Technical Article

# Occupancy Sensor Operation with Lighting Fixtures

**Product:** Leviton OSFHU Passive Infrared Fixture Mount High Bay Sensors

**Article ID:** 09222009-BC/AM-01

**Date:** September 22, 2009

**Summary:** This article is intended to provide guidance for the operation of Leviton OSFHU Passive Infrared Fixture Mount High Bay Sensors.

**Information:**

## Passive Infrared Occupancy Sensors - Operation

This section of the document will cover three different aspects of Occupancy Sensors PIR technology for all manufacturers: Coverage area, Field of view, and Coverage patterns.

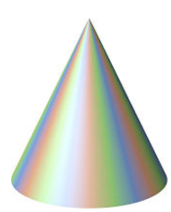
### Coverage Area

Coverage area is represented in square feet and maximum floor spacing. While we specify this detail in our literature the coverage is dependent on mounting location and height, size or amount of motion being detected, direction of motion compared to placement, ambient temperature, temperature of environment, and sensitivity adjustment.

General Rules: Higher than recommended mounting increases coverage area and increases the size of the detecting segments at floor level. In layman terms, the PIR sensors divide an area into zones of coverage – "detection zones". A higher mounting height increases the coverage area and size of gaps in "detection zones". As a result, distances between detection zones will grow throughout the coverage area, requiring larger motion to activate the sensor. Large spaces may require more sensors in order to accurately detect motion throughout the area. To more accurately define and control the detection zones from false triggering, multiple lenses are required for different coverage patterns and mounting heights.

### Field of view

Refers to the angle within which the occupancy sensor will detect motion. The OSFHU type sensors have a 360 degree horizontal field of view. Most are concerned with the vertical field of view angle. The ratio between the vertical field of view and the height of the ceiling equates to the sensors coverage area. This is represented with a conical FOV, in other words, the shape is like a cone.



Example: The OSFHU low bay sensor (lens) has a 2:1 spacing to mounting height at 8ft. to 20ft with a coverage area of 16ft to 40ft.

### Coverage Pattern
Coverage patterns are determined by lens on the infrared sensor and segment masking. The coverage patterns have a direct affect on the field of view and coverage patterns relationships. Examples of coverage patterns include omni-directional or 360 degrees for open areas and bi-directional or xxx degrees in two directions for aisle way.

## Leviton High Bay Sensor (OSFHU) Operation

This section will cover the operational components of the high bay occupancy sensors: Flashing Green LED, Variable Lenses, Sensitivity Adjustment, and Walk Testing for PIR Sensors.

### Flashing Green LED
The ASIC chip used in the OSFHU product is designed to protect against false triggering the load ON. The Green LED flashes the first time it receives a “significant” infrared heat signature. After detection, an algorithm initiates to determine when the relay will close. When the relay closes, there has been a "validation" of the signal, which turns the load ON. This design is intended to prevent the load from turning ON when not needed (False ON) in response to noise or weaker signals such as machinery, air currents, pets, rodents, etc.

Occupancy Sensors are energy saving devices with extremely good payback margins when they do not false trigger. The LED flashing a few times before “lights ON” is a visual indication that the false detection algorithms are activated and taking a moment to screen out noise.

### Variable Lenses
A variety of lenses are available for specific applications. By use of the lenses, the user may precisely tailor the coverage area to the mounting height assuring optimal function. Masking labels are also included with PIR sensor products to allow installers or customers to create custom coverage patterns by blocking “masking” a portion of the lens to meet the application requirement.

- White High Bay lens: used for mounting heights from 20 to 40 feet.
- Black Aisle lens: used for mounting heights from 20 to 40 feet, masked for use in Aisle applications.
- Blue Low Bay lens: used for mounting heights from 8 to 20 feet.

### Sensitivity Adjustment
This is located on the back of the sensor under the product label. This sensitivity adjustment is for minor fine tuning coverage sensitivity. This may be used where false triggering is occurring or for when a minor PIR is not detecting quick enough.

## PIR Operational Variables

### Temperature
The environmental temperature of an application will impact operation of passive infrared sensors. PIR technology detects movement of a heat source between detection zones. In colder environments, PIR sensors will detect a heat signature more readily than in hotter environments.

### Application Considerations
Coverage patterns should be staggered and overlapped to assure optimal coverage. Staggering the sensors mounting location assures that moving objects will cross a detection zone. Overlapping coverage areas is a good way to assure ample coverage.

Narrow aisles need special consideration. For example, a five foot wide aisle requires more fixtures for most reliable field of view detection. An object could move within the five feet and still be inside of a single detection zone, and motion would not be sensed.

## Occupancy Sensor Testing (Walk Test)

This section of the document will cover the testing parameters for occupancy sensors: Standard Field of View Walk Test, and Two/One Walk Test.

### Standard Field of View Walk Test
To conduct a correct field of view walk test, the walk test must be completed by walking around the perimeter (circumference) of the coverage pattern. This is the most precise way to measure the accuracy of the PIR sensor. Passive Infrared technology divides an area into “detection zones” and functions by detecting the movement of a heat signature from one zone to another. The size of the “detection zones” of the Field of View is directly related to the mounting height. The higher the mounting height the larger motion required to cross the “detection zones” and active the sensor.

### Two/One Walk Test
Another method for walk testing is to start at the outer edge of the field of view and take two steps towards the sensor and then take one step back from the sensor until you walk directly under the sensor. This is repeated around the entire 360 degree field of view. This demonstrates the difference between the “radial” and “tangential” capability of the sensor. For example, the larger the Field of View or coverage area the greater each of these “zones” grows. This could be a dramatic impact for “radial” detection especially for aisle way implementations.

