# B848-LX – Configurable IO MSTP Controller Installation and Wiring Guide

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# B848-LX - Configurable RTU MSTP Controller Disclaimer

Before proceeding to the installation of this controller or any device, please note the following:

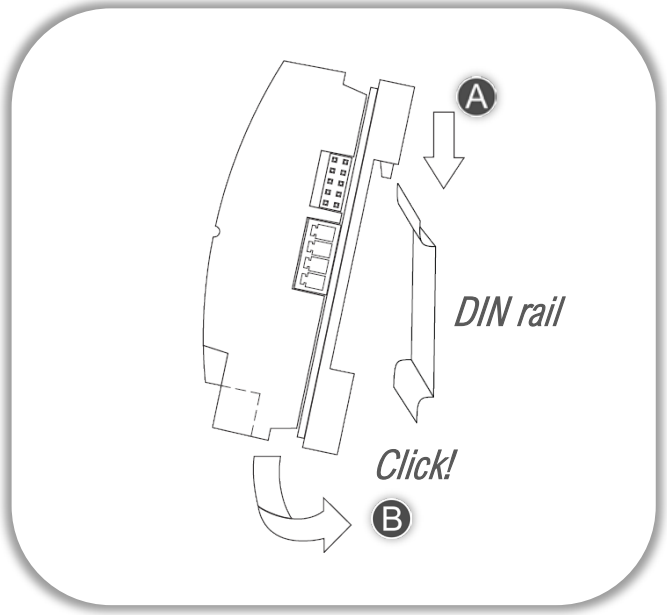
This manual applies to ***Onyxx LX UI software version 4.0*** and higher and using ***firmware version 2.224*** and higher.

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

- All installations shall be made by a properly certified technicians and respect all local mandatory codes and regulations.
- Electronic controls are static sensitive devices: discharge yourself properly before manipulating and installing the controller.
- Any short circuit or incorrect wiring may permanently damage the controller or the 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.

# B848-LX - Configurable RTU MSTP Controller Contents

# B848-LX - Configurable RTU MSTP Controller
# Installation - Mount the B848 following these simple instructions.




*Mount the controller using the quick mounting method, on a DIN rail .*

- A *Align the brackets above the DIN rail and slide the unit down onto the rail*
  *Press the bottom of the unit down onto the rail until you hear a "click".*
- B *The easy release spring retaining clip holds the unit firmly in place.*

*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.*

*Make sure the controller is mounted inside an approved enclosure that meets local building code requirements or any other suitable protective enclosure. The installer is responsible for ensuring that local building codes are respected. If replacing an older controller, label the wires before removing the older controller and installing the new one. Never remove or install a controller while it is powered.*

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

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# Interface
## Product label

This controller is designed to facilitate control and management of terminal equipment typically used in the HVAC industry.

It allows powerful yet flexible solutions that can be tailored and sized according to any project needs.

All key functions across all Onyxx LX programmable controllers are very similar and operate in the same fashion.


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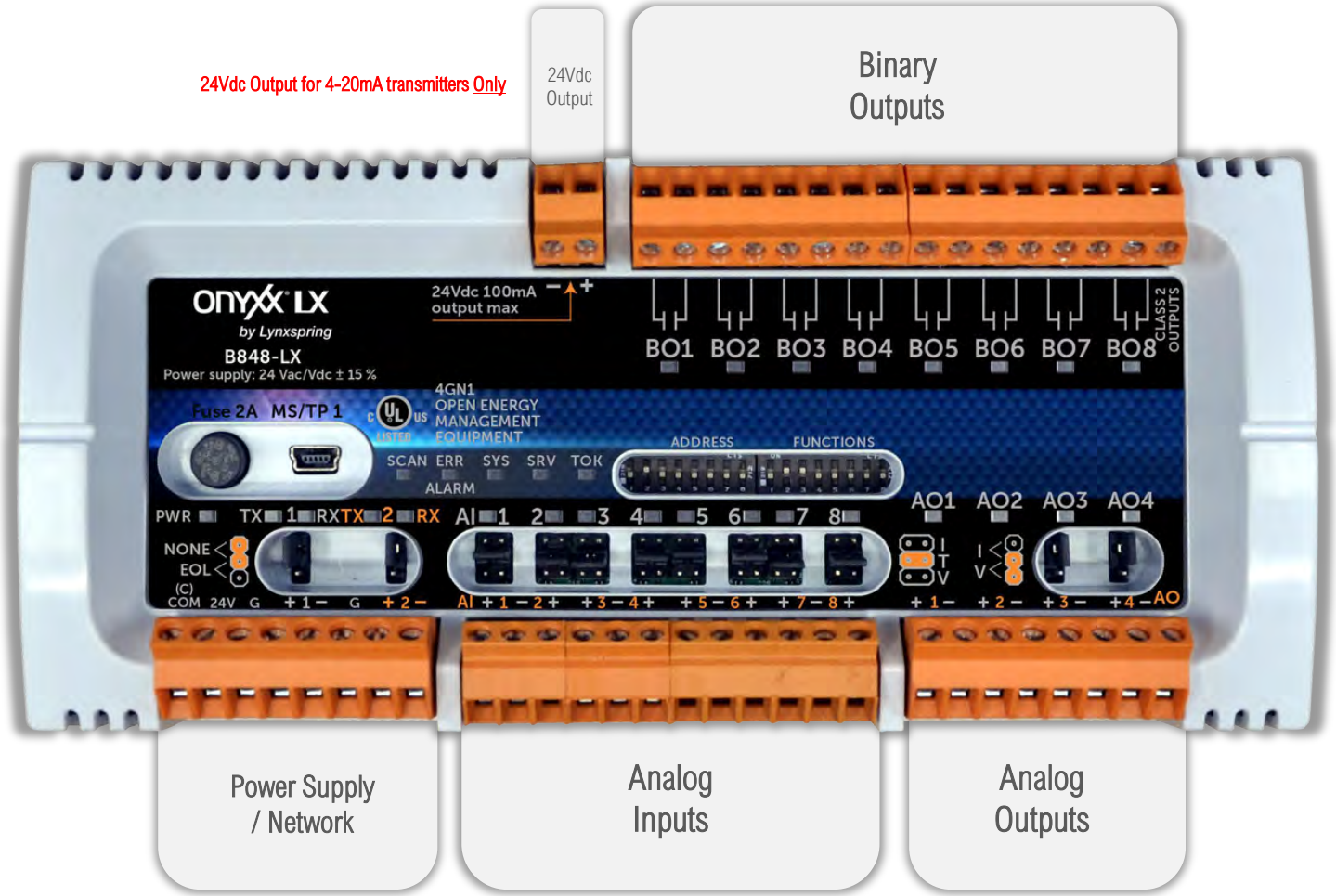
# B848-LX - Configurable RTU MSTP Controller Terminal Blocks

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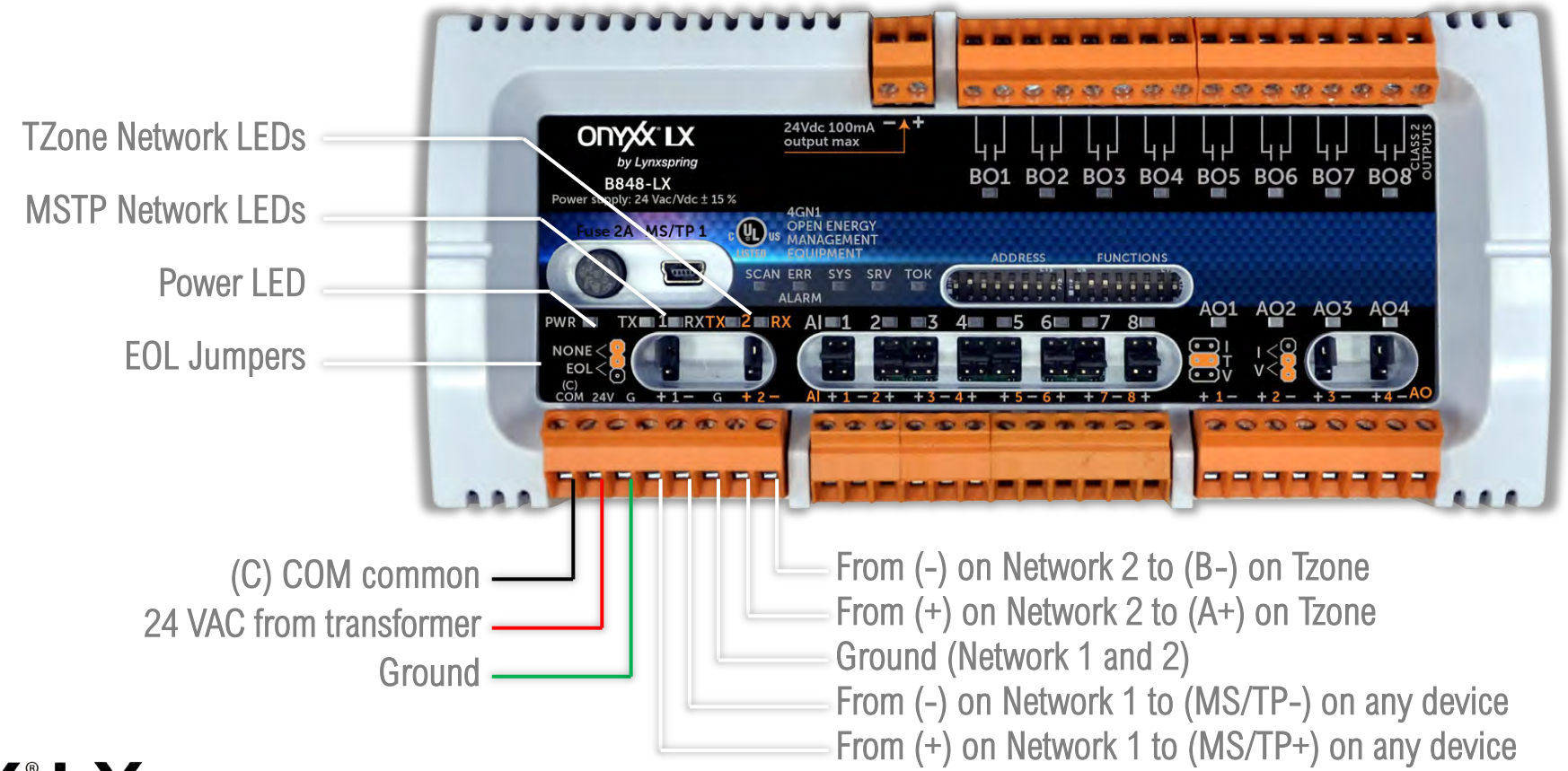
# Installation

## Wiring Instructions, Power and Network terminal block

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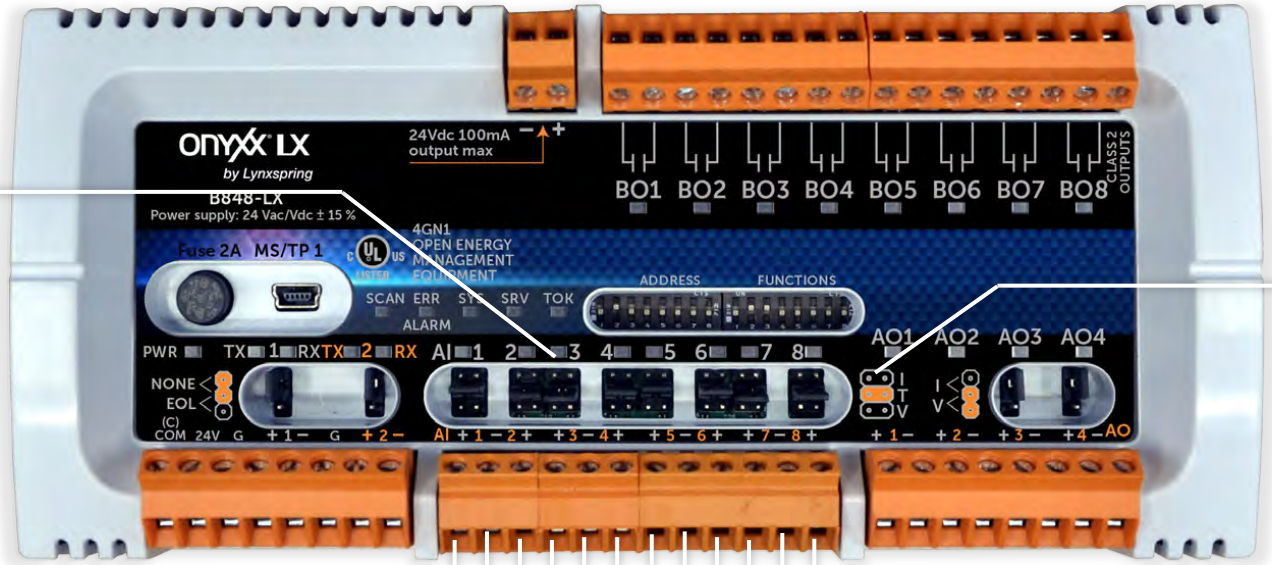
# Installation

## Wiring Instructions, Analog Inputs Terminal Block

Analog Inputs
Status LEDs




Input type jumper :

- I : Current Intensity
  *0..20 mA / 4..20 mA*
- T : Thermistor
  *10K Type 3 (std) or Type 2*
- V : Voltage
  *0-10 VDC / 2-10 VDC*

Analog Input/Universal Input 1 (+)
Analog Input/Universal Input 1 & 2 (-)
Analog Input/Universal Input 2 (+)
Analog Input/Universal Input 3 (+)
Analog Input/Universal Input 3 & 4 (-)
Analog Input/Universal Input 4 (+)

(+) Analog Input/Universal Input 5
(-) Analog Input/Universal Input 5 & 6
(+) Analog Input/Universal Input 6
(+) Analog Input/Universal Input 7
(-) Analog Input/Universal Input 7 & 8
(+) Analog Input/Universal Input 8

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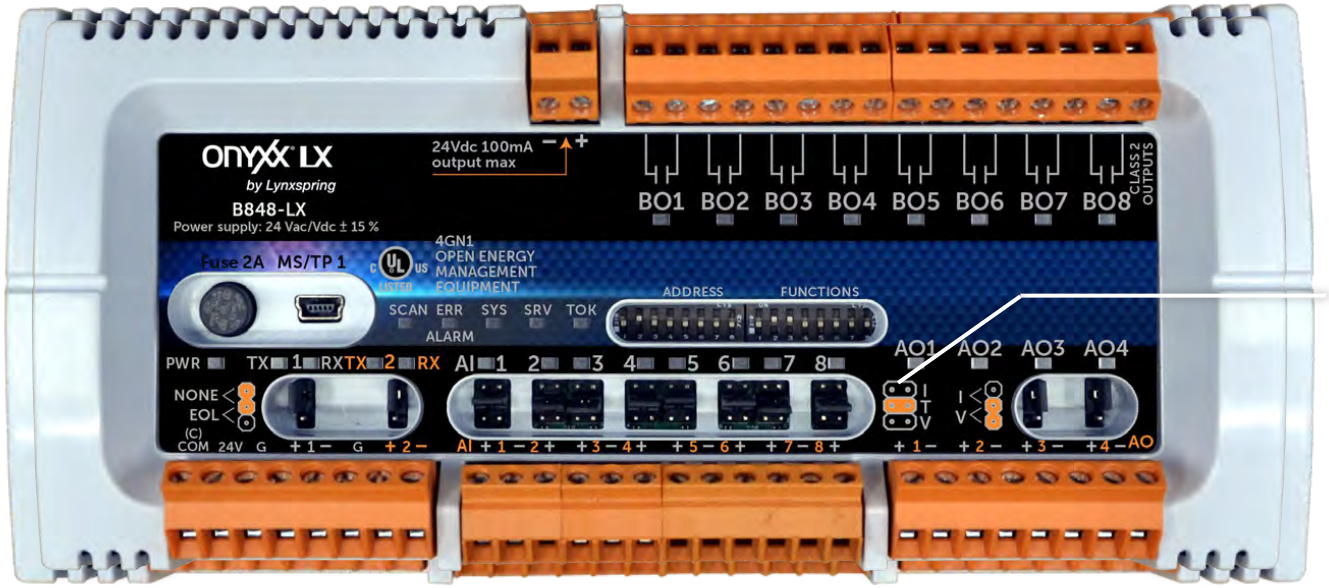
# Installation

## 4-20mA / 0-10VDC Analog Inputs Application Note




Input type jumper :

I : Current Intensity

*0..20 mA / 4..20 mA*

V : Voltage

*0-10 VDC / 2-10 VDC*

*When using a 4-20mA input to the AI's, those are limited to below and must be configured in **Onyxx LX UI** in the following procedure: -RH Sensor Physical Location, choose an AI, set jumper to I, 2-10VDC = 4-20mA 0% -100%RH*
*-CO2 choose an AI, set jumper to I, 4-20mA = 400-2000 PPM*
*-Pressure Sensor Physical Location, choose an AI, set jumper to I, 2-10VDC = 4-20mA 0 -1 inH2O [example]*
***You cannot use 4-20mA on temp inputs in Onyxx LX UI, the system is designed to read 10K type thermistors***

