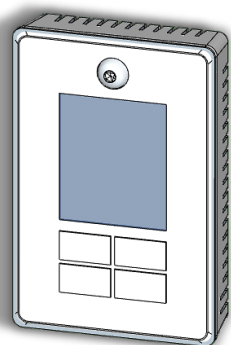
BW437MHC-RTU-LX  
Base Model  
Model *w/PIR Motion Sensor w/Humidity Sensor w/CO2 Sensor*



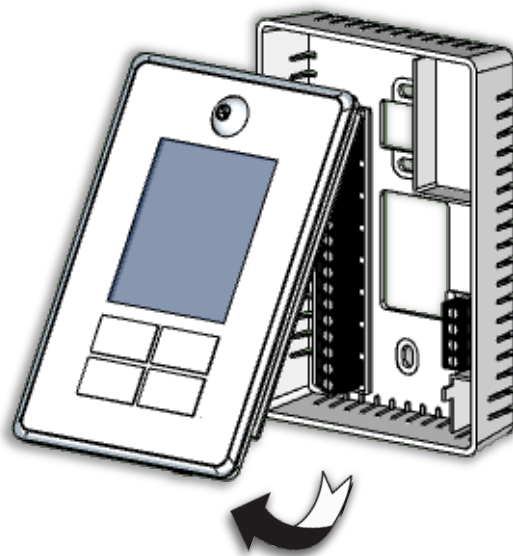
# Installation

## BW437-RTU-LX Mounting Instructions

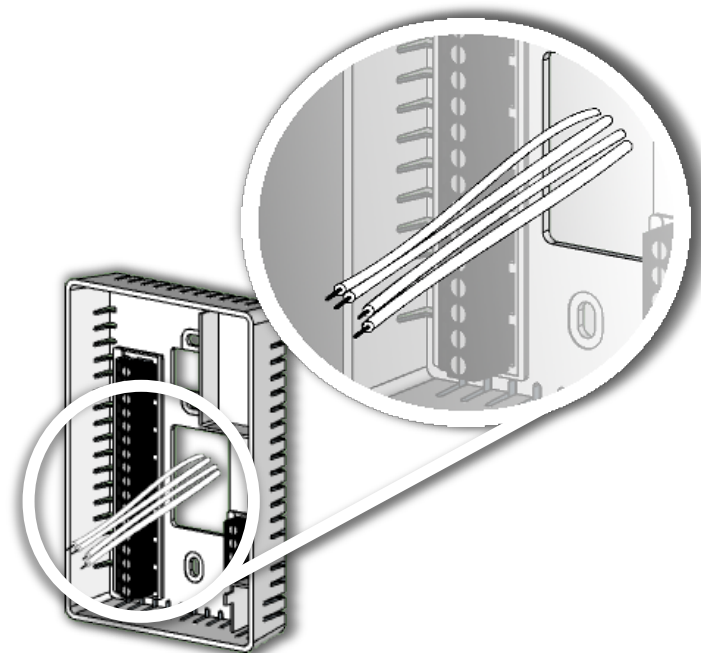
1. After unpacking your BW437-RTU-LX, unscrew the retaining screw at the bottom of the unit.



2. Gently pull the cover away from the base.



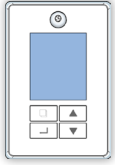
3. Pull the wires through the hole in the base.



**ONYXX<sup>®</sup> LX**

BY LYNXSPRING

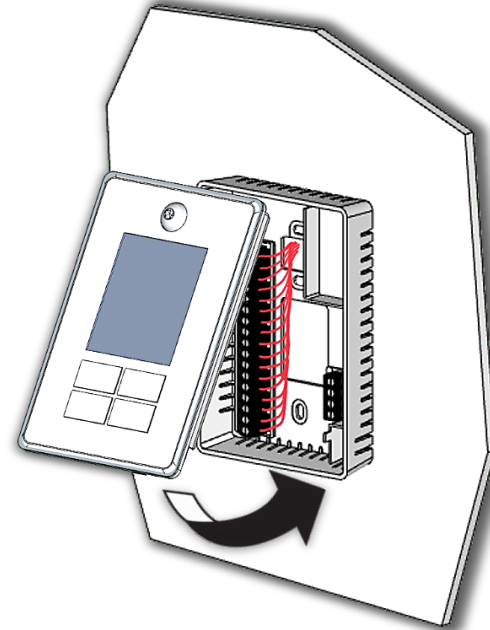
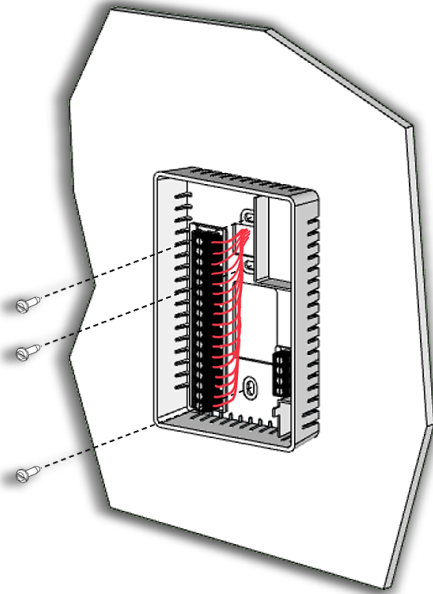
[www.lynxspring.com](http://www.lynxspring.com)



# Installation

## BW437-RTU-LX Mounting Instructions

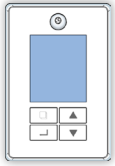
4. Connect the wires to the terminal, referring to the chart inside the base for the proper connections.
5. Before replacing the cover, make sure that you have made any necessary modification to DIP switch or jumper settings (see “Jumper Settings”).



*Electronic controls are static sensitive devices; discharge yourself properly before manipulating and installing the device.*

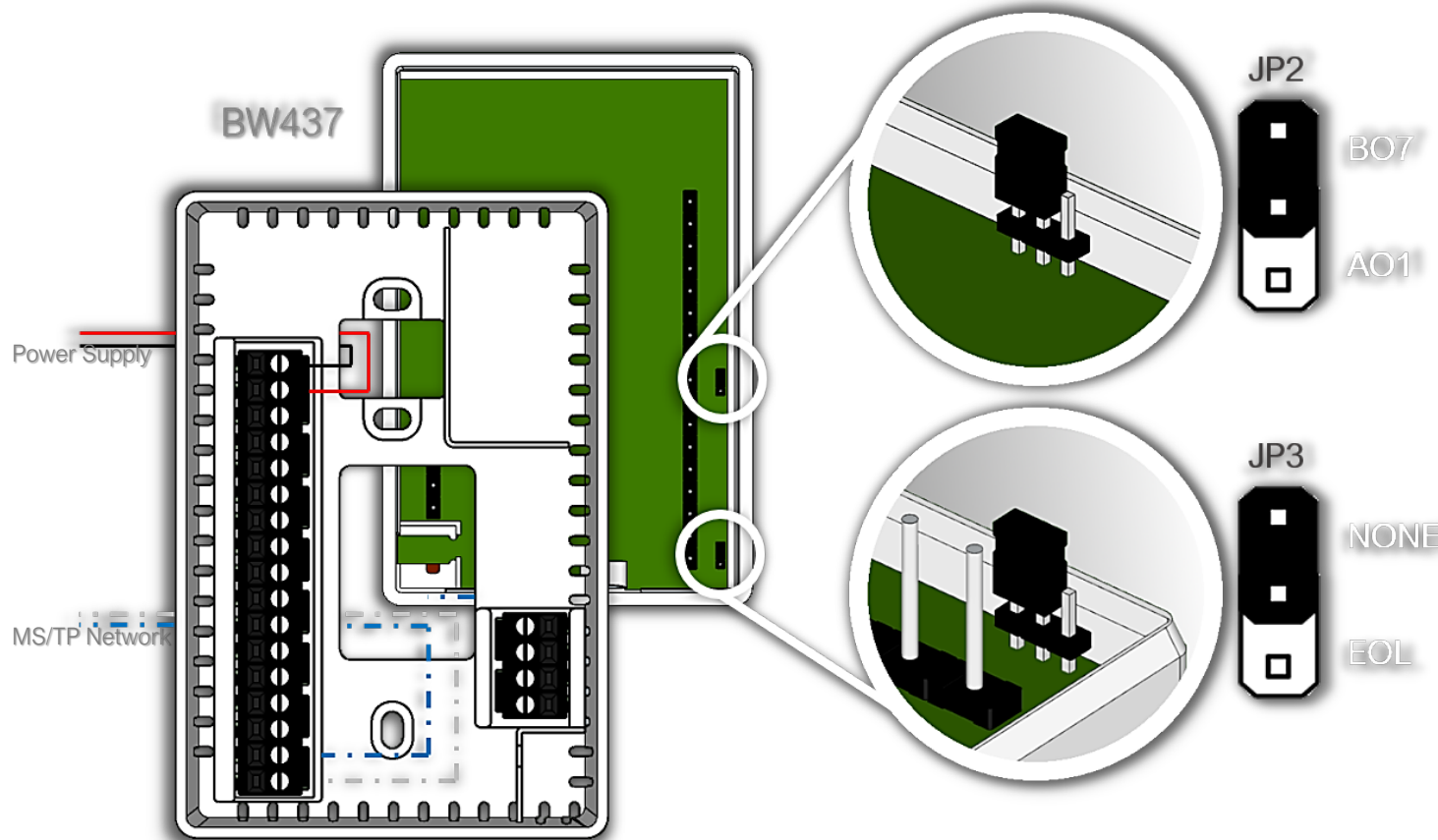


*Short circuits or incorrect wiring may permanently damage the controller. Double check your wiring before applying power. If a control failure could lead to personal injury and/or loss of property, the installer must add safety devices and/or alarm systems to protect against failures.*



# Installation

## Internal Jumper Settings



### Jumpers setting:

*JP2 to select between B07 or A01:*

*Jumper up = Using B07 (Low Speed Fan)*

*Jumper down = Using A01 (ECM)*

*JP3 enables EOL (120 Ohm ):*

*Set jumpers to EOL position if this device is the last node of the BACnet MS/TP network.*

*Jumper up = EOL not activated*

*Jumper down = EOL activated*





# Installation

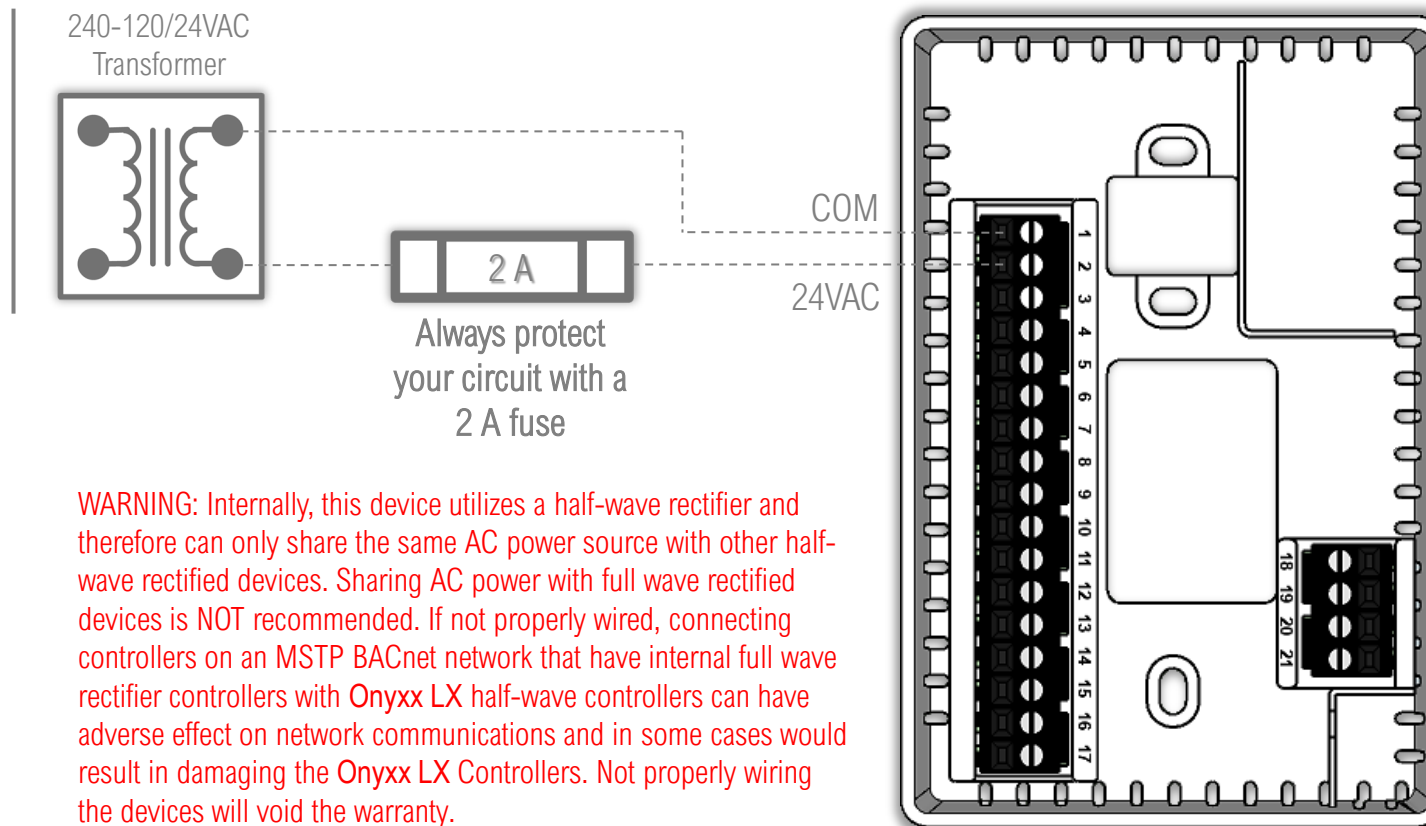
## Power Supply Connections

Add 24VAC transformer when the power is not supplied by the equipment

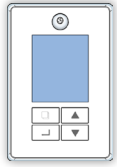
The BW437 must be powered using a Class 2, 24Vac transformer. When powering from a 24Vac transformer, do not ground either side of the transformer's secondary

For details on grounding within control panels, NFPA 79 and UL508A provide the required details.

Wire size based on VA rating and distance from Power source



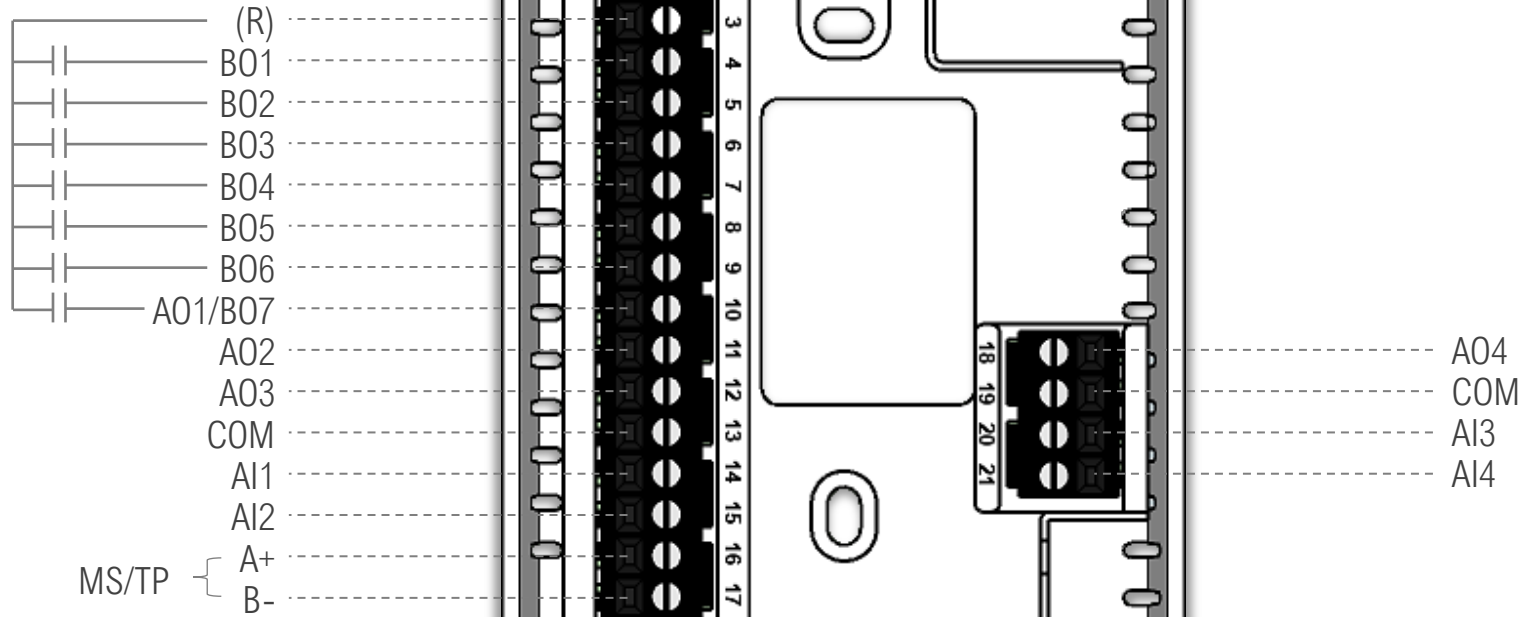
**WARNING:** Internally, this device utilizes a half-wave rectifier and therefore can only share the same AC power source with other half-wave rectified devices. Sharing AC power with full wave rectified devices is NOT recommended. If not properly wired, connecting controllers on an MSTP BACnet network that have internal full wave rectifier controllers with Onyx LX half-wave controllers can have adverse effect on network communications and in some cases would result in damaging the Onyx LX Controllers. Not properly wiring the devices will void the warranty.



