

## Maestro® 0-10 V Sensor Applications

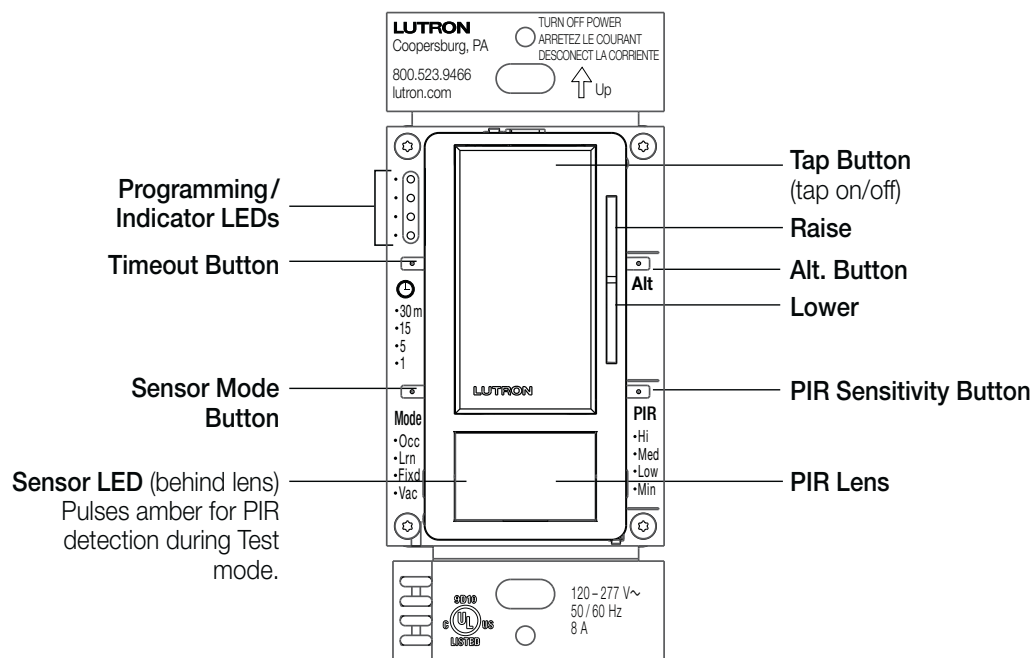
This document serves as a supplement to the Maestro® 0-10 V Dimmer Sensor Installation Guide for the following model numbers:

**MS-Z101-XX:** Occupancy/Vacancy Sensor

**MS-Z101-V-XX:** Vacancy Sensor

**Note:** For performance specifications, including load ratings, see the Maestro® 0-10 V Dimmer Sensor spec submittal (P/N 369833) at [www.lutron.com/TechnicalDocumentLibrary/369833.pdf](http://www.lutron.com/TechnicalDocumentLibrary/369833.pdf)

### Maestro® 0-10 V Dimmer Sensor User Interface (shown without faceplate)



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## Glossary

**Fade-to-On** – The time required for the lights to reach the preset light level when the Tap button is pressed.

**Fade-to-Off** – The time required for the lights to turn off (from the ON state) when the Tap button is pressed.

**Fine Motion** – Very small movements like reading a magazine.

**High-End Trim** – Ability to change the highest achievable light level to which the dimmer can be adjusted.

**Indicator LEDs** – LEDs that are used when programming your Dimmer Sensor.

**Low-End Trim** – Ability to change the lowest achievable light level to which the dimmer can be adjusted.

**Major Motion** – Large movements like walking, standing up, sitting down, etc.

**Minor Motion** – Small movements like drinking a cup of coffee, etc.

**Occupancy** – The sensor automatically turns ON when you enter the room, and turns off when you vacate the room.

**Occupancy with Fixed ALD** – The sensor automatically turns the lights ON when you enter the room, and there is not enough ambient light in the room. The sensor will determine how much ambient light is enough, based on a fixed level you select. The sensor will turn the lights off when the room is vacated.

**Occupancy with Learning ALD** – The sensor automatically turns the lights ON when you enter the room, and there is not enough ambient light in the room. If there is enough light, it will NOT turn the lights ON. If it did not respond as you desired, press the Tap button within 5 seconds of entering the room to change the state of the lights. The sensor will learn your preference for how much ambient light is enough, based on these interactions. The sensor will turn the lights off when the room is vacated.

**Occupied Level** – A programmable setting that determines the light level the Dimmer Sensor will turn on to, once occupancy has been detected.

**Off-While-Occupied** – Setting that determines whether or not the lights will stay off when the sensor has been manually turned off, but motion is still detected.

**PIR Sensitivity** – Setting that adjusts the level of Passive Infrared sensitivity your sensor will use to detect motion.

**Preset Level** – The Dimmer Sensor will turn all lights ON to the last light level that has been selected by the user (1% -100%).

**Selectable Dimming Curve** – Ability to choose one of two dimming technologies to result in a consistent rate of change in perceived light intensity. By offering two options, you can choose the technology that optimizes the dimming of your connected load.

**Sensor LEDs** – LEDs under the sensor lens that are used to show when motion is detected during Test Mode.

**Sensor Mode** – Setting that determines how your sensor will respond upon detecting initial occupancy. There are four available settings: Occupancy (Occ), Occupancy with Learning ALD (Lrn), Occupancy with Fixed ALD (Fixd), and Vacancy (Vac).

**Tap Button** – Large button used for turning the load ON/OFF manually.

**Test Mode** – A short Timeout with LED feedback to help the user determine sensor coverage in the space.



**Timeout** – Setting that determines how long the lights will remain ON after the room has been vacated, and motion has not been detected.

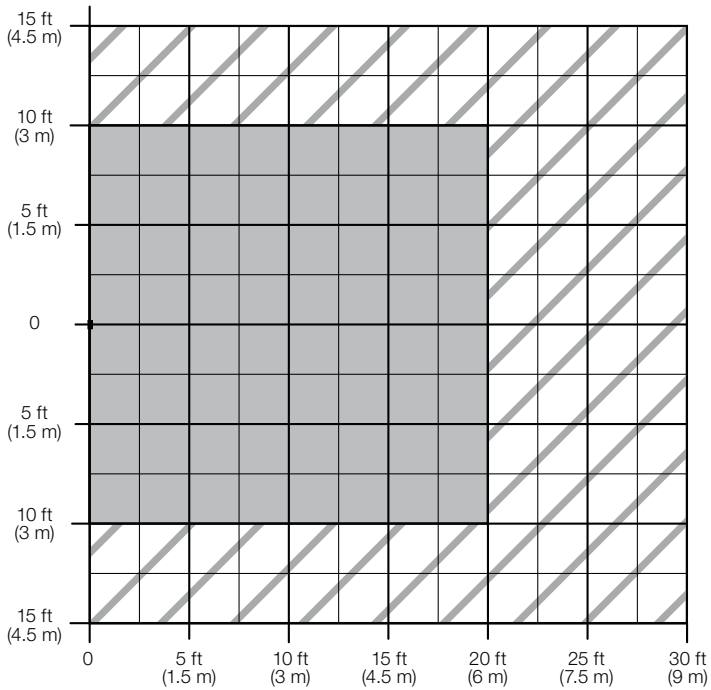
**Walk-Thru Mode** – Setting that turns the lights off before Timeout has expired if occupancy is only detected for a brief period.

**Vacancy** – The lights will only turn ON if the Tap button is pressed. The sensor will turn the lights off when the room is vacated.

## Sensor Coverage Area

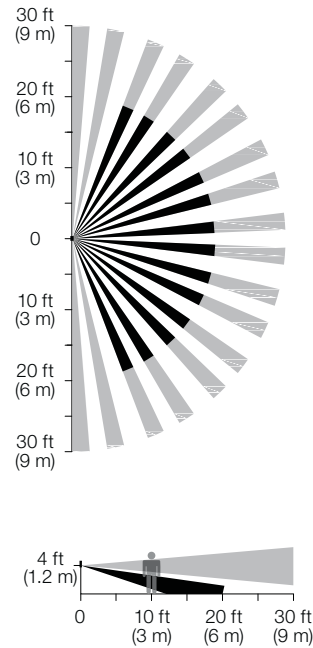
### NEMA WD7 Coverage

-  Major motion coverage: 900 ft<sup>2</sup> (81 m<sup>2</sup>)
-  Minor motion coverage: 400 ft<sup>2</sup> (36 m<sup>2</sup>)



Test Room Dimensions: 37 ft x 38 ft (11.28 m x 11.6 m)  
 Test Floor Surface Material: Carpet  
 Sensor Coverage Angle: 180°

### Passive Infrared Beam Diagram (For Reference Only)



## Settings Overview

The Maestro® 0-10 V Dimmer Sensor has many features that allow you to configure the unit to meet your individual needs. This page includes all the button press shortcuts for modifying those features. For detailed information on each setting, please see the corresponding page.

### To display the current settings:

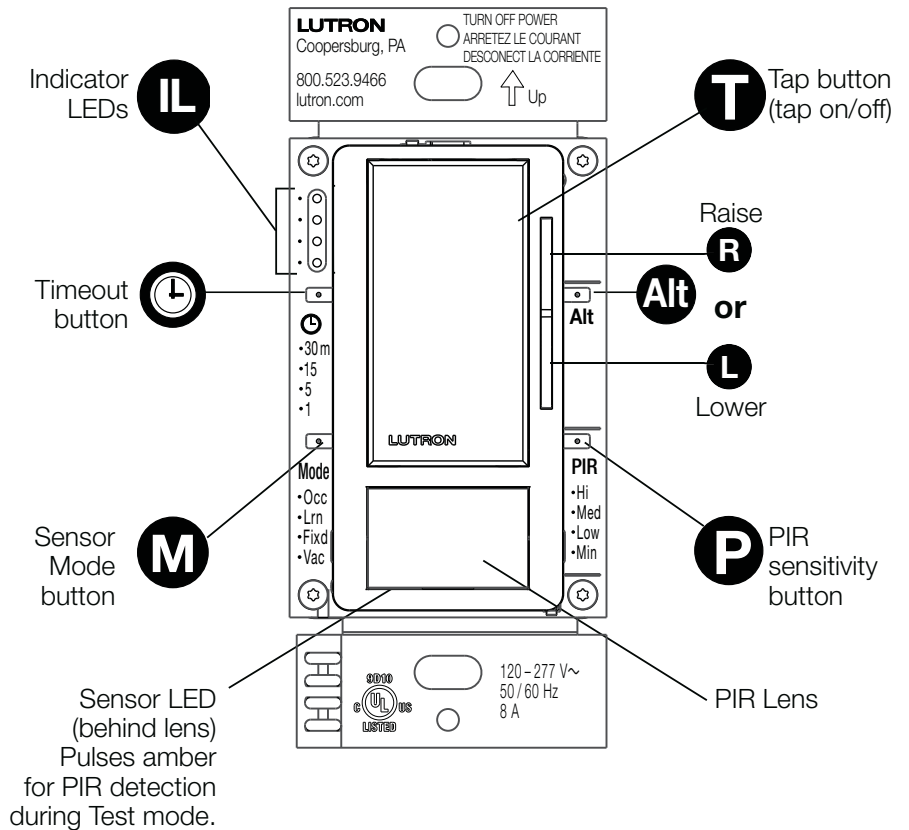
Tap the Timeout (⌚), Sensor Mode (M), or PIR Sensitivity (P) button. The indicator LED (IL) that corresponds to the current setting will illuminate.

### To change the current settings:

Press and hold the desired button (⌚, M, or P) until an IL begins to flash (about 3 seconds).

Tap the same button to cycle to your desired setting.