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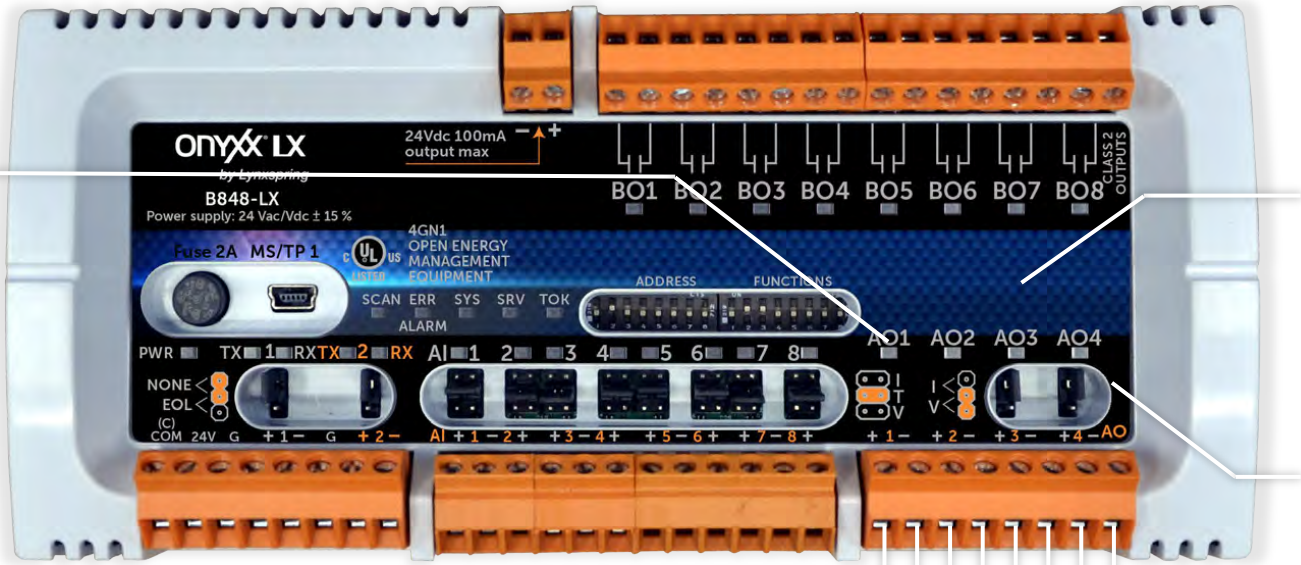
# Installation

## Wiring Instructions, Analog Output terminal block

Analog Output Status LEDs




Analog Output 1 (+)
Analog Output 1 (-)
Analog Output 2 (+)
Analog Output 2 (-)
Analog Output 3 (+)
Analog Output 3 (-)
Analog Output 4 (+)
Analog Output 4 (-)

Analog Output type jumper :

I : Current Intensity

*0..20 mA / 4..20 mA*

V : Voltage

*0..10 Vdc / 2..10 Vdc*

*Please note that only AO3 & AO4 can be configured using the jumper.*
*AO1 & AO2 in VDC Only*

*Application Note 4-20mA Outputs*
*On AO3 and AO4 for 4-20mA, you can use this for the following outputs: Set Jumper to I.*
*-Modulating Humidifier function by selecting 2-10VDC in your signal type 2-10VDC = 4-20mA 0-100% output*
*Modulating Heating/Cooling 2-10VDC = 4-20mA 0-100% output*
*Modulating Economizer 2-10VDC = 4-20mA 0-100% output*

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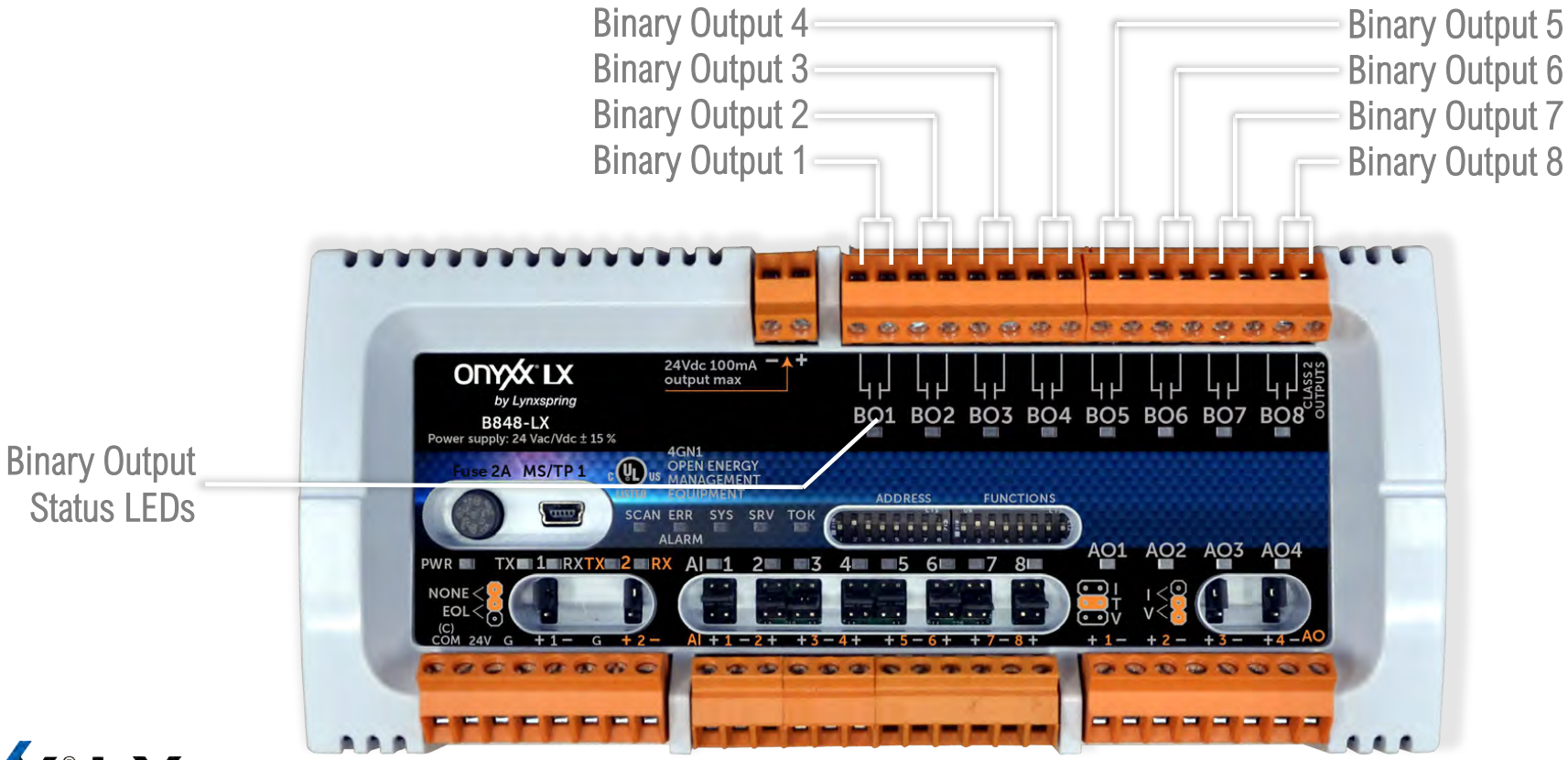
# Installation

## Wiring Instructions, Binary Output Terminal Block

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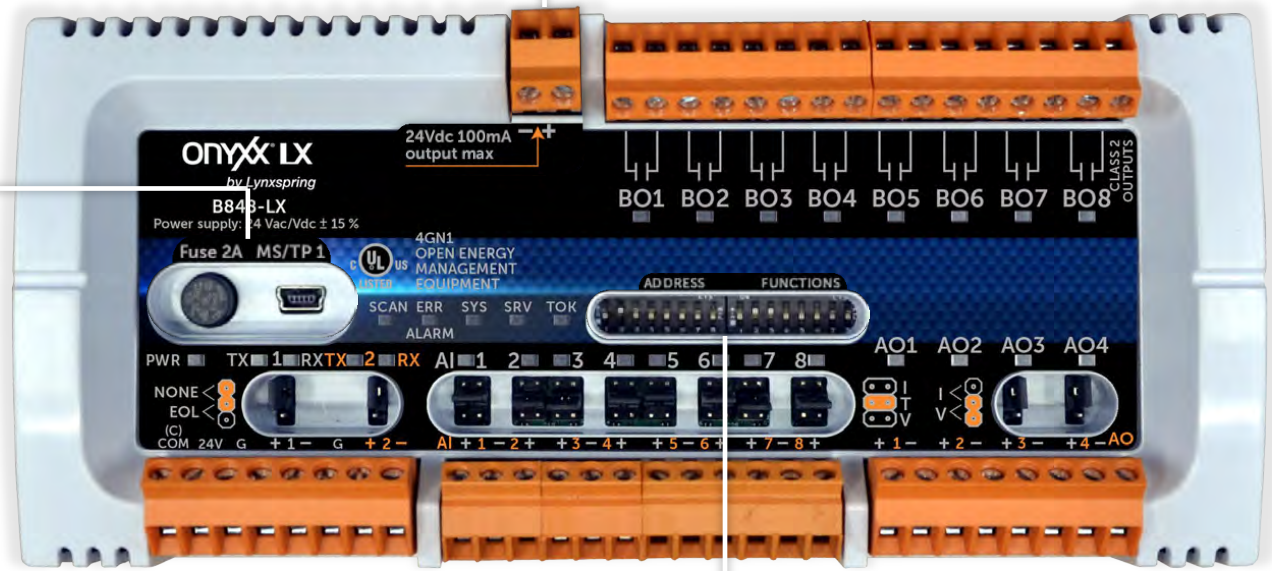
# Installation

## Wiring Instructions, MS/TP network Access and Addressing

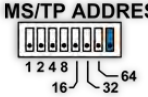
24Vdc Output for 4-20mA transmitters Only

MiniUSB Connection for Networking & 2 A Fuse



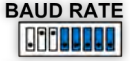

DIP switches

**MS/TP ADDRESS**




*Address configures the MS/TP address*
*The Values of the On Switches adds up*
*1-2-4-8-16-32-64*
*Possible Address : 1 - 127*

**BAUD RATE**



76800 BAUD SHOWN
Blue = Keep to off position

*Functions configures the Baud Rate (BPS)*
*Switches Configuration : Off = 0, On = 1*
*Available baud rates :*
***010*** *- 9600 BPS,* ***110*** *- 19200 BPS,* ***001*** *- 38400 BPS,* ***011*** *- 76800 BPS*

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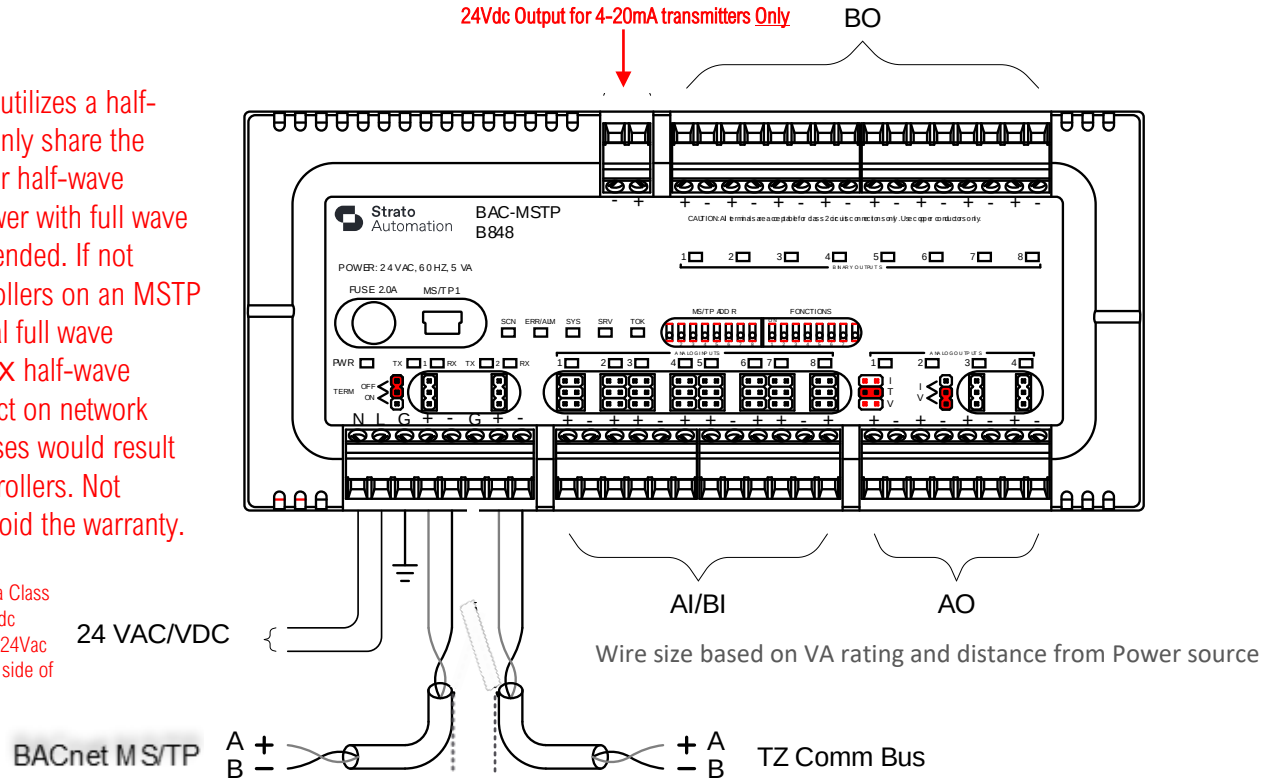
# Installation

## Wiring Instructions, MS/TP Network, TZ Comm Bus, and Power

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 Onyxx LX half-wave controllers can have adverse effect on network communications and in some cases would result in damaging the Onyxx LX Controllers. Not properly wiring the devices will void the warranty.

The B848 can be powered using a Class 2, 24Vac transformer, or to a 24Vdc power source. If powering from a 24Vac transformer, do not ground either side of the transformer's secondary.




Wire size based on VA rating and distance from Power source

For maximum protection from electrostatic discharge or other forms of EMI connect each controller to earth ground using a #16 AWG and keep these wires as short as possible.

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

Proper grounding of a controller is important to ensure a high probability of surviving a nearby lightning strike as well as other possible electrical surges.

---------- *Cable shield connection (Refer to RS485 network guidelines for proper wiring)*

Cables suitable for use in an RS-485 network should have an impedance of between 100 and 130 ohms, a capacitance between conductors of less than 30 pF per foot (100 pF per meter), and a capacitance between conductors and shield less than 60 pF per foot (200 pF per meter).