# Installation

## I/O Wiring Instructions

*\*\*recommend using pilot relays in any application utilizing Binary outputs as switching loads. \*\**



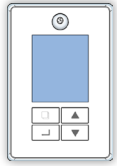
RS-485 Wire Required for communications wiring

# ONYXX<sup>®</sup> LX

BY LYNXSPRING

Supported Wire Size 28-16 AWG

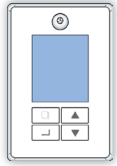
[www.lynxspring.com](http://www lynxspring.com)



# Installation

## I/O Wiring Instructions

I/Os			RT 2STG	RT ECON	HP 2STG	RT IAQ	RT MOD	HP DEH	HUM-DEH	RT 3STG	RT 4STG	HP 3STG	HP 4STG
Connector	Object	Name											
1			COM	COM	COM	COM	COM	COM	COM	COM	COM	COM	COM
2			24V	24V	24V	24V	24V	24V	24V	24V	24V	24V	24V
3			(R)	(R)	(R)	(R)	(R)	(R)	(R)	(R)	(R)	(R)	(R)
4	BO1	BO_1	G	G	G	G	G	G	G	G	G	G	G
5	BO2	BO_2	Y1	Y1	Y1	Y1	Y1	Y1	Y1	Y1	Y1	Y1	Y1
6	BO3	BO_3	Y2	Y2	Y2	Y2	Y2	Y2	Y2	Y2	Y2	Y2	Y2
7	BO4	BO_4	W1	W1	W1	W1	W1	O (O/B)	W1	Y3	Y3	Y3	Y3
8	BO5	BO_5	W2	W2	O (O/B)	W2	*	DeHum	W2	W1	Y4	O (O/B)	Y4
9	BO6	BO_6	OCC	OCC	OCC	*	OCC	OCC	Dehum	W2	W1	O	O (O/B)
10	BO7	BO_7	P-EXH	P-EXH	P-EXH	P-EXH	P-EXH	*	*	OCC	W2	OCC	OCC
10	AO1	AO_1	*	*	*	*	*	*	Hum	*	*	*	*
11	AO2	AO_2	*	*	*	Analog heat	Analog heat	*	*	*	*	W1	W1
12	AO3	AO_3	*	*	*	*	*	*	OCC	*	*	*	*
18	AO4	AO_4	*	Econo	Econo	Econo	*	*	*	*	OCC	*	*
13			COM	COM	COM	COM	COM	COM	COM	COM	COM	COM	COM
14	AI1	AI_1	BI1	BI1	BI1	BI1	BI1	BI1	BI1	BI1	BI1	BI1	BI1
15	AI2	AI_2	OAT	OAT	OAT	OAT	OAT	WS	Supply RH high limit	OAT	OAT	OAT	OAT
20	AI3	AI_3	SAT	SAT	SAT	SAT	SAT	SAT	SAT	SAT	SAT	SAT	SAT
21	AI4	AI_4	RS	RS	RS	RS	RS	RS	RS	RS	RS	RS	RS
(Internal)	AI5	RoomT	Room T	Room T	Room T	Room T	Room T	Room T	Room T	Room T	Room T	Room T	Room T
(Internal)	AI6	RoomRH	Room RH	Room RH	Room RH	Room RH	Room RH	Room RH	Room RH	Room RH	Room RH	Room RH	Room RH
(Internal)	AI7	RoomCO2	Room CO2	Room CO2	Room CO2	Room CO2	Room CO2	Room CO2	Room CO2	Room CO2	Room CO2	Room CO2	Room CO2
(Internal)	BI1	Motion	Motion	Motion	Motion	Motion	Motion	Motion	Motion	Motion	Motion	Motion	Motion
16			A+ MS/TP	A+ MS/TP	A+ MS/TP	A+ MS/TP	A+ MS/TP	A+ MS/TP	A+ MS/TP	A+ MS/TP	A+ MS/TP	A+ MS/TP	A+ MS/TP
17			B- MS/TP	B- MS/TP	B- MS/TP	B- MS/TP	B- MS/TP	B- MS/TP	B- MS/TP	B- MS/TP	B- MS/TP	B- MS/TP	B- MS/TP

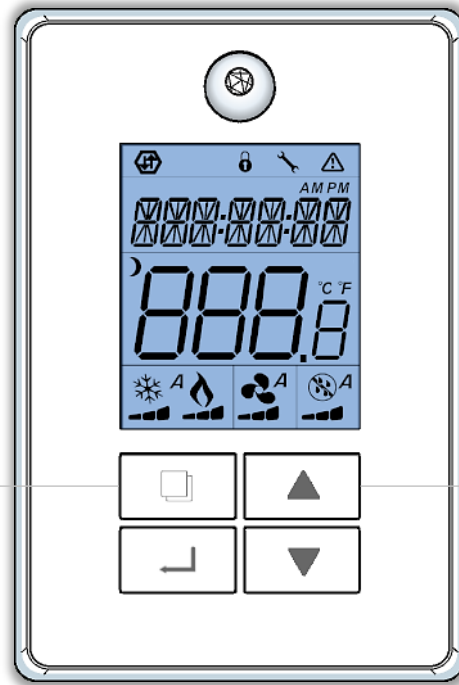


# Parameters Buttons

User adjustable interface functions of the BW437-RTU-LX

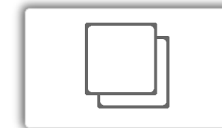
Hold for 3 seconds to display the device Name

Hold for 7 seconds to Enable or Disable PIR state screen display. The backlight display will follow the PIR movement detection for a few minutes



Hold for 3 seconds to display the device Model

*System Mode*



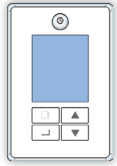
*Up*



*Fan Mode*



*Down*



# Display Icons

## Local LCD



The signal icon indicates network connection status

Visible and fixed static = Online to both the BACnet MSTP network and the Strato Automation server

Blinking = Online to the BACnet MSTP network only



The lock icon indicates that setpoints have been locked from the network and cannot be modified by the thermostat keys



The wrench icon indicates that the device is in configuration mode



The warning icon indicates that there may be MSTP communication errors / problem (invalid frames)

Check wiring and use an MSTP sniffer tool if necessary

**AM PM**

Displays whether the time is AM or PM



This line displays the room temperature or room setpoint

Use up and down arrows to temporarily modify the display setpoint



Displays the time (hh:mm) on the first line and the day of the week.



Icon to display night mode / unoccupied.



The water droplet icon indicates whether the dehumidification or humidification process is on and working

The segmented bar indicates whether the humidifier is at 33, 66 or 100% output capacity

The A indicates that the humidity function is in Automatic mode



The fan icon indicates that fan is on and working

The segmented bars indicates whether the fan in 1st, 2nd or 3rd speed

The A indicates that the Fan mode is in Automatic mode



The snowflake indicates that cooling process is on and working

The segmented bar indicates whether the cooling is at 33, 66 or 100% output capacity

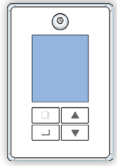
The A indicates that the cooling function is in Automatic mode



The flame indicates that heating process is on and working

The segmented bar indicates whether the heating is at 33, 66 or 100% output capacity

The A indicates that the heating function is in Automatic mode



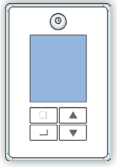
# Display Messages Local LCD

## AI-1 and AI-2 as external inputs Display Messages MSV100

Message	Sequence of each input selection
None	(None): No function will be associated with the input
Rem NSB Ovr	(NSB Night Setback): NSB timer clock input. The scheduling will now be set as per the binary input. It provides low-cost setback operation via a dry contact. Contact opened = Unoccupied Contact closed = Occupied
No Msg	(OVR Override): Temporary occupancy remote override contact. This function disables the central button override function on the equipment Controller. The override function is now controlled by a manual remote closed contact.
Filter	(Filter): Filter will be displayed on the Equipment Controller screen when the input is in fault and MSV100 will provide status alarm. Contact opened = No alarm Contact closed = Alarm displayed
Service	(Service): Service will be displayed on the Equipment Controller screen when the input is in fault. It can be tied into the HVAC unit control card, which provides an alarm in case of malfunction. This is a latching function and requires either a power cycle or writing to MSV3 to Off and then back to the desired mode to clear this alarm to return the device to normal function. Contact opened = No alarm Contact closed = Alarm displayed
Fanlock	(Fan lock): When this input is chosen it will monitor the status of the fan and lock out Fan, Heat and Cool and MSV100 will provide status alarm and FANLOCK will be displayed on the Equipment Controller screen when in fault. This is a latching function and requires either a power cycle or writing to MSV3 to Off and then back to the desired mode to clear this alarm to return the device to normal function. Contact opened = Alarm displayed Contact closed = No alarm

## Display Messages MSV100

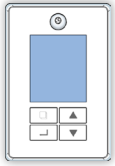
Message	Sequence
Frozen	(SupplyFrozen): SupplyFrozen will be displayed on the Equipment Controller screen when in fault. It is triggered internally when the measured supply temperature falls below 38 F. This is a latching function and requires a power cycle or writing to MSV3 to Off and then back to the desired mode to clear this alarm to return the device to normal function. This requires a supply air sensor.



# Cooling and heating stages














## Application Note

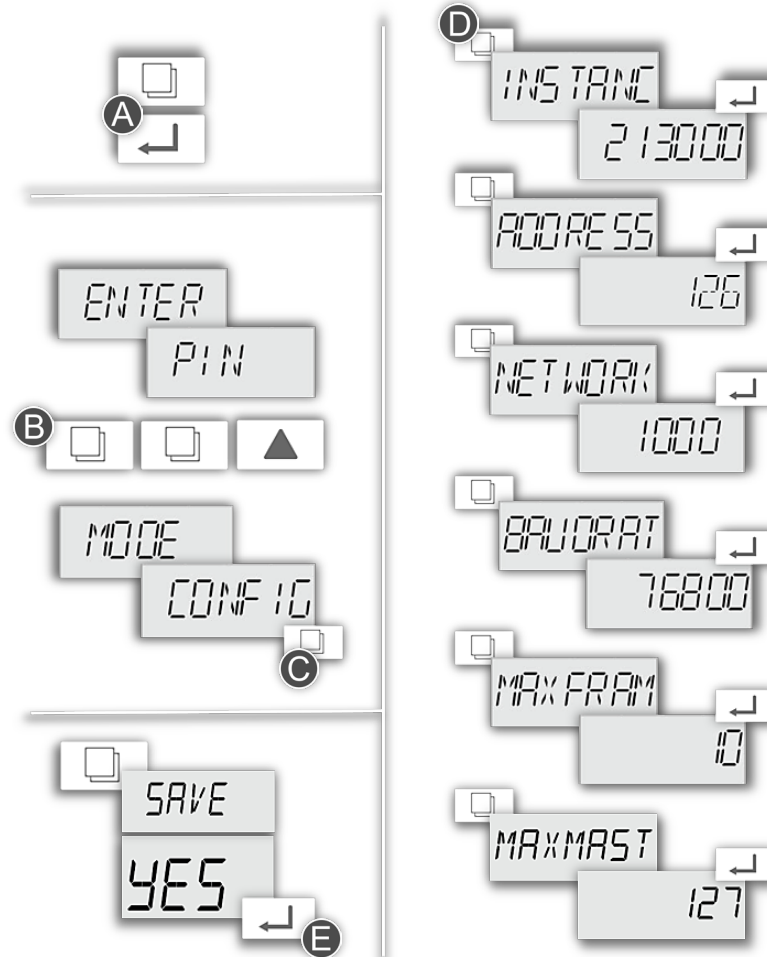
<b>Binary Output</b>	(Binary outputs staging): There is a fixed 3 min delay before the first stage of heating or cooling will start. There is a 1 min delay for each stage afterward. See demand curves on each sequence in this guide.
<b>Change Over</b>	(Heating/Cooling Change Over): There is a fixed 3 min delay before the first stage of heating or cooling will start when changing over from heating or cooling for both Binary and Analog outputs.
<b>Analog Output</b>	(Analog outputs staging): There is a fixed 1 min delay before the analog outputs of heating or cooling will start. Staging will depend on the [AV-59] calculated effective SAT against the [AV-16] Supply air Temp. This is calculated internally by the PID. See demand curves on each sequence in this guide.



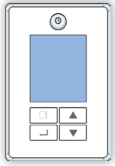
# Using the menus

## Network Configuration Settings

- A** Set the BW437-RTU's configuration in the "CONFIG MODE" directly on the BW437-RTU's screen using the keypad. To be able to do so, press simultaneously  and  buttons for 3 seconds.
- B** Press these PIN keys in sequence on the BW437-RTU's keypad    *CONFIG MODE* will blink on the screen
- C** Press the  button to start cycling through the configuration menus.
- D** Press  button to cycle through each parameter  
Access any configuration menu by pressing  on the menu's display screen,  
Using the   and the  button, adjust each digit to the desired value.  
When done, press  once more to confirm the new value.
- E** Accept to SAVE by selecting YES and pressing 

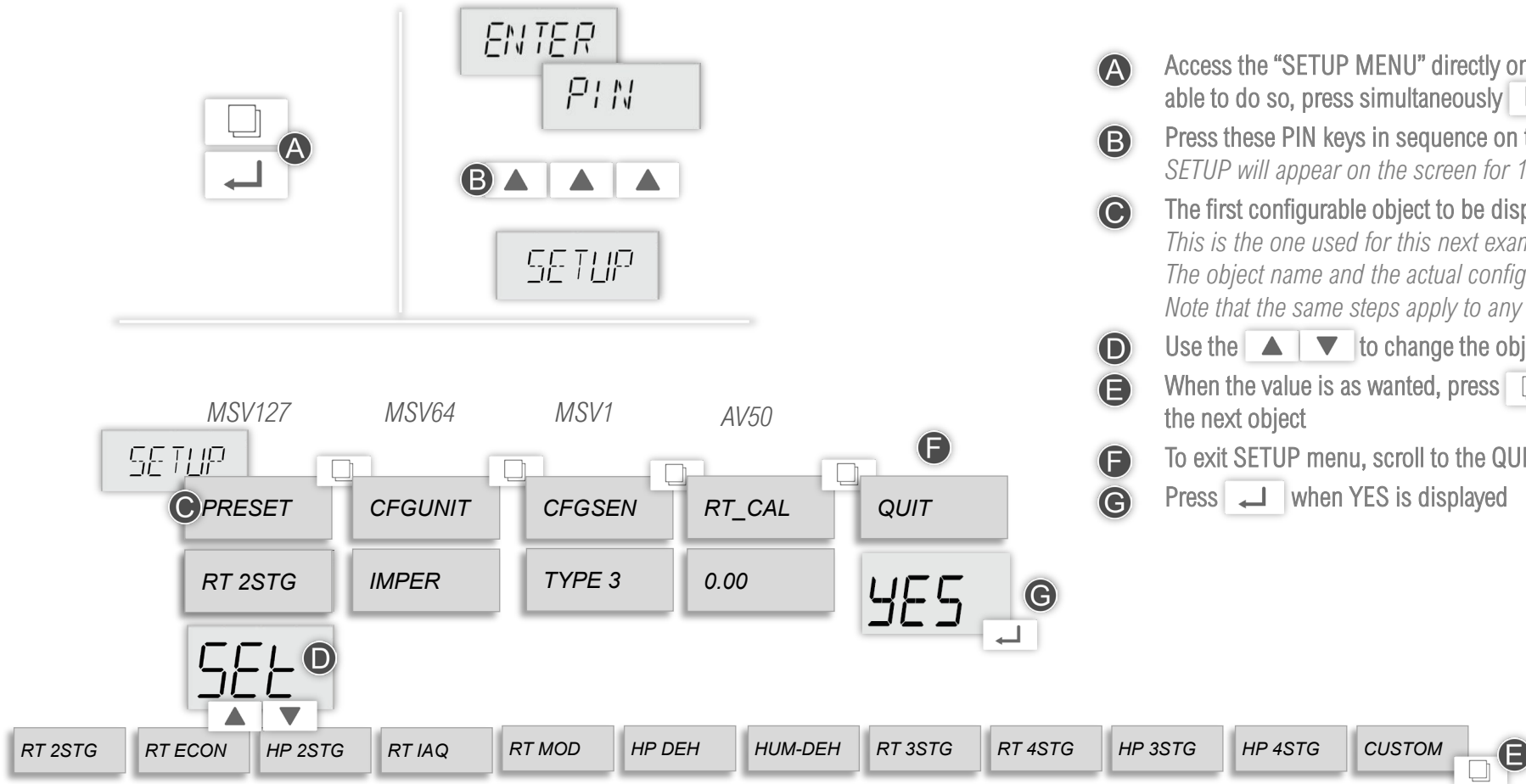




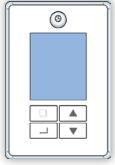


# Using the menus

## Setup menu (quick setup)



- A** Access the “SETUP MENU” directly on the BW437RTU’s screen using the keypad. To be able to do so, press simultaneously **COPY** and **ENTER** buttons for 3 seconds.
- B** Press these PIN keys in sequence on the BW437RTU’s keypad **▲ ▲ ▲**  
*SETUP will appear on the screen for 1 second*
- C** The first configurable object to be displayed in the SETUP menu is the PIPENUM  
*This is the one used for this next example*  
*The object name and the actual configuration will blink alternatively on screen.*  
*Note that the same steps apply to any other configurable object*
- D** Use the **▲ ▼** to change the object SETUP configuration
- E** When the value is as wanted, press **COPY** or **ENTER** to save the settings and switch to the next object
- F** To exit SETUP menu, scroll to the QUIT menu using **COPY**
- G** Press **ENTER** when YES is displayed

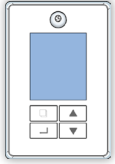


# Using the menus

## Setup menus (quick setup)

SETUP

<i>Object Instance</i>	<i>Setup menu</i>	<i>Description</i>	<i>Options</i>	<i>Function</i>
<i>MSV127</i>	<i>Preset</i>	<i>Select application</i>		<i>See Table Next page</i>
<i>MSV64</i>	<i>CFGunit</i>	<i>Units configuration</i>	<i>Metric</i> <i>Imper</i>	<i>Sets the system for using metric units (Degree C)</i> <i>Sets the system for using imperial units (Degree F)</i>
<i>MSV1</i>	<i>CFGsens</i>	<i>Remote thermistor type</i>	<i>Type 3</i> <i>Type 2</i>	<i>Sets remote thermistor types to 10K-3 (10K type 3)</i> <i>Sets remote thermistor types to 10K-2 (10K type 2)</i>
<i>AV50</i>	<i>RT_Cal</i>	<i>Room temperature calib</i>	<i>- 3.00 (C/F)</i> <i>+ 3.00 (C/F)</i>	<i>Allows calibration of the room sensor used for the main temperature control loop of the thermostat. Default is (0.00 C/F)</i>



# Using the Menus

## Setup Menus (quick setup)

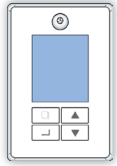
### Table

SETUP

*Object*  
*Instance*  
*MSV 127*

	<i>Application</i>	<i>Fan</i>	<i>Htg Stg 1</i>	<i>Htg Stg 2</i>	<i>Mod Htg</i>	<i>Clg Stg 1</i>	<i>Clg Stg 2</i>	<i>Clg Stg 3</i>	<i>Clg Stg 4</i>	<i>Rev Valve</i>	<i>Econ Mod</i>	<i>CO2</i>	<i>Dehumid Stg</i>	<i>Humidifier Stg</i>	<i>Humidifier Mod</i>
<i>RT 2STG</i>	<i>RTU</i>	X	X	X		X	X								
<i>RT ECON</i>	<i>RTU</i>	X	X	X		X	X				X				
<i>HP 2STG</i>	<i>Heatpump</i>	X	X			X	X			X	X				
<i>RT IAQ</i>	<i>RTU</i>	X	X	X		X	X				X	X			
<i>RT MOD</i>	<i>RTU</i>	X	X		X	X	X								
<i>HP DEH</i>	<i>Heatpump</i>	X				X	X			X			X		
<i>HUM-DEH</i>	<i>RTU</i>	X	X	X		X	X						X		X
<i>RT 3STG</i>	<i>RTU</i>	X	X	X		X	X	X			X				
<i>RT 4STG</i>	<i>RTU</i>	X	X	X		X	X	X	X		X				
<i>HP 3STG</i>	<i>Heatpump</i>	X	X			X	X	X		X					
<i>HP 4STG</i>	<i>Heatpump</i>	X	X			X	X	X	X	X					
<i>Custom</i>															

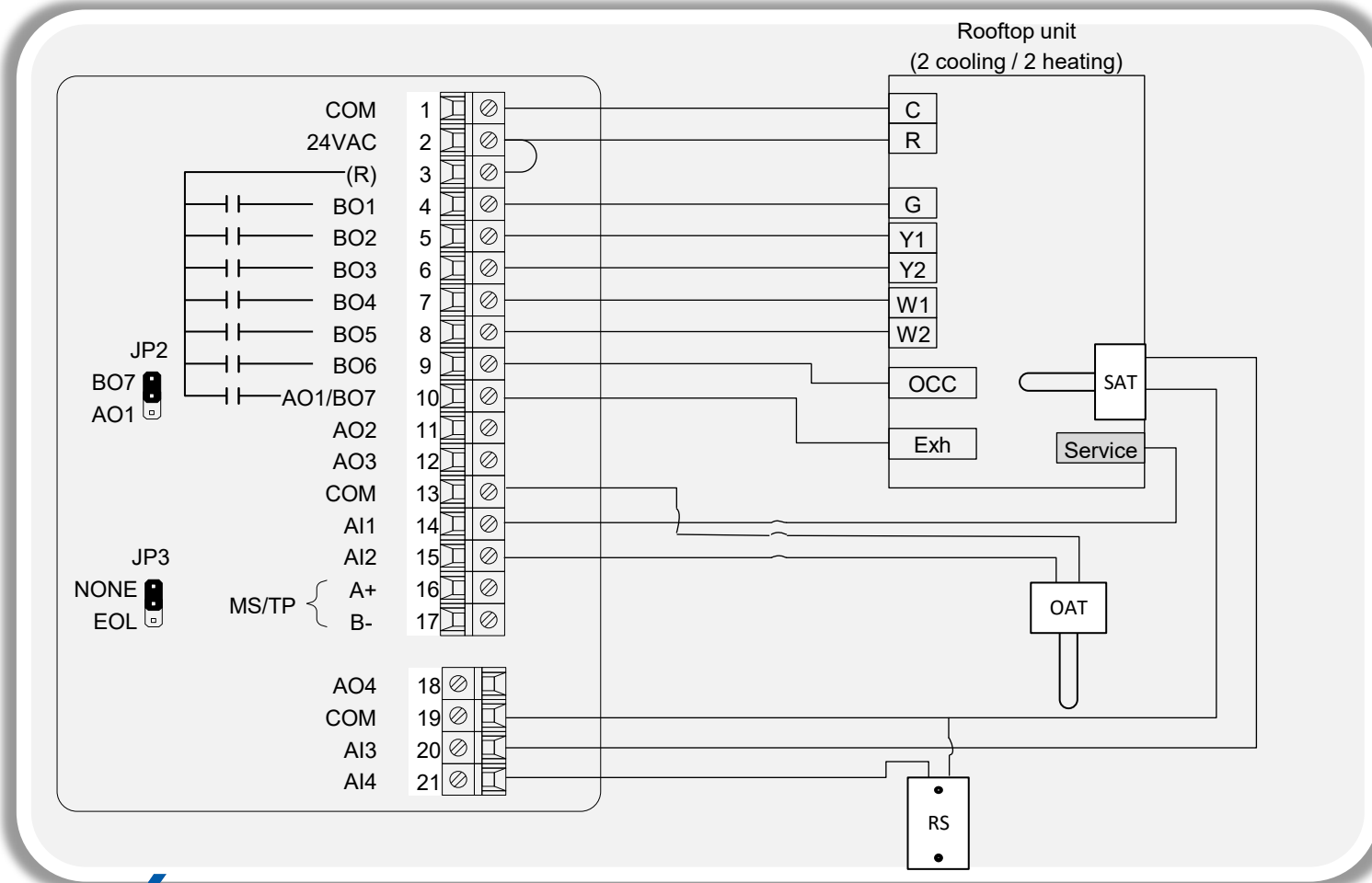
Please note: MSV, 7, 8, 9, 10, 16, 17, 18, 19, 23, 27, 28, 30, 32, 44, 45, 46, 48, 49 52, 54, 55, 65 & 68 are used for "custom" configuration applications. Make sure MSV127 is set to "custom" **BEFORE** setting any of those MSV's