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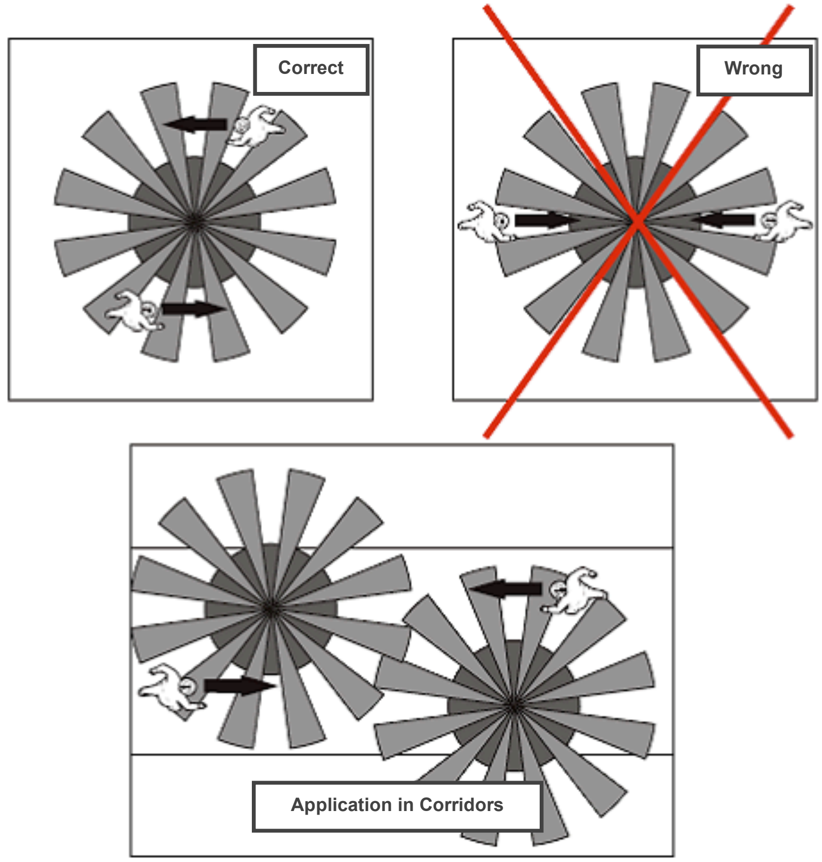


## Lighting Fixture Operations

This section will cover three different aspects of lighting fixtures: Occupancy Sensor, Electronic Ballasts, and Fluorescent Ballasts

### Occupancy Sensors

Sensors are a simple relay device, similar to a light switch. When motion is detected, a relay closes completing the current path to the ballast, which then “strikes” the lamp.

### Electronic Ballasts

Ballast selection and operation varies, always consult ballast manufacturer for operation and best practices.

- Instant-start electronic ballasts are the most popular type of electronic ballast today because they provide maximum energy savings and they start lamps without delay or flashing. Since they do not provide lamp electrode heating, instant-start ballasts generally consume less energy than comparable rapid-start, program rapid-start or programmed-start ballasts. As a result, they usually provide the most energy efficient solution. Instant-start ballasts use 1.5 to 2 watts less energy per lamp than rapid-start. They also have the least amount of output leads, making for easy installation.

Instant-start electronic ballasts provide a high initial voltage (typically 600V for F32T8 lamps) to "strike" the lamp. This high voltage initiates discharge between the unheated electrodes of the lamp. However, the cold electrodes of lamps operated by an instant-start ballast may deteriorate more quickly than the warmed electrodes of lamps operated by a rapid-start, program rapid-start or programmed-start ballasts. Lamps operated by instant-start ballasts will typically withstand 10-15 thousand switch cycles. Instant-start ballasts are typically wired in parallel. This means that if one lamp fails, the other lamps in the circuit will remain lit.

- Rapid-start ballasts have a separate set of windings that provide a low voltage (approx. 3.5 volts) to the electrodes for one second prior to lamp ignition. A starting voltage somewhat lower than that of an instant-start ballast (typically 450-550V for F32T8 lamps) is applied, striking an electrical arc inside the lamp. Most rapid-start electronic ballasts continue to heat the electrode even after the lamp has started, which results in a power loss of 1.5 to 2 watts per lamp. Lamps operated by a rapid-start electronic ballast will typically withstand 15-20 thousand switch cycles. Rapid-start ballasts are typically wired in series. This means that if one lamp fails, all other lamps in the circuit will extinguish.

- Programmed-start electronic ballasts provide maximum lamp life in frequent starting conditions (>50,000 starts). Programmed-start ballasts like the Mark 5™, Mark 7™, Mark 10™, and Optanium™ programmed-start family of products use a custom integrated circuit that monitors lamp and ballast conditions to ensure optimal system lighting performance. Programmed-start ballasts precisely heat the lamp cathodes to approximately 700°C prior to lamp ignition, thus the lamps are delayed upon startup. This puts the least amount of stress on the lamp electrodes, resulting in maximum lamp life regardless of the number of lamp starts. Programmed-start ballasts are typically wired in series, so if one lamp fails....

### Fluorescent Lamps

These fluorescent tubes are gas-discharge lamps that use electricity to excite mercury vapor. The excited atoms produce short-wave ultraviolet light causing a phosphor to fluoresce, producing visible light. Fluorescent lamps require a ballast to regulate the flow of power through the lamp. A fluorescent lamp converts electrical power into useful light more efficiently than an incandescent lamp. Lower energy cost typically offsets the higher initial cost of the lamp.

**Contact:** If you have any questions or concerns, please call LMS technical support at (800) 959-6004.

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