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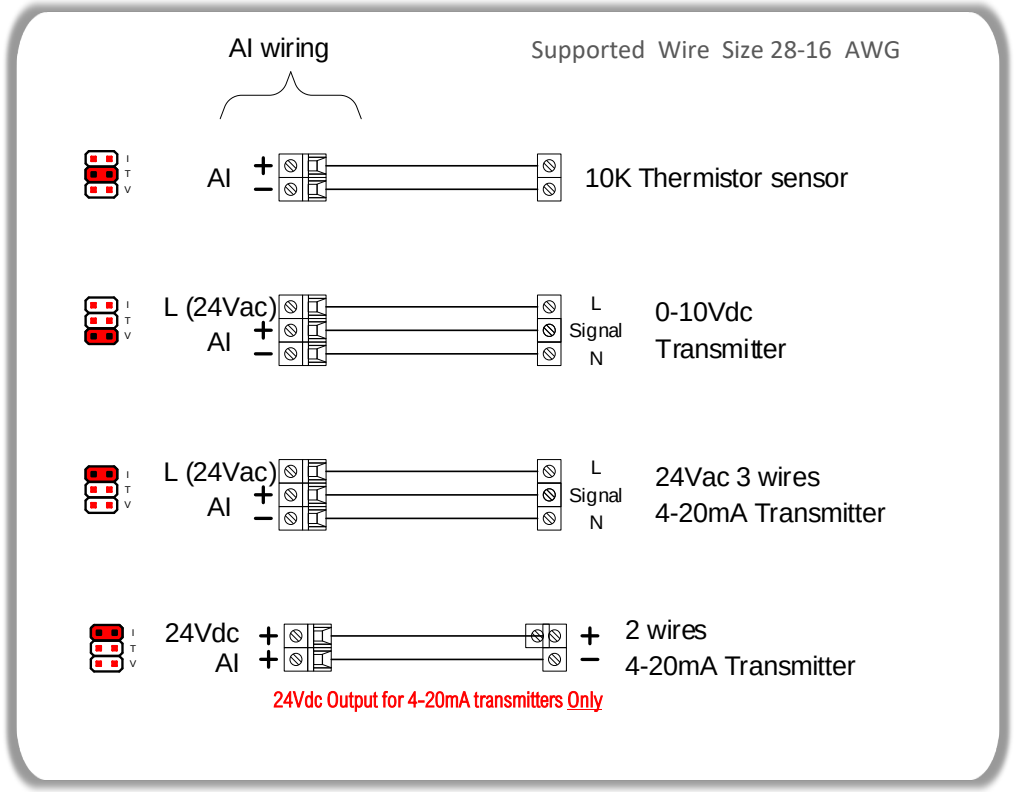
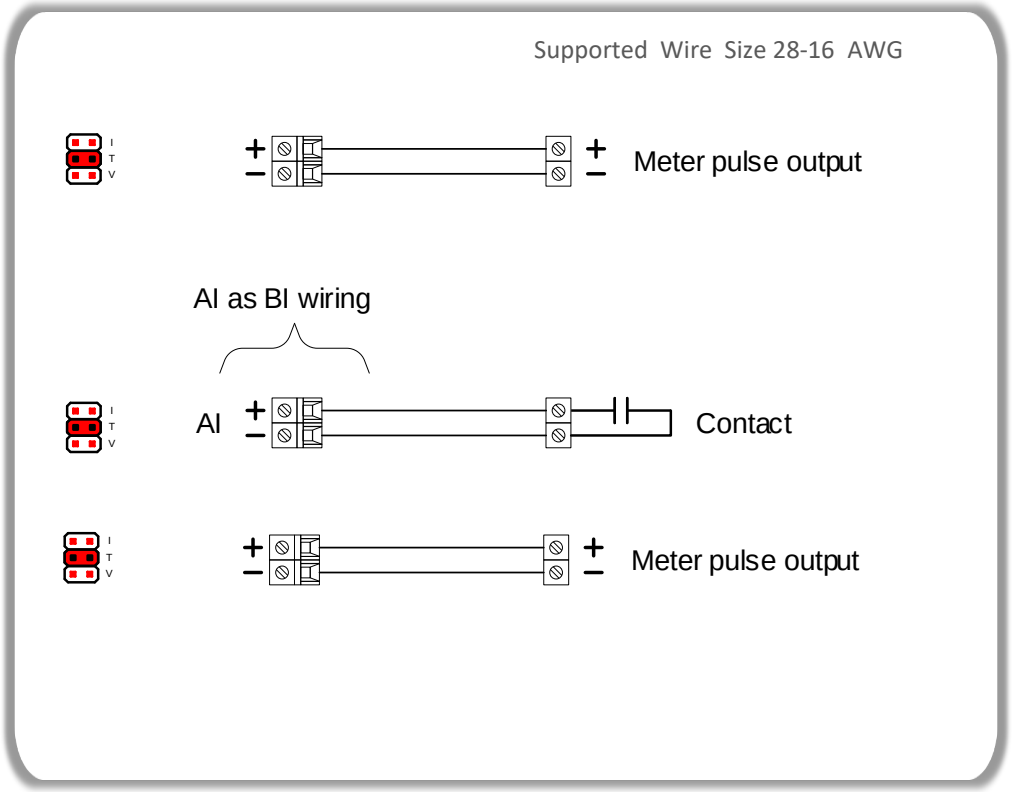
# Installation

## Wiring Instructions, Analog Input Wiring

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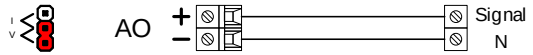
# Installation

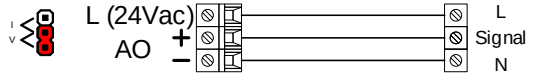
## Wiring Instructions, Analog Output and Binary Output Wiring

AO wiring

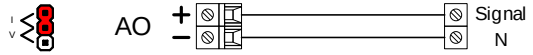
Supported Wire Size 28-16 AWG



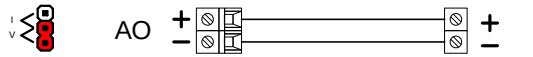

Self powered 0 to 10Vdc device



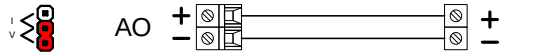

0 to 10Vdc device (4mA max)




4-20mA device



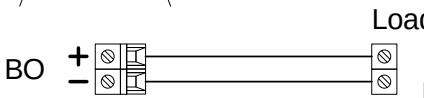

0 / 10Vdc on/off output (20mA max)



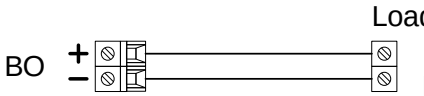

0 / 10Vdc time proportional pulse output (from 2 to 30sec @ 20mA max)

BO wiring

Supported Wire Size 28-16 AWG




Isolated on/off contact to drive load
max 1A @ 30Vac/dc



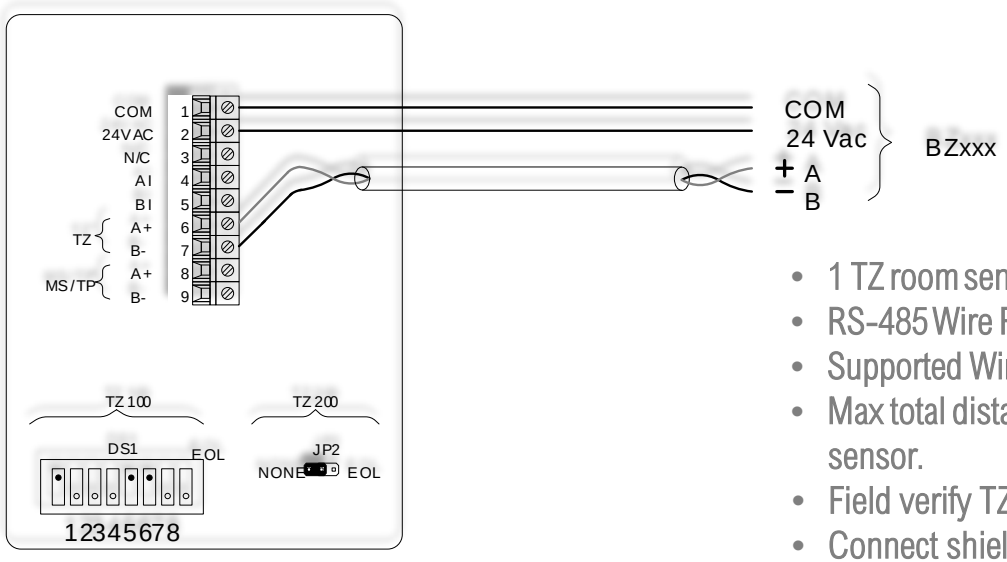

Isolated time proportional output
Pulses from 2 to 30sec max 1A @ 30Vac/dc

Note: The BO outputs are isolated electronic and not polarized contacts (equivalent to a mecanical relay); So, the +/- indications are irrelevant and can be connected any direction.

If Using 24Vdc for Binary outputs, use an external 24Vdc power supply

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

# TZ Room Sensor Wiring




- 1 TZ room sensor allowed per B848 controller
- RS-485 Wire Required for communications wiring
- Supported Wire Size 28-16 AWG for power wiring, recommend 18 AWG
- Max total distance of communication wire of 300 ft from controller to the TZ room sensor.
- Field verify TZone addressing and EOL jumpers
- Connect shield to ground, at only one extremity of the network
- MS/TP A+ and B+ are optional; they are directly connected to the USB connector below the TZxxx. The goal is to allow access to the MSTP network from the special USB to MSTP adapter.
- If there is a loss in communication to the TZ controller BV24 will indicate a fault , AV 9 will = - 40 °F and the fan, heating and cooling will be disabled, and the economizer damper will return to minimum position.

# Sequence of Operation

## Fan Control

The Fan can be configured for *On/Off, Modulating*, *On-Off+Modulating or 2 or 3 speed* control. When configured for modulating or On-Off +Modulating control, the controller can control a VFD device and speed control.

The Fan will turn On-Off based on the schedule or a command from the network. The Fan can be configured to operate in *Continuous* mode or *Intermittent* during occupied times. When set for Intermittent, the Fan will follow the *Minimum On Time* (1 min) to prevent short cycling of the Fan.

## Modulating/On-Off+Modulating control

The modulating signal output will operate from minimum to maximum speed based upon demand. There are two points you can set for modulating fan speed control. A minimum speed AV21 [default is 30%] and a maximum speed AV28 [default is 100%].

## Modulating/On-Off+Modulating control for VFD and Duct Static Pressure

The VFD signal will modulate to maintain static duct pressure compared to the Pressure *Setpoint* (1" WC). The VFD has a *Minimum Speed* (30%) setpoint to prevent motor overheating.

## 2 [Low-High] or 3 [Low, Medium and High] Speed Fan control

The 2 or 3 speed fan control has two separate functions. When selecting to use 2 speed, the fan will start in low speed and switch to high speed based on demand. A two-speed motor is required to use this function. You will utilize BO1 for High and BO2 for Low. When selecting 3 speed you can chose to manually set your fan speed to low, medium or high speed, or you can select auto which will switch speeds based upon demand. A three-speed motor is required to use this function. When utilizing 2 or 3 speed fan control, you must choose a fan sequence MSV97 and a Fan Mode MSV12.

# Sequence of Operation

### Fan Status
When configured, the status is used internally to prove the Fan before starting any heating or cooling operations and if detected as faulted will lock out fan until physical input is cleared.

### Outside Air Temperature (OAT)
When configured, the outside air is used to enable the economizer for free Cooling and used as a Heating and Cooling lockout.

If the OAT is greater than the *Heating Authorization* setpoint (65°F/18°C), Heating will not be enabled.
If the OAT is greater than the *Cooling Authorization* setpoint (53°F/12°C), Cooling will be enabled.

### Supply Sensor Freeze Protection
If the supply air sensor has been configured, the Fan will shut down if the supply air falls below the *Freeze Setpoint* (37°F) for more than 30 seconds. Not configurable, requires supply air sensor. Supply Air temperature must read over 39 °F for three minutes to re-enable fan.

### Freeze Stat Input
If the Freeze Stat input has been configured, a physical freeze stat latching device [normally open] is installed, and the freeze stat input reads active [contact closed on freezing condition], a message on live view will display BV7 [Active] and the unit will not function until the latching device is reset.

### Anti-Ice input
If the anti-ice input has been configured, and ice is detected on the coil from a physical input and reads Ice_detected, then cooling is NOT allowed, and cooling demand will be forced to zero 0% until the anti-ice input has been cleared and reads normal.

### Drain Pan Overflow input/Condensate avoidance
If the drain pan overflow input has been configured, and the drain pan input reads *overflow*, then cooling is NOT allowed, and cooling demand will be forced to zero 0% and will not interrupt fan control until the drain pain overflow has been cleared and reads normal.

# Sequence of Operation

## Room Temperature Control

The controller can be configured to use a single TZone Room sensor for control of a single space.

An ACI [A/AN-R2SO-RJ6-16-C5] wired sensor slider (0-5K = 65°F -85°F) with push-button override can be used by selecting AI-1 for Room Temp [MSV-17] and AI-2 for Room Temp Setpoint [MSV-18] in SLC setup.

A Trane Wired Sensor [BAYSENS074A] 1K room Dial setpoint (50°F -85°F) with push-button override / cancel and can be used by selecting AI-1(Trane) for Room Temp [MSV-2] and AI-2 (Trane) for Room Temp Setpoint [MSV-3] in Onyxx LX UI setup. This is to be used with a Trane Tracer SC system writing Occupancy [BV-5] at present value. Timed Override Status can be read from [MSV-72] for Trane sequence of operation.

The controller can be configured to use MSV 3 set to virtual for setpoint control to write to AV 15 RoomTSP.

### *Occupied Cooling control with Room Sensor*

During occupied mode and a call for Cooling, the system will cycle the configured outputs to maintain the occupied *Cooling Setpoint* (74°F).

Cooling demand needs to be 15% to start. Cooling will disable lower than 5% demand. Valve modulation will be from 0 to 100%. So, the valve will start at 15% demand and will modulate until 100%. Cooling valve will close until 5% then switch to 0%.

Cooling outputs can be configured for staged control (up to 4 stages), modulating (up to 2 outputs), or 1 stage + modulating. As the room temperature drops below the cooling setpoint, outputs are cycled on and off to maintain the Cooling setpoint.

### *Occupied Heating mode with Room Sensor*

During occupied mode and a call for Heating, the system will cycle the configured outputs to maintain the occupied Heating Setpoint (72°F). As the room temperature drops below the heating setpoint, outputs are cycled on and off to maintain the Heating setpoint.

Cooling demand needs to be 15% to start. Cooling will disable lower than 5% demand. Valve modulation will be from 0 to 100%. So, the valve will start at 15% demand and will modulate until 100%. Cooling valve will close until 5% then switch to 0%.

When the Downstream T° sensor is configured, the outputs will cycle to maintain a discharge air setpoint of the *High Limit Heating* (default 122°F) setpoint until the space temperature is satisfied.

# Sequence of Operation

*Unoccupied Cooling control with Room Sensor*
During unoccupied mode and a call for Cooling, the system will cycle the configured outputs to maintain the *Unoccupied Cooling Setpoint* (80°F).

*Unoccupied Heating mode with Room Sensor*
During unoccupied mode and a call for Heating, the system will cycle the configured outputs to maintain the *Unoccupied Heating Setpoint* (65°F).

*Standby Cooling control with Room Sensor*
When a motion sensor is configured on an AI or a TZ200 room sensor is used with a PIR sensor, and motion is not sensed in the space for 60 min (cfg) Cooling will be maintaining the Cooling Setpoint plus the standby cooling offset.

*Standby Heating control with Room Sensor*
When a motion sensor is configured on an AI or a TZ200 room sensor is used with a PIR sensor, and motion is not sensed in the space for 60 min (cfg) Heating will be maintaining the Heating Setpoint minus the standby heating offset.

# Sequence of Operation

### Constant Volume Control

This mode is used with BZ122 and BZ424 VAV controllers. The control supports voting or demand for Cooling and Heating as required from the VAV controllers.

### Fan Mode

Operates as described in the Fan Control.

With **Onyxx LX UI**, the controller can be configured to use the calculated Heating and cooling demand from each BZ122 and BZ424 controller assigned to the BP848 controller. When using this mode, configure the *Control T°* Location to Address List. Next, in the *MS/TP Address List (2)* option, choose the VAV controllers by the controllers' MS/TP address to report their cooling and heating demands to the controller. The unit will control its Heating and Cooling based on demand.

# Sequence of Operation

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## Demand Control

In this mode, the unit will control the heating outputs and cooling outputs based on the Cooling and heating demand from the VAV controllers. The unit can control based on the Minimum, Average, or Maximum demand call for heat or Cooling. To set the unit's control on demand, set the *HtgDemandType* and *ClgDemandType* to the appropriate setting.
Example –

- Demand Minimum - Heating or Cooling works with the smallest demand
- Demand Average - Heating or Cooling works with the average demand
- Demand Maximum - Heating or Cooling works with the biggest demand

The controller will monitor the Heating and cooling demand from the VAV controllers as stated above.

If the cooling demand is greater than 15% for more than 3 min, the Fan is on, fan status is true, and the cooling demand is greater than the heating demand, the cooling mode will be energized.
Cooling outputs will be staged on/off or modulate to maintain the *Minimum Supply Setpoint* (55°F/13°C) at 100% demand call. When the demand call is 0%, the Cooling will be staged on/off or modulated to maintain the *Neutral Supply Setpoint* (68°F/20°C).

Cooling demand needs to be 15% to start. Cooling will disable lower than 5% demand. Valve modulation will be from 0 to 100%. So, the valve will start at 15% demand and will modulate until 100%. Cooling valve will close until 5% than switch to 0%.

*Note*: Neutral setpoint is designed for colder climates to supply air tempering for minimum outside air.

If the heating demand is greater than 15% for more than 3 min, the Fan is on, fan status is true, and the heating demand is greater than the cooling demand, the heating mode will be energized.
Heating outputs will be staged on/off or modulate to maintain the *Maximum Supply Setpoint* (104°F/40°C) at 100% demand call. When the demand call is 0%, the heat will be staged on/off or modulated to maintain the *Neutral Supply Setpoint* (68°F/20°C).

Heating demand needs to be 15% to start. Heating will disable lower than 5% demand. Valve modulation will be from 0 to 100%. So, the valve will start at 15% demand and will modulate until 100%. Heating valve will close until 5% then switch to 0%.

*Note*: Neutral setpoint is designed for colder climates to supply air tempering for minimum outside air.

# Sequence of Operation

## Heat Pump Control

In this mode, the unit will control based on the sequence of operation described in the *Room Temp Control* and the *Constant Volume Control*.

The compressor will be energized whenever there is a call for heating or cooling. The Reversing Valve can be configured to energize on a cooling (O) call or a call for heating (B).
***Note:*** This is based on the equipment manufacture so ensure this is set correctly to prevent damage to the equipment.