# Installation

## I/O Wiring & Sequence

### MSV127 – RT 2STG

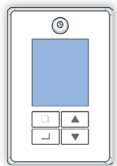


RT 2STG: Sets for a 1 on/off fan, 2 on/off heat & 2 on/off cooling stages RTU unit

#### Notes:

- BO6 is an occupancy output that follows the main occupancy
- BO7 is an on/off power exhaust that follows the main occupancy when the main fan BO1 is on
- AI's can be configured for various options as per MSV2, 27, 28, 66 & 67

Add 24VAC transformer when the power is not supplied by the equipment



# Installation

## I/O Wiring & Sequence

### MSV127 – RT 2STG

#### Sequence of operation

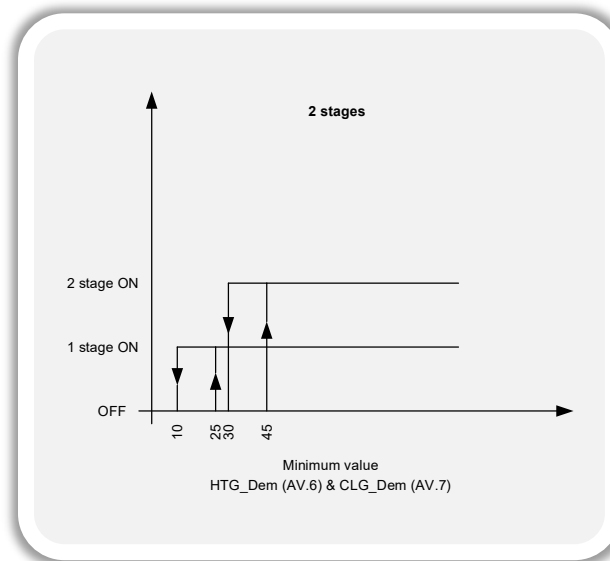
**Occupied Mode:** Setpoints will revert to those defined by occupied cooling and heating setpoints

**Occupied Override Mode:** The system will revert to occupied mode for the duration determined by the “OvrTime\_Set AV27” parameter

**On a call for cooling / System mode is Cooling or Auto:** Cooling stages will be energized according to cooling demand AV7 as per % threshold values to maintain room temperature. Heating outputs are not energized

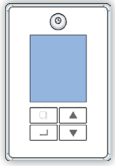
**On a call for heating / System mode is Heating or Auto :** Heating stages will be energized according to heating demand AV6 as per % threshold values to maintain room temperature. Cooling outputs are not energized

**Fan operation:** Occupied mode the fan will follow the fan mode setting (MSV4 Fan Mode). Fan On will make the fan run continuously during occupied hours. Fan Auto will only energize the fan on a call for a heating or cooling stage to be energized



- Fan needs to be on
- Call For Cooling or Heating at least 180 seconds
- There is a 60 seconds delay between each stage

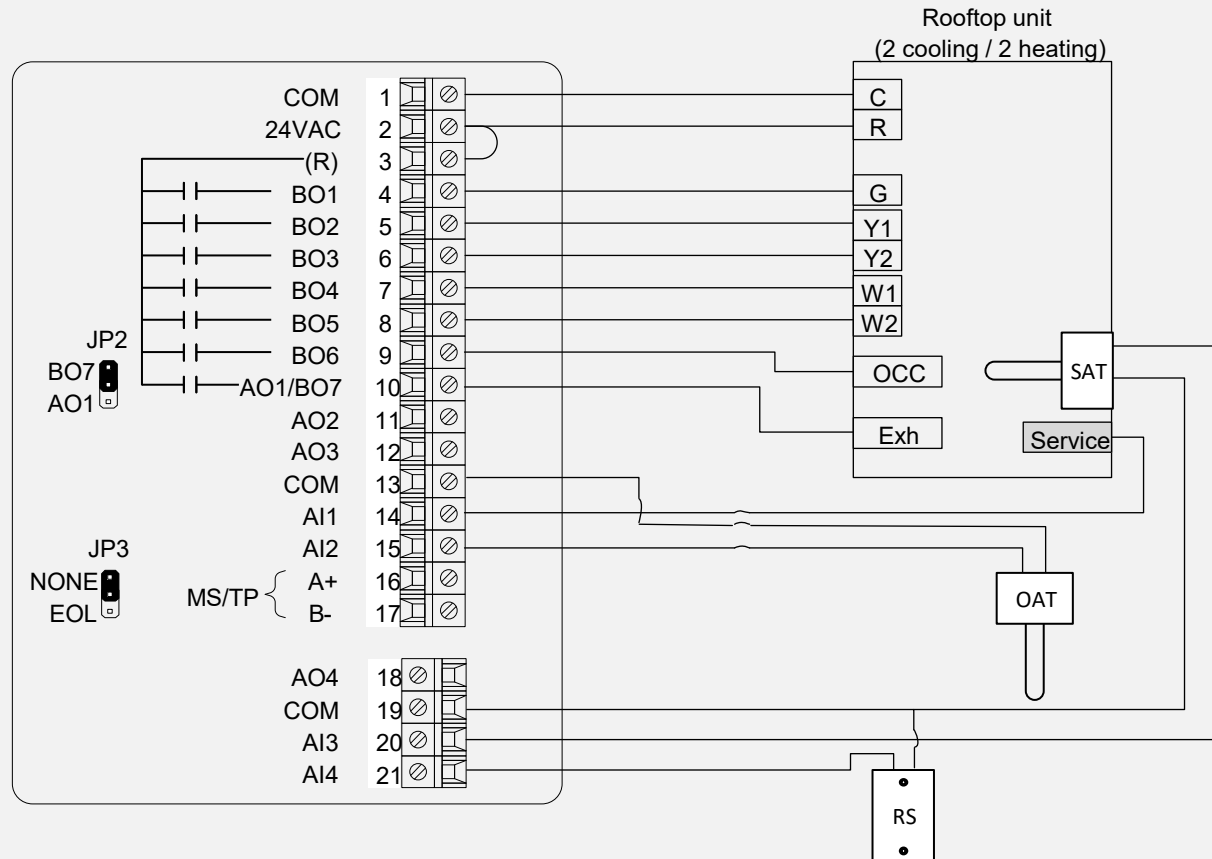
Add 24VAC transformer when the power is not supplied by the equipment



# Installation

## I/O Wiring & Sequence

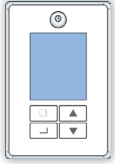
### MSV127 – RT ECON



RT 2STG: Sets for a 1 on/off fan, 2 on/off heat & 2 on/off cooling stages RTU unit

#### Notes:

- BO6 is an occupancy output that follows the main occupancy
- BO7 is an on/off power exhaust that follows the main occupancy when the main fan BO1 is on
- AI's can be configured for various options as per MSV2, 27, 28, 66 & 67



# Installation

## I/O Wiring & Sequence

### MSV127 – RT ECON

#### Sequence of operation

**Occupied Mode:** Setpoints will revert to those defined by occupied cooling and heating setpoints

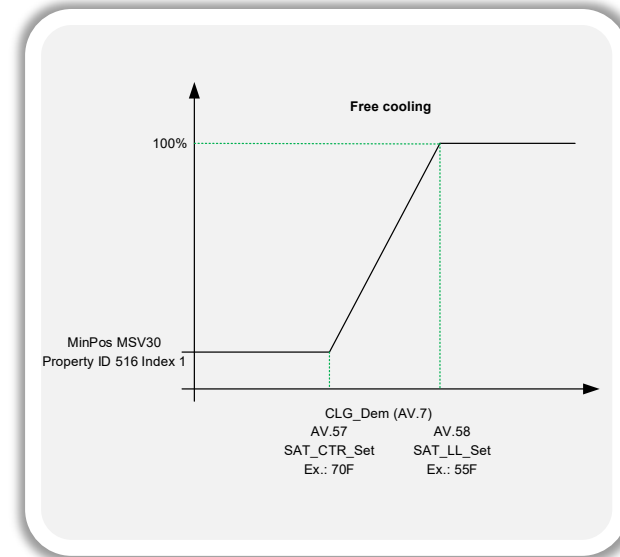
**Occupied Override Mode:** The system will revert to occupied mode for the duration determined by the “OvrTime\_Set AV27” parameter

**On a call for cooling / System mode is Cooling or Auto and OAT > than the economizer changeover value:** Cooling stages will be energized according to cooling demand AV7 as per % threshold values to maintain room temperature. Heating outputs are not energized

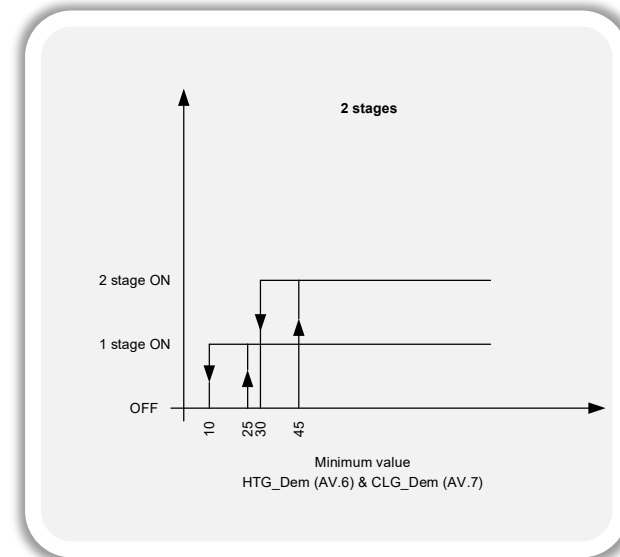
**On a call for cooling / System mode is Cooling or Auto and OAT < than the economizer changeover value:** Cooling stages will be not be energized. Cooling will be provided by modulating the economizer from it's minimum position according to cooling demand AV7. The supply temperature will be modulated between the economizer center setpoint AV57 and the low limit setpoint AV58

**On a call for heating / System mode is Heating or Auto :** Heating stages will be energized according to cooling demand AV7 as per % threshold values to maintain room temperature. Cooling outputs are not energized

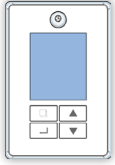
**Fan operation:** Occupied mode the fan will follow the fan mode setting (MSV4 Fan Mode). Fan On will make the fan run continuously during occupied hours. Fan Auto will only energize the fan on a call for a heating or cooling stage to be energized



- Economizer OAT Changeover is set at: AV29 OAT, Property ID 516, Index 2
- Free cooling authorized status on BV8
- Call For Cooling at least 180 seconds



- Fan needs to be on
- Call For Cooling or Heating at least 180 seconds
- There is a 60 seconds between each stages



# Installation

## I/O Wiring & Sequence

### MSV127 – RT ECON

#### Economizer

The controller can be configured with the economizer option to take advantage of free cooling. The two *Control Types* of that can be configured are Off-Auto or Modulating control.

#### Dry Bulb

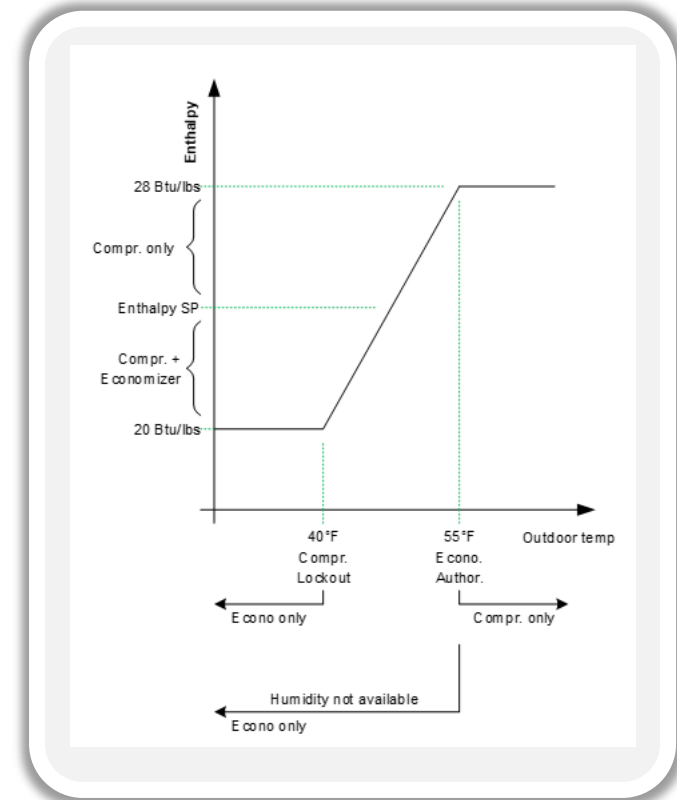
The economizer is enabled to utilize free cooling when there is a call for cooling and the outside air temperature is less than the OAT Econo Authorization setpoint.

When the control type is set to Off-Auto, and economizer is enabled, the output will energize the manufacturers equipment economizer control.

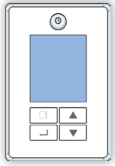
When the control type is set for Modulating, the controller will modulate the outside air damper from minimum to 100% to maintain the Minimum Supply Setpoint (55°F/13°C) at 100% demand call. When the demand call is 0%, the economizer will be set Off or Modulated to maintain the Neutral Supply Setpoint (68°F/20°C). This sequence requires an Outdoor Air Sensor only and setting the OAT Econo Authorization setpoint at a value higher than the OAT [ex. OAT Econo Authorization setpoint = 70 °F and OAT = 62 then Economizer will operate] Setting the Economizer schedule, Econo control type and output location.

#### Enthalpy

If the calculated enthalpy is LESS than the enthalpy setpoint, the economizer will run in free cooling mode when it receives a call for cooling and our sequence allows compressor operation during economizer mode which can be a way to save energy when we cool the outdoor air instead of the return air. This sequence requires an Outdoor Air sensor, a Supply Air sensor, a Mixed Air sensor and a Humidity sensor location in Econo Config and Control Sensor physical location in Hum and Dehumid Config. The OAT Econo Authorization setpoint must be a value higher than the OAT [ex. OAT Econo Authorization setpoint = 70 °F and OAT = 62 then Economizer will operate] Setting the Economizer schedule, Econo control type and output location to run the Enthalpy Economizer sequence.



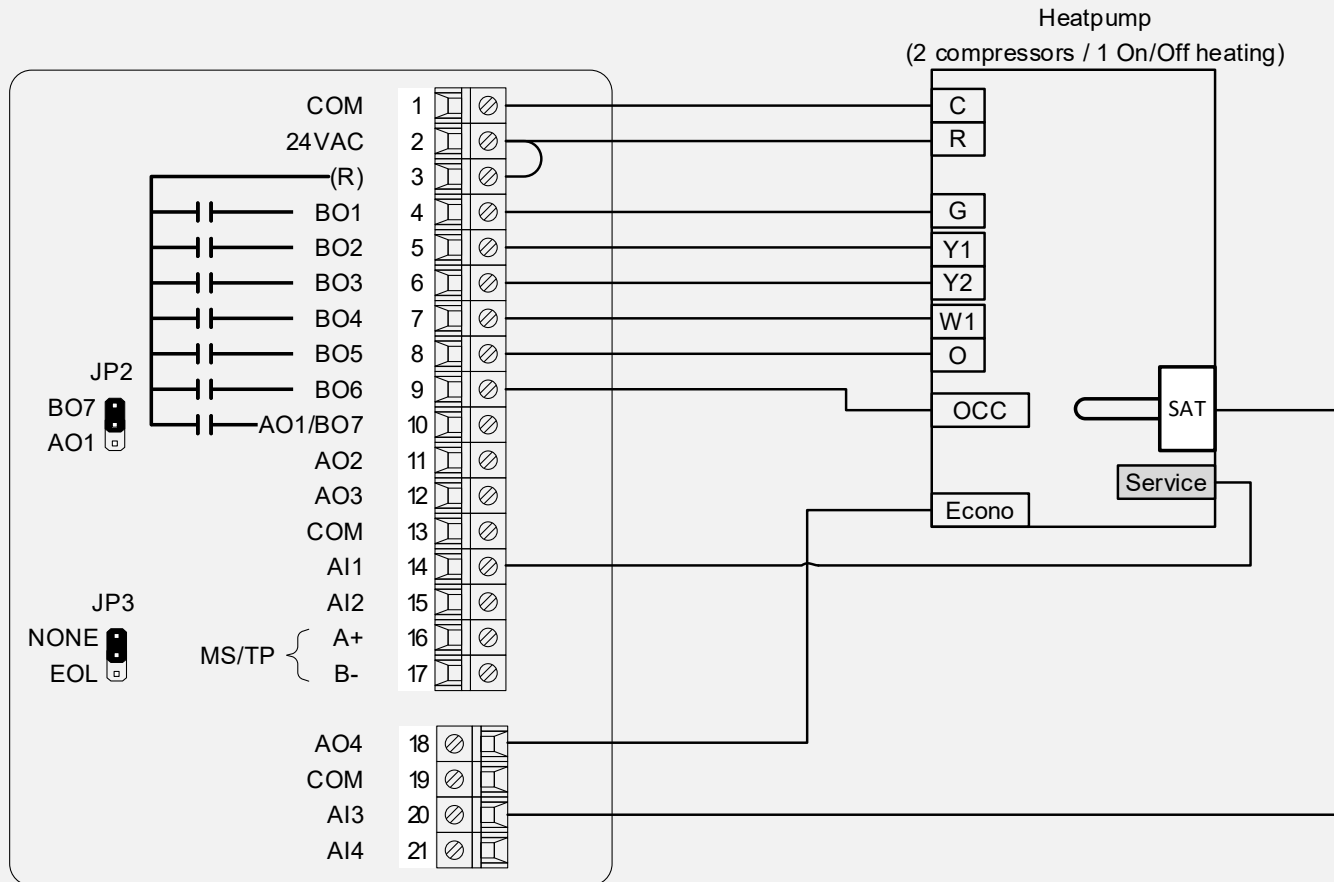




# Installation

## I/O Wiring & Sequence

### MSV127 – HP 2STG

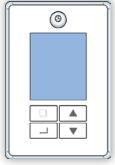


HP 2STG: Sets for a 1 on/off fan, 2 on/off heatpump, 1 on/off reheat, 1 reversing valve stages with 0-10 VDC economizer HEATPUMP unit

#### Notes:

- BO6 is an occupancy output that follows the main occupancy
- BO7 is an on/off power exhaust that follows the main occupancy when the main fan BO1 is on
- AI's can be configured for various options as per MSV2, 27, 28, 66 & 67

Add 24VAC transformer when the power is not supplied by the equipment



# Installation

## I/O Wiring & Sequence

### MSV127 – HP 2STG

#### Sequence of operation

**Occupied Mode:** Setpoints will revert to those defined by occupied cooling and heating setpoints

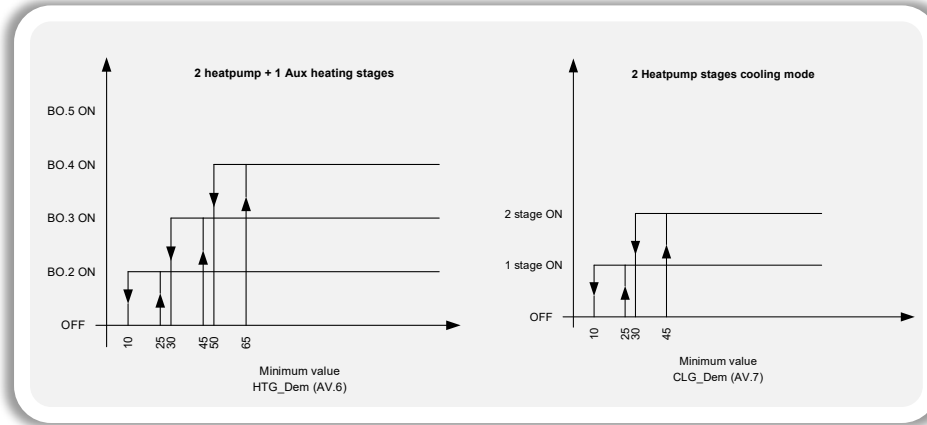
**Occupied Override Mode:** The system will revert to occupied mode for the duration determined by the “OvrTime\_Set AV27” parameter