Press and hold the same button until the IL goes solid to lock your selection (about 3 seconds).



## Button Press Shortcuts

Default settings are shown in **bold**

**Fade-to-On Rate** (pg. 6)

- 15 sec
- 5 sec
- 2.5 sec
- 0.75 sec**

⌚ + R

**Low-End Trim** (pg. 9)

- High Range
- Medium Range**
- Low Range
- Minimum Range

T + L

**PIR Sensitivity** (pg. 13)

- High**
- Medium
- Low
- Minimum

P

**Fixed ALD Light Level** (pg. 17)

- High
- Medium
- Low**
- Minimum

M + Alt

**Fade-to-Off Rate** (pg. 7)

- 15 sec
- 5 sec
- 2.5 sec**
- 0.75 sec

⌚ + L

**Occupied Level** (pg. 10)

- 100%
- 50%
- Preset

M + R

**Selectable Dimming Curve** (pg. 14)

- True Square Law
- Linear**

R + Alt

**Timeout** (pg. 18)

- 30 minutes
- 15 minutes**
- 5 minutes
- 1 minute

⌚

**High-End Trim** (pg. 8)

- High Range**
- Medium Range
- Low Range
- Minimum Range

T + R

**Off-While-Occupied** (pg. 12)

- Disabled
- Enabled**

⌚ + P

**Sensor Mode** (pg. 15)

- Occupancy (Auto-ON/Auto-OFF)**
- Occupancy w/Learning ALD
- Occupancy w/Fixed ALD
- Vacancy (Manual-ON/Auto-OFF)

M

**Walk-Thru Mode** (pg. 19)

- Disabled
- Enabled**

⌚ + Alt

**Preset Level** (pg. 11)

- Locked: High Range
- Locked: Medium Range
- Locked: Low Range
- Locked: Minimum Range

M + L


Unlock

## Changing the Fade-to-On Rate:

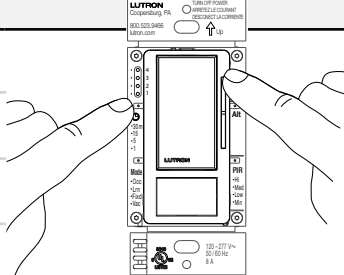
1. Press and hold **⏸** and **R** until an indicator LED (**IL**) begins to flash (about 3 seconds). Release both buttons.
2. Tap the **⏸** or **R** repeatedly to select desired setting. Hold **⏸** or **R** to save setting.

**Fade-to-On Rate**

- 15 sec
- 5 sec
- 2.5 sec
- 0.75 sec

 + **R**

Fade-to-On Rate	
<b>IL</b>	<b>Settings</b>
<input type="radio"/>	15 seconds
<input type="radio"/>	5 seconds
<input type="radio"/>	2.5 seconds
<input checked="" type="radio"/>	0.75 seconds



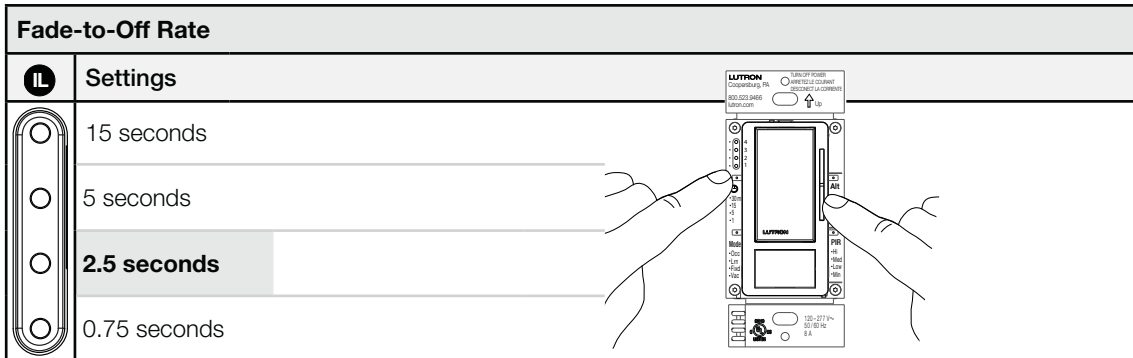
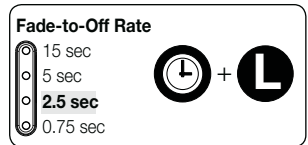
**Default Setting:** 0.75 seconds

## Additional Information:

Faster Manual Fade-ON times are more practical and slower Manual Fade-ON times are thought to be more elegant. If the light that is controlled by the dimmer is the first or only light that will be turned ON in a particular room, most people find it advantageous to use a faster time so that the room is immediately illuminated. Art lighting or other accent lighting is often more pleasing with a slower fade time. This fade time adjustment only applies to manual actuation of the Tap button. All occupancy based fade times are fixed to 0.5 seconds for Auto-On.

## Changing the Fade-to-Off Rate:

1. Press and hold **⏸** and **L** until an indicator LED (**L**) begins to blink or flash (about 3 seconds).
2. Tap the **⏸** or **L** repeatedly to select desired setting. Hold **⏸** or **L** to save setting.



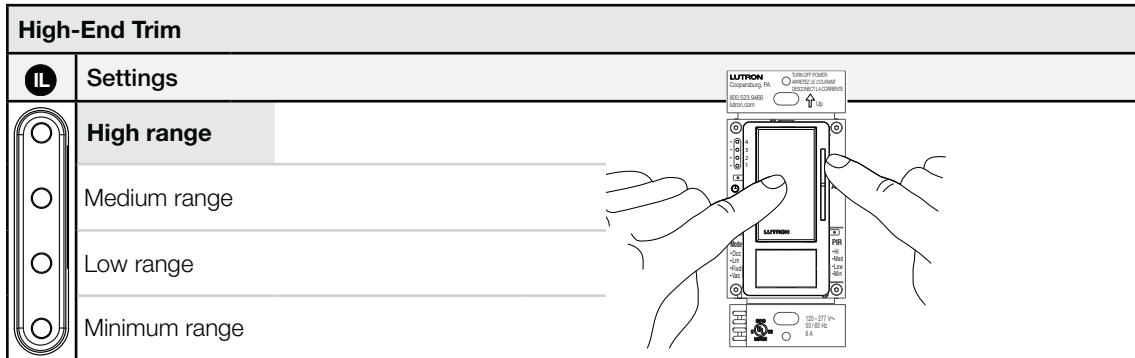
**Default Setting:** 2.5 seconds

## Additional Information:

A slower Manual Fade-OFF Time is suggested for rooms where the user wishes to leave while the lights are still providing illumination. Please be aware that the light dimming may not be immediately noticeable for settings of 5 seconds or longer. This fade time adjustment only applies to manual actuation of the Tap button. All occupancy based fade times are fixed to 10 seconds for Auto Off.

## Changing the High-End Trim:

1. Press and hold **T** and **R** until the PIR lens flashes (about 7 seconds).
2. Press and hold **R** until the #4 indicator light (**L**) is reached and the lights dim up no further. Hold **L** until the desired light level is achieved. Single tap **T** to save setting.



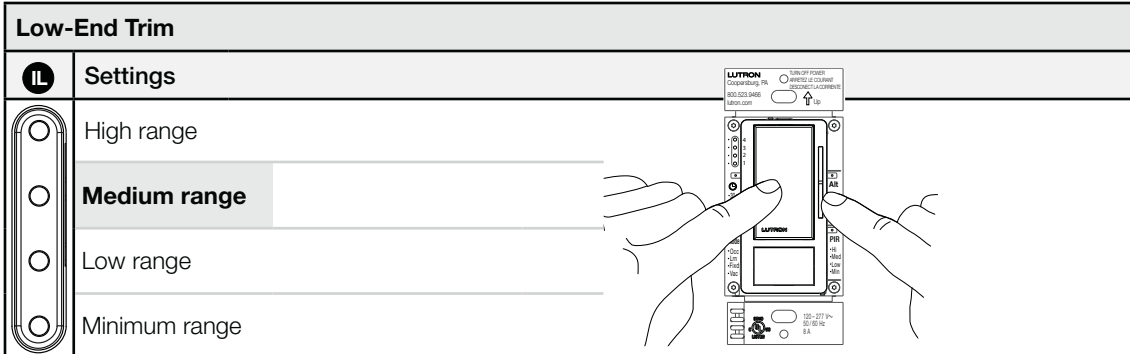
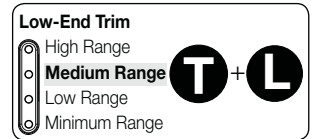
**Default Setting:** High range

## Additional Information:

High-end trim is adjustable from 6 – 10.5 V. The maximum light output of connected fixtures can be decreased for energy savings in over-lit spaces.

## Changing the Low-End Trim:

1. Press and hold **T** and **L** until the PIR lens flashes (about 7 seconds).
2. Press and hold **L** until the #1 indicator light (**L**) is reached and the lights dim down no further. Hold **R** until all bulbs are on and stable (no flickering) or otherwise desired light level is achieved. Single tap **T** to save setting.



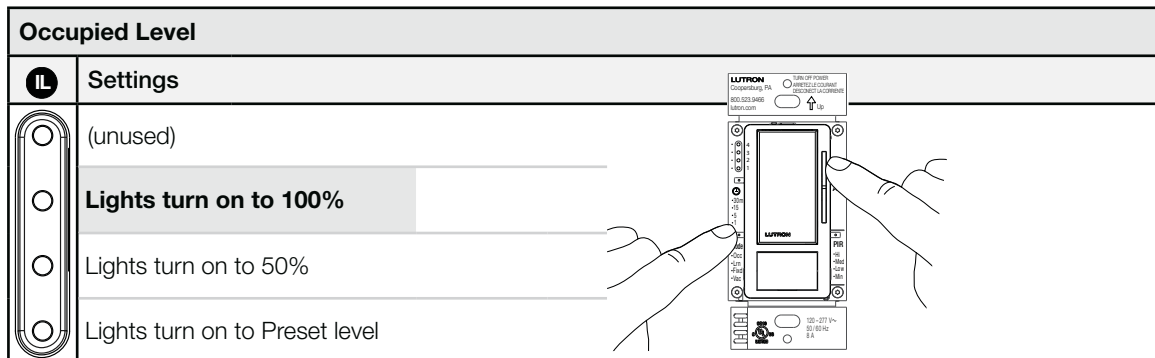
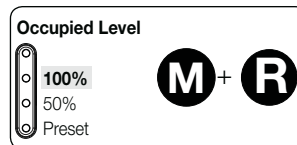
**Default Setting:** Medium range

## Additional Information:

Low-end trim is adjustable from 0.6 – 2 V. Trimmable low-end can ensure a stable light level. Some fixtures will flicker or drop out if trimmed too low.

## Changing the Occupied Level:

1. Press and hold **M** and **R** simultaneously until an indicator LED (**IL**) begins to flash (about 3 seconds).
2. Tap **R** to cycle to your desired setting.
3. Press and hold **R** until the indicator light (**IL**) goes solid to lock your selection.



**Default Setting:** Lights turn on to 100%

## Additional Information:

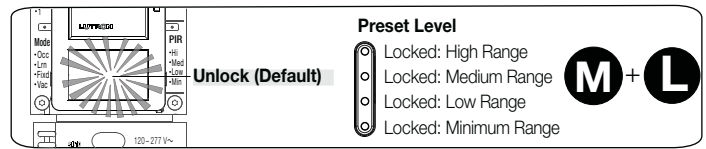
### What do I want?