If the room temp is three or more degrees below the heating setpoint, the *AUX Heat* will be enabled.

## Outside Air Lockouts (OAT)

If configured, the compressors can be disabled if the OAT falls below the compressor lockout setpoint (default 40°F).
If configured, the Auxiliary Heat can be disabled if the OAT rises above the Aux. Heating Lockout (default 140°F)

# Sequence of Operation

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## Static Pressure Control

Static pressure can be controlled by either modulating a Bypass damper or by controlling a VFD.

### *Modulating/On-Off+Modulating control*

The VFD signal will modulate to maintain duct static pressure compared to the *Pressure Setpoint* (1" WC). The VFD has a *Minimum Speed* (20%) setpoint to prevent motor overheating.

### *Bypass Damper control*

The Bypass damper will be modulated to maintain the duct static pressure compared to the *Pressure Setpoint* (1" WC).

## 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.

# Sequence of Operation

## Power Exhaust

The power exhaust works with the Economizer mode and can control either by Off-On, Modulating, or Off-On+Modulating control.

### *Modulating/On-Off+Modulating control*

When the *Control Type* is set to Modulating/Off-On+Modulating, the fan will be enabled when the economizer damper is equal to the *Economizer Position (On)* setpoint (cfig) and be disabled when the damper is equal to the *Economizer Position (Off)* setpoint (cfg).

The speed of the fan will modulate based on the economizer damper position. The fan speed will be set at the *Min Speed (AO*) setpoint when the economizer is at the *Economizer Position (On)* setpoint.

### *On-Off*

When the *Control Type* is set to Off-On, the fan will be enabled when the economizer damper is equal to the *Economizer Position (On)* setpoint (cfig) and be disabled when the damper is equal to the *Economizer Position (Off)* setpoint (cfg).

### *Fan Status*

The fan status can be configured for status only.

# Sequence of Operation

### Humidifier

The humidifier mode is enabled to control an external humidifier when the space humidity is low. The Humidifier outputs can be configured for staged control (up to 2 stages), modulating, or 1 stage + modulating.

When the Humidity in the space is less than *the Control RH Setpoint*, and the Outside air is less than the *Outdoor RH Setpoint*, the outputs will be staged on/off or modulate to maintain the *Control RH Setpoint*.

When a *High Limit RH* sensor is configured, typically in the supply duct, the humidifier outputs will be limited and staged on/off or modulate to maintain the *High Limit RH Setpoint*. This will prevent saturating the duct with too much moisture.

### Demand Control Ventilation Application and Sequence (as set per AV 31, MSV-20 & 21)

If the current CO2 measured reading from the MSV-20 selected zone sensor and/or the selection from MSV-21 exceeds the CO2 setpoint [AV31], the outdoor air damper will open to the maximum position [AV-68] and the fan will increase to 100% if using a Modulating Fan or On if Fan is On/Off type.

If the measured reading from the MSV-20 selected zone sensor and/or the selection from MSV-21 reaches within 100ppm greater than the CO2 setpoint [AV31], the fan and damper will modulate toward normal operation in the BP848 controller. Once the measured reading from the MSV-20 selected zone sensor and/or the selection from MSV-21 is less than the CO2 setpoint [AV31], the BP848 controller returns to normal operation.

C02 can be configured using a TZ200 series controller, an analog input 0-10vdc [0-2000ppm fixed scale], or an external BACnet point.

# Sequence of Operation

## Dehumidification

### Sequence of operation: Choosing a BO MSV 56

When *Dehumidification* is enabled, if the humidity sensor rises above *the Dehumidification Control Setpoint*, *the Dehumidification Output* will enable until the humidity sensor falls below *the Dehumidification Control Setpoint*. ***Dehumidification*** is independent of temperature control. This sequence is for external dehumidification control.

### Sequence of operation: Choosing Reheat MSV 56

When *Dehumidification* is enabled, if the humidity sensor rises above *the Dehumidification Control Setpoint*, *the Dehumidification Output* will enable until the humidity sensor falls below *the Dehumidification Control Setpoint*. ***Dehumidification*** is independent of temperature control. A supply air sensor and a humidity input is required. This sequence is for internal dehumidification control.

When configured with modulating heating or cooling, the chilled water valves would open to 100% (adj) providing dehumidification and the hot water valves would modulate to maintain the SAT setpoint preventing overcooling.

On a call for dehumidification, all compressors are turned on. The first stage heat gas, reheat valve or electric coil is modulated to maintain a supply temp “SupSPcalc” between 55° “SupSPminClg” and 68°F “SupSPneutral”.

The “SupSPcalc” is calculated from cooling demand “ZClgDemand” 0 to 45%. ZClgDemand at 0% will maintain 68°F in the supply. Progressively ZClgDemand at 45% will maintain 55°F in the supply.

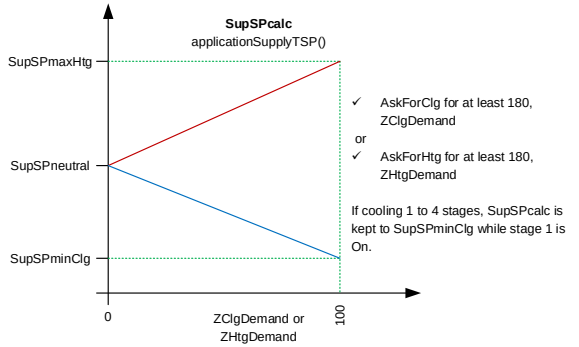
When ZClgDemand reach over 45% the unit reverts to normal cooling mode and reheat is de-energized.
If ZClgDemand lower than 30% and there is still a call for dehumidification all compressors are turned back on (the minimum on and off times and stages delays are still active during compressor operation).

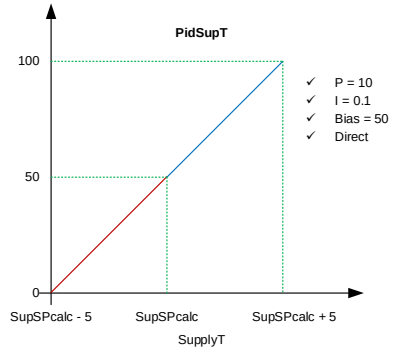
When the humidity control setpoint is satisfied, reheat and compressors resume normal functions.
During the Dehumidification cycle, Economizers are disabled until the dehumidification cycle is terminated.
During the Dehumidification cycle, if modulating fan or multiple speed is selected [MSV23], then fan will be set to maximum/high until dehumidification cycle is terminated.
If during a dehumidification cycle, there is a call for heating, the dehumidification cycle is terminated.
If during a dehumidification cycle, there is a CO2 event [DCV], the dehumidification cycle is terminated.

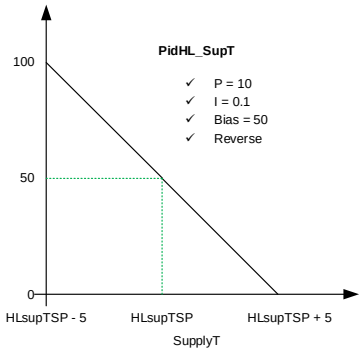
**Note When using the Dehumidification sequence with an Economizer sequence, the Dehumidification sequence will only work with Enthalpy Economization Sequence, and it will not work with Drybulb Economization Sequence.*

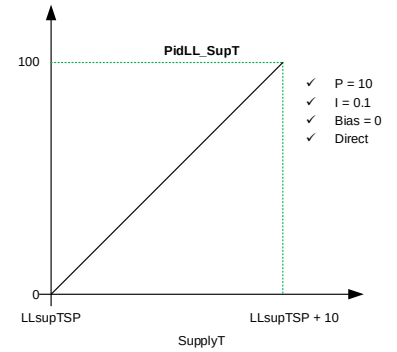
# Sequence of Operation Details

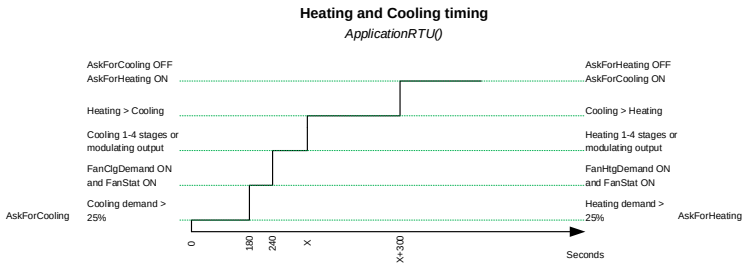
## Temperature

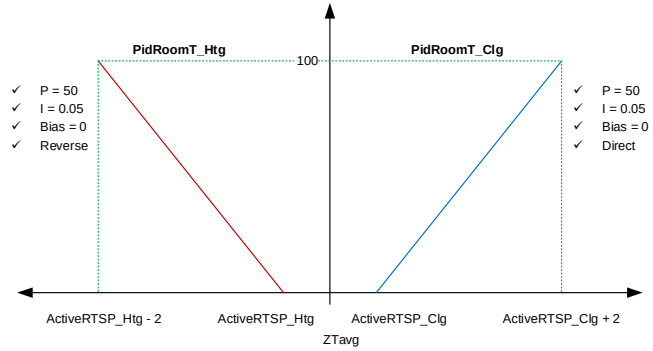
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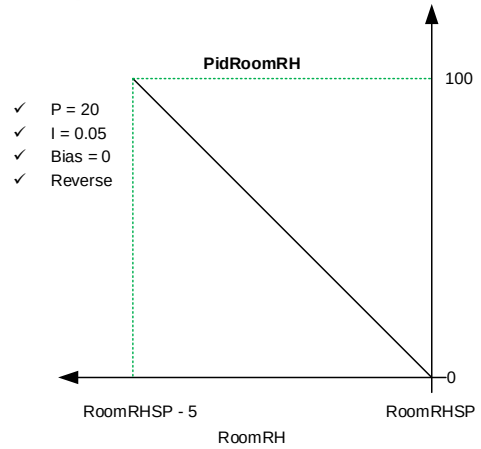
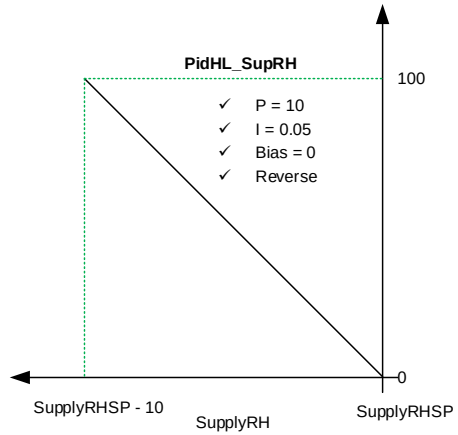
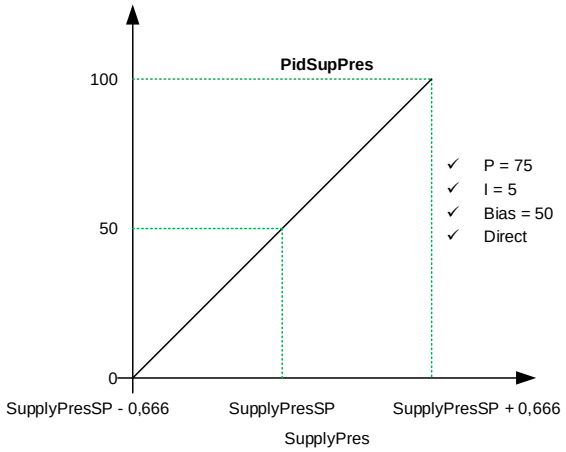
# Sequence of Operation Details

## Humidity




## Pressure

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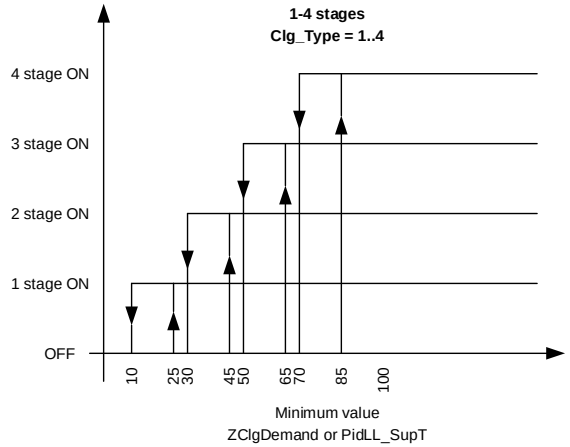
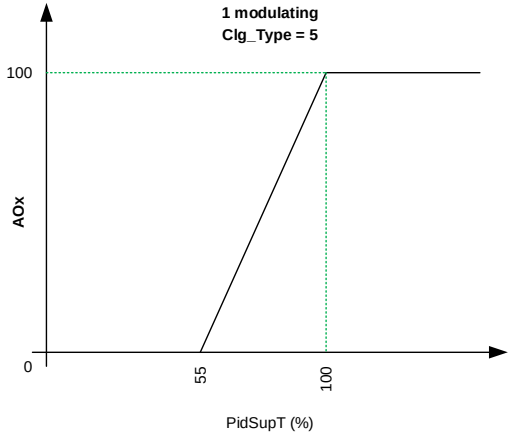
# Sequence of Operation Details

## Cooling




- ✓ AskForCooling for at least 180 seconds
- ✓ FanClgDemand ON for at least 60 seconds
- ✓ There is at least 180 seconds between each stage
- ✓ isFanRunning true
- ✓ isCoolingAllowed true

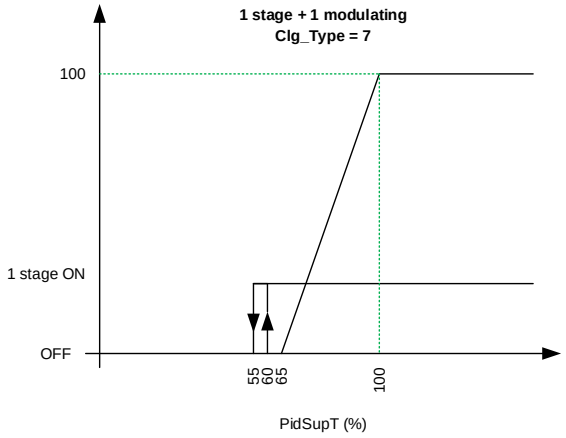
Stage 1 ON = ZClgDemand.var1 (25)
Stage 2 ON = ZClgDemand.var2 (45)
Stage 3 ON = ZClgDemand.var3 (65)
Stage 4 ON = ZClgDemand.var4 (85)
Deadband = ZClgDemand.var5 (15)




- ✓ AskForCooling for at least 180 seconds

or

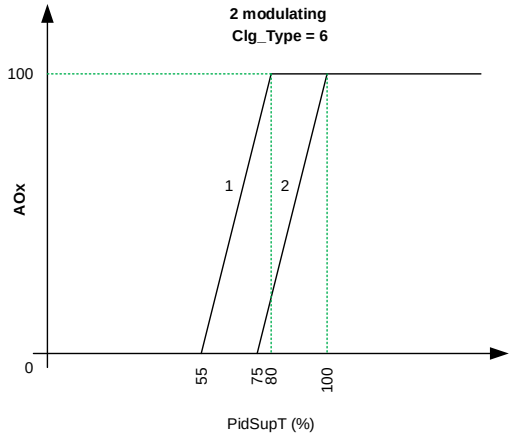
- ✓ AskForHeat is OFF
- ✓ Occupied mode
- ✓ FanClgDemand ON for at least 60 seconds
- ✓ isCoolingAllowed true




- ✓ AskForCooling for at least 180 seconds

or

- ✓ AskForHeat is OFF
- ✓ Occupied mode
- ✓ FanClgDemand ON for at least 60 seconds
- ✓ isCoolingAllowed true




- ✓ AskForCooling for at least 180 seconds

or

- ✓ AskForHeat is OFF
- ✓ Occupied mode
- ✓ FanClgDemand ON for at least 60 seconds
- ✓ isCoolingAllowed true

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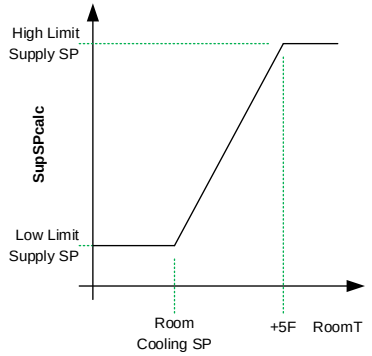
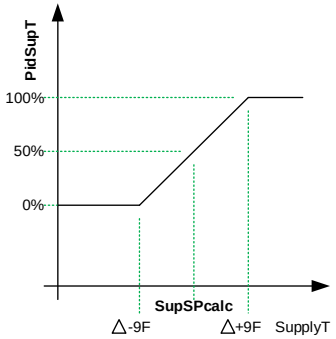
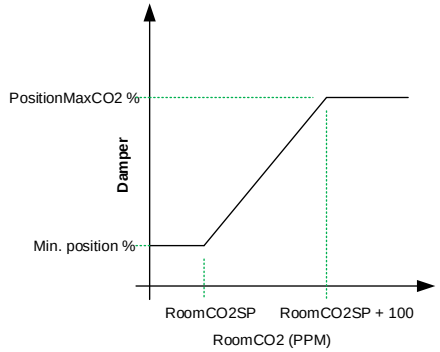
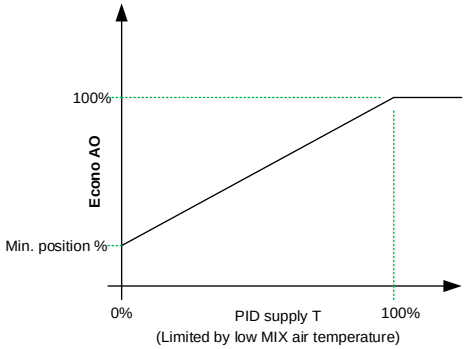
# Sequence of Operation Details