**On a call for cooling / System mode is Cooling or Auto and OAT > than the economizer changeover value:** Reversing valve will be set in cooling (default 0 setting). HPump stages will be energized according to cooling demand AV7 as per % threshold values to maintain room temperature. Heating outputs are not energized

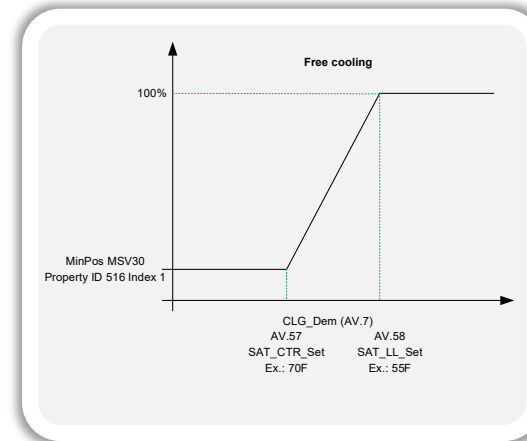
**On a call for cooling / System mode is Cooling or Auto and OAT < than the economizer changeover value:** HPump stages will be not be energized. Cooling will be provided by modulating the economizer from it's minimum position according to cooling demand AV7. The supply temperature will be modulated between the economizer center setpoint AV57 and the low limit setpoint AV58

**On a call for heating / System mode is Heating or Auto :** Reversing valve will be set in heating / non energized (default 0 setting). HPump stages will be energized according to heating demand AV6 as per % threshold values to maintain room temperature

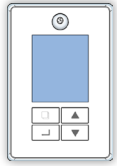
**Fan operation:** Occupied mode the fan will follow the fan mode setting (MSV4 Fan Mode). Fan On will make the fan run continuously during occupied hours. Fan Auto will only energize the fan on a call for a heating or cooling stage to be energized



- Fan needs to be on
- Call For Cooling or Heating at least 180 seconds
- There is a 60 seconds between each stages



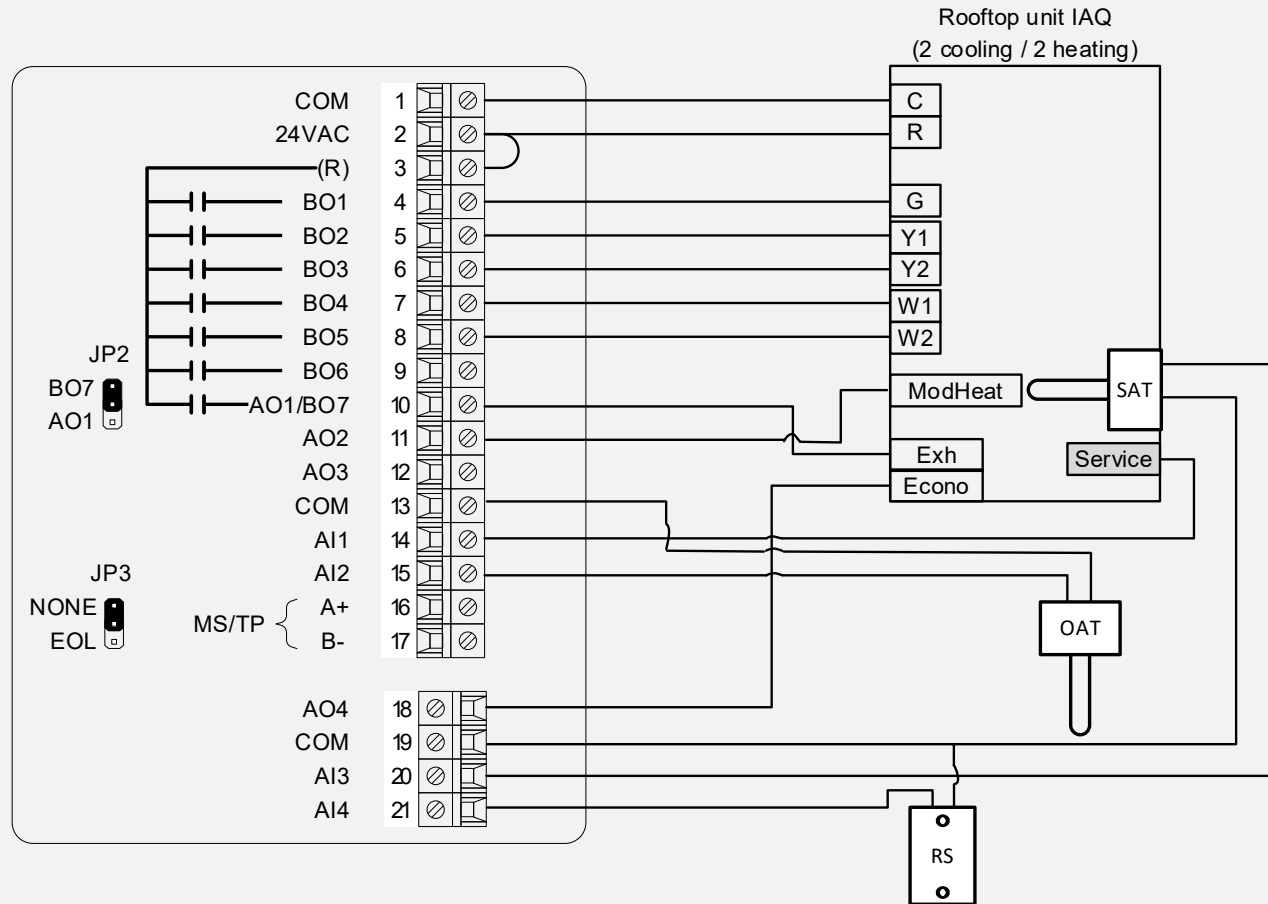
- Economizer OAT Changeover is set at: AV29 OAT, Property ID 516, Index 2
- Free cooling authorized status on BV8
- Call For Cooling at least 180 seconds



# Installation

## I/O Wiring & Sequence

### MSV127 – RT IAQ

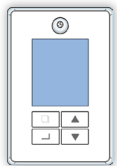


RT IAQ: Sets for a 1 on/off fan, 2 on/off heat, 2 on/off cooling stages with 0-10 VDC economizer RTU unit. *CO2 model needed*

#### Notes:

- BO7 is an on/off power exhaust that follows the main occupancy when the main fan BO1 is on
- AI's can be configured for various options as per MSV2, 27, 28, 66 & 67

Add 24VAC transformer when the power is not supplied by the equipment



# Installation

## I/O Wiring & Sequence

### MSV127 – RT IAQ

#### Sequence of operation

**Occupied Mode:** Setpoints will revert to those defined by occupied cooling and heating setpoints

**Occupied Override Mode:** The system will revert to occupied mode for the duration determined by the “OvrTime\_Set AV27” parameter

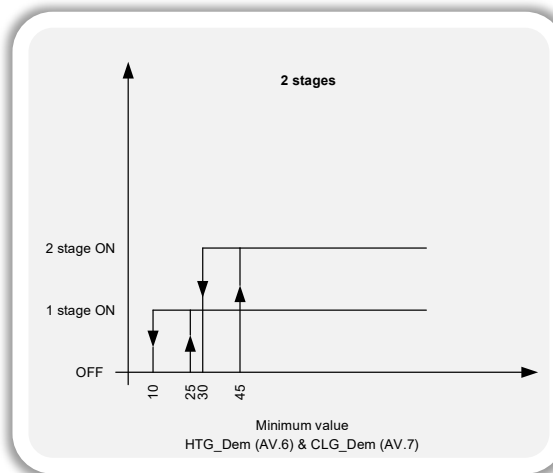
**On a call for cooling / System mode is Cooling or Auto and OAT > than the economizer changeover value:** Cooling stages will be energized according to cooling demand AV7 as per % threshold values to maintain room temperature. Heating outputs are not energized.

**On a call for cooling / System mode is Cooling or Auto and OAT < than the economizer changeover value:** Cooling stages will be not be energized. Cooling will be provided by modulating the economizer from it's minimum position according to cooling demand AV7. The supply temperature will be modulated between the economizer center setpoint AV57 and the low limit setpoint AV58.

**On a call for heating / System mode is Heating or Auto:** Heating stages will be energized according to cooling demand AV7 as per % threshold values to maintain room temperature. Cooling outputs are not energized.

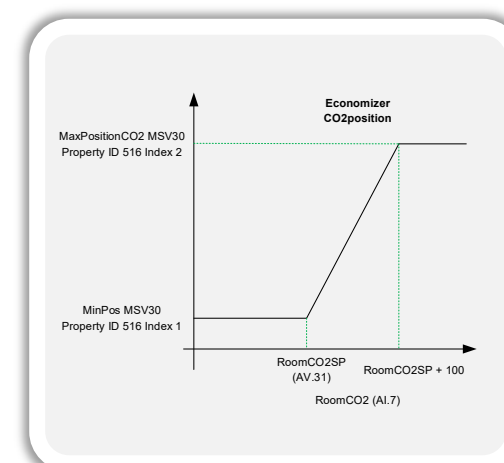
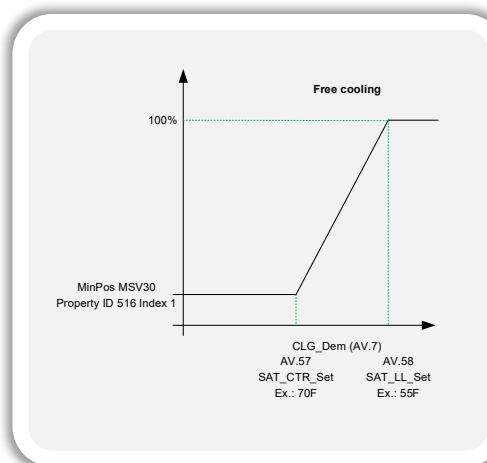
**On a call for IAQ control due to CO2 levels:** The system needs to be in occupied mode. The fresh air economizer will open based on CO2 levels from the economizer minimum position to its max CO2 position level as per settings. The free colling demand can by-pass the current economizer damper position and open it past its current IAQ demand position based on the free cooling demand.

**Fan operation:** Occupied mode the fan will follow the fan mode setting (MSV4 Fan Mode). Fan On will make the fan run continuously during occupied hours and auto in unoccupied mode. Fan Auto will only energize the fan on a call for a heating or cooling stage to be energized.

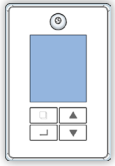


- Fan needs to be on
- Call For Cooling or Heating at least 180 seconds
- There is a 60 seconds between each stages

- Economizer OAT Changeover is set at: AV29 OAT, Property ID 516, Index 2
- Free cooling authorized status on BV8
- Call For Cooling at least 180 seconds



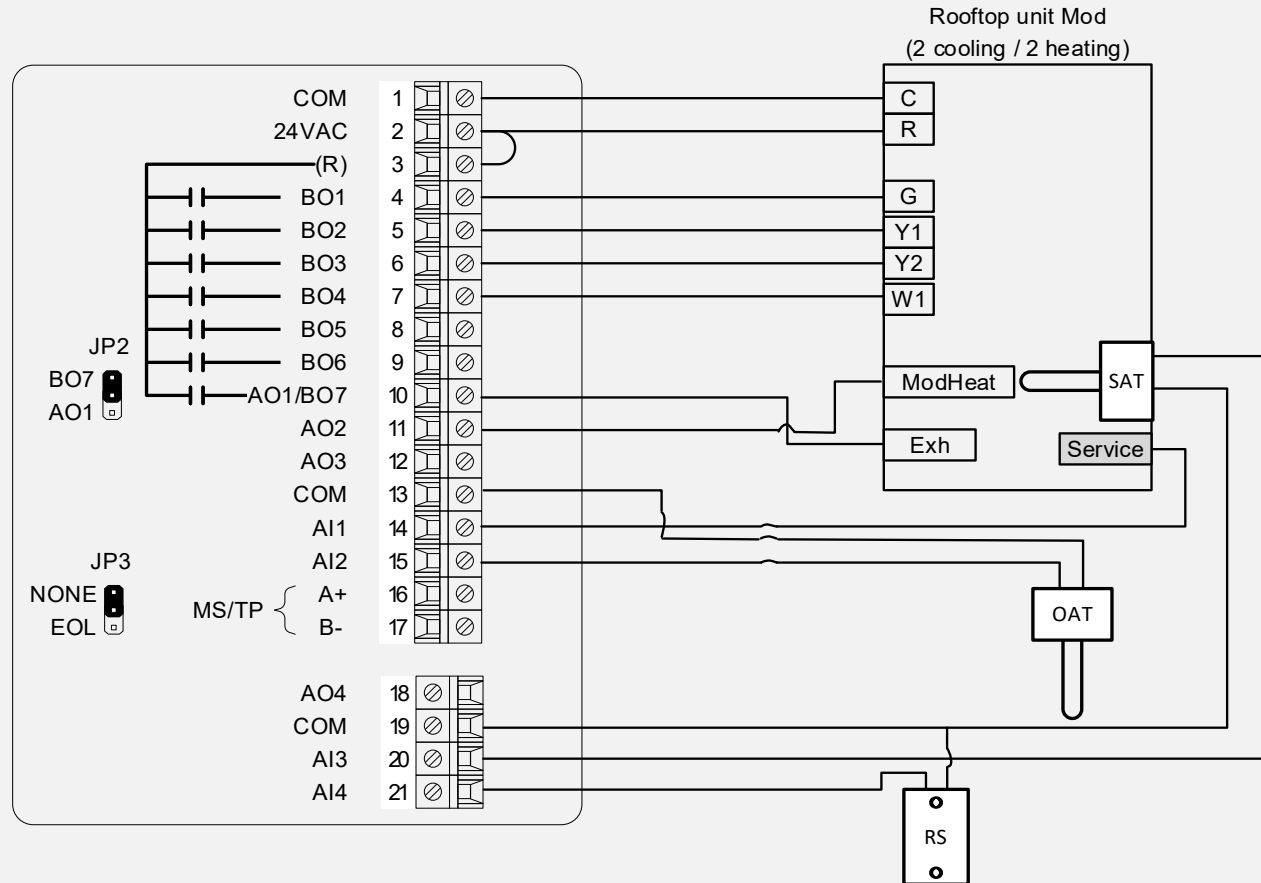
BY LYNXSPRING



# Installation

## I/O Wiring & Sequence

### MSV127 – RT MOD

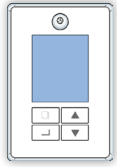


RT MOD: Sets for a 1 on/off fan, 1 on/off heat, 2 on/off cooling stages with 0-10 VDC heating RTU unit

#### Notes:

- BO6 is an occupancy output that follows the main occupancy
- BO7 is an on/off power exhaust that follows the main occupancy when the main fan BO1 is on
- AI's can be configured for various options as per MSV2, 27, 28, 66 & 67

Add 24VAC transformer when the power is not supplied by the equipment



# Installation

## I/O Wiring & Sequence MSV127 – RT MOD

### Sequence of operation

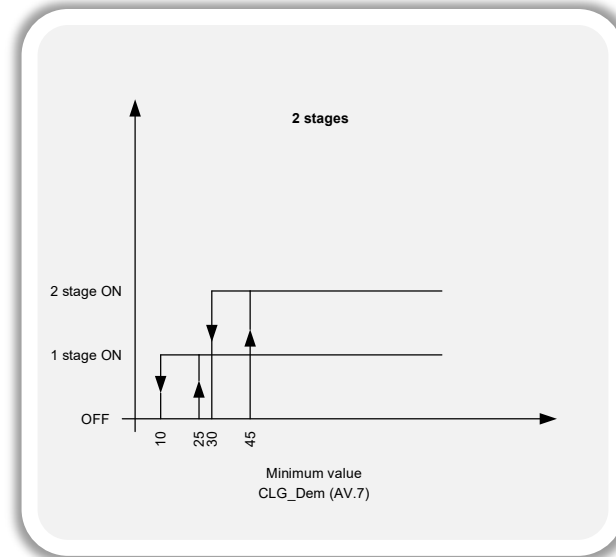
**Occupied Mode:** Setpoints will revert to those defined by occupied cooling and heating setpoints

**Occupied Override Mode:** The system will revert to occupied mode for the duration determined by the “OvrTime\_Set AV27” parameter

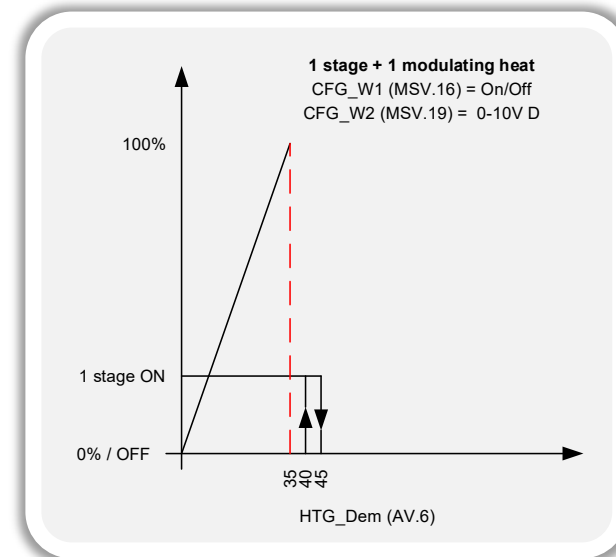
**On a call for cooling / System mode is Cooling or Auto:** Cooling stages will be energized according to cooling demand AV7 as per % threshold values to maintain room temperature. Heating outputs are not energized

**On a call for heating / System mode is Heating or Auto :** Modulating heating output and On/Off stage will energize as per % threshold according to heating demand AV6 values to maintain room temperature. Cooling outputs are not energized

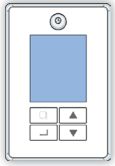
**Fan operation:** Occupied mode the fan will follow the fan mode setting (MSV4 Fan Mode). Fan On will make the fan run continuously during occupied hours. Fan Auto will only energize the fan on a call for a heating or cooling stage to be energized



- Fan needs to be on
- Call For Cooling at least 180 seconds
- There is a 60 seconds between each stages



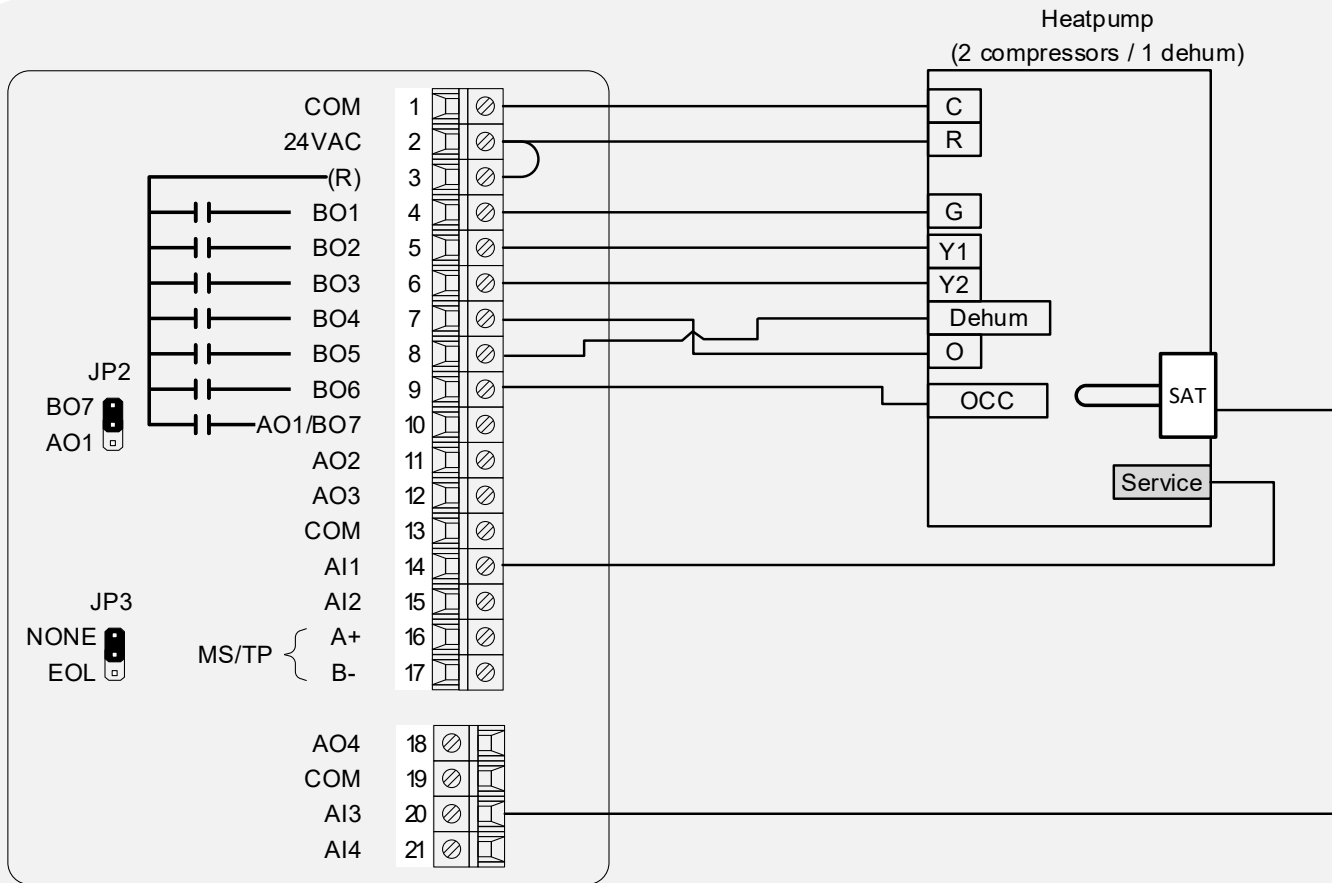
- Fan needs to be on
- Call For Heating at least 180 seconds
- Various settings available for voltage range and actions