- Preset Level allows for full customization of your preferred light level.
- When the Occupied Level is set to the Preset Level, the Dimmer Sensor will automatically and manually turn on to the selected Preset Level. Please see page 11 for information on Changing the Preset Level.
- 100% will ensure that the lights are turned on to the brightest available level upon entering a room. If you want the most light possible upon entering a room, this is the best choice.
- If you would like the default level to match the default level of other Maestro® products in your house, 50% is the default light level for manual operation of Maestro® products.

## Changing the Preset Level:

If dimming range of bulbs is satisfactory, save these instructions for future reference, otherwise follow the steps below.

1. Press and hold **M** and **L** at the same time until the PIR lens or an **IL** begins to flash (about 7 seconds).
2. Adjust the light level in the room to the desired Locked Preset level using the **R** and **L** buttons. **IL** represents the approximate light level in the room as you adjust. For an Unlocked Preset, dim the lights to their lowest level and hold **L** for 3 seconds until the PIR Lens LED begins flashing to indicate an Unlocked Preset has been selected.
3. Single tap **M** to save setting.



Preset Level	
<b>IL</b> Settings	
<input checked="" type="radio"/> Locked-High range	
<input type="radio"/> Locked-Medium range	
<input type="radio"/> Locked-Low range	
<input type="radio"/> Locked-Minimum range	

**Default Setting:** PIR unlocked

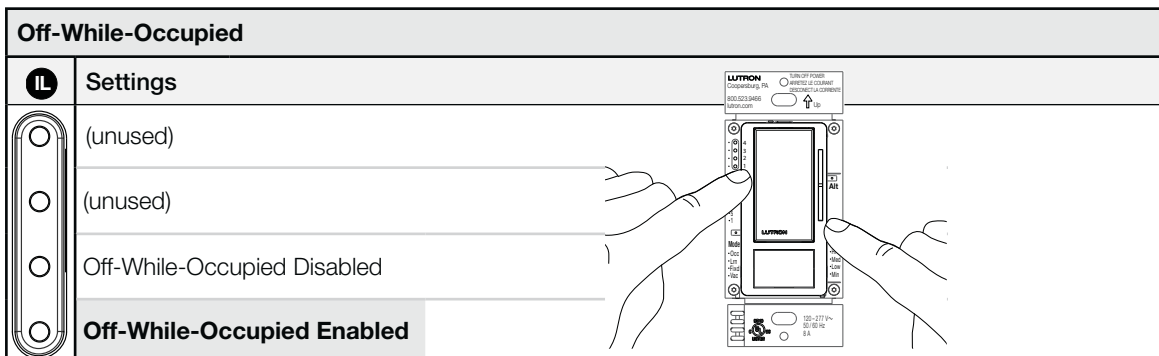
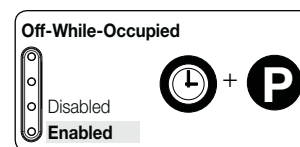
## Additional Information:

**When the Preset Level is set to a “locked” level,** the Dimmer Sensor will turn ON to the predetermined “locked” level with a single tap of the Tap button.

**When the Preset Level is set to “unlocked,”** a single tap of the Tap button will turn the Dimmer Sensor ON to the light level which it was adjusted to the last time the light was on.

## Changing the Off-While-Occupied Setting:

1. Press and hold the Timeout (⌚) and PIR (P) buttons at the same time until an indicator LED (L) begins to flash (about 3 seconds).
2. Tap the PIR (P) button to cycle to your desired setting.
3. Press and hold PIR (P) button until the indicator LED (L) goes solid to lock your selection (about 3 seconds).



**Default Setting:** Off-While-Occupied Enabled

## Additional Information:

This setting determines how the sensor will respond when the lights are turned off, and the room remains occupied. Changing this setting will modify the behavior of all sensor modes, except for Vacancy mode.

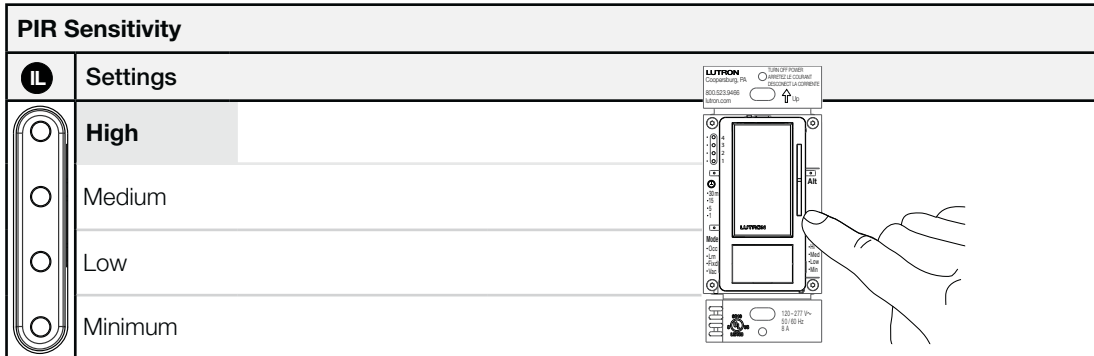
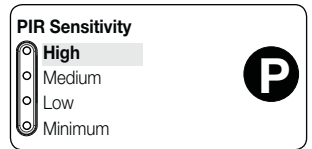
- **Enabled:** If the lights are manually turned off, the sensor will keep those lights off as long as the room is occupied, and the Timeout has not expired. This is the default setting of the Off-While-Occupied mode.
- **Disabled:** If the lights are manually turned off, the sensor will wait for 25 seconds before trying to detect occupancy again. The 25 second period is designed to allow occupants to exit a room without re-triggering the lights, but still provide the necessary Auto-ON functionality for high-traffic areas. If the lights are turned off, and someone remains in the room, the lights will turn back ON when motion is detected, after about 25 seconds.

### What do I want?

- If you want the lights to automatically turn ON when someone enters the room, and your application is a high-traffic area (bathroom, hallway, etc.), “Off-While-Occupied Disabled” is recommended, to keep the sensor as responsive to brief occupancy as possible.
- If you want the lights to automatically turn ON when someone enters the room, but you also would like to be able to turn the lights off and have them stay off while the room is occupied (i.e. conference room presentations, movies, etc.), then “Off-While-Occupied Enabled” is recommended. It is also likely that your Timeout for this application should be greater than 5 minutes in situations where movement is minimal.

## Changing the PIR Sensitivity:

1. Press and hold the PIR Sensitivity button (P) until an indicator LED (IL) begins to flash (about 3 seconds).
2. Tap the PIR Sensitivity button (P) to cycle to your desired PIR Sensitivity setting.
3. Press and hold the PIR Sensitivity button (P) until the indicator LED (IL) goes solid to lock your selection (about 3 seconds).



**Default Setting:** High

## Additional Information:

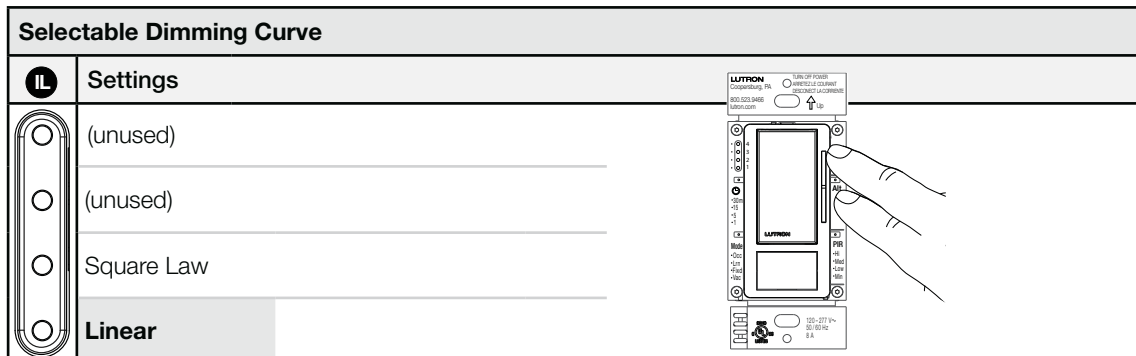
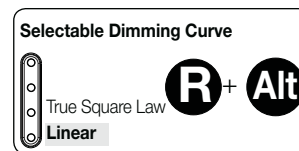
The PIR sensitivity of the sensor can be adjusted based on the expected level of activity in the room. The default setting is “High Sensitivity” which will perform best for most applications. Rarely, if the sensor is placed near external noise sources such as heating and cooling vents, it may turn the lights ON without occupancy. If this occurs, lowering the sensitivity to Medium, Low, or Minimum may resolve the problem.

### What do I want?

- The type of activity and amount of foot traffic will help dictate at which setting the sensor should be set. “High Sensitivity” is recommended for spaces where the occupants will often be seated for long periods of time and performing fine motions such as turning a page. “Low Sensitivity” is recommended for spaces that generally only experience large motions such as foot traffic.
- Additionally, if the sensor sees a specific area that is not desired (ex: a hallway outside of the room in which the sensor is installed), Lutron offers a lens mask kit (Lutron® P/N 50013614) that can be ordered through Tech Support (1.800.523.9466). Alternatively, selectively placing opaque tape (painters tape, electrical tape, masking tape, etc.) over certain parts of the lens can limit its field of vision to block undesired detection areas. Masking the lens may affect ALD performance.

## Changing the Selectable Dimming Curve:

1. Press and hold **R** and ALT (**Alt**) until an indicator LED (**IL**) begins to blink or flash (about 3 seconds). Release both buttons.
2. Tap the ALT (**Alt**) button to cycle to your desired Dimming Curve setting.
3. Press and hold ALT (**Alt**) until the indicator LED (**IL**) goes solid to lock your selection (about 3 seconds).



**Default Setting:** Linear

## Additional Information:

Our eyes do not perceive light in a linear fashion. Square Law Dimming accounts for the fact that the eye is more sensitive to changes in low intensities of light than in high, which results in what can be perceived as a smoother, larger dimming range. In order to achieve square law dimming, your control and your fixtures must be configured properly as a pair. The option to select either linear or square law dimming provides flexibility to achieve square law dimming with a larger set of 0–10 V<sub>ac</sub> fixtures.

### What do I want?

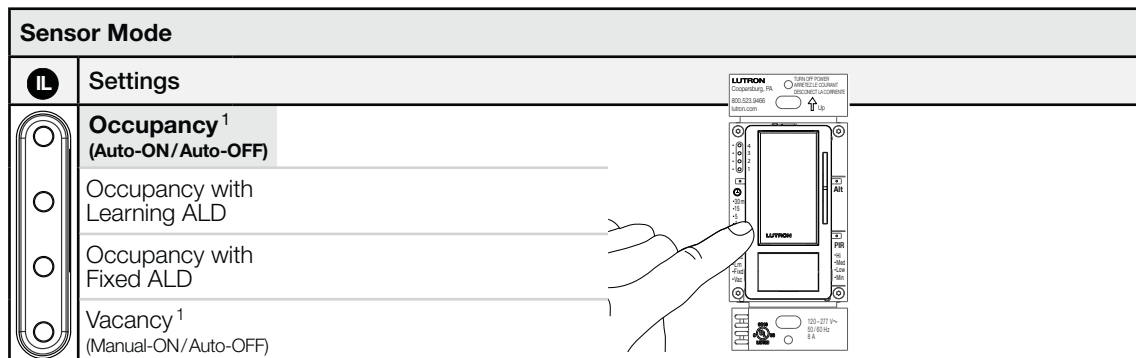
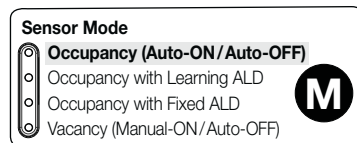
- Selecting the Square Law dimmer curve may provide finer control at the low-end of the dimmable range. This may be beneficial if you notice less of a difference in the light level when dimming at the low-end of the dimmable range.