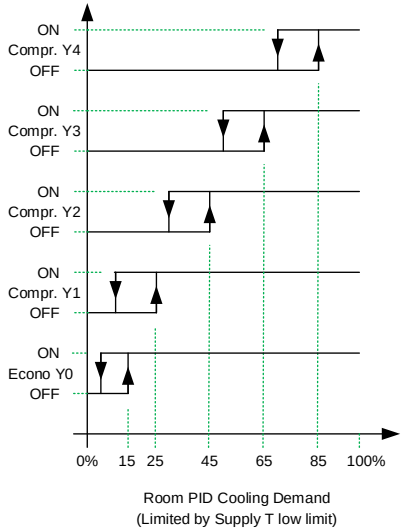


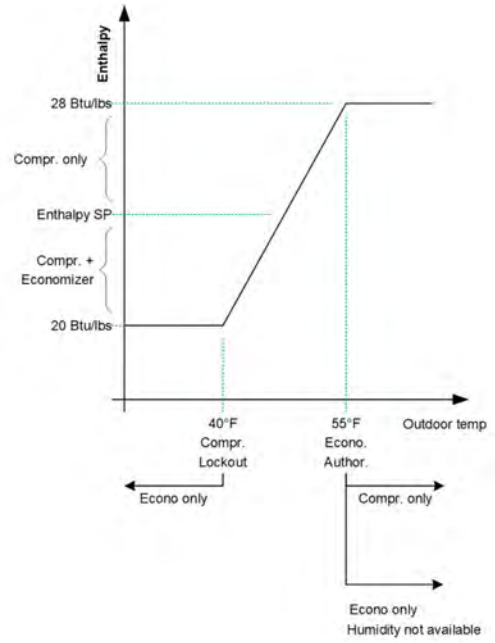




## Economizer

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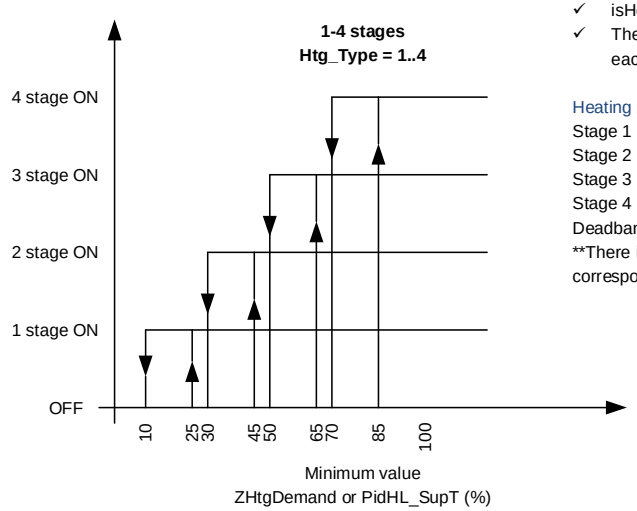
# Sequence of Operation Details

## Heating

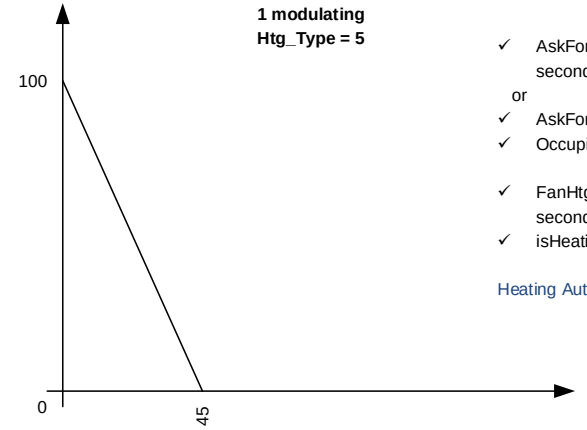
**1-4 stages**
**Htg_Type = 1..4**




- ✓ AskForHeating for at least 180 seconds
- ✓ isHeatingAllowed true
- ✓ There is at least 60 seconds between each stage

Heating Authorization = OAT.var1
Stage 1 ON = ZHtgDemand.var1 (25)
Stage 2 ON = ZHtgDemand.var2 (45)
Stage 3 ON = ZHtgDemand.var3 (65)
Stage 4 ON = ZHtgDemand.var4 (85)
Deadband = ZHtgDemand.var5 (15)
**There is no parameters in Solonet that corresponding to these values.

**1 modulating**
**Htg_Type = 5**

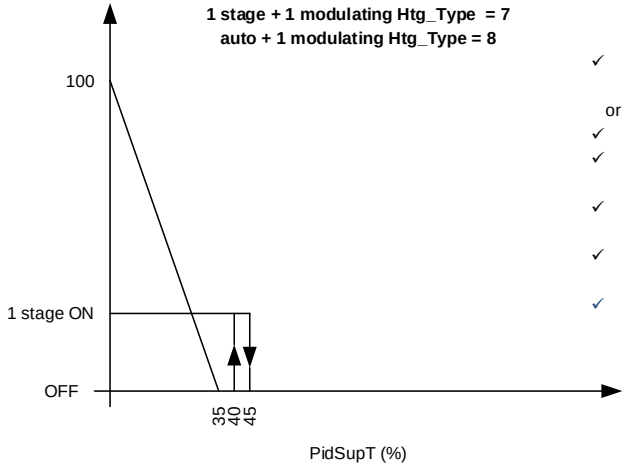



- ✓ AskForHeating for at least 180 seconds
  or
- ✓ AskForCool is OFF
- ✓ Occupied mode

- ✓ FanHtgDemand ON for at least 60 seconds
- ✓ isHeatingAllowed true

Heating Authorization = OAT.var1

**1 stage + 1 modulating Htg_Type = 7**
**auto + 1 modulating Htg_Type = 8**

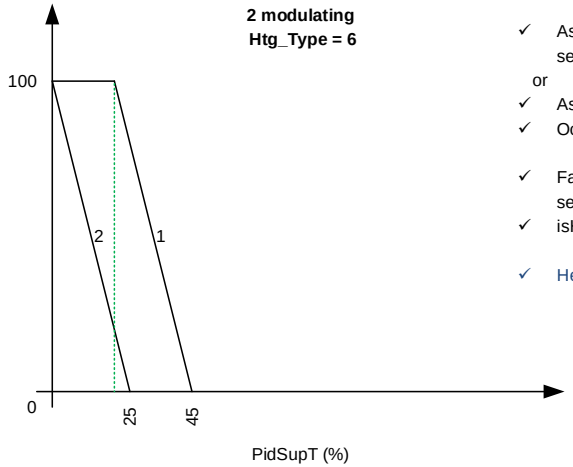



- ✓ AskForHeating for at least 180 seconds
  or
- ✓ AskForCool is OFF
- ✓ Occupied mode

- ✓ FanHtgDemand ON for at least 60 seconds
- ✓ isHeatingAllowed true

- ✓ Heating Authorization = OAT.var1

**2 modulating**
**Htg_Type = 6**




- ✓ AskForHeating for at least 180 seconds
  or
- ✓ AskForCool is OFF
- ✓ Occupied mode

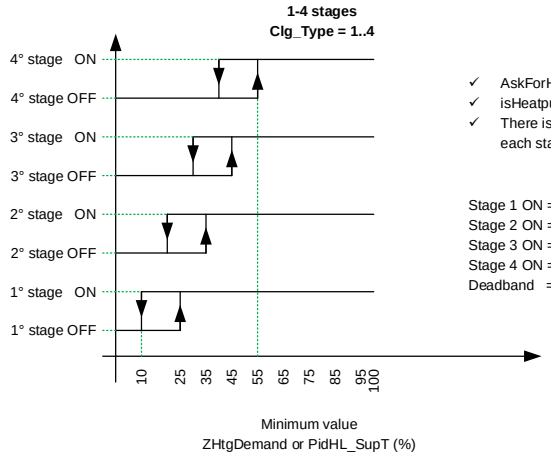
- ✓ FanHtgDemand ON for at least 60 seconds
- ✓ isHeatingAllowed true

- ✓ Heating Authorization = OAT.var1

# Sequence of Operation Details

## HEAT PUMP CONTROL

### setHeatingHpY() (Compressors)

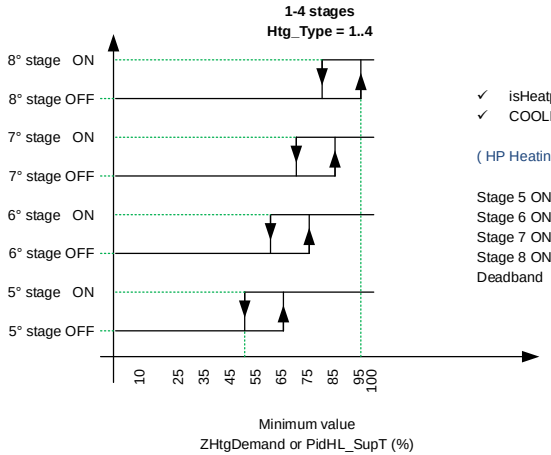



- ✓ AskForHeating for at least 180 seconds
- ✓ isHeatpumpAllowed true
- ✓ There is at least 60 seconds between each stage

Stage 1 ON = ZClgDemand.var1 (25)
Stage 2 ON = ZClgDemand.var2 (35)
Stage 3 ON = ZClgDemand.var3 (45)
Stage 4 ON = ZClgDemand.var4 (55)
Deadband = ZClgDemand.var5 (15)

**Note:**
Use ZClgDemands private variables to compare with ZHtgDemand when heatpump heating mode **is permitted** (depend on OAT)

### setHeatingHp() (Auxiliary heat)

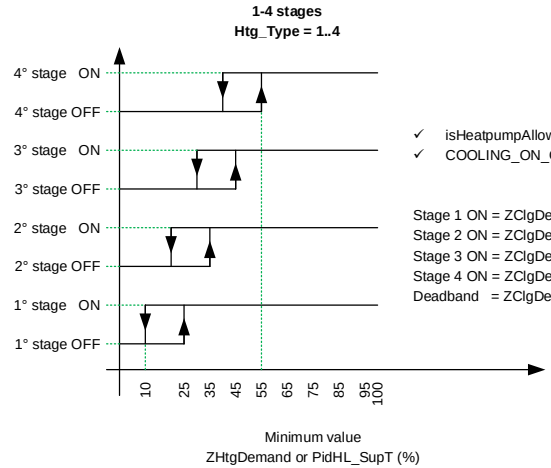



- ✓ isHeatpumpAllowed true
- ✓ COOLING_ON_OFF_DELAY_SECONDS completed

( HP Heating Authorization = OAT.var1 )

Stage 5 ON = ZHtgDemand.var1 (65)
Stage 6 ON = ZHtgDemand.var2 (75)
Stage 7 ON = ZHtgDemand.var3 (85)
Stage 8 ON = ZHtgDemand.var4 (95)
Deadband = ZHtgDemand.var5 (15)

**Note:**
Use ZhtgDemands private variables to compare with ZHtgDemand when heatpump heating mode **is permitted** (depend on OAT)

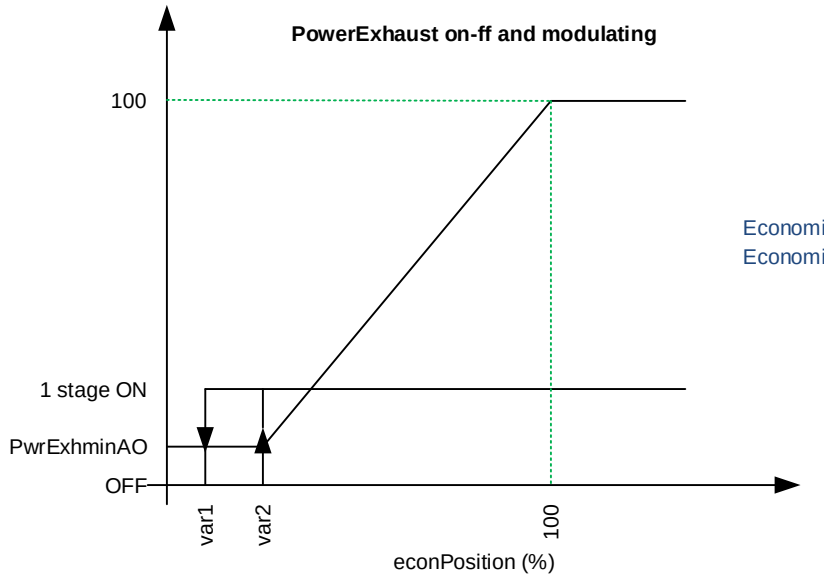



- ✓ isHeatpumpAllowed false
- ✓ COOLING_ON_OFF_DELAY_SECONDS completed

Stage 1 ON = ZClgDemand.var1 (25)
Stage 2 ON = ZClgDemand.var2 (35)
Stage 3 ON = ZClgDemand.var3 (45)
Stage 4 ON = ZClgDemand.var4 (55)
Deadband = ZClgDemand.var5 (15)

**Note:**
Use ZClgDemands private variables to compare with ZHtgDemand when heatpump heating mode **NOT permitted** (depend on OAT)

# Sequence of Operation Details

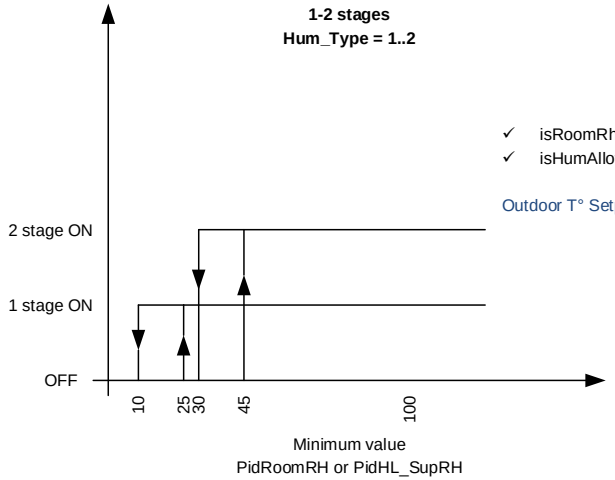



Economizer Position (On) = PwrExh_Type.var1
Economizer Position (Off) = PwrExh_Type.var2