# Installation

## I/O Wiring & Sequence

### MSV127 – HP DEH

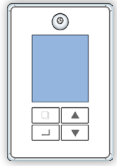


HP DEH: Sets for a 1 on/off fan, 2 on/off heatpump, 1 on/off dehumidification, 1 reversing valve stages HEATPUMP unit

#### Notes:

- BO6 is an occupancy output that follows the main occupancy
- BO6 is an on/off dehumidification output that follows dehumidification demand
- AI's can be configured for various options as per MSV2, 27, 28, 66 & 67

Add 24VAC transformer when the power is not supplied by the equipment



# Installation

## I/O Wiring & Sequence

### MSV127 – HP DEH

#### Sequence of operation

**Occupied Mode:** Setpoints will revert to those defined by occupied cooling and heating setpoints

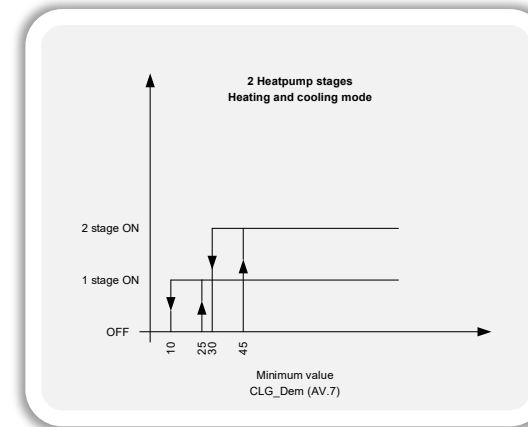
**Occupied Override Mode:** The system will revert to occupied mode for the duration determined by the “OvrTime\_Set AV27” parameter

**On a call for cooling / System mode is Cooling or Auto:** Reversing valve will be set in cooling (default 0 setting). HPump stages will be energized according to cooling demand AV7 as per % threshold values to maintain room temperature. Heating outputs are not energized

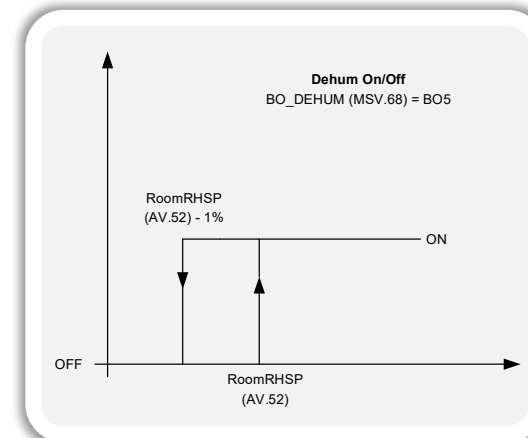
**On a call for heating / System mode is Heating or Auto :** Reversing valve will be set in heating / non energized (default 0 setting). HPump stages will be energized according to heating demand AV6 as per % threshold values to maintain room temperature

**On a call for dehumidification:** Active in any control mode. If the room humidity rises above the dehumidification setpoint, the dehumidification command will be sent to Hpump unit. If the room humidity drops below the dehumidification setpoint, the dehumidification command will be cancelled

**Fan operation:** Occupied mode the fan will follow the fan mode setting (MSV4 Fan Mode). Fan On will make the fan run continuously during occupied hours. Fan Auto will only energize the fan on a call for a heating or cooling stage to be energized



- Fan needs to be on
- Call For Cooling or Heating at least 180 seconds
- There is a 60 seconds between each stages



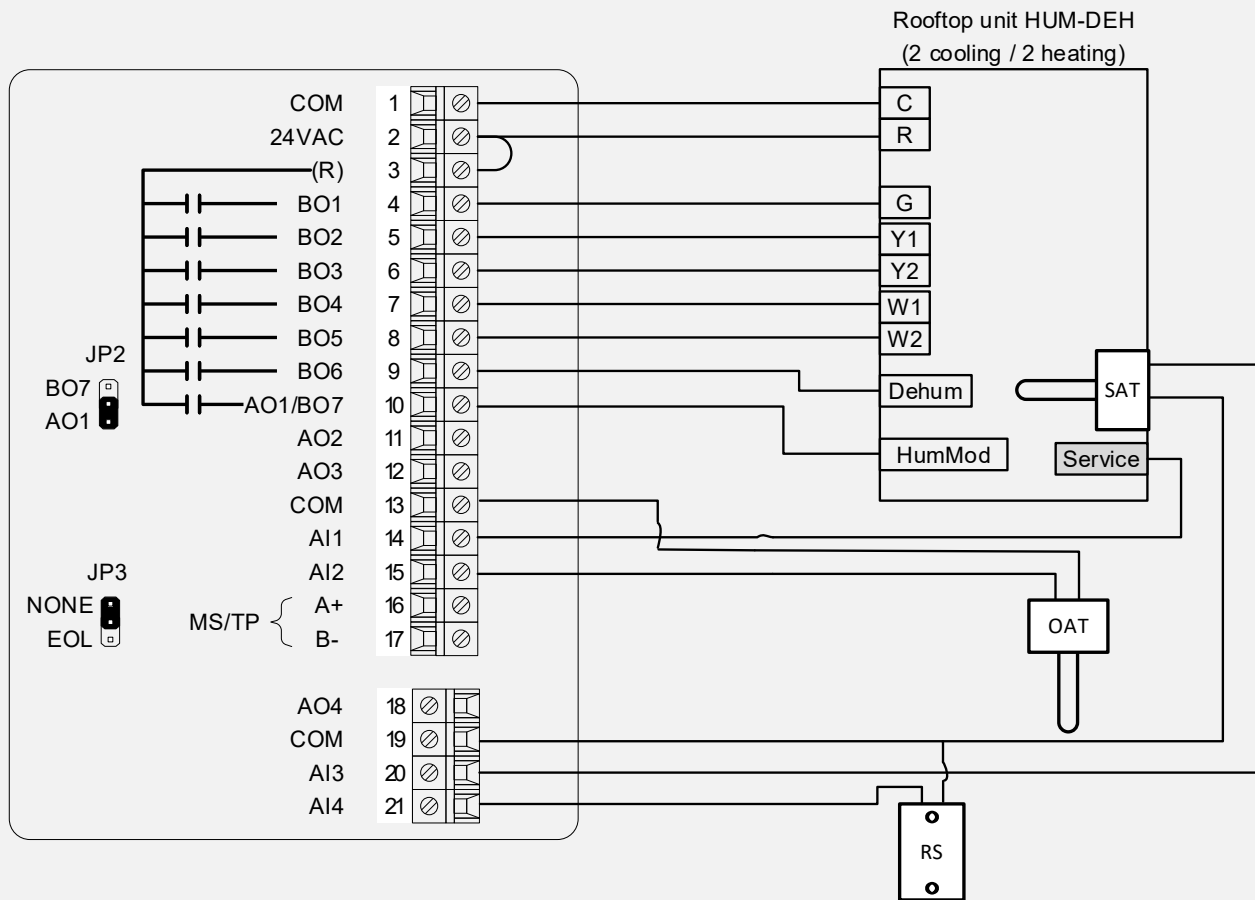




# Installation

## I/O Wiring & Sequence

### MSV127 – HUM-DEH (RTU)



HUM-DEH: Sets for a 1 on/off fan, 2 on/off heat, 2 on/off cooling, 1 on/off dehumidification stages with 0-10 VDC humidifier RTU unit

#### Notes:

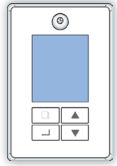
BOx is an on/off dehumidification output that follows dehumidification demand

BOx is an on/off humidification output that follows humidification demand

AO1 is a 0-10 VDC humidification output that follows humidification demand

AI's can be configured for various options as per MSV2, 27, 28, 66 & 67

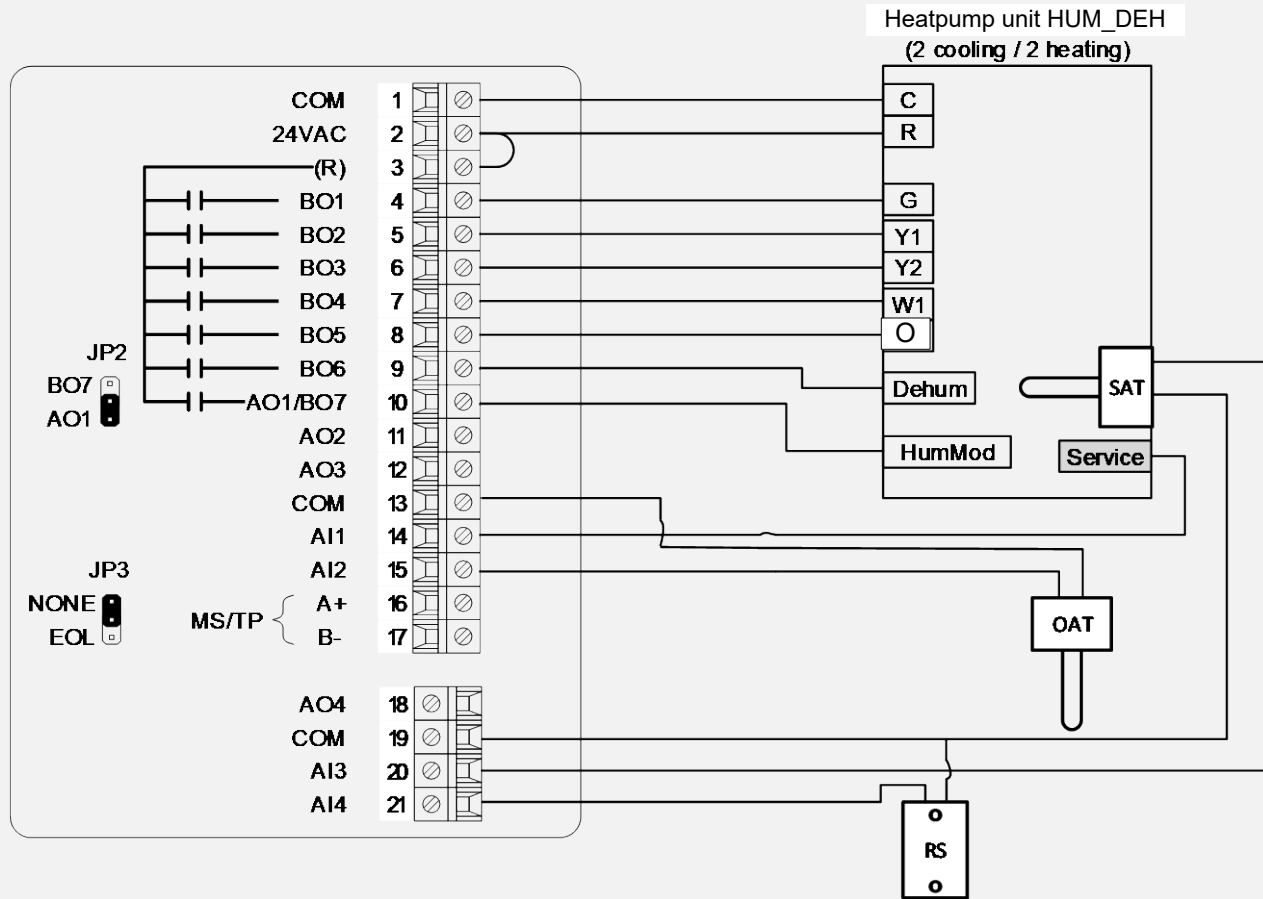
Add 24VAC transformer when the power is not supplied by the equipment



# Installation

## I/O Wiring & Sequence

### MSV127 – HUM-DEH (HP)



HUM-DEH: Sets for a 1 on/off fan, 2 on/off heat, 2 on/off cooling, 1 on/off dehumidification stages with 0-10 VDC or On/Off humidifier HP unit

Notes:

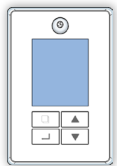
BOx is an on/off dehumidification output that follows dehumidification demand

BOx is an on/off humidification output that follows humidification demand

AO1 is a 0-10 VDC humidification output that follows humidification demand

AI's can be configured for various options as per MSV2, 27, 28, 66 & 67

Add 24VAC transformer when the power is not supplied by the equipment



# Installation

## I/O Wiring & Sequence

### MSV127 – HUM-DEH (RTU)

#### Sequence of operation

**Occupied Mode:** Setpoints will revert to those defined by occupied cooling and heating setpoints

**Occupied Override Mode:** The system will revert to occupied mode for the duration determined by “OvrTime\_Set AV27”

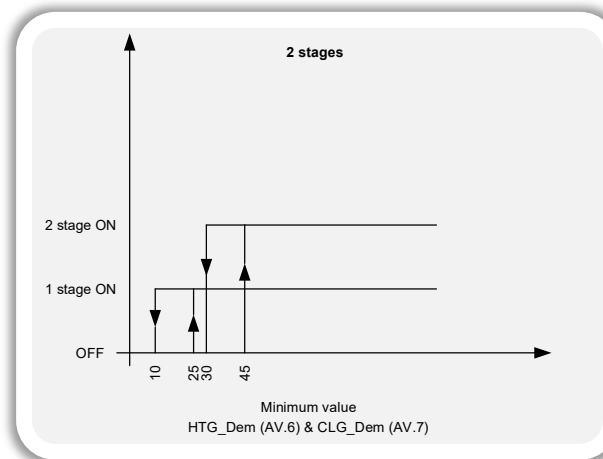
**On a call for cooling / System mode is Cooling or Auto:** Cooling stages will be energized according to cooling demand AV7 as per % threshold values to maintain room temperature. Heating outputs are not energized

**On a call for heating / System mode is Heating or Auto :** Heating stages will be energized according to cooling demand AV7 as per % threshold values to maintain room temperature. Cooling outputs are not energized

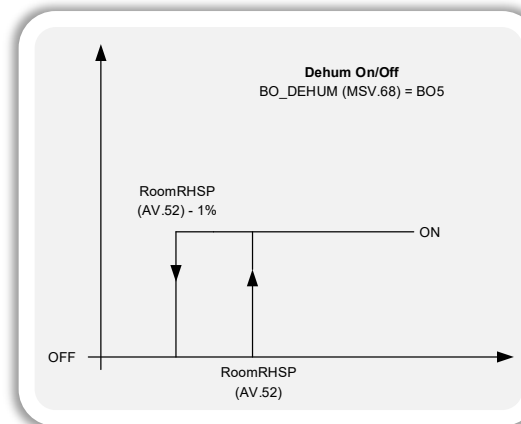
**On a call for dehumidification:** Active in any control mode. If the room humidity rises above the dehumidification setpoint, the dehumidification command will be sent to Rooftop unit. If the room humidity drops below the dehumidification setpoint, the dehumidification command will be cancelled

**On a call for humidification:** Active in heating mode only with OAT<0C/32F. The analog modulating humidifier will modulate/ [Binary on/off] to maintain the room humidity setpoint. If a supply humidity sensor is installed, the humidifier will throttle down [Binary on/off] to prevent the supply humidity to rise above the supply humidity high limit setpoint

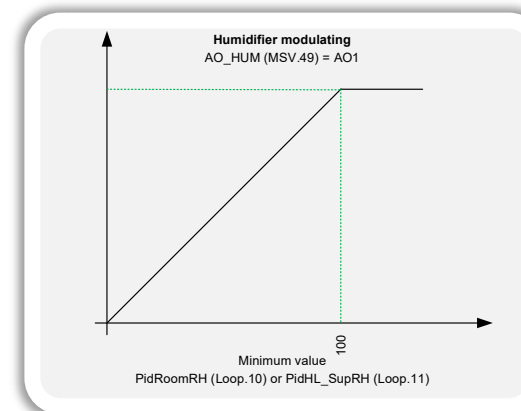
**Fan operation:** Occupied mode the fan will follow the fan mode setting (MSV4 Fan Mode). Fan On will make the fan run continuously during occupied hours and auto in unoccupied mode. Fan Auto will only energize the fan on a call for a heating or cooling stage to be energized.