Smooth balanced dimming is always preferred. In most cases, no changes are required to achieve this. Use the chart below to identify if the Dimmer Sensor’s dimming curve needs to be adjusted.

Control	Driver/Ballast	What end-user might notice:
Linear	Linear	The lights will dim from low-end to 80% quickly and then 80% to 100% slowly
Linear (default)	Square	Balanced dimming
Square	Linear	Balanced dimming
Square	Square	The lights will dim slowly from low end to 20% and then quickly from 20% to 100%

## Changing the Sensor Mode:

1. Press and hold the Mode button **M** until an indicator LED (**IL**) begins to flash (about 3 seconds).
2. Tap the Mode button **M** to cycle to your desired Sensor Mode setting.
3. Press and hold the Mode button **M** until the indicator LED (**IL**) goes solid to lock your selection (about 3 seconds).



<sup>1</sup> Sensor Mode is locked as “Vacancy” in the MS-Z101-V and cannot be changed.

**Default Setting:** Occupancy (Auto-ON/Auto-OFF)

## Additional Information:

The automatic functionality of the sensor can be adjusted to change how the lights respond upon initial occupancy. All sensor modes will turn the lights OFF when no motion has been detected and the Timeout has expired.

- **Occupancy (Auto-ON/Auto-OFF):** The lights will always turn ON when motion is detected.
- **Occupancy with Learning ALD:** The lights will turn ON when motion is detected and ambient light is too low. The lights will remain OFF if there is sufficient ambient light in the room. Further details on how Learning ALD works can be found on the next page.
- **Occupancy with Fixed ALD:** The lights will turn ON when motion is detected and ambient light is too low. If there is sufficient ambient light in the room, the lights will remain off when motion is detected. The default fixed level is “Low”. To change your fixed light level, see “Changing the Fixed ALD Light Level” instructions (page 17).
- **Vacancy (Manual-ON/Auto-OFF):** The lights will NOT turn ON automatically. Lights will only turn ON when the Tap button has been pressed.

### What do I want?

- If you want the lights to always automatically turn ON when someone enters the room, the sensor mode should be set to “Occupancy (Auto-ON / Auto-OFF).”
- If you prefer that the lights only turn ON when the Tap button is pressed, choose Vacancy (Manual-ON / Auto-OFF). The unit will only turn off automatically when occupancy is no longer detected. Bedrooms are a typical application where Manual-ON mode would work better than Auto-ON mode for most users.
- If you’d like the lights to turn ON, but want to keep the lights off when there’s plenty of daylight, “Occupancy with Learning ALD” is a great way to teach the sensor your preferred light level for when lights should remain off.
- If you’d like the lights to turn ON, but want to keep the lights off when there’s plenty of daylight, and you’d like to LOCK the setting that determines how much light is needed to keep lights off, “Occupancy with Fixed ALD” is the best option. This setting is ideal for conference rooms with many different users and plenty of natural light. In a busy conference room, this setting will provide consistent, convenient energy savings and ambiance.

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## Learning Ambient Light Detect (ALD) – How it Works

Ambient Light Detect (ALD) is a feature that allows you to maximize savings by keeping lights off when there is enough natural light in a space to provide fulfill your lighting requirements.

Lutron's Learning ALD feature learns your preference as you live with the product in your space. The learning algorithm utilizes user inputs to determine when ambient light is sufficient.

### Will my sensor utilize Learning ALD?

Your sensor will utilize Learning ALD if you've selected "Occupancy with Learning ALD" (Lrn) mode while programming your unit.

### How does the sensor learn my preference?

Whenever you enter a room with a Dimmer Sensor utilizing the Learning ALD feature, the sensor will either turn the lights ON, or keep the lights OFF, based on its current ALD light level threshold. If you enter the room, and the lights do not respond as you'd like, press the Tap button on your unit to turn the lights ON (or OFF, if that was your preference) within 5 seconds of entering the room. The sensor has now begun learning your preferred ALD threshold. It may take multiple interactions for the sensor's adjustments to match your preferred ALD threshold. Here is an example to illustrate the learning process:

1. You enter the room and the lights stay off, but you decide you want the lights ON because there is not enough ambient light in the space.
2. You press the Tap button (within 5 seconds of entering room).
3. The unit has learned from this, and has begun to adjust its ALD light threshold towards your preference.

### If I press a button AFTER 5 seconds of being in a room, will my unit "learn" that preference?

No, you must interact within the first 5 seconds of entering the room.

### How many times do I have to interact with the sensor to get it to remember my settings?

The sensor typically learns the appropriate threshold in 6-10 consistent interactions.

### I'm utilizing the Learning ALD feature, but when I enter the room and turn the lights off, they turn back ON. What's happening?

If you have "Off-While-Occupied" set to "Disabled", you may experience the lights turning back ON while in ALD mode if you turn the lights off and continue to occupy the space. This means that the sensor is getting closer to your preferred light level, but has not learned it yet. After a few more interactions with the unit, the lights will stay off at the desired light level, even if the space remains occupied.

### I believe I'm using Learning ALD correctly, but I'm still not getting the response I expect. What could be happening?

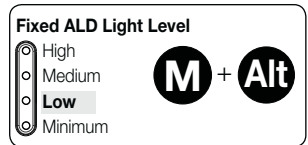
- You may have multiple users with widely different preferences. If multiple users continue to "teach" the unit separate preferences, it will continue to try to adjust to meet the threshold, but may be stuck somewhere in between the preferences of the two users. Consider using "Occupancy with Fixed ALD" at one of the four light level thresholds.
- You may not be able to reach your unit within 5 seconds. If your interactions do not happen within 5 seconds, you may not be teaching the unit a new threshold. This lack of interaction may be reinforcing the current threshold (because the sensor thinks you like the current setting).

### Many people use the room in which the sensor is located. How can I "lock" an ALD light level so it doesn't change daily?

Use the "Occupancy with Fixed ALD" feature. The Fixed ALD light level threshold you choose will not change based on user interactions.

## Changing the Fixed ALD Light Level:

1. Press and hold the Sensor Mode (M) and ALT (Alt) buttons until the indicator LED (IL) begins to flash (about 3 seconds).
2. The Ambient Light Detect light level will now be displayed on the indicator LED (IL). Tap the Mode (M) button to cycle to your desired setting.
3. Press and hold the Mode (M) button until the indicator LED (IL) goes solid to lock your selection (about 3 seconds).



Fixed ALD Light Level	
IL	Settings
○	High - turns lights ON unless room is very bright
○	Medium
○	<b>Low</b>
○	Minimum - turns lights ON only when room is nearly dark

**Default Setting:** Low (only applies when “Fixed ALD Mode” has been selected as the active “Sensor Mode”)

## Additional Information:

When a unit is set to “Occupancy with Fixed ALD” mode, the light level at which the lights will remain off when the space is occupied can be adjusted. If the light in the room is higher than the level set by the user, the lights will remain off. If the light in the room is lower than the light level set, the lights will turn ON.

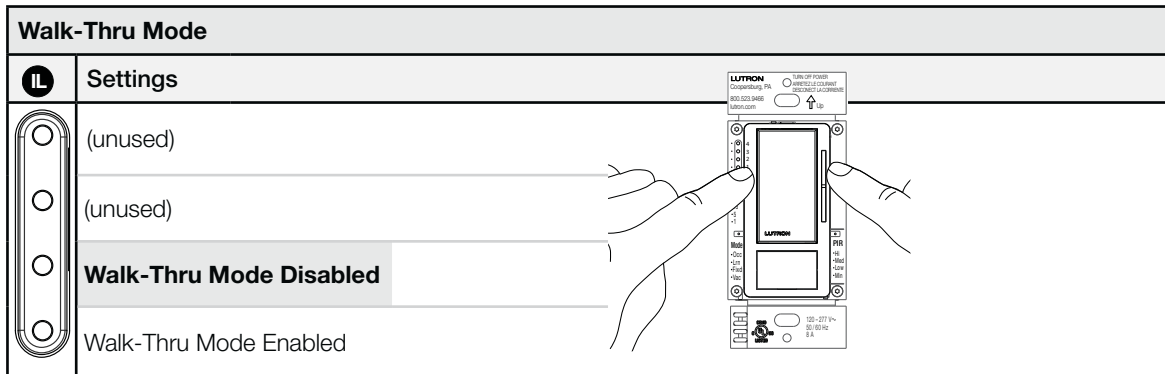
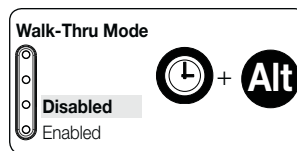
### What do I want?

- If you set the light level to “High”, the lights will almost always turn ON when motion is detected. The only time the lights will not turn ON when motion is detected is when it is extremely bright in the room.
- If you set the light level to “Minimum”, the lights will almost always remain OFF. The lights will only turn ON when motion is detected, and there is very little ambient light in the room.



## Changing the Walk-Thru Mode:

1. Press and hold the Timeout (⌚) and ALT (Alt) buttons until the indicator LED (IL) begins to flash.
2. The Walk-Thru mode setting will now be displayed on the indicator LED (IL). Tap the ALT (Alt) button to cycle to your desired setting.
3. Press and hold the ALT (Alt) button until the indicator LED (IL) goes solid to lock your selection (about 3 seconds).



**Default Setting:** Walk-Thru Mode Disabled

## Additional Information:

Walk-Thru Mode is a setting that allows lights set to a long Timeout to shut off after a short duration when the space is only occupied momentarily. After initial occupancy, this mode allows the sensor to turn the lights in the room back OFF if the space is occupied for a very brief amount of time (less than 3 minutes). If motion is detected consistently within 3 minutes of initial occupancy, the sensor will keep the lights ON for the normal Timeout setting.

- **Walk-Thru Mode Enabled:** If the space is occupied momentarily, the lights will turn off after 3 minutes instead of the normal Timeout setting.
- **Walk-Thru Mode Disabled:** The lights will always remain ON for the full Timeout duration.

### What do I want?

- If you would like the lights in your space to turn off quickly, when the space is only briefly occupied select “Enabled”. This setting is ideal for conference rooms with long Timeouts that may experience periodic brief occupancy events, such as a second-shift cleaning crew or security guard checking the campus of a commercial building.
- If you prefer consistent sensor behavior, or utilize CFL or fluorescent lights in your application, Walk-Thru mode should be “Disabled”.

### Notes:

- To maintain bulb life, the recommended minimum Timeout for fluorescent bulbs is 15 minutes. As a result, Walk-Thru mode is not recommended for applications with CFL or fluorescent lights.
- If Walk-Thru mode is enabled, that setting will override a 1-minute Timeout setting, if that setting is also selected. The lights will remain ON for 3 minutes at a minimum if Walk-Thru mode is enabled.

## Entering and Using Test Mode

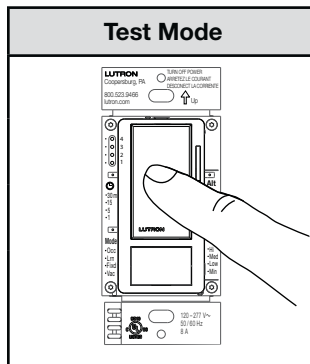
Test Mode is a short Timeout (less than 15 seconds) that will test the coverage area of the sensor with the current settings.

### To Enable Test Mode:

1. Press and hold the Tap button until the PIR lens flashes (about 7 seconds).
2. The device will exit Test Mode automatically after 5 minutes of inactivity, or when the Tap button is pressed.