# Sequence of Operation Details

## Humidifier

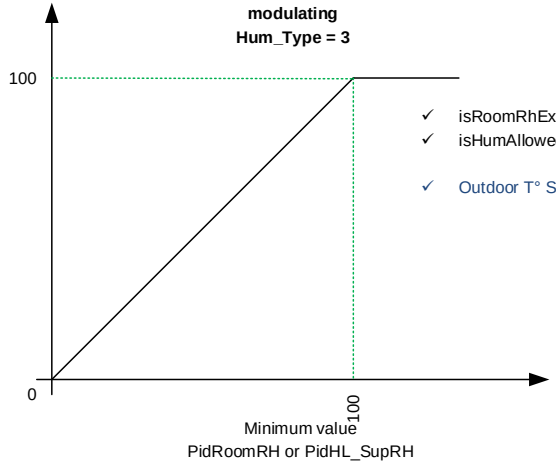
**1-2 stages**
**Hum_Type = 1..2**




- ✓ isRoomRhExist
- ✓ isHumAllowed true

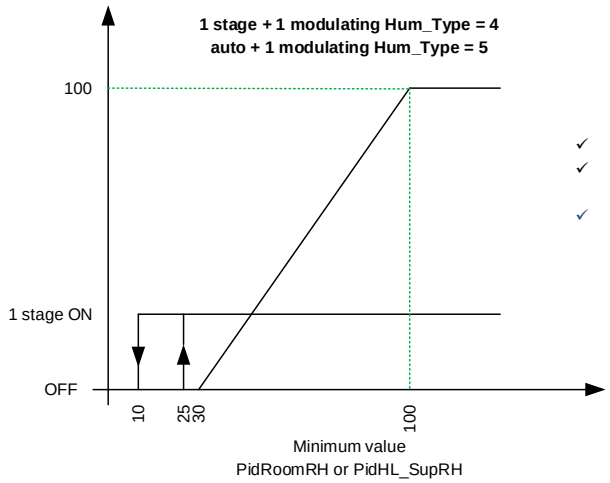
Outdoor T° Setpoint = Hum_Type.var1

**modulating**
**Hum_Type = 3**




- ✓ isRoomRhExist
- ✓ isHumAllowed true
- ✓ Outdoor T° Setpoint = Hum_Type.var1

**1 stage + 1 modulating Hum_Type = 4**
**auto + 1 modulating Hum_Type = 5**




- ✓ isRoomRhExist
- ✓ isHumAllowed true
- ✓ Outdoor T° Setpoint = Hum_Type.var1

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

| Object Instance | Object name | Description | Default value | Tags | Minimum range value | Maximum range value | Inactive_Text | Active_Text |
|---|---|---|---|---|---|---|---|---|
| AI0 | AI_1 | Analog input 1 | --- | Cfg | 0 | 4092 | | |
| AI1 | AI_2 | Analog input 2 | --- | Cfg | 0 | 4092 | | |
| AI2 | AI_3 | Analog input 3 | --- | Cfg | 0 | 4092 | | |
| AI3 | AI_4 | Analog input 4 | --- | Cfg | 0 | 4092 | | |
| AI4 | AI_5 | Analog input 5 | --- | Cfg | 0 | 4092 | | |
| AI5 | AI_6 | Analog input 6 | --- | Cfg | 0 | 4092 | | |
| AI6 | AI_7 | Analog input 7 | --- | Cfg | 0 | 4092 | | |
| AI7 | AI_8 | Analog input 8 | --- | Cfg | 0 | 4092 | | |
| BO0 | BO_1 | Binary output 1 | Off | Cfg | --- | --- | Off | On |
| BO1 | BO_2 | Binary output 2 | Off | Cfg | --- | --- | Off | On |
| BO2 | BO_3 | Binary output 3 | Off | Cfg | --- | --- | Off | On |
| BO3 | BO_4 | Binary output 4 | Off | Cfg | --- | --- | Off | On |
| BO4 | BO_5 | Binary output 5 | Off | Cfg | --- | --- | Off | On |
| BO5 | BO_6 | Binary output 6 | Off | Cfg | --- | --- | Off | On |
| BO6 | BO_7 | Binary output 7 | Off | Cfg | --- | --- | Off | On |
| BO7 | BO_8 | Binary output 8 | Off | Cfg | --- | --- | Off | On |
| AO1 | AO_1 | Analog output 1 | --- | Cfg | 0% | 100 % | | |
| AO2 | AO_2 | Analog output 2 | --- | Cfg | 0% | 100 % | | |
| AO3 | AO_3 | Analog output 3 | --- | Cfg | 0% | 100 % | | |
| AO4 | AO_4 | Analog output 4 | --- | Cfg | 0% | 100 % | | |

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Please note that objects tagged as:

- Cfg: represent configuration properties of the device that are typically only set once during commissioning and start-up
- User: represent properties or objects that are typically manipulated by users of the controller
- 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

| Object Instance | Object name | Description | Default value | Tags | Minimum range value | Maximum range value | Inactive_Text | Active_Text |
|---|---|---|---|---|---|---|---|---|
| AV0 | AddrList_Grp1 | Address List, Group 1 (qty) | --- | Cfg | 0 | 25 | | |
| AV1 | AddrList_Grp2 | Address List, Group 1 (qty) | --- | Cfg | 0 | 25 | | |
| AV2 | AddrList_Grp3 | Address List, Group 1 (qty) | --- | Cfg | 0 | 25 | | |
| AV5 | ZNbOnline | Number of zones currently online | --- | Status | 0 | 75 | | |
| AV6 | ZHtgDemand | Zones Heating Demand | --- | Status | 0% | 100 % | | |
| AV7 | ZClgDemand | Zones Cooling Demand | --- | Status | 0% | 100 % | | |
| AV8 | ZTmin | Minimum Zones Room T° | 0°F | Status | 32°F (0°C) | 122°F (50°C) | | |
| AV9 | ZTavg | Average Zones Room T° | 0°F | Status | 32°F (0°C) | 122°F (50°C) | | |
| AV10 | ZTmax | Maximum Zones Room T° | 0°F | Status | 32°F (0°C) | 122°F (50°C) | | |
| AV11 | ZUnoccHLTSP | Zones unoccupied H.L. T° setpoint | 82.4°F (29.1°C) | User | 32°F (0°C) | 122°F (50°C) | | |
| AV12 | ZUnoccLLTSP | Zones unoccupied L.L. T° setpoint | 64.4F (17.7°C) | User | 32°F (0°C) | 122°F (50°C) | | |
| AV14 | ReturnT | Return T° | 71.6F (22.0°C) | Staus | 32°F (0°C) | 122°F (50°C) | | |
| AV15 | RoomTSP | Room (return) T° Setpoint | 72.0F (22.2°C) | User | 32°F (0°C) | 122°F (50°C) | | |
| AV16 | SupplyT | Supply T° | 55.4°F (13.0°C) | Status | 32°F (0°C) | 122°F (50°C) | | |
| AV17 | HLsupTSP | H.L. supply T° setpoint (recom. 50°C) | 122F (50°C) | Cfg | 32°F (0°C) | 122°F (50°C) | | |
| AV18 | LLsupTSP | L.L. supply T° setpoint (recom. 8°C) | 46.4F (8.11°C) | Cfg | 32°F (0°C) | 122°F (50°C) | | |
| AV19 | FZsupTSP | Freeze supply T° setpoint (recom. 3°C) | 37.4F (3.0°C) | Cfg | 32°F (0°C) | 122°F (50°C) | | |
| AV20 | FanStThreshold | Fan analog input status threshold | 0% | Cfg | 0% | 100 % | | |
| AV21 | FanMinAO | Fan analog min. output | 0% | Cfg | 0% | 100 % | | |
| AV22 | SupplyPres | Supply static pressure | 0"WC | Status | 0"WC | 1"WC | | |

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# Analog Values

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|---|---|---|---|---|---|---|---|---|
| AV23 | SupplyPresSP | Supply static pressure setpoint | 0"WC | Cfg | 0"WC | 1"WC | | |
| AV24 | FanMinOnTime | Fan minimum ON time | 10Min | Cfg | 0.5 Min | 30 Min | | |
| AV26 | MotionTime | Motion sensor active time | 60 Min | Cfg | 0 Min | 300 Min | | |
| AV27 | OvrTime | Occupancy override active time | 60 Min | Cfg | 0 Min | 300 Min | | |
| AV28 | FanMaxAO | Fan analog max output | 10Min | Cfg | 0.5 Min | 30 Min | | |
| AV29 | OAT | Outside air T° | 0°F | Status | 32°F (0°C) | 122°F (50°C) | | |
| AV30 | RoomCO2 | Room (return) CO2 | 0 PPM | Status | | | | |
| AV31 | RoomCO2SP | Room (return) CO2 Setpoint | 800 PPM | Cfg | | | | |
| AV33 | RTSPmin_Occ | Minimum Room T° setpoint | 59.0°F (15.0°C) | Cfg | 32°F (0°C) | 122°F (50°C) | | |
| AV34 | RTSPmax_Occ | Maximum Room T° setpoint | 82.0°F (27.7°C) | Cfg | 32°F (0°C) | 122°F (50°C) | | |
| AV35 | RTSPclg_Occ | Room T° cooling setpoint, occupied | 74.0°F (23.3°C) | User | 32°F (0°C) | 122°F (50°C) | | |
| AV36 | RTSPhtg_Occ | Room T° heating setpoint, occupied | 72.0°F (22.2°C) | User | 32°F (0°C) | 122°F (50°C) | | |
| AV37 | RTSP_DeadBand | RTSP deadband between Clg and Htg | 2°F | Cfg | | | | |
| AV38 | RTSPclg_Unocc | Room T° cooling setpoint, unoccupied | 78.8°F (26°C) | User | 32°F (0°C) | 122°F (50°C) | | |
| AV39 | RTSPhtg_Unocc | Room T° heating setpoint, unoccupied | 64.4°F (18°C) | User | 32°F (0°C) | 122°F (50°C) | | |
| AV40 | RTSPclg_STBd t | Standby mode, RTSP clg offset (pos.) | 2°F | Cfg | | | | |
| AV41 | RTSPhtg_STBdt | Standby mode, RTSP htg offset (neg.) | -2°F | Cfg | | | | |
| AV42 | ActiveRTSP_Clg | Active cooling room T° setpoint | 78.8°F (26°C) | Status | 32°F (0°C) | 122°F (50°C) | | |
| AV43 | ActiveRTSP_Htg | Active heating room T° setpoint | 64.4°F (18°C) | Status | 32°F (0°C) | 122°F (50°C) | | |
| AV46 | PwrExhMinAO | Power exhaust analog min. output | 0% | Status | 0% | 100 % | | |
| AV47 | PwrExhStThres | PwrExh analog input status threshold | 0% | Status | 0% | 100 % | | |

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# Analog Values

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|---|---|---|---|---|---|---|---|---|
| AV49 | PidSupPresOut | PID supply pressure output | 0% | Status | 0% | 100 % | | |
| AV50 | DehumSP | Dehumidification Setpoint | | | | | | |
| AV51 | RoomRH | Room(or return) R.H. | 144.9% | Status | 0% | 100 % | | |
| AV52 | RoomRHSP | Room (or return) R.H. setpoint | 25% | User | 0% | 100 % | | |
| AV53 | SupplyRH | Supply (hi limit) R.H. | 156.8% | Cfg | 0% | 100 % | | |
| AV54 | SupplyRHSP | Supply (hi limit) R.H. setpoint | 75% | Cfg | 0% | 100 % | | |
| AV56 | SupSPmaxHtg | Supply T° setpoint @ 100% htg demand | 104.0°F (40.0°C) | Status | 32°F (0°C) | 122°F (50°C) | | |
| AV57 | SupSPneutral | Supply T° setpoint @ 0% htg, 0% clg | 68.0°F (20.0°C) | Status | 32°F (0°C) | 122°F (50°C) | | |
| AV58 | SupSPminClg | Supply T° setpoint @ 100% clg demand | 55.4°F (13.0°C) | Status | 32°F (0°C) | 122°F (50°C) | | |
| AV59 | SupSPcalc | Supply T° setpoint calculated | 55.4°F (13.0°C) | Cfg | 32°F (0°C) | 122°F (50°C) | | |
| AV60 | ComprLockout | Compressor Lockout | 4.0°F (-20.0°C) | Cfg | -22°F (-30°C) | 176°F (80°C) | | |
| AV61 | ComprStgDelay | Compressor stages delay | 10 sec | Cfg | 0 sec | 300 sec | | |
| AV62 | HtgStgDelay | Heating stages delay | 10 sec | Cfg | 0 sec | 300 sec | | |
| AV63 | FanRunTime | Fan run time before stages permitted | 10 sec | Cfg | 0 sec | 300 sec | | |

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|---|---|---|---|---|---|---|---|---|
| AV65 | FanHtgOffDelay | Delay to stop fan if no heating demand | 0 Min | Cfg | 0% | 100 % | | |
| AV66 | FanClgOffDelay | Delay to stop fan if no cooling demand | 0 Min | Cfg | 0% | 100 % | | |
| AV67 | EconMinPos | Economizer minimum position | 20% | Cfg | 0% | 100 % | | |
| AV68 | EconMaxPos | Economizer maximum CO2 position | 100% | Cfg | 0% | 100 % | | |
| AV69 | PwrExhOff | Power Exh off (Economizer position) | 10% | Cfg | 0% | 100 % | | |
| AV70 | PwrExhOn | Power Exh on (Economizer position) | 50% | Cfg | 0% | 100 % | | |
| AV71 | OATHumAuth | Outside air temp humidifier authorize | 32.0°F (0.0°C) | Cfg | -4°F (-20°C) | 122°F (50°C) | | |
| AV72 | OATHtgAuth | Outside air temp Heating authorize | 32.0°F (0.0°C) | Cfg | -4°F (-20°C) | 122°F (50°C) | | |
| AV73 | OATEconAuth | Outside air temp Economizer authorize | 32.0°F (0.0°C) | Status | -4°F (-20°C) | 122°F (50°C) | | |
| AV75 | OAHum | Outside air Humidity | 32.0°F (0.0°C) | Status | -4°F (-20°C) | 122°F (50°C) | | |
| AV76 | OAE | Outside air Enthalpy | - | Status | 20 BTU/lbs | 28 BTU/lbs | | |
| AV77 | EnthSP | Economizer Enthalpy Setpoint | - | Cfg | 20 BTU/lbs | 28 BTU/lbs | | |
| AV78 | MixedAirTSP | Economizer Mixed Air Setpoint | 32.0°F (0.0°C) | Cfg | -4°F (-20°C) | 122°F (50°C) | | |
| AV79 | MAT | Economizer Mixed Air Temperature | 32.0°F (0.0°C) | Cfg | -4°F (-20°C | 122°F (50°C) | | |
| AV80 | Calib_RoomT | Room T° calibration | 0°F (0°C) | Cfg | -9°F (-5°C | 9°F (5°C) | | |
| AV81 | Calib_RoomSP | Room T° Setpoint calibration | 0°F (0°C) | Cfg | -9°F (-5°C | 9°F (5°C) | | |

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| Object Instance | Object name | Description | Default value | Tags | Minimum range value | Maximum range value | Inactive_Text | Active_Text |
|---|---|---|---|---|---|---|---|---|
| AV89 | ChOverSP | Changeover temperature setpoint | 64.0°F (17.8°C) | Cfg | 0°F (-17.8°C) | 122°F (50°C) | | |
| AV90 | ChOverT | Changeover temperature reading | -40.0°F (-40.0°C) | Cfg | 0°F (-17.8°C) | 122°F (50°C) | | |
| AV91 | HtgRunTme | Heating run time (for floating output) | 95 sec | Cfg | 0 | 360 | | |
| AV92 | ClgRunTme | Cooling run time (for floating output) | 95 sec | Cfg | 0 | 360 | | |

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# Binary Values

| Object Instance | Object name | Description | Default value | Tags | Minimum range value | Maximum range value | Inactive_Text | Active_Text |
|---|---|---|---|---|---|---|---|---|
| BV2 | ZOvr | Zones occupancy override activated | Off | Status | | | | |
| BV3 | ZMotion | Zones motion detected | Off | Status | | | Off | Active |
| BV5 | SystemOccSchd | System occupancy schedule | Night | Status | | | Off | Active |
| BV6 | EconOccSched | Economiser occupancy schedule | Night | Status | | | Night | Day |
| BV7 | FreezeCond | Freeze condition active ? | Normal | Status | | | Night | Day |
| BV8 | FreeClgAuth | Free cooling authorized? | No | Status | | | No | Yes |
| BV10 | SaveAndRestart | Save objects to flash and restart | Normal | Status | | | Normal | Active |
| BV14 | FanControl | Supply fan control | Continuous | Cfg | | | Normal | Active |
| BV15 | FanStat | Fan status | Off | Status | | | Continuous | Intermittent |
| BV16 | PwrExhStat | Power exhaust status | Off | Status | | | Off | On |
| BV17 | FanHtgDemand | Intermittent fan demand on Heating | Off | Status | | | Off | On |
| BV18 | FanClgDemand | Intermittent fan demand on Cooling | Off | Status | | | Off | On |
| BV19 | Dehdemand | Dehumidification Demand | Off | Status | | | Off | On |
| BV20 | DehAuth | Dehumidification Authorization | No | Status | | | No | Yes |
| BV21 | EnthalpyAuth | Economizer Enthalpy Authorization | No | Status | | | No | Yes |
| BV23 | DehAuth | Dehumidification Authorization | No | Status | | | No | Yes |
| BV24 | TZstatus | TZxxx communication status | Normal | Status | | | Normal | Fault |
| BV40 | ChOverStatus | Change over status | Cold | Status | | | Cold | Hot |
| BV41 | Anti_Ice | Ice detection status on coil | Normal | Status | | | Normal | Ice_Detected |
| BV42 | Drain_Pan | Overflow detection inside drain pan | Normal | Status | | | Normal | Overflow |

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# Multi-State Values

| Object Instance | Object name | Description | Tags | Default value | State texts |
|---|---|---|---|---|---|
| MSV0 | Units_Type | Units configuration (T° & Pressure) | Cfg | °F, H2O | °F, H2O<br>°C, H2O<br>°F, PA<br>°C, PA |
| MSV1 | Tstor10K_Type | Thermistors type (std type 3 or type 2) | Cfg | Type 3 (std) | Other<br>Type 3 (std)<br>Type 2 |
| MSV2 | RoomT_Loc | Room T° physical location | Cfg | AI-1 | None<br>AI-1..AI-8<br>Tzone<br>AdrList |
| MSV3 | RoomTSP_Loc | Room (return) T° SP location (occ.) | Cfg | Virtual | None<br>AI-1..AI-8<br>Tzone<br>AdrList |