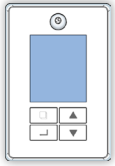


- Fan needs to be on
- Call For Cooling or Heating at least 180 seconds
- There is a 60 seconds between each stages



- Fan needs to be on
- Based on AV59 Eff\_RH humidity value
- Based on a modulating 0-10 VDC humidifier

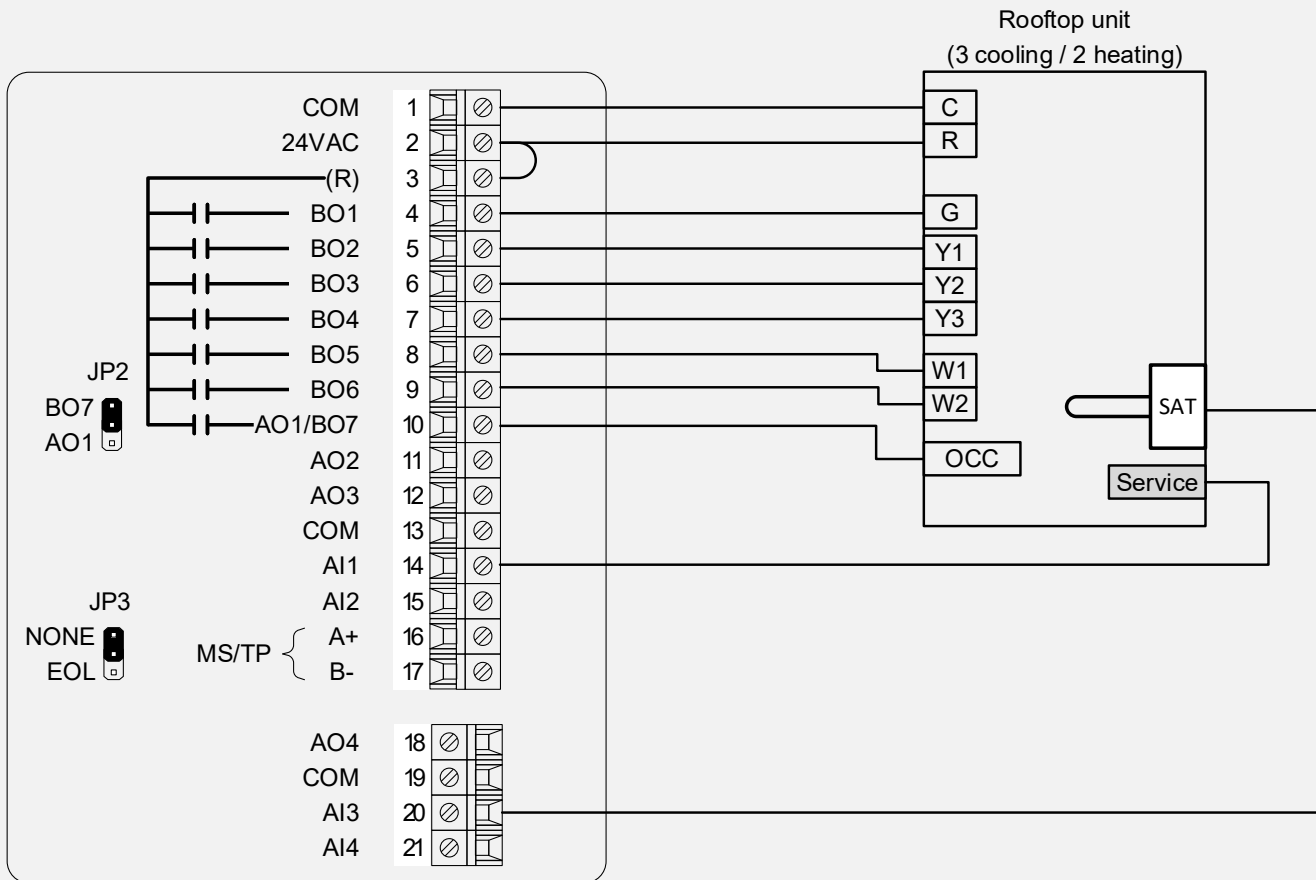




# Installation

## I/O Wiring & Sequence

### MSV127 – RT 3STG



RT 3STG: Sets for a 1 on/off fan, 2 on/off heat & 3 on/off cooling stages RTU unit

#### Notes:

- BO7 is an occupancy output that follows the main occupancy
- AI's can be configured for various options as per MSV2, 27, 28, 66 & 67

Add 24VAC transformer when the power is not supplied by the equipment



# Installation

## I/O Wiring & Sequence

### MSV127 – RT 3STG

#### Sequence of operation

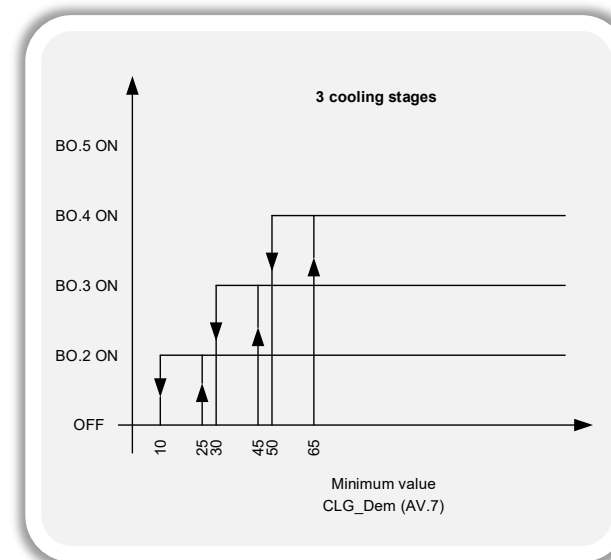
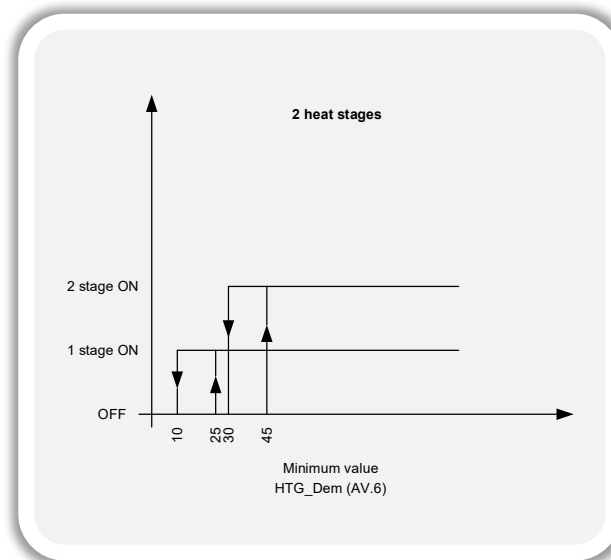
**Occupied Mode:** Setpoints will revert to those defined by occupied cooling and heating setpoints

**Occupied Override Mode:** The system will revert to occupied mode for the duration determined by the “OvrTime\_Set AV27” parameter

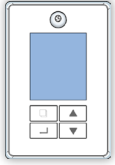
**On a call for cooling / System mode is Cooling or Auto:** Cooling stages will be energized according to cooling demand AV7 as per % threshold values to maintain room temperature. Heating outputs are not energized

**On a call for heating / System mode is Heating or Auto :** Heating stages will be energized according to heating demand AV6 as per % threshold values to maintain room temperature. Cooling outputs are not energized

**Fan operation:** Occupied mode the fan will follow the fan mode setting (MSV4 Fan Mode). Fan On will make the fan run continuously during occupied hours. Fan Auto will only energize the fan on a call for a heating or cooling stage to be energized



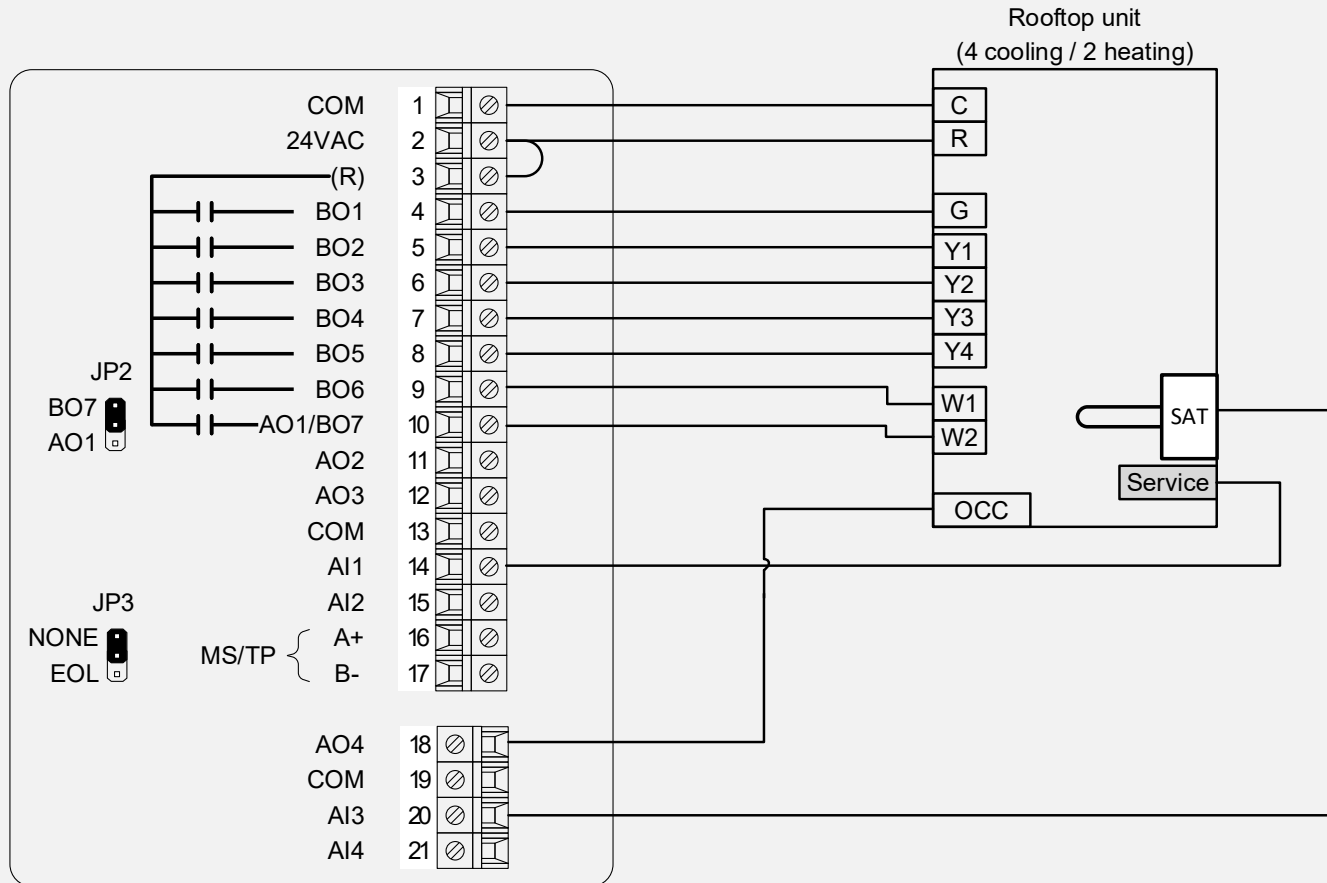
- Fan needs to be on
- Call For Cooling or Heating at least 180 seconds
- There is a 60 seconds between each stages



# Installation

## I/O Wiring & Sequence

### MSV127 – RT 4STG

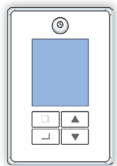


RT 4STG: Sets for a 1 on/off fan, 2 on/off heat & 4 on/off cooling stages RTU unit

#### Notes:

- AO4 is an occupancy output that follows the main occupancy where 0% = unoccupied and 100% = occupied
- AI's can be configured for various options as per MSV2, 27, 28, 66 & 67

Add 24VAC transformer when the power is not supplied by the equipment



# Installation

## I/O Wiring & Sequence

### MSV127 – RT 4STG

#### Sequence of operation

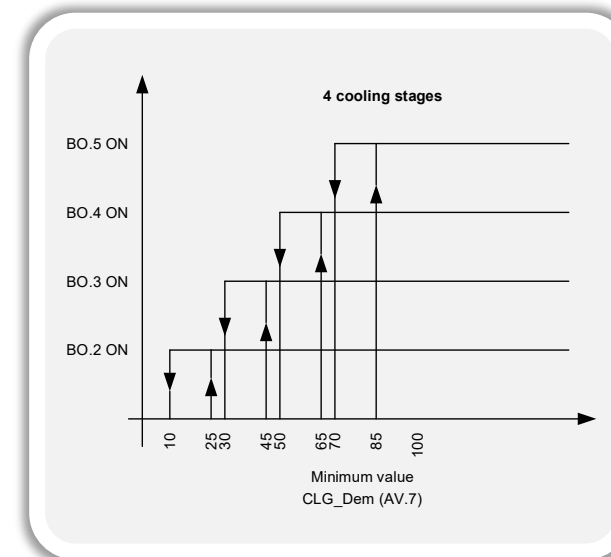
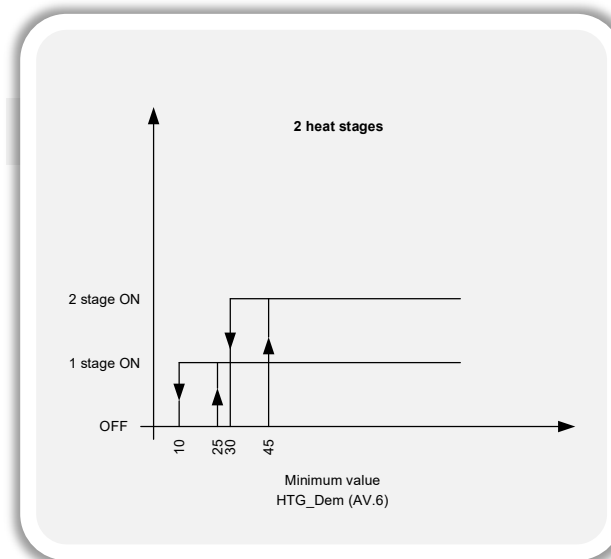
**Occupied Mode:** Setpoints will revert to those defined by occupied cooling and heating setpoints

**Occupied Override Mode:** The system will revert to occupied mode for the duration determined by the “OvrTime\_Set AV27” parameter

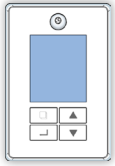
**On a call for cooling / System mode is Cooling or Auto:** Cooling stages will be energized according to cooling demand AV7 as per % threshold values to maintain room temperature. Heating outputs are not energized

**On a call for heating / System mode is Heating or Auto :** Heating stages will be energized according to heating demand AV6 as per % threshold values to maintain room temperature. Cooling outputs are not energized

**Fan operation:** Occupied mode the fan will follow the fan mode setting (MSV4 Fan Mode). Fan On will make the fan run continuously during occupied hours. Fan Auto will only energize the fan on a call for a heating or cooling stage to be energized



- Fan needs to be on
- Call For Cooling or Heating at least 180 seconds
- There is a 60 seconds between each stages



# Using the menus

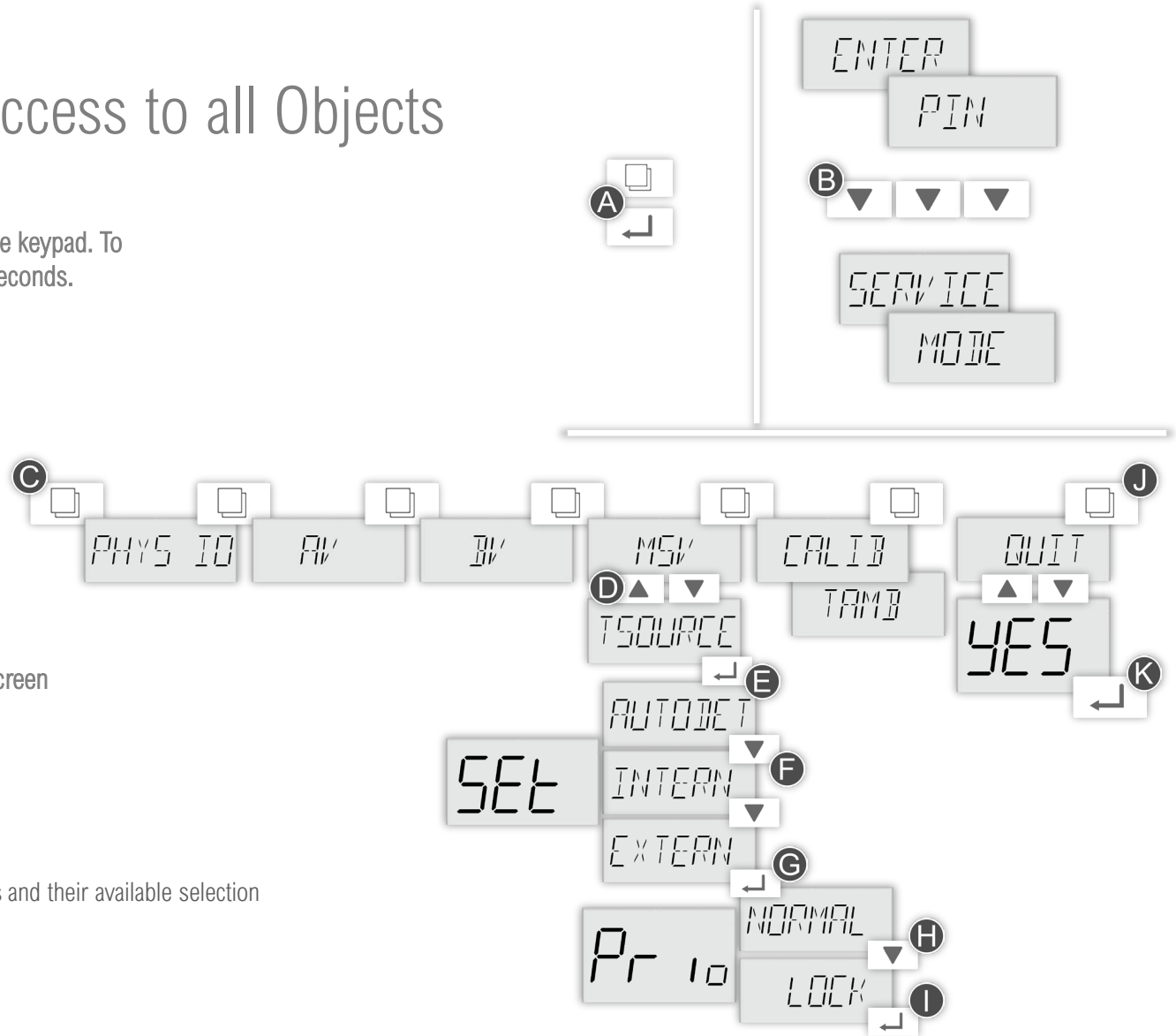
## Service menus / Allows Keypad Access to all Objects

- A** Access the “Service menus” directly on the BW437-RTU’s screen using the keypad. To be able to do so, press simultaneously and buttons for 3 seconds.
- B** Press these PIN keys in sequence on the BW437RTU’s keypad  
“SERVICE MODE” will blink on the screen
- C** Use the button to scroll through the list of menus
- D** Use the to scroll trough a category of objects
- E** Press on any object to access its configurable settings
- F** Use the to scroll trough the settings
- G** Once your setting is selected, press to access the Priority screen
- H** Use the to select the objects priority
- I** Once your priority is selected, press to confirm your choice
- J** To exit SERVICE MODE, press for 3 seconds to access the QUIT screen
- K** Using the press when “YES” is displayed

### Notes:

Please refer to the object list tables below for a reference on each objects and their available selection

The typical priority set at stage **H** is “Normal”


















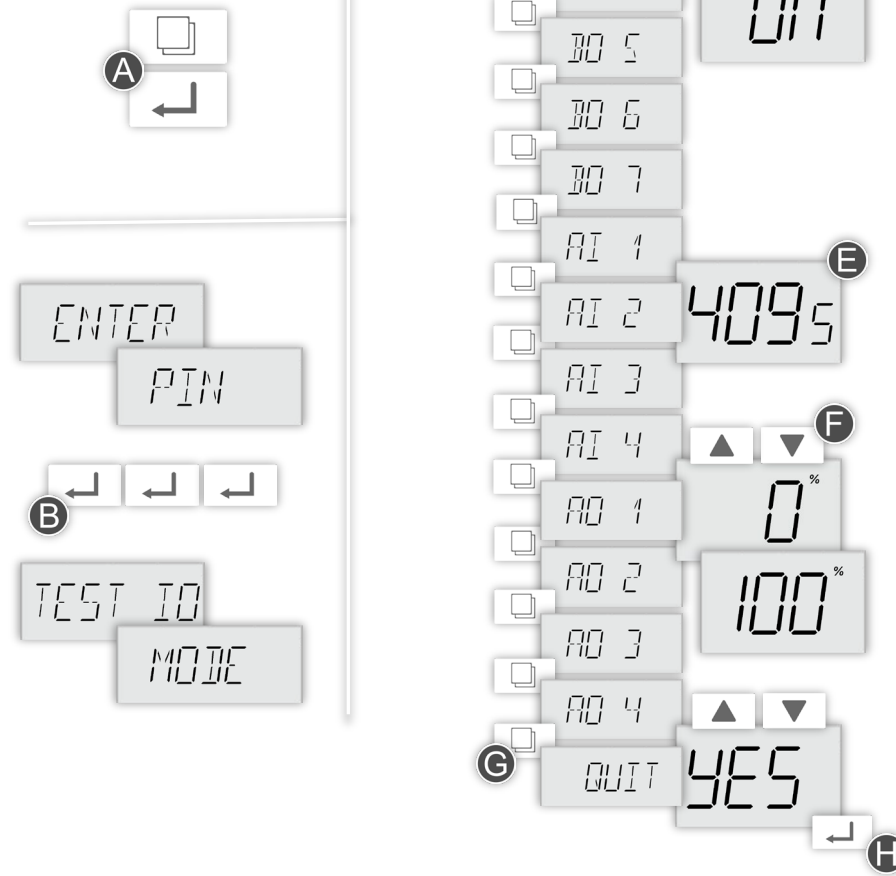
## Using the menus

### Test IO mode menu / Allows Local Testing of I/O's

- A** Access the "Test IO mode" directly on the BW437's screen using the keypad. To be able to do so, press simultaneously  and  buttons for 3 seconds.
- B** Press these PIN keys in sequence on the BW437RTU's keypad  
*"TEST IO MODE" will blink on the screen*
- C** Use the  button to scroll through the list of IO's
- D** Use the   to change the binary output object state
- E** AI reading goes from 0 to 4095 (raw count value / not adjustable)
- F** Use the   to change the analog output object value
- G** To exit TEST IO MODE, scroll to the QUIT menu using 
- H** Using the  , press  when "YES" is displayed

Notes:

Exiting the Test IO mode will revert the controller to its normal state of operation as per the configuration used





# Physical Inputs and Outputs (AI's, AO's, BI's & AO's)



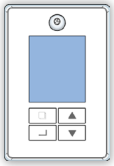
Use JP2 jumper to choose between B07 or A01