### Notes:

- An amber sensor LED flashes to indicate PIR detection. If no motion is detected for the entire duration of the shorter Timeout (15 seconds), the load(s) being controlled by the Dimmer Sensor will turn off. The load(s) will turn back ON when motion is detected.
- If Test Mode is entered within 2 minutes of power-up, sensor LED will blink quickly twice and repeat every 2 seconds until the sensor is ready.

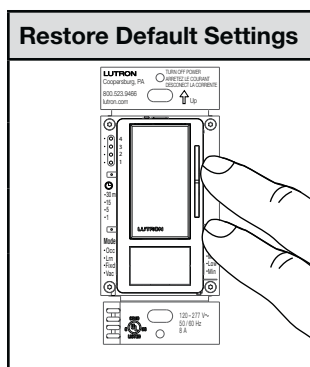


## Restoring Default Settings

The Dimmer Sensor has the ability to be returned to its original default settings. This ability allows the programmer a risk-free experience to try multiple setting configurations.

### To Restore Default Settings:

Press and hold **Alt** and **P** until all **L** blink slowly (about 7 seconds). This will restore ALL of the settings back to the default settings.



### Note:

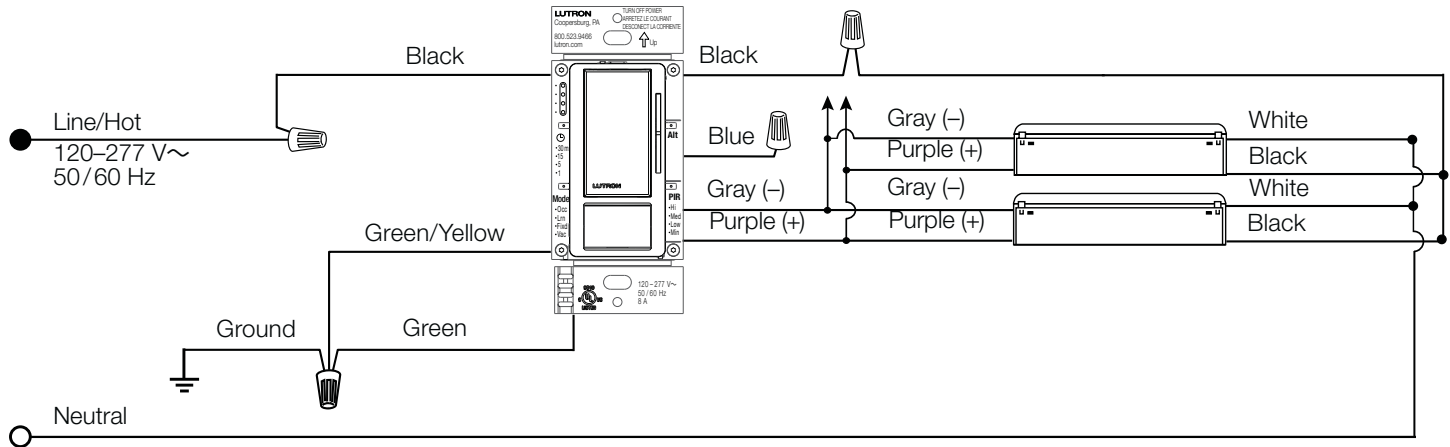
The default settings are:

Fade-to-On Rate .....	0.75 seconds
Fade-to-Off Rate .....	2.5 seconds
Fixed ALD Light Level .....	Low
High-End Trim .....	High range
Low-End Trim .....	Medium range
Occupied Level .....	100%
Off-While-Occupied .....	Off-While-Occupied Enabled
PIR Sensitivity .....	High
Preset Level .....	Unlocked
Timeout .....	15 minutes
Selectable Dimming Curve .....	Linear
Sensor Mode .....	Occupancy (Auto-ON/Auto-OFF)
Walk-Thru Mode .....	Walk-Thru Mode Disabled

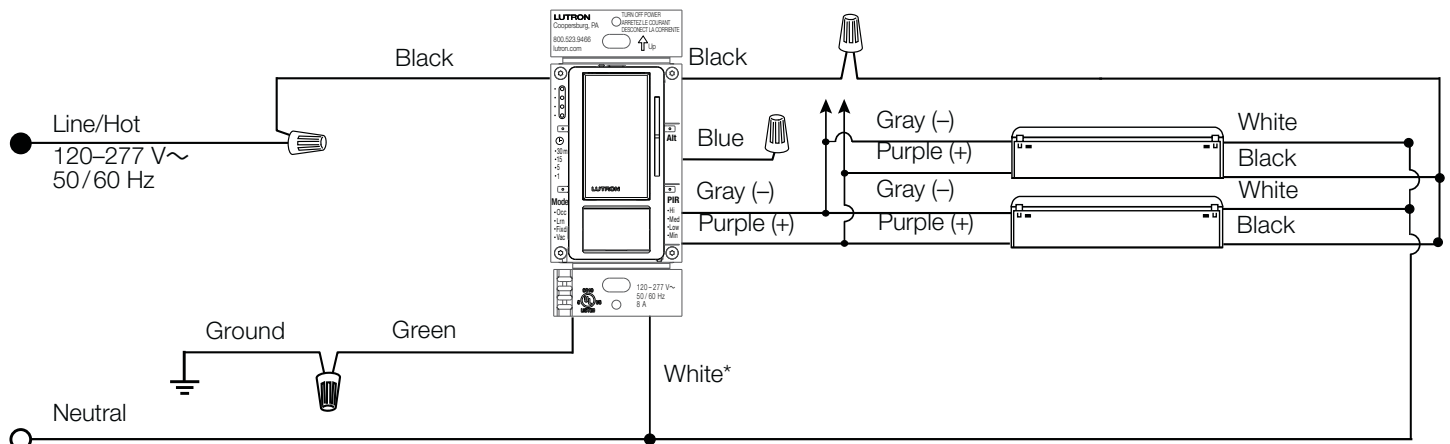
**NOTE:** After restoring the default settings, the Dimmer Sensor will reset. This will take ~10 seconds. During this time, the Dimmer Sensor will not respond to motion or button presses.

## Wiring Diagrams

**Wiring Diagram 1A:  
Single Pole Wiring without Neutral**

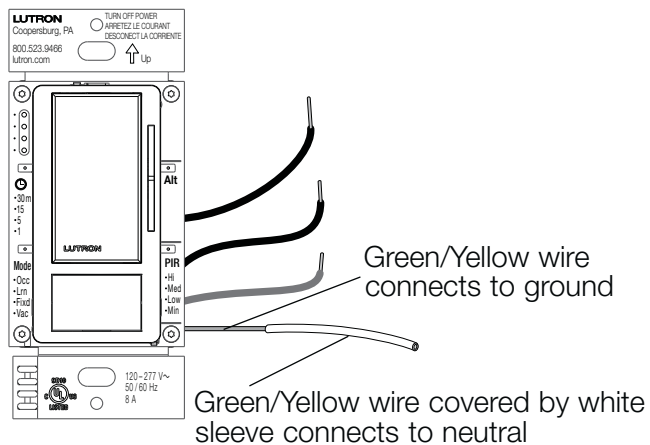


**Wiring Diagram 1B:  
Single Pole Wiring with Neutral**



**\* Wiring Diagrams with Neutral:**

Dimmer Sensor must have the green/yellow wire connected to ground to function, or the white sleeve can be placed over the green/yellow wire then connected to neutral.

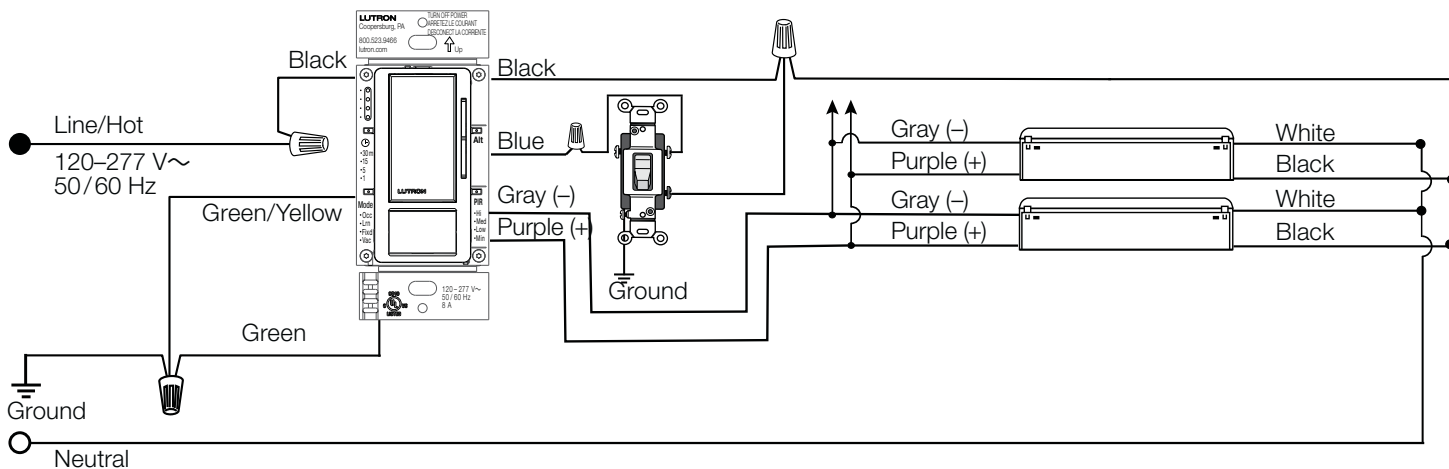


**NOTE:**

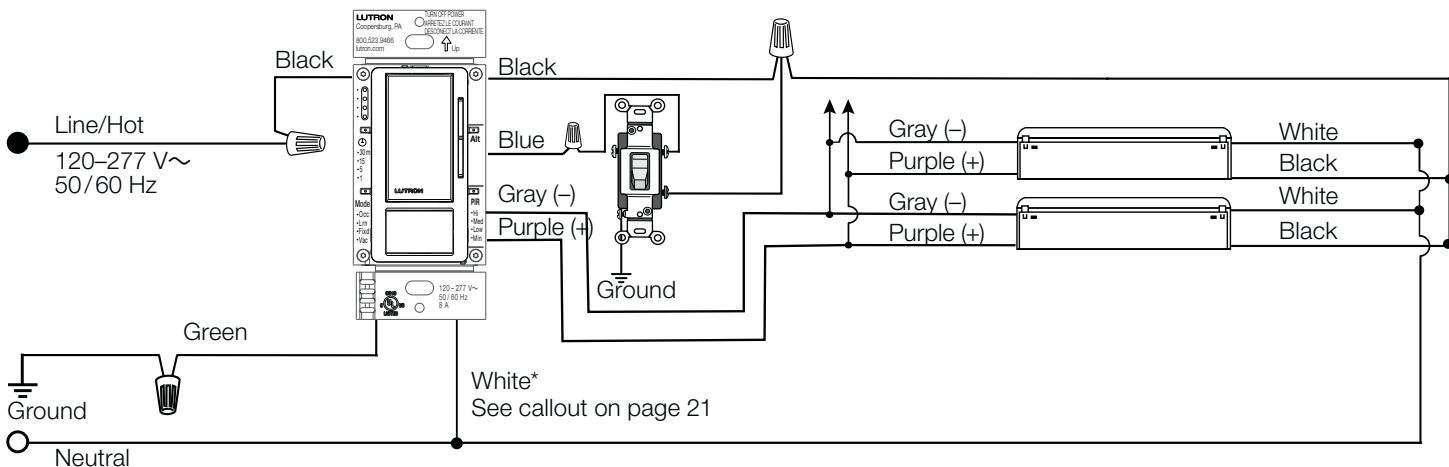
- When using controls in single location installations, cap the blue wire. **Do not** connect the blue wire to any other wiring or to ground.