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# Multi-State Values

| Object Instance | Object name | Description | Tags | Default value | State texts |
|---|---|---|---|---|---|
| MSV4 | Units_Type | Cooling control type | Cfg | None | None<br>1 Stage<br>2 Stage<br>3 Stage<br>4 Stage<br>1 modulating<br>2 modulating<br>1 Stg + 1 mod. |
| MSV5 | Clg_Type | Cooling BO physical loc. (first stage) | Cfg | None | None<br>BO-2..BO-8 |
| MSV6 | ClgBO_Loc | Cooling AO physical loc. (first stage) | Cfg | None | None<br>AO-1..AO-4 |
| MSV7 | ClgAO_Loc | Cooling output 1 formula | Cfg | Off-On | 0-10 VDC, Dir.<br>0-10 VDC, Rev.<br>2-10 VDC, Dir.<br>2-10 VDC, Rev.<br>Off-On<br>Pulse, Dir.<br>Pulse, Rev. |

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# Multi-State Values

| Object Instance | Object name | Description | Tags | Default value | State texts |
|---|---|---|---|---|---|
| MSV8 | Clg2_Form | Cooling output 2 formula | Cfg | None | 0-10 VDC, Dir.<br>0-10 VDC, Rev.<br>2-10 VDC, Dir.<br>2-10 VDC, Rev.<br>Off-On<br>Pulse, Dir.<br>Pulse, Rev. |
| MSV9 | Clg3_Form | Cooling output 3 formula | Cfg | None | 0-10 VDC, Dir.<br>0-10 VDC, Rev.<br>2-10 VDC, Dir.<br>2-10 VDC, Rev.<br>Off-On<br>Pulse, Dir.<br>Pulse, Rev. |
| MSV10 | Clg4_Form | Cooling output 4 formula | Cfg | None | 0-10 VDC, Dir.<br>0-10 VDC, Rev.<br>2-10 VDC, Dir.<br>2-10 VDC, Rev.<br>Off-On<br>Pulse, Dir.<br>Pulse, Rev. |
| MSV11 | Mode | System Mode | Cfg | | Off<br>Auto<br>Cool<br>Heat |

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# Multi-State Values

| Object Instance | Object name | Description | Tags | Default value | State texts |
|---|---|---|---|---|---|
| MSV12 | FanMode | Fan mode | Cfg | None | Low. Medium<br>High, Auto |
| MSV13 | Htg_Type | Heating control type | Cfg | None | None,1 Stage,2 Stage<br>3 Stage,4 Stage<br>1 modulating<br>2 modulating<br>1 Stg + 1 mod.<br>1 Auto + 1 mod |
| MSV14 | HtgBO_Loc | Heating BO physical loc. (first stage) | Cfg | None | None<br>BO-2..BO-8 |
| MSV15 | HtgAO_Loc | Heating AO physical loc. (first stage) | Cfg | None | None<br>AO-1..AO-4 |
| MSV16 | Htg1_Form | Heating output 1 formula | Cfg | Off-On | 0-10 VDC, Dir.<br>0-10 VDC, Rev.<br>2-10 VDC, Dir.<br>2-10 VDC, Rev.<br>Off-On<br>Pulse, Dir.<br>Pulse, Rev. |

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|---|---|---|---|---|---|
| MSV17 | Htg2_Form | Htg2_Form | Cfg | Off-On | 0-10 VDC, Dir.<br>0-10 VDC, Rev.<br>2-10 VDC, Dir.<br>2-10 VDC, Rev.<br>Off-On<br>Pulse, Dir.<br>Pulse, Rev. |
| MSV18 | Htg3_Form | Htg3_Form | Cfg | Off-On | 0-10 VDC, Dir.<br>0-10 VDC, Rev.<br>2-10 VDC, Dir.<br>2-10 VDC, Rev.<br>Off-On<br>Pulse, Dir.<br>Pulse, Rev. |
| MSV19 | Htg4_Form | Htg4_Form | Cfg | Off-On | 0-10 VDC, Dir.<br>0-10 VDC, Rev.<br>2-10 VDC, Dir.<br>2-10 VDC, Rev.<br>Off-On<br>Pulse, Dir.<br>Pulse, Rev. |

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# Multi-State Values

| Object Instance | Object name | Description | Tags | Default value | State texts |
|---|---|---|---|---|---|
| MSV20 | CO2_Loc | CO2 sensor physical location | Cfg | None | None<br>AI-1..AI-8<br>External |
| MSV21 | CO2_Form | CO2 sensor Formula | Cfg | None | Min<br>Avg<br>Max |
| MSV23 | Fan_Type | Fan conrol type (BO-0 and/or AO) | Cfg | Off-On | Off-On<br>Modulating<br>Off-On + Mod. |
| MSV24 | FanAO_Form | Fan analog output formula | Cfg | 0-10 VDC | 0-10 VDC<br>2-10 VDC<br>Unused |
| MSV25 | FanStat_Loc | Fan status physical location | Cfg | None | None<br>AI-1..AI-8<br>External |
| MSV26 | FanStat_Form | Fan status formula | Cfg | None | Off-On<br>0-10 VDC, %<br>2-10 VDC, % |

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|---|---|---|---|---|---|
| MSV27 | OAT_Loc | Outside air T° physical location | Cfg | None | None<br>AI-1..AI-8<br>External |
| MSV28 | SupT_Loc | Supply T° physical location | Cfg | None | None<br>AI-1..AI-8<br>External |
| MSV29 | Econ_Type | Economizer control | Cfg | None | None<br>Off-Auto<br>Modulating |
| MSV30 | Econ_Loc | Economizer physical location | Cfg | None | None<br>BO-5<br>BO-6<br>BO-7<br>BO-8<br>AO-1<br>AO-2<br>AO-3<br>AO-4 |
| MSV31 | Econ_Form | Economizer output formula | Cfg | None | Off-On<br>0-10 VDC<br>2-10 VDC |

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# Multi-State Values

| Object Instance | Object name | Description | Tags | Default value | State texts |
|---|---|---|---|---|---|
| MSV32 | PwrExh_Type | Power exhaust control type ==VAR== | Cfg | None | None<br>Off-On<br>Modulating<br>Off-On + Mod. |
| MSV33 | PwrExhBO_Loc | Power exhaust BO physical location | Cfg | None | None<br>Off-On<br>Modulating<br>Off-On + Mod. |
| MSV34 | PwrExhAO_Loc | Power exhaust AO physical location | Cfg | None | None<br>BO-2..BO-8 |
| MSV35 | PwrExhAO_Form | Power exhaust analog output formula | Cfg | None | 0-10 VDC<br>2-10 VDC<br>Unused |
| MSV36 | PwrExhStat_Loc | Power exhaust status physical location | Cfg | None | None<br>AI-1<br>AI-2<br>AI-3<br>AI-4<br>AI-5<br>AI-6<br>AI-7<br>AI-8<br>External |
| MSV37 | PwrExStat_Form | Power exhaust status formula | Cfg | None | Off-On<br>0-10 VDC<br>2-10 VDC |

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| Object Instance | Object name | Description | Tags | Default value | State texts |
|---|---|---|---|---|---|
| MSV38 | RetT_Loc | Return T° physical location | Cfg | None | None<br>AI-1..AI-8<br>External |
| MSV40 | BypassDmp_Loc | Bypass damper physical location | Cfg | None | None<br>Float BO-2,3<br>Float BO-3,4<br>Float BO-4,5<br>Float BO-5,6<br>Float BO-6,7<br>Float BO-7,8<br>AO-1<br>AO-2<br>AO-3<br>AO-4 |
| MSV41 | BypassDmp_Form | Bypass damper output formula | Cfg | 0-10 VDC, Dir. | 0-10 VDC, Dir.<br>0-10 VDC, Rev.<br>2-10 VDC, Dir.<br>2-10 VDC, Rev.<br>Floating, Dir.<br>Floating, Rev. |

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# Multi-State Values

| Object Instance | Object name | Description | Tags | Default value | State texts |
|---|---|---|---|---|---|
| MSV42 | PresSnsr_Loc | Pressor Sensor Location | Cfg | None | None<br>AI-1..AI-8<br>External |
| MSV43 | PresSnsr_Form | Pressure sensor formula | Cfg | 0-10 VDC, 1.0" | 0-10 VDC, 1.0"<br>0-10 VDC, 2.5"<br>0-10 VDC, 5.0"<br>2-10 VDC, 1.0"<br>2-10 VDC, 2.5"<br>2-10 VDC, 5.0" |
| MSV44 | Motion_Loc | Motion sensor location | Cfg | None | Auto Detect<br>NO, AI-4 (BI)<br>NC, AI-4 (BI)<br>NO, AI-5 (BI)<br>NC, AI-5 (BI)<br>NO, AI-6 (BI)<br>NC, AI-6 (BI)<br>NO, AI-7 (BI)<br>NC, AI-7 (BI)<br>NO, AI-8 (BI)<br>NC, AI-8 (BI)<br>External |

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# Multi-State Values

| Object Instance | Object name | Description | Tags | Default value | State texts |
|---|---|---|---|---|---|
| MSV45 | SystemSch_Loc | System scheduler location | Cfg | None (Off) | None (Off)<br>None (On)<br>Scheduler<br>AI-1 (BI)..AI-8 (BI)<br>External |
| MSV46 | EconSch_Loc | Economizer scheduler location | Cfg | None (Off) | None (Off)<br>None (On)<br>Scheduler<br>AI-1 (BI)..AI-8 (BI)<br>External |
| MSV47 | Hum_Type | Humidifier control type ==VAR== | Cfg | None | None<br>1 Stage<br>2 Stage<br>Modulating<br>1 Stg + 1 mod.<br>Auto + mod. |
| MSV48 | HumBO_Loc | Hum. BO physical loc. (first stage) | Cfg | None | None<br>BO-2..BO-8 |
| MSV49 | HumAO_Loc | Hum. AO physical loc. (first stage) | Cfg | None | None<br>AO-1..AO-4 |

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# Multi-State Values

| Object Instance | Object name | Description | Tags | Default value | State texts |
|---|---|---|---|---|---|
| MSV50 | Hum1_Form | Humidifier output 1 formula | Cfg | 0-10 VDC, Dir | 0-10 VDC, Dir.<br>0-10 VDC, Rev.<br>2-10 VDC, Dir.<br>2-10 VDC, Rev.<br>Off-On<br>Pulse, Dir.<br>Pulse, Rev. |
| MSV51 | Hum2_Form | Humidifier output 2 formula | Cfg | 0-10 VDC, Dir. | 0-10 VDC, Dir.<br>0-10 VDC, Rev.<br>2-10 VDC, Dir.<br>2-10 VDC, Rev.<br>Off-On<br>Pulse, Dir.<br>Pulse, Rev. |
| MSV52 | RoomRH_Loc | Room (return) RH sensor location | Cfg | None | None<br>AI-1..AI-8<br>External<br>Local TZ200<br>TZ200 List |
| MSV53 | RoomRH_Form | Room (return) RH sensor formula | Cfg | 0-10 VDC, % | 0-10 VDC, %<br>2-10 VDC, %<br>Unused |

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# Multi-State Values

| Object Instance | Object name | Description | Tags | Default value | State texts |
|---|---|---|---|---|---|
| MSV54 | SupplyRH_Loc | Supply (hi limit) R.H. sensor location | Cfg | None | None<br>AI-1..AI-8<br>External |
| MSV55 | SupplyRH_Form | Supply (hi limit) R.H. sensor formula | Cfg | 0-10 VDC, Dir. | 0-10 VDC, %<br>2-10 VDC, %<br>Unused |
| MSV56 | Deh_Loc | Dehumidification output location | Cfg | None | None<br>BO-2 – BO8<br>Modulating |
| MSV57 | HumInput | Humidity Input | Cfg | None | None<br>AI-1 – AI-8<br>External<br>Local TZ200<br>TZ200 List |
| MSV58 | MixedAirTempInput | Mixed Air Temp Input | Cfg | None | None<br>AI-1 – AI-8<br>External |

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# Multi-State Values

| Object Instance | Object name | Description | Tags | Default value | State texts |
|---|---|---|---|---|---|
| MSV60 | HtgDemandType | Heating demand type selection (in occupied mode) | Cfg | Average | Minimum<br>Average<br>Maximum |
| MSV61 | ClgDemandType | Cooling demand type selection (in occupied mode) | Cfg | Average | Minimum<br>Average<br>Maximum |
| MSV62 | RoomTSPType | Room temp setpoint type (in occupied mode) | Cfg | None | Heating<br>Central<br>Cooling |

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# Multi-State Values

| Object Instance | Object name | Description | Tags | Default value | State texts |
|---|---|---|---|---|---|
| MSV65 | Equipment | Equipment Type | Cfg | RTU/AHU | RTU/AHU<br>Heatpump |
| MSV66 | RevValve | Reversing Valve Type (O/B) | Cfg | None | None<br>O (O on cool)<br>B (B on heat) |
| MSV67 | OB_Loc | Reversing Valve O/B Output Location | Cfg | None | None<br>BO-2<br>BO-3<br>BO-4<br>BO-5<br>BO-6<br>BO-7<br>BO-8 |
| MSV68 | HtgClgMode | Heating/cooling mode | Status | N/A | Heat<br>Cool<br>Unused |
| MSV72 | TimedOvrStatus | Timed Override Status | Status | Idle | Idle<br>TimeOvrRequest<br>TimeOvrCancel |

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# Multi-State Values

| Object Instance | Object name | Description | Tags | Default value | State texts |
|---|---|---|---|---|---|
| MSV90 | ChOverTyp | FCU ChangeOver input type | Cfg | None | None, ChOver NO Heat, ChOver NO Cool, ChOver Sensor |
| MSV91 | ChOverLoc | FCU ChangeOver input location | Cfg | None | None<br>AI1-AI8<br>External |
| MSV92 | Anti_Ice_Loc | Anti ice input location (BI) | Cfg | None | None<br>AI1-AI8 |
| MSV93 | Freeze_Lo | Freezing detection location (BI) | Cfg | None | None<br>AI1-AI8 |
| MSV94 | FanLock | Fan lock | Status | None | None<br>Lock |
| MSV95 | Cond_Loc | Condensation input location | Cfg | one | None<br>AI1-AI8 |

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# Multi-State Values

| Object Instance | Object name | Description | Tags | Default value | State texts |
|---|---|---|---|---|---|
| MSV96 | SeqOper | CFG Control sequence of operation | Cfg | Cool-Heat-Auto | Cool-heat-Auto<br>Cool-Heat, Cool Only<br>Heat Only |
| MSV97 | Fan_Seq | CFG Control fan sequence | Cfg | L-M-H | L-M-H, L_H<br>L-M-H-A<br>L-H-A, On-Auto |
| MSV98 | Key Lock | CFG Keypad lock level | Cfg | None | None<br>Fan<br>Mode<br>Fan+Mode<br>All |

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# PID Loops

| Object Instance | Object name | Description | Action | Kp | Ki | Bias |
|---|---|---|---|---|---|---|
| LOOP1 | PidRoomT_Clg | Room T° control loop, cooling | Direct | 20 | 0.05 | 0 |
| LOOP2 | PidRoomT_Htg | Room T° control loop, heating | Reverse | 20 | 0.05 | 0 |
| LOOP4 | PidSupPres | Supply pressure control loop | Direct | 75 | 5 | 50 |
| LOOP6 | PidSupT | Supply T° control loop | Direct | 5 | 0.1 | 50 |
| LOOP7 | PidHL_SupT | Supply T° high limit control loop | Reverse | 5 | 0.1 | 50 |
| LOOP8 | PidLL_SupT | Supply T° low limit control loop | Direct | 5 | 0.1 | 50 |
| LOOP10 | PidRoomRH | Room RH control loop | Reverse | 20 | 0.05 | 0 |
| LOOP11 | PidHL_SupHR | Supply RH high limit control loop | Direct | 10 | 0.05 | 0 |
| LOOP12 | PidMAT | Mix air T for economizer control | Direct | 10 | 0.05 | 0 |

# TZ Series Room Sensors

| *Object name* | *Description* | *Room T* | *Setpoint* | *Units* | *Override* | *Status* |
|---|---|---|---|---|---|---|
| *Tzone1*** | *Wall mount interface* | *Current Value* | *Adjustable* | *°F* | *Normal* | *Normal* |