<i>Object Instance</i>	<i>RTU Object name</i>	<i>Description</i>	<i>Default value</i>	<i>Tags</i>	<i>Minimum range value</i>	<i>Maximum range value</i>	<i>Inactive_Text</i>	<i>Active_Text</i>
B01	BO_1	Based on MSV127 config	Off	Status			Off	On
B02	BO_2	Based on MSV127 config	On	Status			Off	On
B03	BO_3	Based on MSV127 config	Off	Status			Off	On
B04	BO_4	Based on MSV127 config	Off	Status			Off	On
B05	BO_5	Based on MSV127 config	Off	Status			Off	On
B06	BO_6	Based on MSV127 config	Off	Status			Off	On
B07	BO_7	Based on MSV127 config	Off	Status			Off	On
A01	AO_ECM	Based on MSV127 config	0%	Status	0%	100%		
A02	AO_2	Based on MSV127 config	0%	Status	0%	100%		
A03	AO_3	Based on MSV127 config	0%	Status	0%	100%		
A04	AO_4	Based on MSV127 config	0%	Status	0%	100%		
A11	AI_1	Analog input 1		Status	Based on AI1_cfg object MSV46			
A12	AI_2	Analog input 2		Status	Based on AI2_cfg object MSV47			
A13	AI_3	Analog input 3		Status	Based on AI3_cfg object MSV48			
A14	AI_4	Analog input 4		Status				
A15	RoomT	Room temperature	N/A	Status	32°F (0°C)	122°F (50°C)		
A16	RoomRH	Room humidity	N/A	Status	5%	90%		
A17	RoomCO2	Room CO2		Status	0 PPM	2000 PPM		
BI1	Motion	Motion detection	Off	Status			Off	Active

Please note: Object description for all the BO's and AO's are **automatically generated** by the configuration of MSV127 and will refresh automatically based on BV4 = On

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- Status: represent objects or properties that are "typically" meant to be displayed on graphics for various required visualization
- Cmd: represent objects that can be controlled directly by other BACnet external process



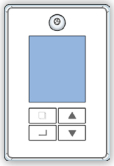
# Analog Values



<i>Object Instance</i>	<i>RTU Object name</i>	<i>Description</i>	<i>Tags</i>	<i>Default value</i>	<i>Minimum range value</i>	<i>Maximum range value</i>
AV1	RoomTSP	Room Temperature setpoint	User	72°F (22°C)	54°F (12°C)	90°F (32°C)
AV6	HTG_Dem	Heating demand	Status	---	0%	100%
AV7	CLG_Dem	Cooling demand	Status	---	0%	100%
AV9	Eff_T	Effective temperature used for control	Status	---	-40°F (-40°C)	122°F (50°C)
AV16	SATemp	Supply air temperature	Status	---	-40°F (-40°C)	122°F (50°C)
AV19	SATFRSP_Set	Set supply freezing temperature	Status	---	-40°F (-40°C)	122°F (50°C)
AV21	ECM_min_Set	Fan analog min. output	Cfg	0%	0%	100%
AV24	Fan_MinOn_Time	Fan minimum ON time	Cfg	10 min	0 min	60 min
AV27	OvrTime_Set	Set occupancy override time	Cfg	60 min	0 min	480 min
AV29	OATemp	Outdoor air temperature	Status	---	-40°F (-40°C)	122°F (50°C)
AV31	CO2_SP_Set	Set CO2 Setpoint	Cfg	800 PPM	0 PPM	2000 PPM
AV33	MinCLSP	Set minimum cooling setpoint	Cfg	60°F (15°C)	54°F (12°C)	100°F (37.5°C)
AV34	MaxHTSP	Set maximum heating setpoint	Cfg	82°F (28°C)	40°F (4.5°C)	90°F (32°C)
AV35	OccCLSP	Set occupied cooling setpoint	User	73°F (23°C)		
AV36	OccHTSP	Set occupied heating setpoint	User	71°F (21°C)		
AV37	SP_DB_Set	Set deadband	Cfg	2°F (1°C)	2°F (1.1°C)	5°F (2.8°C)
AV38	Unoc_CL_Set	Set unoccupied cooling setpoint	Cfg	79°F (26°C)		
AV39	Unoc_HT_Set	Set unoccupied heating setpoint	Cfg	65°F (18°C)		
AV40	STBCoolOffset	Set standby cooling offset (+)	Cfg	+ 2°F (1.1°C)	2°F (1.1°C)	5°F (2.8°C)
AV41	STBHeatOffset	Set standby heating offset (-)	Cfg	- 2°F (1.1°C)	2°F (1.1°C)	5°F (2.8°C)
AV42	EffCLSP	Effective cooling setpoint	Status	---		
AV43	EffHTSP	Effective heating setpoint	Status	---		

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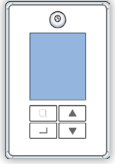
# Analog Values



<i>Object Instance</i>	<i>RTU Object name</i>	<i>Description</i>	<i>Tags</i>	<i>Default value</i>	<i>Minimum range value</i>	<i>Maximum range value</i>
AV50	RT_Cal	Room temperature calib	Cfg	0.0°F (0.0°C)	-3.0°F (-3.0°C)	3.0°F (3.0°C)
AV51	Eff_RH	Effective humidity used for control	Status	40%	0%	100%
AV52	HUM_SP	Set humidity setpoint	Cfg	40%	0%	100%
AV53	SAH	Supply humidity reading	Status	0%	0%	100%
AV54	SAH_HL_Set	Supply humidity high limit setpoint	Cfg	75%	50%	98%
AV55	DEH_SP	Set dehum setpoint	Cfg	60%	0%	100%
AV56	SAT_HL_Set	Set supply air high limit setpoint	Cfg	104°F (40°C)	0.0°F (0.0°C)	140°F (60°C)
AV57	SAT_CTR_Set	Set supply air neutral setpoint	Cfg	68°F (20°C)	0.0°F (0.0°C)	140°F (60°C)
AV58	SAT_LL_Set	Set supply air low limit setpoint	Cfg	55°F (13°C)	0.0°F (0.0°C)	140°F (60°C)
AV59	Eff_SAT	Effective supply air calc. setpoint	Status	---	0.0°F (0.0°C)	140°F (60°C)
AV60	ComprLockout	Compressor Lockout	Cfg	55°F (13°C)	0.0°F (0.0°C)	140°F (60°C)
AV65	EconoMin_Pos	Eco min position	Cfg	0%	0%	100%
AV66	EconoMaxCO2Pos	Econo max position (for CO2)	Cfg	0%	0%	100%
AV67	OATheatOutAuth	Heating authorization (from OAT)	Cfg	55°F (13°C)	0.0°F (0.0°C)	140°F (60°C)
AV68	OATeconOutAuth	Economizer authorization (from OAT)	Cfg	55°F (13°C)	0.0°F (0.0°C)	140°F (60°C)
AV75	OAH	Outside air humidity	Status	---	0%	100%
AV76	OAE	Outside air enthalpy	Status	---	10 BTU/lbs	55 BTU/lbs
AV77	EnthSP	Enthalpy setpoint	Cfg	20 BTU/lbs	20 BTU/lbs	28 BTU/lbs
AV78	MatSP	Mixed air temperature for economizer	Cfg	65°F (18°C)	0.0°F (0.0°C)	140°F (60°C)
AV79	MAT	Mixed air temperature	Status	---	0.0°F (0.0°C)	140°F (60°C)

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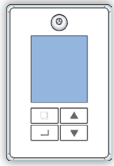
# Binary Values



<i>Object Instance</i>	<i>RTU Object name</i>	<i>Description</i>	<i>Tags</i>	<i>Default value</i>	<i>Inactive_Text</i>	<i>Active_Text</i>
<i>BV2</i>	<i>OVRSTAT</i>	<i>Occupancy override status</i>	<i>Status</i>	<i>Normal</i>	<i>Normal</i>	<i>Overrid</i>
<i>BV3</i>	<i>Mot_Det</i>	<i>Motion detection</i>	<i>Status</i>	<i>Moving</i>	<i>None</i>	<i>Moving</i>
<i>BV4</i>	<i>AutogenDesc</i>	<i>Autogenerate I/O descriptions</i>	<i>Cfg</i>	<i>Off</i>	<i>Off</i>	<i>On</i>
<i>BV5</i>	<i>Occ_Sch</i>	<i>System occupancy schedule</i>	<i>Status</i>	<i>---</i>	<i>Off</i>	<i>On</i>
<i>BV7</i>	<i>Freeze_Status</i>	<i>Freeze condition status</i>	<i>Status</i>	<i>---</i>	<i>Normal</i>	<i>Active</i>
<i>BV8</i>	<i>Free_CL_Status</i>	<i>Free cooling authorization status</i>	<i>Status</i>	<i>---</i>	<i>No</i>	<i>Yes</i>
<i>BV21</i>	<i>EnthalpyAuth</i>	<i>Enthalpy Authorize</i>	<i>Status</i>	<i>---</i>	<i>No</i>	<i>Yes</i>

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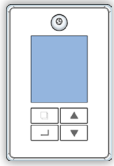
# Multi-State Values



<i>Object Instance</i>	<i>RTU Object name</i>	<i>Description</i>	<i>Tags</i>	<i>Default value</i>	<i>State texts</i>
<i>MSV1</i>	<i>CFGsens</i>	<i>Remote thermistor 10K</i>	<i>Cfg</i>	<i>Type 3</i>	<i>Type 3</i> <i>Type 2</i>
<i>MSV2</i>	<i>AI_RS</i>	<i>Select room temperature input</i>	<i>Cfg</i>	<i>Intern</i>	<i>Intern</i> <i>AI-1</i> <i>AI-2</i> <i>AI-3</i> <i>AI-4</i>
<i>MSV3</i>	<i>MODE</i>	<i>System mode</i>	<i>User</i>	<i>On</i>	<i>Off</i> <i>Auto</i> <i>Cool</i> <i>Heat</i>
<i>MSV4</i>	<i>FAN</i>	<i>Set fan mode</i>	<i>User</i>	<i>Auto</i>	<i>On</i> <i>Auto</i>
<i>MSV5</i>	<i>Eff_Occ</i>	<i>Effective occupancy mode</i>	<i>Status</i>	<i>---</i>	<i>Occupied</i> <i>Unoccup</i> <i>TempOcc</i> <i>Standby</i>
<i>MSV6</i>	<i>Loc-Occ</i>	<i>Occupancy command</i>	<i>User</i>	<i>Loc-Occ</i>	<i>Loc_Occ</i> <i>Occupied</i> <i>Unoccup</i>

Please note that objects tagged as:

- **Cfg:** represent configuration properties of the device that are typically only set once during commissioning and start-up
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- **Cmd:** represent objects that can be controlled directly by other BACnet external process



# Multi-State Values

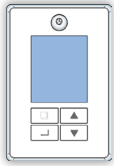


<i>Object Instance</i>	<i>RTU Object name</i>	<i>Description</i>	<i>Tags</i>	<i>Default value</i>	<i>State texts</i>
<i>MSV7</i>	<i>CFG_Y1</i>	<i>Set cooling output 1 operation</i>	<i>Cfg</i>	<i>None</i>	<i>None</i> <i>Off-On</i> <i>0-10V D(direct)</i> <i>0-10V R(reversed)</i> <i>2-10V D(direct)</i> <i>2-10V R(reversed)</i> <i>Pulsed D(direct)</i> <i>Pulsed R(reversed)</i>
<i>MSV8</i>	<i>CFG_Y2</i>	<i>Set cooling output 2 operation</i>	<i>Cfg</i>	<i>None</i>	<i>"Same as above"</i>
<i>MSV9</i>	<i>CFG_Y3</i>	<i>Set cooling output 3 operation</i>	<i>Cfg</i>	<i>None</i>	<i>None</i> <i>Off-On</i>
<i>MSV10</i>	<i>CFG_Y4</i>	<i>Set cooling output 4 operation</i>	<i>Cfg</i>	<i>None</i>	<i>None</i> <i>Off-On</i>

**Please note:** MSV, 7, 8, 9, 10, 16, 17, 18, 19, 23, 27, 28, 30, 32, 44, 45, 46, 48, 49 52, 54, 55, 65 & 68 are used for "custom" configuration applications. Make sure MSV127 is set to "custom" **BEFORE** setting any of those MSV's

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# Multi-State Values

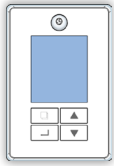


<i>Object Instance</i>	<i>RTU Object name</i>	<i>Description</i>	<i>Tags</i>	<i>Default value</i>	<i>State texts</i>
<i>MSV16</i>	<i>CFG_W1</i>	<i>Set heating output 1 operation</i>	<i>Cfg</i>	<i>None</i>	<i>None</i> <i>Off-On</i> <i>0-10V D(direct)</i> <i>0-10V R(reversed)</i> <i>2-10V D(direct)</i> <i>2-10V R(reversed)</i> <i>Pulsed D(direct)</i> <i>Pulsed R(reversed)</i> <i>O (O/B)</i> <i>B (O/B)</i>
<i>MSV17</i>	<i>CFG_W2</i>	<i>Set heating output 2 operation</i>	<i>Cfg</i>	<i>None</i>	<i>"Same as above"</i>
<i>MSV18</i>	<i>CFG_W3</i>	<i>Set heating output 3 operation</i>	<i>Cfg</i>	<i>None</i>	<i>None</i> <i>Off-On</i>
<i>MSV19</i>	<i>CFG_W4</i>	<i>Set heating output 4 operation</i>	<i>Cfg</i>	<i>None</i>	<i>None</i> <i>Off-On</i>

Please note that objects tagged as:

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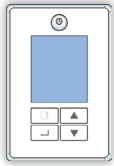
# Multi-State Values



<i>Object Instance</i>	<i>RTU Object name</i>	<i>Description</i>	<i>Tags</i>	<i>Default value</i>	<i>State texts</i>
<i>MSV23</i>	<i>CFG_FAN</i>	<i>Select fan output</i>	<i>Cfg</i>	<i>B01</i>	<i>B01 B02 A01 A02 B01_A01 B01_A02</i>
<i>MSV27</i>	<i>AI_OAT</i>	<i>Select outside air temp. input</i>	<i>Cfg</i>	<i>None</i>	<i>None AI-1 AI-2 AI-3 AI-4 External</i>
<i>MSV28</i>	<i>AI_SAT</i>	<i>Select supply air temp. input</i>	<i>Cfg</i>	<i>None</i>	<i>"Same as above"</i>
<i>MSV30</i>	<i>AO_ECO</i>	<i>Select economizer output</i>	<i>Cfg</i>	<i>None</i>	<i>None BO-5 BO-6 BO-7 AO-1 AO-2 AO-3 AO-4</i>

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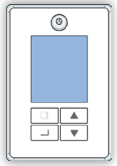
# Multi-State Values



<i>Object</i>	<i>RTU</i>	<i>Description</i>	<i>Tags</i>	<i>Default value</i>	<i>State texts</i>
<i>Instance</i> MSV32	<i>Object name</i> CFG_EXH	Select power exhaust output	Cfg	None	None BO-6 BO-7 AO-4 BO-6 & AO-4 BO-7 & AO-4
MSV44	BI_PIR	Select PIR Motion sensor input	Cfg	Intern	NO, AI1 (BI) NC, AI1 (BI) NO, AI2 (BI) NC, AI2 (BI) NO, AI3 (BI) NC, AI3 (BI) NO, AI4 (BI) NC, AI4 (BI) External Intern

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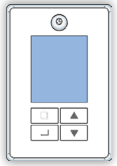
# Multi-State Values



<i>Object</i>	<i>RTU</i>	<i>Description</i>	<i>Tags</i>	<i>Default value</i>	<i>State texts</i>
<i>Instance</i>	<i>Object name</i>				
<i>MSV45</i>	<i>BI_SCH_Input</i>	<i>Select schedule input</i>	<i>Cfg</i>	<i>None</i>	<i>None (Off)</i> <i>None (On)</i> <i>Scheduler</i> <i>AI-1</i> <i>AI-2</i> <i>AI-3</i> <i>AI-4</i> <i>External</i>

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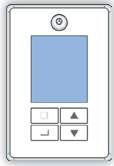
# Multi-State Values



<i>Object Instance</i>	<i>RTU Object name</i>	<i>Description</i>	<i>Tags</i>	<i>Default value</i>	<i>State texts</i>
<i>MSV48</i>	<i>BO_HUM</i>	<i>Select humidifier BO output</i>	<i>Cfg</i>	<i>None</i>	<i>None</i> <i>BO-2</i> <i>BO-3</i> <i>BO-4</i> <i>BO-5</i> <i>BO-6</i> <i>BO-7</i> <i>BO-5+BO-6 (2stages)</i> <i>BO-6+BO-7 (2stages)</i>
<i>MSV49</i>	<i>AO_HUM</i>	<i>Select humidifier AO output</i>	<i>Cfg</i>	<i>None</i>	<i>None</i> <i>AO-1</i> <i>AO-2</i> <i>AO-3</i> <i>AO-4</i>
<i>MSV52</i>	<i>AI_RH</i>	<i>Select room humidity input</i>	<i>Cfg</i>	<i>Intern</i>	<i>None</i> <i>AI-1</i> <i>AI-2</i> <i>AI-3</i> <i>AI-4</i> <i>External</i> <i>Intern</i>

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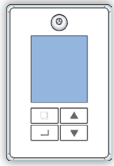
# Multi-State Values



<i>Object Instance</i>	<i>RTU Object name</i>	<i>Description</i>	<i>Tags</i>	<i>Default value</i>	<i>State texts</i>
<i>MSV54</i>	<i>AI_SRH</i>	<i>Select supply humidity input</i>	<i>Cfg</i>	<i>None</i>	<i>None</i> <i>AI-1</i> <i>AI-2</i> <i>AI-3</i> <i>AI-4</i> <i>External</i>
<i>MSV55</i>	<i>AIC_SRH</i>	<i>Set supply humidity input signal</i>	<i>Cfg</i>	<i>0-10V</i>	<i>0-10V</i> <i>2-10V</i>
<i>MSV57</i>	<i>OAH_Loc</i>	<i>Outside humidity physical input loc.</i>	<i>Cfg</i>	<i>None</i>	<i>None</i> <i>AI-1</i> <i>AI-2</i> <i>AI-3</i> <i>AI-4</i> <i>External</i> <i>Intern</i>
<i>MSV58</i>	<i>MAT_OCC</i>	<i>Mixed air temperature sensor loc.</i>	<i>Cfg</i>	<i>None</i>	<i>None</i> <i>AI-1</i> <i>AI-2</i> <i>AI-3</i> <i>AI-4</i> <i>External</i>

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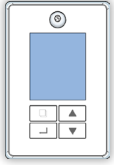
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<i>Object Instance</i>	<i>RTU Object name</i>	<i>Description</i>	<i>Tags</i>	<i>Default value</i>	<i>State texts</i>
<i>MSV62</i>	<i>CFGSetp</i>	<i>Room setpoint displayed</i>	<i>Cfg</i>	<i>Heat SP</i>	<i>Heat SP Center Cool SP</i>
<i>MSV64</i>	<i>CFGUnit</i>	<i>Unit configuration</i>	<i>Cfg</i>	<i>Imper</i>	<i>Metric Imper(ial)</i>
<i>MSV65</i>	<i>BO_OCC</i>	<i>Select occupied output</i>	<i>Cfg</i>	<i>None</i>	<i>None B02 B03 B04 B05 B06 B07 A01 A02 A03</i>

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# Multi-State Values



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<i>MSV66</i>	<i>AI1_CFG</i>	<i>Select predefined AI1 logic</i>	<i>Cfg</i>	<i>None</i>	<i>None NSB OVR FILTER SERVICE FANLOCK</i>
<i>MSV67</i>	<i>AI2_CFG</i>	<i>Select predefined AI2 logic</i>	<i>Cfg</i>	<i>None</i>	<i>None NSB OVR FILTER SERVICE FANLOCK</i>
<i>MSV68</i>	<i>BO_DEHU</i>	<i>Select dehumidification output</i>	<i>Cfg</i>	<i>None</i>	<i>None BO-2 BO-3 BO-4 BO-5 BO-6 BO-7</i>

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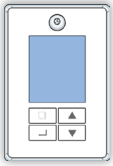
# Multi-State Values



<i>Object Instance</i>	<i>RTU Object name</i>	<i>Description</i>	<i>Tags</i>	<i>Default value</i>	<i>State texts</i>
MSV70	PB	CFG Heating/cooling proportional band	Cfg	5F 2.2C	3F 1.2C 4F 1.7C 5F 2.2C 6F 2.8C 7F 3.3C 8F 3.5C 9F 5.0C 10F 5.6C
MSV75	KeyLock	SCFG Keypad lock level	Cfg	None	None Fan Mode FanMode All