## Wiring Diagrams (continued)

**Wiring Diagram 2A:**  
**3-Way Wiring without Neutral and with Standard Mechanical Switch**



**Wiring Diagram 2B:**  
**3-Way Wiring with Neutral and with Standard Mechanical Switch**



**NOTES:**

- Important: Some rewiring of the 3-way mechanical switch is required. See page 23.
- The length of the Blue wire (3-way wire) must not exceed 150 ft (45.72 m).
- Only one Dimmer Sensor can be used to control a single load, but it can be installed in any of the available locations within the circuit.

## Wiring Diagrams (continued)

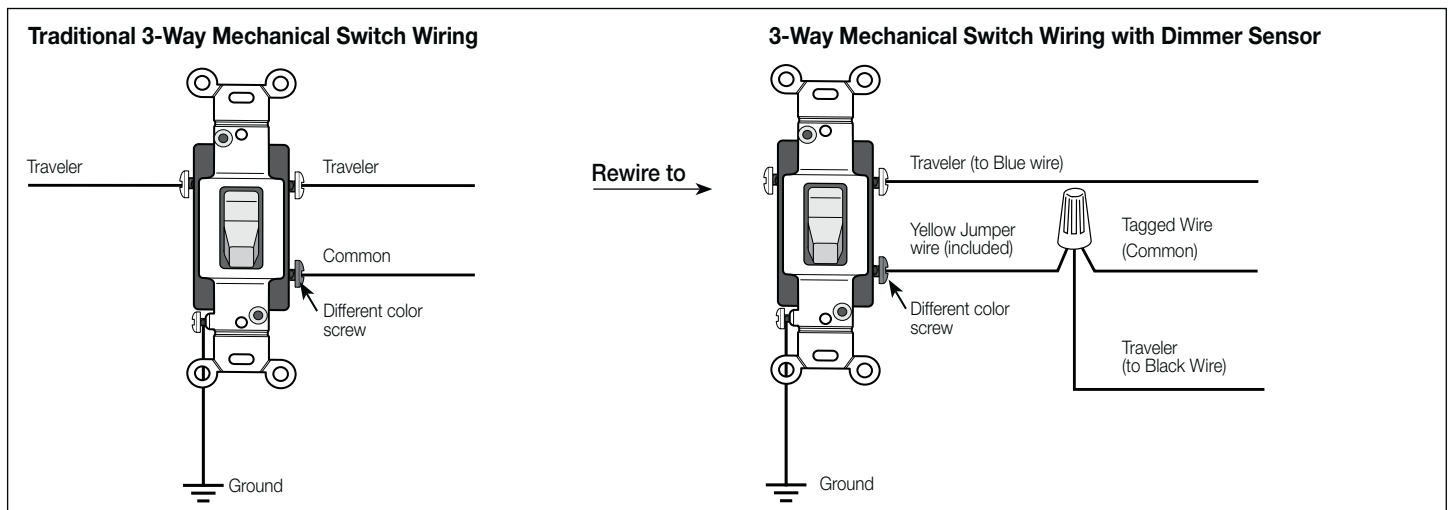
### 3-Way Retrofit Installation

For retrofit 3-way installations the mechanical switch needs to be rewired as shown in the diagram below after wiring the 0–10 V Dimmer Sensor. If the mechanical switch is not rewired, the 3-way installation will not work as expected. Single-pole mechanical switches may also be used in a 3-way installation.

1. Turn Power Off.

**⚠ WARNING! Shock Hazard.** May result in serious injury or death. Turn power OFF at circuit breaker before installing the unit.

2. Connect Ground: Ensure the bare copper or green ground wire from the wallbox is connected to the green ground screw of the mechanical switch.
3. Tag circuit Common: Your 3-way mechanical switch should have three screw terminals, two of the same color, and one of a different color. Tag the wire that is connected to the screw terminal of a different color.
4. Identify the wire that matches the color of the wire you connected to the blue wire of the Dimmer Sensor. Connect this wire to one of the two terminals of the same color.
5. Combine the tagged wire, the remaining wire and yellow jumper wire (included) using a wire connector. Connect the other end of jumper wire to the different color screw.



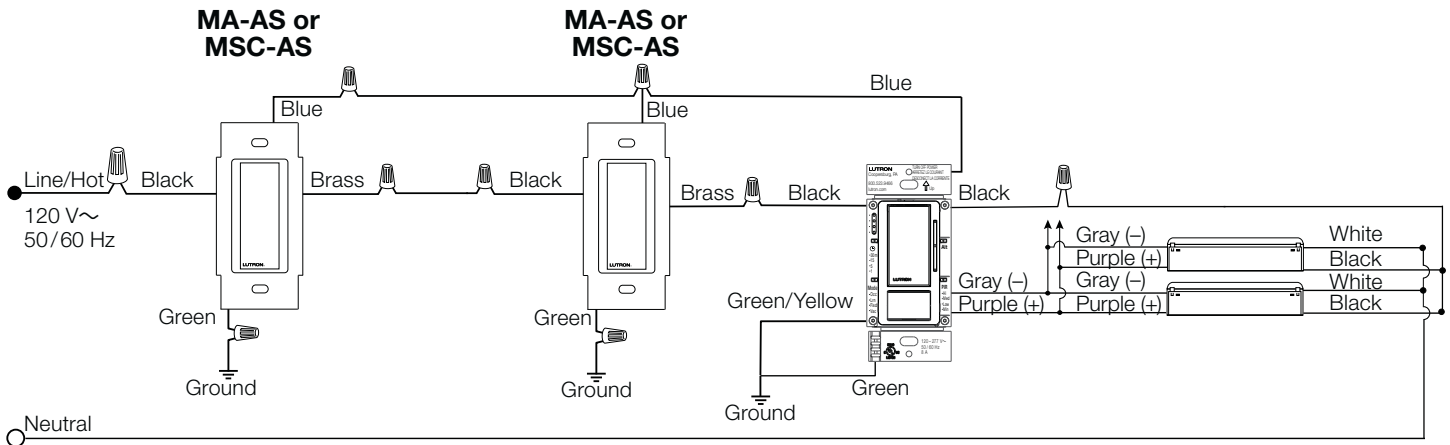
### Dimmer Sensor Troubleshooting

For troubleshooting on your Dimmer Sensor product, see the **Troubleshooting** section beginning on page 29.

## Wiring Diagrams (continued)

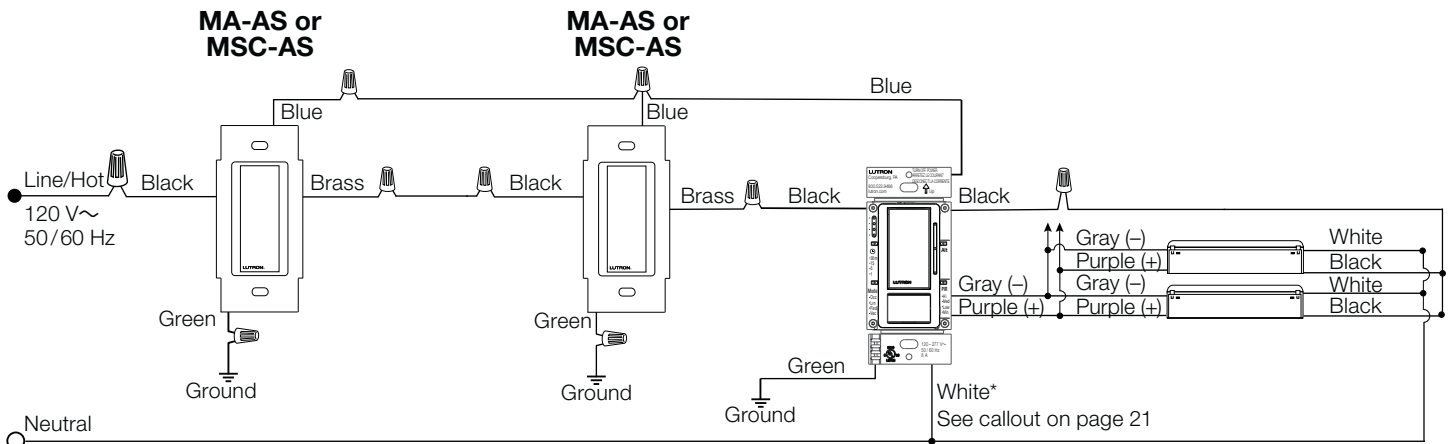
### Wiring Diagram 3A:

120 V~ Multiple Location Installation without Neutral and with Maestro® Accessory Switches



### Wiring Diagram 3B:

120 V~ Multiple Location Installation with Neutral and with Maestro® Accessory Switches



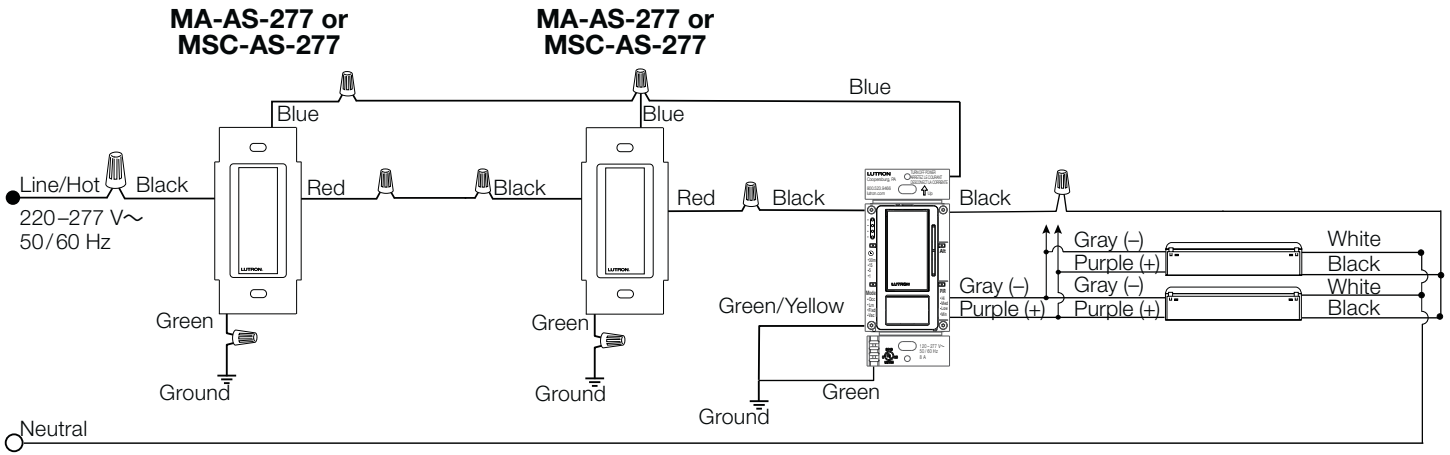
**NOTES:**

- The length of the Blue wire (3-way wire) must not exceed 150 ft (45.72 m).
- Only one Dimmer Sensor can be used to control a single load, but it can be installed in any of the available locations within the circuit.