# RS-485 Network Guidelines

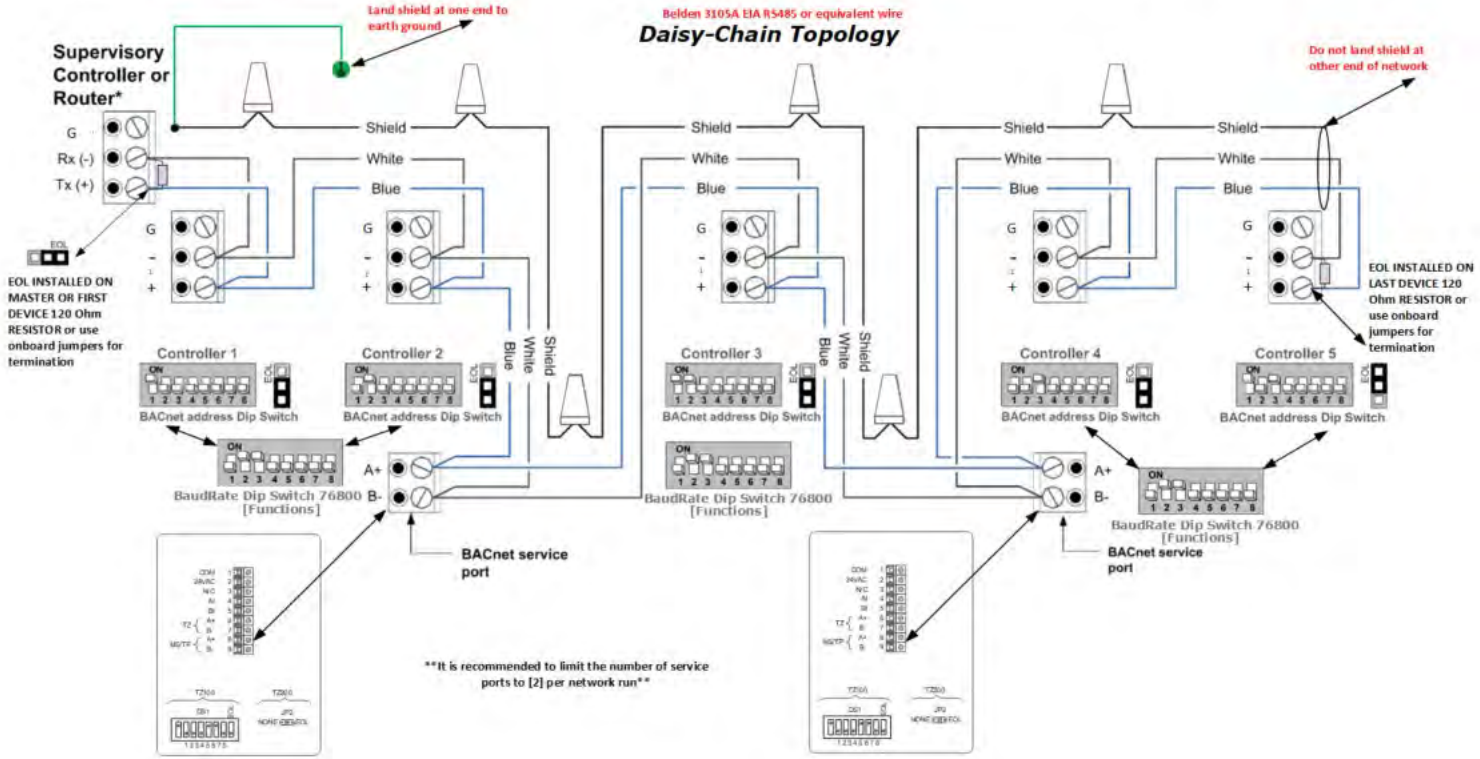
## RS-485 Network Guidelines BP Controllers

***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.



# RS-485 Network Guidelines

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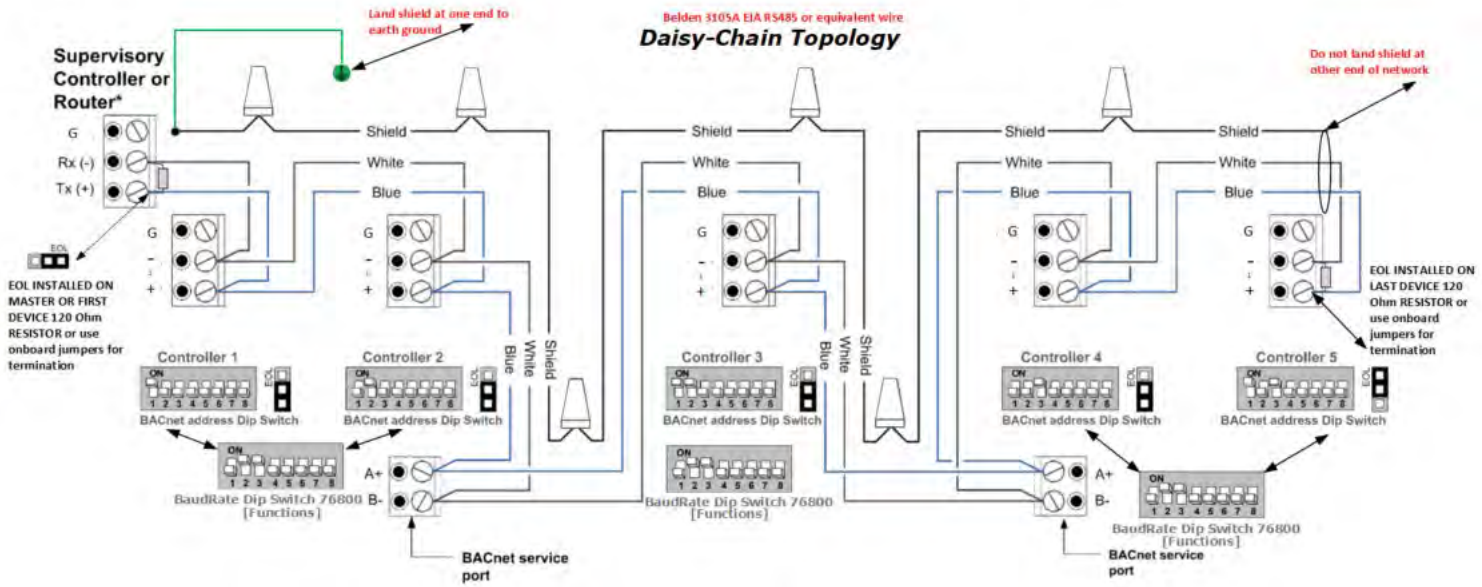
## RS-485 Network Guidelines BP Controllers



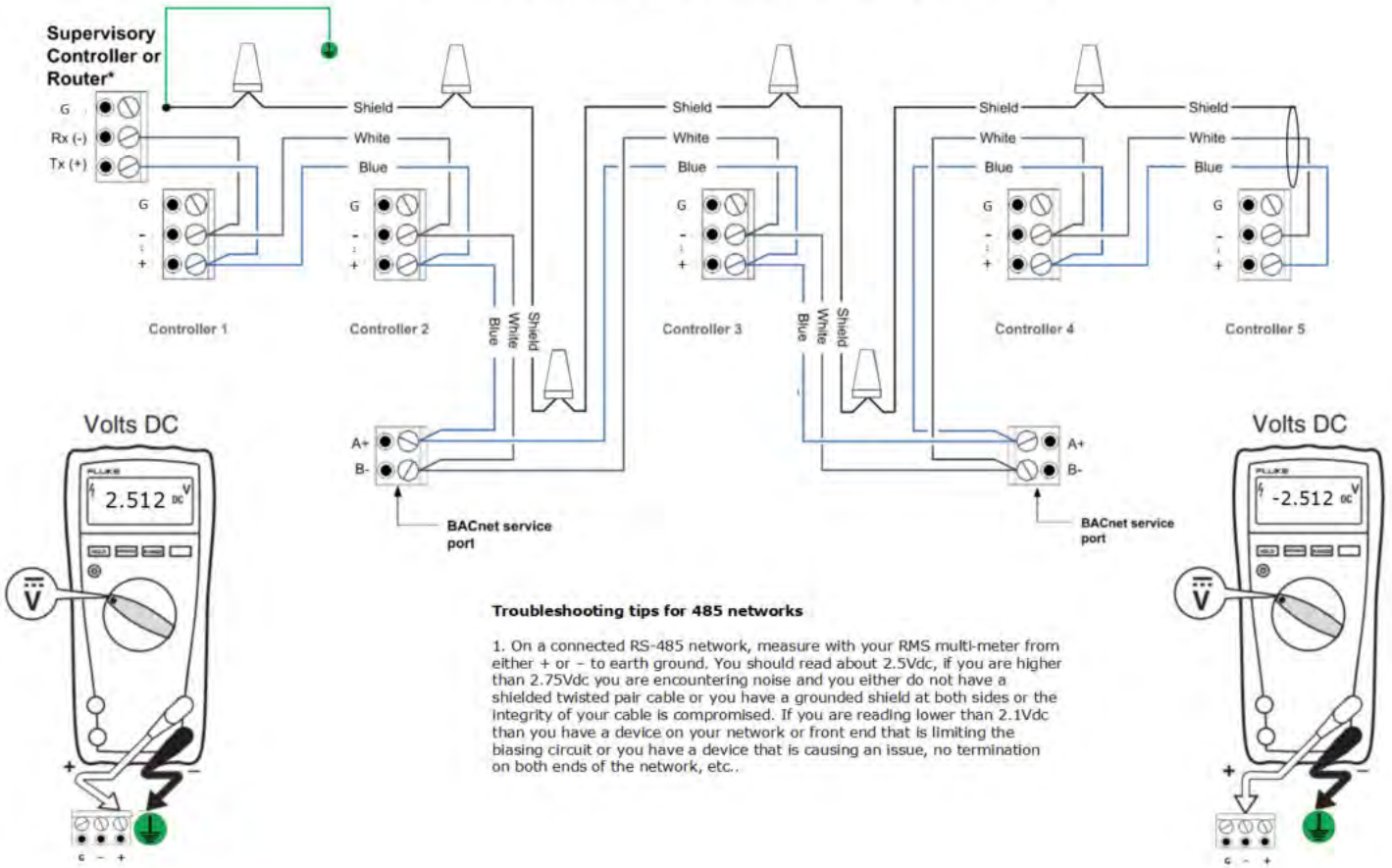

**Troubleshooting tips for 485 networks**

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.

# RS-485 Network Guidelines

ONYXX® LX BY LYNXSPRING

## RS-485 Network Guidelines BP Controllers

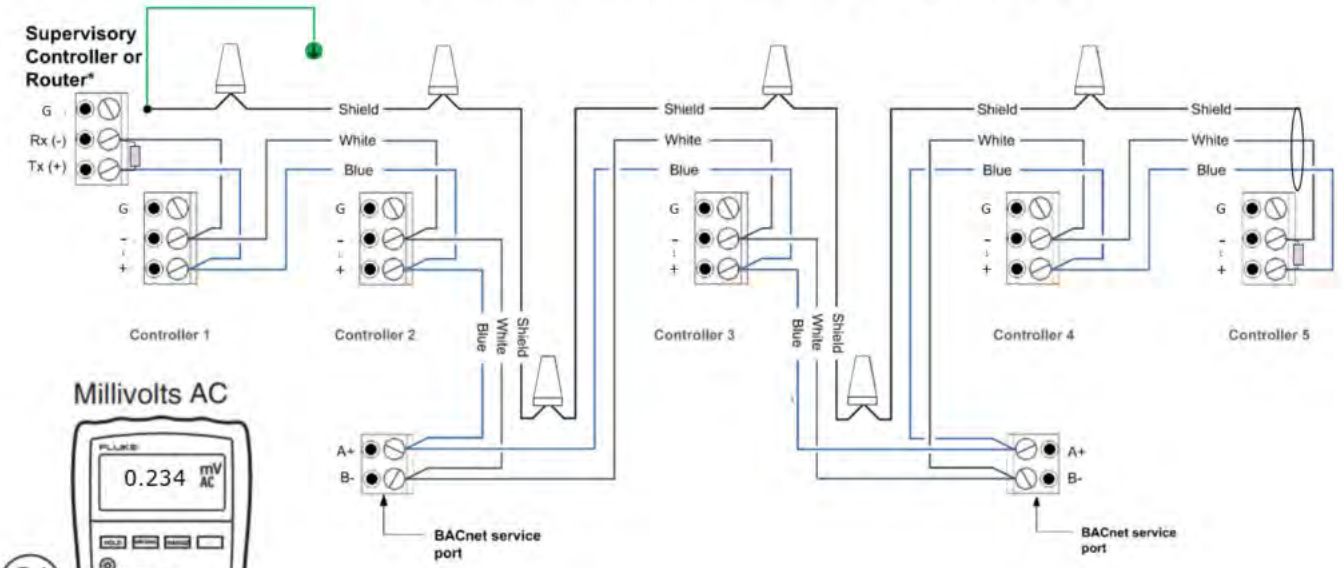



**Troubleshooting tips for 485 networks**

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..

# RS-485 Network Guidelines

## RS-485 Network Guidelines BP Controllers





**Troubleshooting tips for 485 networks**

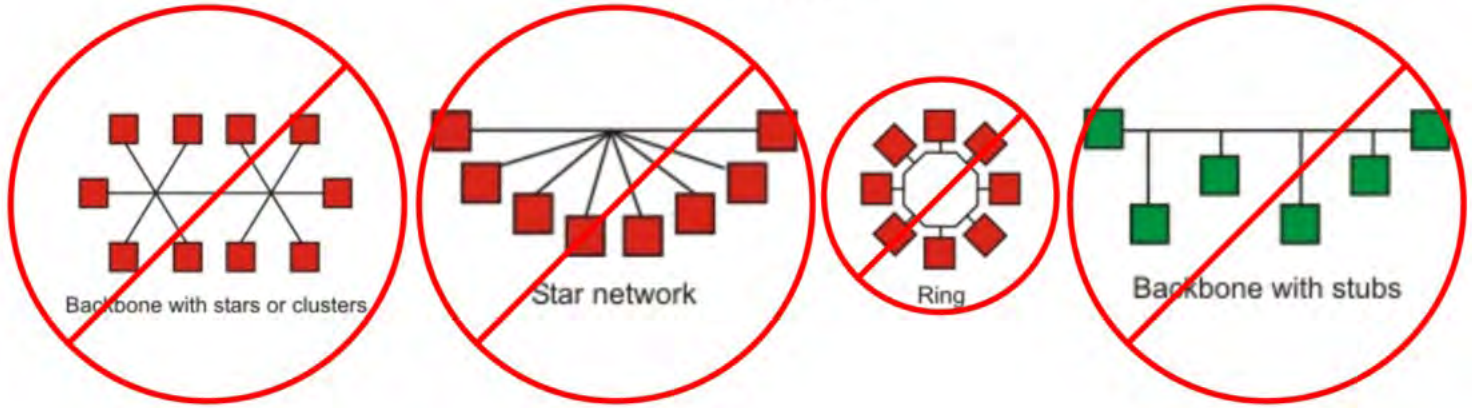
1. Measure with your multi-meter from + to – with your RS-485 network connected. You should read between 200mVac to 600mVac average. If you read greater than 700mVac average then you may have a device that is compromising your network or you do not have your shield landed in one location or your controller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

# RS-485 Network Guidelines

ONYXX® LX BY LYNXSPRING

## RS-485 Network Guidelines BP Controllers

***Non-functioning topologies***



# Technical Specifications

ONYXX® LX
BY LYNXSPRING

**Power supply:**
- 24 VAC/VDC ± 15%; Class 2
- 2.0A Field replaceable fuse

**Current consumption:**
- 6 VA controller only

**Communication protocols:**
- BACnet MS/TP
- RS-485 transceivers feature a 1/4-unit load receiver input impedance, allowing up to 128 transceivers on the bus. These devices are intended for half-duplex communications.
- BTL listed: B-ASC, BACnet Application Specific Controller
- Baud 9600, 19200, 38400, 76800 Bps (76800 default)
- Dip switch addressing
- EOL resistor built-in, jumper
- TZ Comm Bus
- Mini USB2 MS/TP network access (USB-485 cable adapter)

**Hardware**
- Microprocessor: STM32 (ARM CortexTM M3) 32 bits,
- CPU Speed: 180MHz
- Memory: 2MB non-volatile Flash
- (application program)
- RAM: 256 KB RAM
- Real-time clock (RTC): Built-in capacitor (one-week backup)

**Inputs:**

8 Universal Inputs (AI/BI)
- Thermistor 10KΩ (type 2 or 3)
- Dry contact, 500 ms minimum (On-Off)
- Voltage 0 - 10 VDC (Input impedance of 100 K Ω)
- Current 0 - 20 mA (internal resistance of 162 Ω)
- Resolution: 12 Bits (4096 segments)

**Outputs:**

8 Binary Outputs (Mosfet SSR)
- External [Isolated] Power
- 10 to 30VAC/VDC, 0.35A max+
- Built-in thermal overcurrent protection (automatic reset)
- Supports PWM (Pulse-width modulation)

4 Analog Outputs
- Voltage 0 - 10 VDC linear
- 2 AO's can be 0 - 20mA.

**Onboard 24Vdc 100mA output max:**

24Vdc Output for 4-20mA transmitters Only
*Not for use on Binary Outputs*

**Tzone wall interface:**
- Tzone room sensor

**Programming:**
- Configurable using pre-loaded applications: Onyxx LX UI software

**Mechanical:**
- Dimensions: 88.3 mm x 191 mm x 42 mm 3,5″ x 7,5″ x 1,6″
- Stocking temperature: -30 °C to 50 °C / -22 °F to 122 °F
- Operating conditions: -25 °C to 45 °C / -13 °F to 113 °F
- 10% to 90% H.R. without condensation
- Weight: 315 g / 0.7 lb
- Mounting type: Quick mount on DIN rail or with a retractable screw clip system.
- 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.