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# Multi-State Values



<i>Object Instance</i>	<i>RTU Object name</i>	<i>Description</i>	<i>Tags</i>	<i>Default value</i>	<i>State texts</i>
<i>MSV100</i>	<i>HELP_mess</i>	<i>Help message</i>	<i>Status</i>	<i>Normal</i>	<i>Normal</i> <i>Fanlock</i> <i>Supply Frozen</i> <i>Service</i> <i>Filter</i> <i>Rem NSB Ovr</i>
<i>MSV127</i>	<i>Preset</i>	<i>Select application</i>	<i>Cfg</i>	<i>RT 2STG</i>	<i>RT 2STG</i> <i>RT ECON</i> <i>HP 2STG</i> <i>RT IAQ</i> <i>RT MOD</i> <i>HP DEH</i> <i>HUM-DEH</i> <i>RT 3STG</i> <i>RT 4STG</i> <i>HP 3STG</i>

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# RS485 Network Guidelines

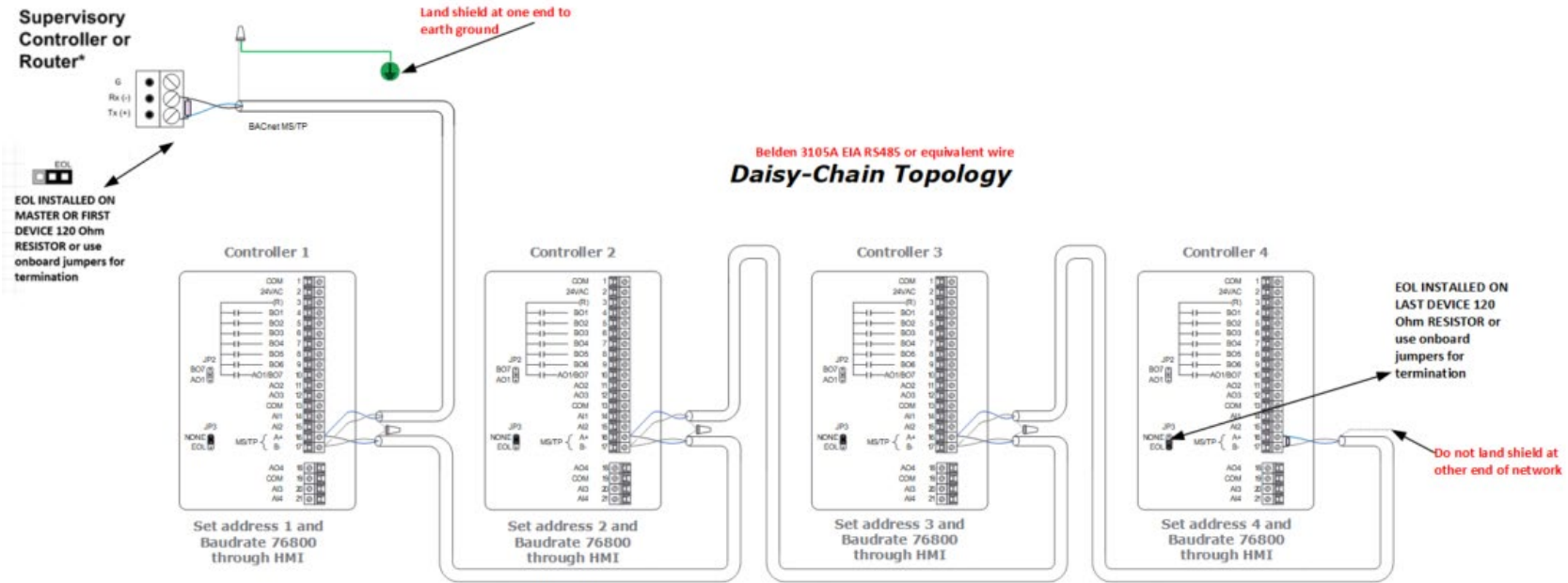
## RS-485 Network Guidelines BW Controllers

***The best way to ensure a robust and reliable RS-485 network is to build it around a daisy-chain configuration.***

### Connecting a multidrop 485 network.

The EIA RS-485 Specification labels the data wires "A" and "B", but many manufacturers label their wires "+" and "-". In our experience, the "+" wire should be connected to the "A" line, and the "-" wire to the "B" line. Reversing the polarity will not damage a 485 device, but it will not communicate. This said, the rest is easy: always connect + to + and - to -.

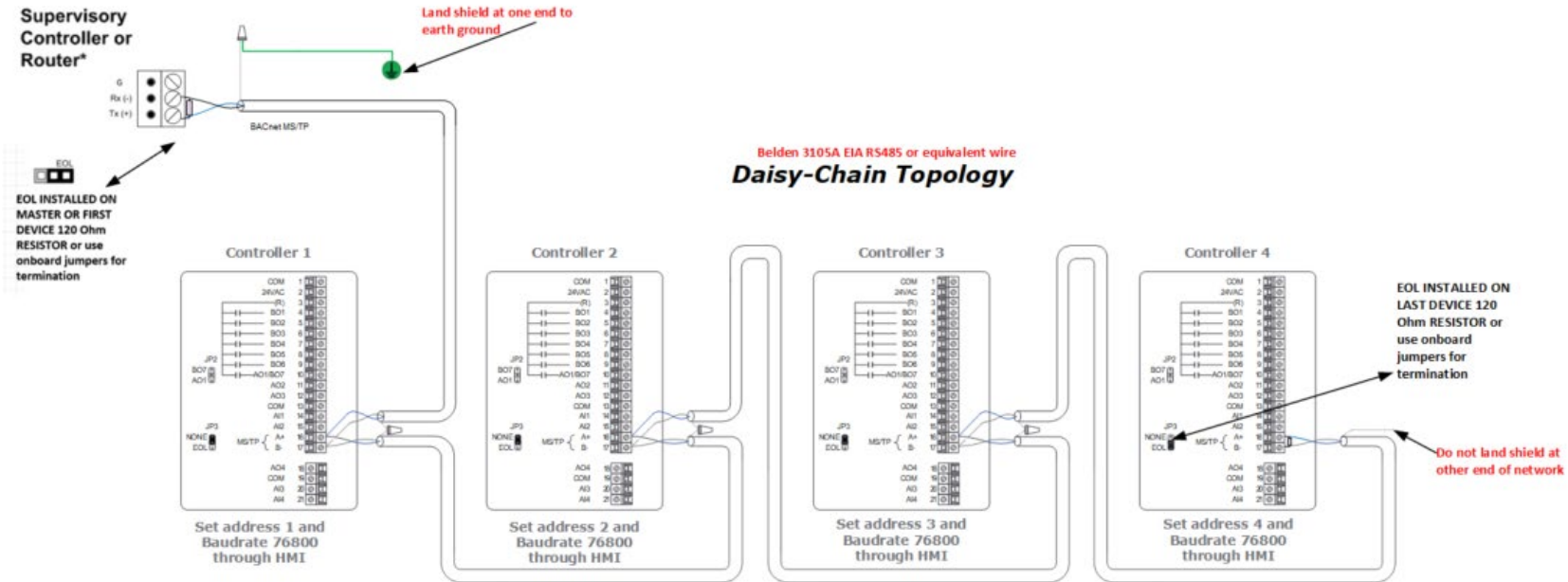
**Signal ground**, don't forget it. While a differential signal does not require a signal ground to communicate, the ground wire serves an important purpose. Over a distance of hundreds or thousands of feet there can be very significant differences in the voltage level of "ground." The function of the signal ground wire is to tie the signal ground of each of the nodes to one common ground. If the ground voltage rises above 3 Vac, data will be lost and often the port itself will be damaged. However, if the differences in signal grounds is too great, further attention is necessary.





# RS485 Network Guidelines

## RS-485 Network Guidelines BW Controllers



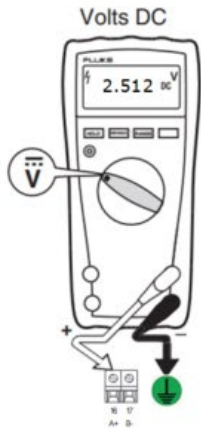
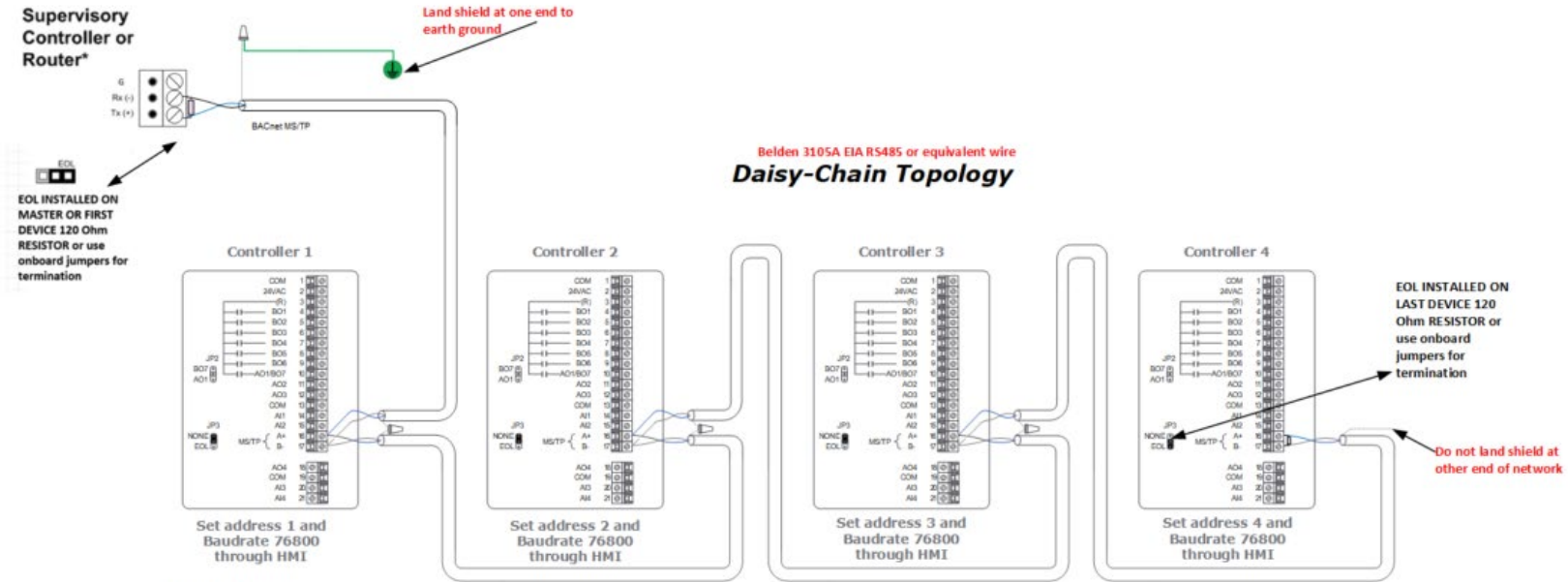
### Troubleshooting tips for 485 networks

1. Ensure that the communication wire is Belden 3105A or equivalent [twisted shielded pair].
2. Ensure your polarity is validated on both sides of your coms cable at each device + to + and - to -.
3. Ensure you have a 120 ohm resistor on both your beginning master device and your last device (or onboard jumpers).
4. Ensure your shield is grounded only at one side and the source is a true earth ground [et. Building steel/beam, dedicated ground].
5. Make sure you are individually addressed on each device.
6. Make sure your Baud Rate is the same on all devices.



# RS485 Network Guidelines

## RS-485 Network Guidelines BW Controllers



### Troubleshooting tips for 485 networks

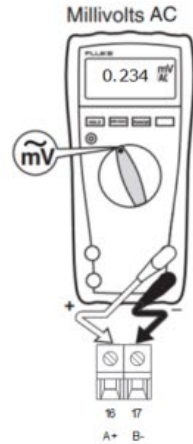
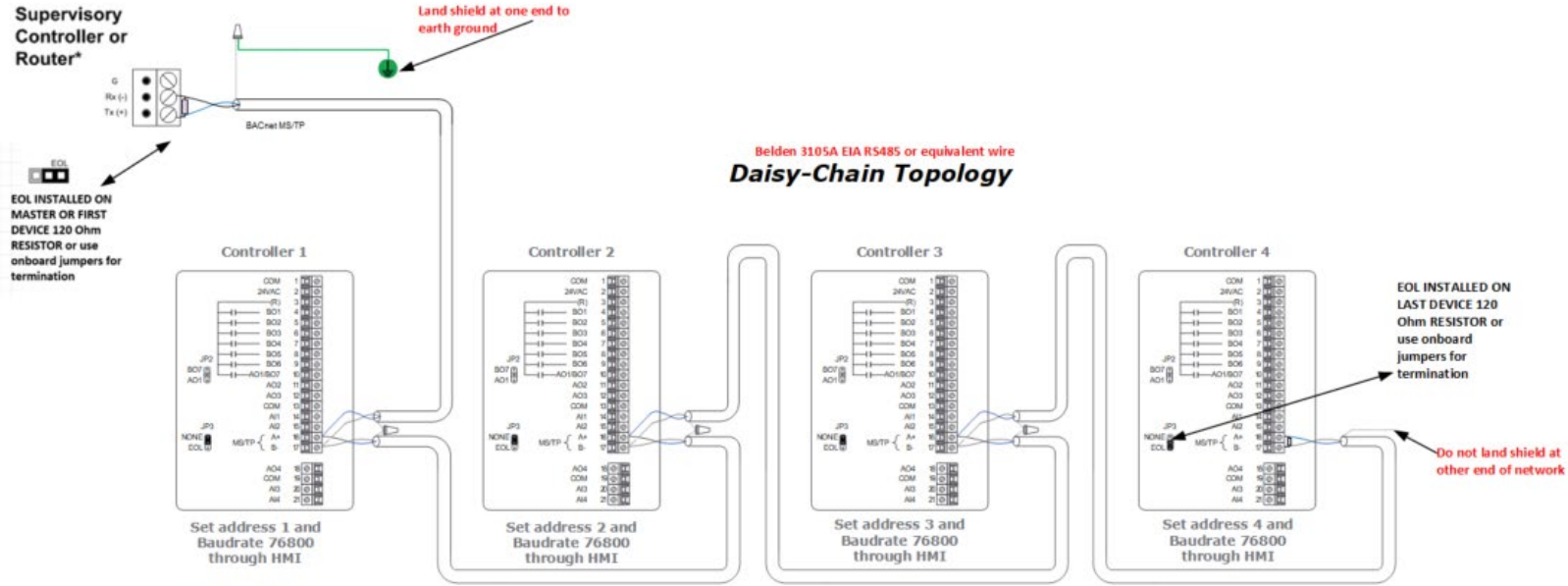
1. On a connected RS-485 network, measure with your RMS multi-meter from either + or - to earth ground. You should read about 2.5Vdc, if you are higher than 2.75Vdc you are encountering noise and you either do not have a shielded twisted pair cable or you have a grounded shield at both sides or the integrity of your cable is compromised. If you are reading lower than 2.1Vdc than you have a device on your network or front end that is limiting the biasing circuit or you have a device that is causing an issue, no termination on both ends of the network, etc..





# RS485 Network Guidelines

## RS-485 Network Guidelines BW Controllers



### Troubleshooting tips for 485 networks

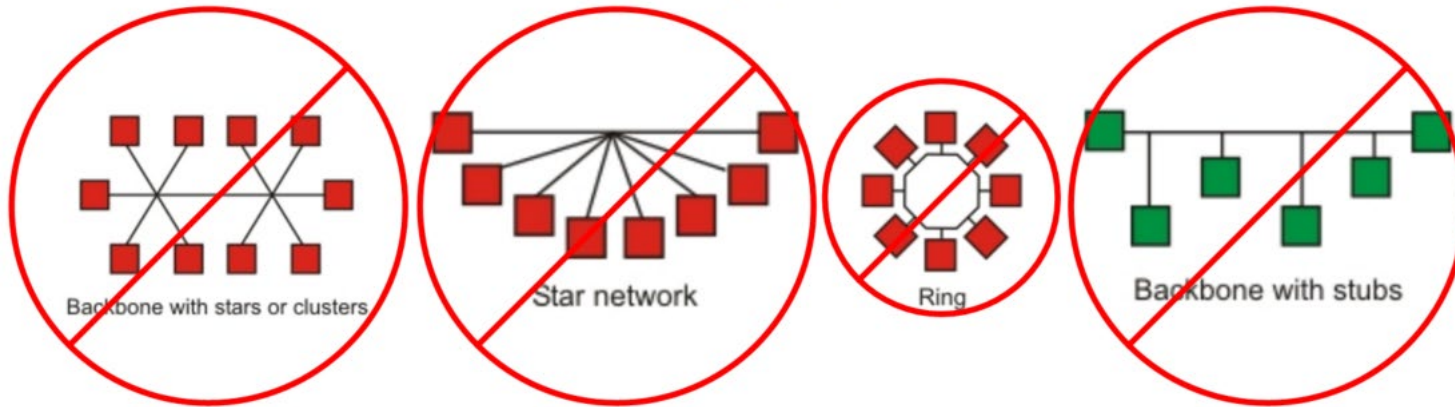
1. Measure with your multi-meter from + to - with your RS-485 network connected. You should read between 200mVac to 600mVac average. If you read greater than 700mVac average then you may have a device that is compromising your network or you do not have your shield landed in one location or your controller grounded.

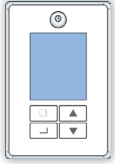


# RS485 Network Guidelines

## RS-485 Network Guidelines BZ Controllers

### *Non-functioning topologies*





# Technical Specifications

## Power supply:

- 24 VAC/VDC  $\pm$  15%; Class 2

## Current consumption:

- 1.5 VA controller only
- 96 VA Max (including outputs 0.5A each)

## Communication protocols:

- BACnet MS/TP
- BTL listed: B-ASC, BACnet Application Specific Controller
- Baud 9600, 19200, 38400, 76800 Bps (76800 default)
- Addressing: Keypad configuration
- Mini USB2 MS/TP network access (USB-485 Cable adapter)

## Hardware

- Microprocessor: STM32 (ARM CortexTM M3) 32 bits,
- CPU Speed: 72MHz
- Memory: 768 KB non-volatile Flash (application program)
- RAM: 96 KB RAM
- Real-time clock (RTC): Built-in capacitor (one-week backup)

## Backlight display / LCD

- Multi-HVAC system symbols, time display, four-segment main numeric display with one decimal

## Programming:

- Configurable with the Onyxx LX UI Software

## Inputs:

- 4 Universal Inputs (AI/BI)
  - Thermistor 10K $\Omega$  (type 2 or 3)
  - Dry contact, 500 ms minimum (On-Off)
  - Voltage 0 - 10 Vdc (Input impedance of 100 K  $\Omega$ )
  - Resolution: 12 Bits (4096 segments)

## Outputs:

- 6 Binary Outputs
  - Mosfet Solid State Relays, Isolated
  - 10 to 30VAC/VDC, 0.5A max

## 3 Analog Outputs

- Voltage 0 - 10 Vdc linear

## 1 Universal AO/DO's

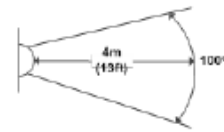
- Jumper selectable
- Same specification as above

## Humidity sensor: Sensirion SHT31

$\pm$ 2 @ 0-100% RH

## PIR sensor

- Operating Principle: Passive Infrared
- Detection Angle: 100 degrees
- Detection Distance: 4M (13ft) maximum
- Detection Area



## CO2 sensor: Sensirion SCD30

- Self-calibrating, non-dispersive infrared (NDIR)
- Sensor Range: 0-5000 PPM
- Accuracy:  $\pm$  30 PPM @ 3% of reading
- Accuracy is valid after a minimum of 3 weeks of continuous operation
- Response Time T63: 2 minutes

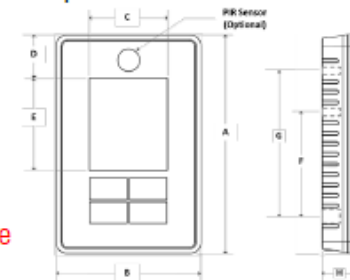
## Mechanical:

- Dimensions: B 3.25" x A 4.88" x 0.8"  
B 83 mm x A 124 mm x 20 mm
- Stacking temperature:  
-30 °C to 50 °C / -22 °F to 122 °F
- Operating conditions:  
-25 °C to 50 °C / -13 °F to 113 °F  
10% to 90% H.R. without condensation
- Weight: 120 g / 0.25 lb
- Mounting type:  
Standard 2" x 4" electrical junction box
- Enclosure: White color, ABS material UL94VO

## Warranty: 1 year

## Certifications:

- UL 916 Energy Management Equipment
- BTL listed: B-ASC, BACnet Application Specific Controller



**WARNING:** Internally, this device utilizes a half-wave rectifier and therefore can only share the same AC power source with other half-wave rectified devices.