## Wiring Diagrams (continued)

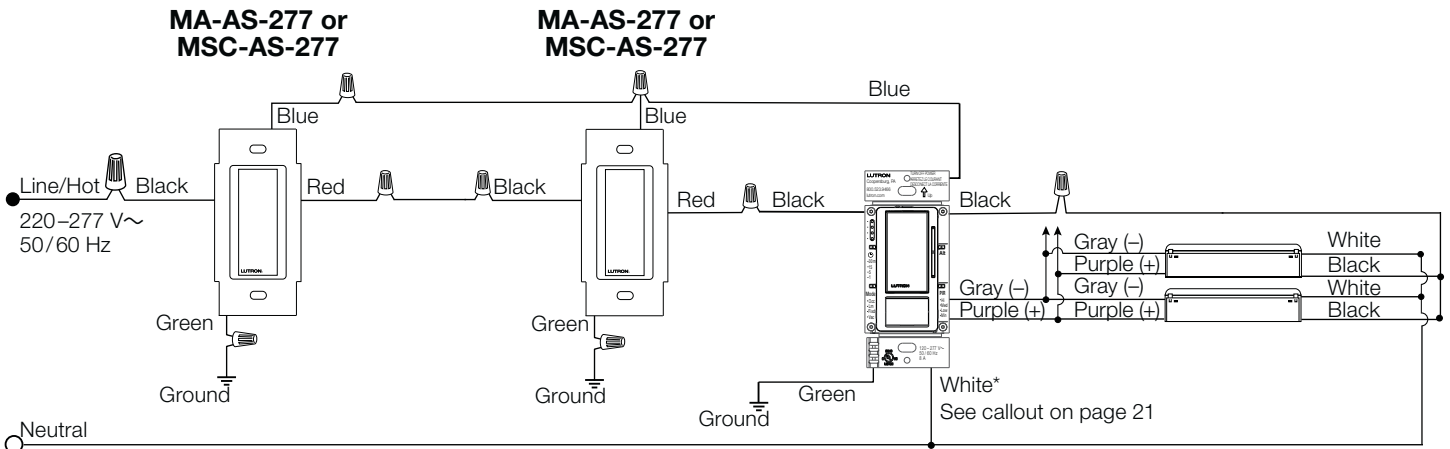
### Wiring Diagram 4A:

220-277 V~ Multi-Location Installation without Neutral and with Maestro® Accessory Switches



### Wiring Diagram 4B:

220-277 V~ Multi-Location Installation with Neutral and with Maestro® Accessory Switches



#### NOTES:

- The length of the Blue wire (3-way wire) must not exceed 150 ft (45.72 m).
- Only one Dimmer Sensor can be used to control a single load, but it can be installed in any of the available locations within the circuit.

## Common Applications and Questions

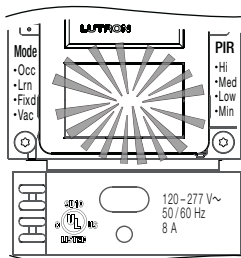
### Sink vs. Source

MS-Z101 is a “sink-only” device (see <http://www.lutron.com/TechnicalDocumentLibrary/048442.pdf> for more information). This means that it requires the ballast or driver to supply the power necessary to drive the 0–10 V<sub>DC</sub> control wires.

MS-Z101 works with all ballasts and drivers that provide a 0–10 V<sub>DC</sub> control signal compliant with IEC 60629 Annex E.2. Note that some LED drivers are sink-only (they require the lighting control to provide the power to drive the 0–10 V<sub>DC</sub> control wires). These will be incompatible with MS-Z101 alone. See below for methods on controlling sink-only fixtures.

### Miswire and incompatible load alert

The user will receive a visual alert when the product’s 0–10 V<sub>DC</sub> control wires (gray and purple) are incorrectly connected or an incompatible load (one which is not compliant with IEC 60629 Annex E.2) is detected. In these conditions, the product will still function as a switch.

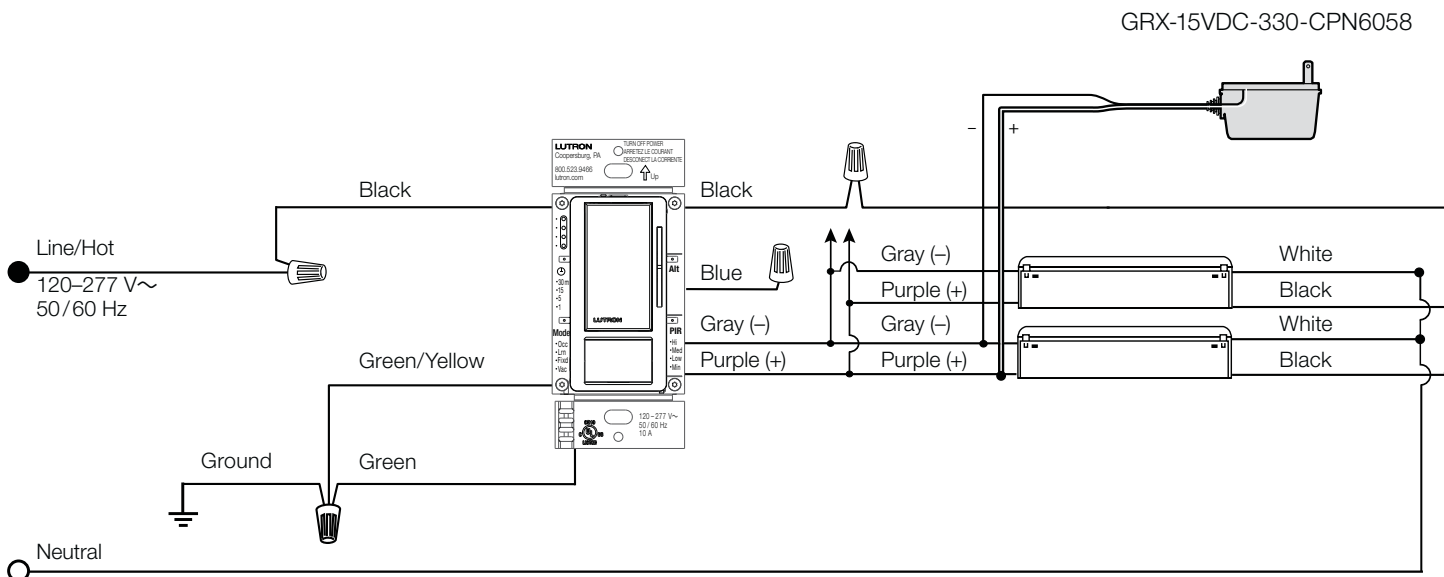


At about 9 seconds after initial power-up, the PIR lens flashes 3 times. Approximately 2 seconds after that, the lens flashes again indicating it detected an error on the 0–10 V<sub>DC</sub> wiring (3 additional flashes).

During operation, the product disables the fade rate to essentially act as a switch. If the user presses the raise or lower button, the lens will flash 3 times and no dimming will occur. This will happen every time raise/lower is pressed until the miswiring is corrected or a compatible load is connected.

To provide an occupancy sensor solution for drivers or ballasts that require power from the control (not compliant with IEC 60629 Annex E.2):

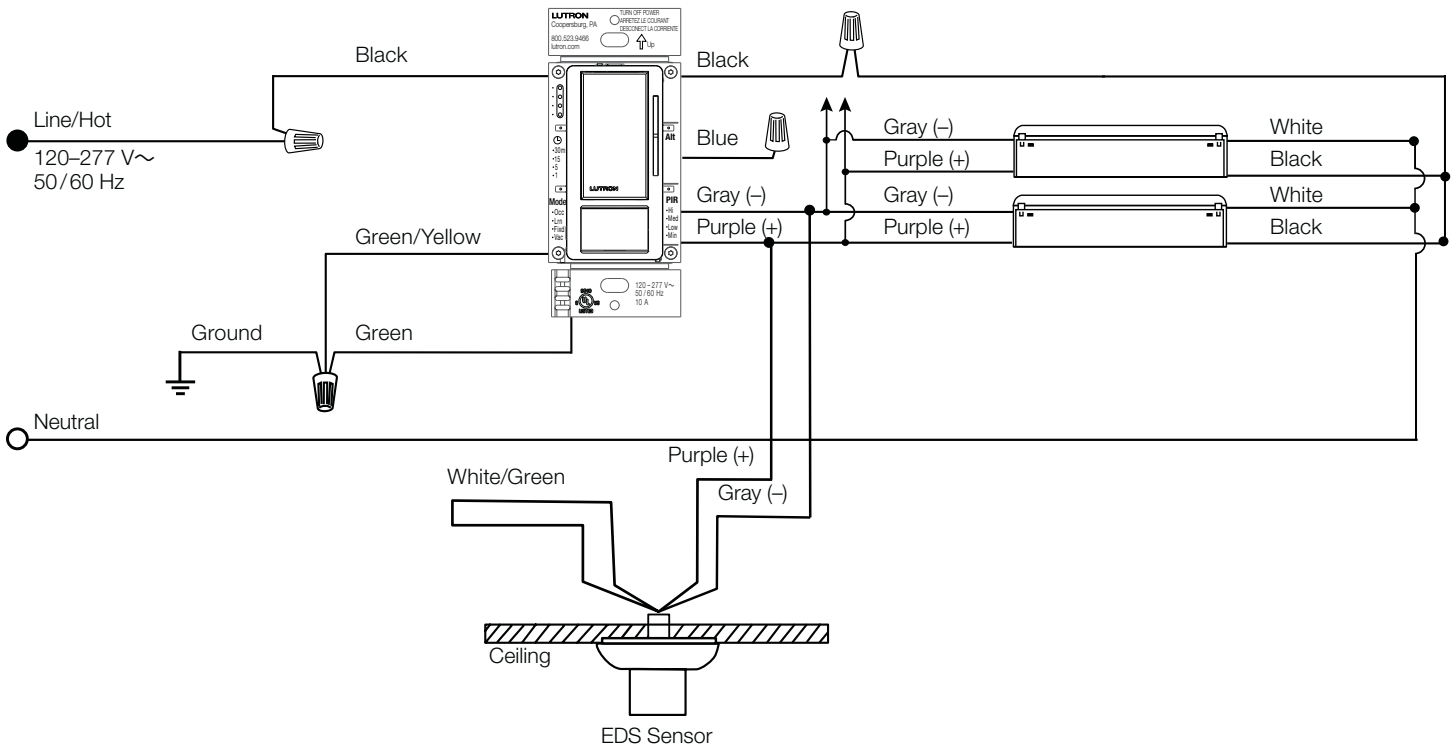
1. Use a Radio Powr Savr™ occupancy sensor and a 0–10 V<sub>DC</sub> PowPak® module (for example, LRF2-OCR2B-P and RMJ-5T-DV-B). See: [http://www.lutron.com/en-US/Products/Pages/SingleRoomControls/Energi\\_TriPak/Overview.aspx](http://www.lutron.com/en-US/Products/Pages/SingleRoomControls/Energi_TriPak/Overview.aspx) for more information.
2. Use a plug-in supply to supply power to the 0–10 V<sub>DC</sub> control wires (see <http://www.lutron.com/TechnicalDocumentLibrary/048442.pdf>). Lutron model number GRX-15VDC-330-CPN6058 has a 10 mA capacity, with capability to operate a minimum of 5 ballasts (drivers) if they are compliant with ESTA E1.3. Note that this requires 120 V<sub>AC</sub> to be available as the power source for the GRX-15VDC-330-CPN6058.



## Energy Codes Requiring Daylighting (ex. ASHRAE 90.1)

Note that certain codes require the presence of daylighting sensing/control. MS-Z101 contains ambient light detection, which is not a solution to ASHRAE 90.1, but below are two options that will help the installer comply with energy codes requiring daylighting:

1. Use MS-Z101 in conjunction with a daylight sensor, such as the EDS Sensor from PLC sensors (<http://www.plcsensors.com/pdf/301%20EDS%20Rev4.pdf>). The MS-Z101 and the EDS sensor connect together on the 0-10 control link as shown in the diagram below. This setup works as long as the ballast or driver provides a current source compliant to IEC 60629 Annex E.2.
2. When using this daylight control with the MS-Z101 one of the controls will dominate the link. This means that whichever control dims the 0-10 V link the most takes precedence.



**NOTE:** Daylighting can also be accomplished by using a Lutron PowPak® 0-10 V module (RMJ-5T-DV-B), Radio Powr Savr™ occupancy sensor (ceiling or wall mount), Pico® wireless control, and a Radio Powr Savr™ daylight sensor. See: [http://www.lutron.com/en-US/Products/Pages/SingleRoomControls/Energi\\_TriPak/Overview.aspx](http://www.lutron.com/en-US/Products/Pages/SingleRoomControls/Energi_TriPak/Overview.aspx) for more information.

## NEMA 410 Inrush Current

MS-Z101 is intended to work with electronic ballasts and drivers that comply with IEC 60629 Annex E.2. These types of loads typically show a high amplitude (short duration) inrush current the moment power is applied. That inrush current can be many times larger than the steady state current.

This product has been tested to NEMA 410 standards for inrush current, per the chart below.

**Peak Current Requirements**

Steady state current (A)	Peak current (A) 120 V~	I <sup>2</sup> t (A <sup>2</sup> sec) 120 V~ See Note	Peak current (A) 277 V~	I <sup>2</sup> t (A <sup>2</sup> sec) 277 V~ See Note
0.5	75	11	77	11
1	107	24	131	27
2	144	41	205	76
3	166	51	258	111
5	192	74	320	205
8	221	98	370	274
10	230	106	430	370
12	235	110	440	387
15	239	114	458	420
16	242	117	480	461

NOTE: I<sup>2</sup>t values based on peak current with a 2 ms duration.

There exist electronic drivers and ballasts whose inrush current is significantly greater than that specified in NEMA 410. In some circumstances, manufacturers of these devices recommend switching them on one at a time because they may trip the breaker. The MS-Z101 has only been tested with devices that comply with NEMA 410 standards and is not recommended to be used in conjunction with devices that do not comply.

## Troubleshooting

Symptom	Possible Cause	Likely Solution
<ul style="list-style-type: none"> <li>After installation, unit does not respond to button presses.</li> <li>After installation, unit only worked once or doesn't work at all.</li> </ul>	Dimmers will not be active for first 10 seconds after installation.	Wait for longer than 10 seconds.
	The product's green/yellow wire is not connected to ground.	Connect the product's green/yellow wire to ground. Refer to wiring diagrams on instruction sheet or at: <a href="http://www.lutron.com/TechnicalDocumentLibrary/369833.pdf">http://www.lutron.com/TechnicalDocumentLibrary/369833.pdf</a>
<ul style="list-style-type: none"> <li>After installation, sensor does not seem to function.</li> </ul>	Junction box is miswired. Hot wire (black) is actually neutral — device cannot function when switching neutral.	Consult an electrician.
	Sensor will not be active for the first 2 minutes after installation.	Please wait 2 minutes after restoring power for the sensor to become operational.
<ul style="list-style-type: none"> <li>After installation, sensor does not seem to function.</li> </ul>	Wiring may be incorrect, or the green/yellow wire is not connected to ground.	Refer to wiring diagrams on instruction sheet or at: <a href="http://www.lutron.com/TechnicalDocumentLibrary/369833.pdf">http://www.lutron.com/TechnicalDocumentLibrary/369833.pdf</a> for directions on how to wire your product.
	The sensor takes up to 2 minutes to perform a calibration following a power cycle. If the lights are OFF and the calibration completes while the space is occupied, the lights will turn ON.	Wait at least 2 minutes for the calibration to complete.
<ul style="list-style-type: none"> <li>Lights do not turn ON when space is occupied.</li> </ul>	Sensor mode is set to Vacancy (Vac) mode.	Refer to "Selecting Custom Settings" on your instruction sheet to set your Sensor Mode to "Occupancy" (Occ) mode.
	Sensor mode is set to "Occupancy with Learning ALD" (Lrn) mode and the light level in the room is too bright.	Turn the lights ON within 5 seconds of entering the room to teach your sensor that it should turn ON at the current light level.
	Sensor mode is set to "Occupancy with Fixed ALD" (Fixd) mode and the light level in the room is too bright.	Raise your Fixed ALD Light level until the lights turn ON in the current light level (Default level is "Low").
	Sensor does not have full view of room and its occupants. Room may be too large for this application.	Move objects blocking sensor's line-of-sight. You must be able to see the sensor for the sensor to "see" you.
	Off-While-Occupied is Enabled and the unit was recently manually turned off.	Refer to "Off-While-Occupied" on your instruction sheet to set "Off-While-Occupied" to "Disabled" or exit room and wait for sensor to Timeout, or manually turn light back ON with Tap button.
	Wiring may be incorrect.	Refer to wiring diagrams on instruction sheet or at: <a href="http://www.lutron.com/TechnicalDocumentLibrary/369833.pdf">http://www.lutron.com/TechnicalDocumentLibrary/369833.pdf</a> for directions on how to wire your product.
<ul style="list-style-type: none"> <li>Lights turn back ON after they are manually turned OFF.</li> </ul>	Off-While-Occupied has been Disabled. The lights will continue to turn back ON 25 seconds after the lights are manually turned off, if the space is still occupied.	Use the instruction sheet "Off-While-Occupied" section to enable Off-While-Occupied.
<ul style="list-style-type: none"> <li>Lights turn OFF while the space is occupied.</li> </ul>	Sensor's Timeout is too short for this application (if Timeout is set to 1 minute, and you are not moving much for 1 minute, the sensor may Timeout without motion).	Refer to "Selecting Custom Settings" on your instruction sheet to increase your Timeout duration.
	Sensor does not have full view of room and its occupants.	Move objects blocking sensor's line-of-sight. The sensor will perform better, if it has line-of-sight to "see" you.
	PIR sensitivity is set too low.	Refer to "Selecting Custom Settings" on your instruction sheet to increase your PIR Sensitivity.

*Continued on the next page...*

## Troubleshooting *(continued)*

Symptom	Possible Cause	Likely Solution
<ul style="list-style-type: none"> <li>Lights never turn OFF, or stay ON longer than desired.</li> </ul>	Sensor's Timeout has not yet expired.	Refer to "Custom Settings" on your instruction sheet to reduce your "Timeout" setting, if the current setting lasts too long.
	Sensors mounted close to doorways can respond to motion outside of the room.	Use "Test Mode" to determine which areas are triggering the sensor to respond when not desired. Selectively cover parts of the lens with electrical tape, or with the lens mask (Lutron® P/N 50013614), which can be ordered through Tech Support (1.800.523.9466). Refer to "Selecting Custom Settings" on your instruction sheet to lower PIR sensitivity.
	Motion is being detected from an external noise source such as an HVAC vent. Some unintended environmental vibrations may trigger the sensor, keeping the lights ON.	Use "Test Mode" to determine which areas are triggering the sensor to respond when not desired. Test Mode will respond based on the current sensitivity settings of each sensor. Refer to "Selecting Custom Settings" on your instruction sheet to lower PIR sensitivity.
<ul style="list-style-type: none"> <li>Lights turn ON in Vacancy mode.</li> </ul>	Lights can turn ON in the 15 second "grace period" following Timeout.	This grace period is intended to allow a user to move after lights go out, if they want the lights to come back ON. If you'd like to verify that the unit is functioning properly, wait 30 seconds AFTER the Timeout has expired before re-entering the room, to verify that the lights do NOT turn ON.
	Sensor mode may be set to something other than Vacancy mode.	Refer to "Selecting Custom Settings" on your instruction sheet to change your sensor mode.
<ul style="list-style-type: none"> <li>Lights turn ON when space is unoccupied.</li> </ul>	Motion is being detected from an external noise source such as an HVAC vent.	Refer to "Selecting Custom Settings" on your instruction sheet to lower PIR sensitivity.
		Use "Test Mode" to determine which areas are triggering the sensor to respond when not desired. Selectively cover parts of the lens with electrical tape, or with the lens mask (Lutron® P/N 50013614), which can be ordered through Tech Support (1.800.523.9466). Masking the lens may affect ALD performance.
<ul style="list-style-type: none"> <li>While utilizing Occupancy with Learning ALD modes, lights do NOT stay OFF when unit is turned OFF.</li> </ul>	Off-While-Occupied is Disabled, and the Dimmer Sensor has not yet learned your light level preference.	Continue to turn the lights OFF, as needed, until the unit learns your preference and keeps the lights OFF.
<ul style="list-style-type: none"> <li>While utilizing Occupancy with Fixed ALD mode, lights do NOT stay OFF when unit is turned OFF.</li> </ul>	Off-While-Occupied is Disabled, and the light level currently set is too high.	Lower the Fixed ALD Light level using the instruction sheet, or find those instructions at: <a href="http://www.lutron.com/TechnicalDocumentLibrary/369833.pdf">http://www.lutron.com/TechnicalDocumentLibrary/369833.pdf</a>
<ul style="list-style-type: none"> <li>Lights are stuck ON.</li> </ul>	Product's green/yellow wire may have been wired to one of the black.	Rewire; check wiring diagrams on instruction sheet, or at: <a href="http://www.lutron.com/TechnicalDocumentLibrary/369833.pdf">http://www.lutron.com/TechnicalDocumentLibrary/369833.pdf</a>
<ul style="list-style-type: none"> <li>3-way installation is not working as expected. Sensor and/or Tap switch do not control load.</li> </ul>	Your 3-way mechanical switch was not rewired to work with the sensor (wiring is different than conventional 3-way wiring).	Check wiring at 3-way mechanical switch, rewire if necessary using instruction sheet or diagrams at: <a href="http://www.lutron.com/TechnicalDocumentLibrary/369833.pdf">http://www.lutron.com/TechnicalDocumentLibrary/369833.pdf</a>
<ul style="list-style-type: none"> <li>Lights turn on to full, then dim back down.</li> </ul>	Dimmer Sensor has a "Fade to On" feature which transitions the lights from OFF to preset ON level over a period of time, up to 2 seconds (adjustable - see 369833). There are some 0-10 V drivers in existence which may negate this behavior, and make the lights turn on immediately to 100% before the ballast or driver detects the control signal and then dims the lights down to the proper level.	This problem is a symptom of the ballast or driver. <ul style="list-style-type: none"> <li>- Make sure the Fade-to-On rate is set to the lowest (default) value of 0.75 seconds (refer to 369833).</li> <li>- Try a different ballast/driver.</li> </ul>

*Continued on the next page...*

**Troubleshooting (continued)**

Symptom	Possible Cause	Likely Solution
<ul style="list-style-type: none"> <li>Lights cannot be dimmed.</li> </ul>	Ballast or driver being used requires power on the control wires from another source.	See <b>Sink vs. Source</b> section of this document.
	Gray and purple wires are miswired.	Refer to wiring diagram on instruction sheet, the <b>Sink vs. Source</b> section of this document, or at <a href="http://www.lutron.com/TechnicalDocumentLibrary/369833.pdf">http://www.lutron.com/TechnicalDocumentLibrary/369833.pdf</a>
<ul style="list-style-type: none"> <li>PIR lens LED flashes after power is applied and when attempting to dim-up or dim-down.</li> </ul>	Ballast or driver being used requires power on the control wires from another source.	See <b>Sink vs. Source</b> section of this document.
	Gray and purple wires are miswired.	Refer to wiring diagram on instruction sheet, the <b>Sink vs. Source</b> section of this document, or at <a href="http://www.lutron.com/TechnicalDocumentLibrary/369833.pdf">http://www.lutron.com/TechnicalDocumentLibrary/369833.pdf</a>

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