

BENEFITS OF BI-LEVEL STAIRWELL LIGHTING & SENSOR TECHNOLOGY

Jeffrey Goldstein, Director Lamar LED

STAIRWELL LIGHTING AS A LIFE SAFETY APPLICATION

- Stairwells in multi-story buildings are typically not at the forefront of most building owners' minds yet are one of the most important spaces when it comes to safety and liability. Occupants rely on stairwells to take safe exit out of the building in emergency situations.
- Stairwells are also a hidden source of energy savings. Based on data from the Lighting Research Center which studied the stairwells in several high-rise commercial and residential buildings installed with Lamar LED's Occu-smart® system, it was proven that on average, stairwells are only occupied about 0.7% of the time on the upper floors, and about 3% of the time on the first few floors. Stairwells in residential multi-story buildings average about 1.4% occupancy.
- Lamar LED's bi-level lighting offers a solution that provides a safer stairwell by automatically raising light levels above code minimums during occupancy and keeping the light levels at the typical code minimum when unoccupied.

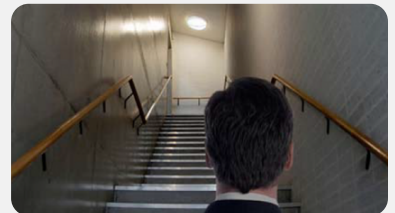
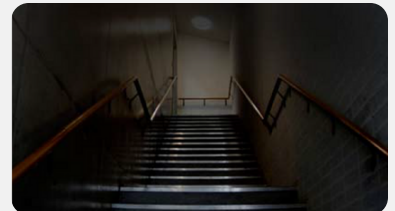
BI-LEVEL LIGHTING OVERVIEW

Lamar LED was on the forefront of technology over 20 years ago when it received NY State funding to help develop the first fully integrated motion sensor-controlled bi-level lighting system. The early versions were made with ultrasonic motion sensors with either two lamps with one controlled by the sensor, or a bi-level ballast which was factory set to 10% of full output. Several formal studies were done by the Lighting Research Center as well as the California Energy Commission where large quantities of Lamar LED's bi-level fixtures were installed in commercial and residential high-rise buildings along with a hospital, and several buildings on campus at the University of California. The result was verifiable proof of concept and implementation, resulting in the utility companies in the state of California and New York offering rebate incentives for the installation of bi-level motion sensor-controlled lighting. This led to more widespread acceptance around the country.

As the concept of using motion sensors in stairwells was new, concerns about Life Safety Codes and Building Codes came into the forefront. Some codes were revised to allow the use of motion sensor controls provided that the failure of a unit would not leave the area in total darkness. A major benefit of bi-level lighting is that the typical code minimum light level of 1% was achieved at the low standby level, so the motion sensor was simply a means to provide higher light levels when the area is occupied to increase occupant safety. Additionally, bi-level fixtures are often equipped with emergency battery backup, so in the event of power failure the required 90 minutes of emergency lighting is met.

As the popularity of bi-level lighting grew, so did competition in the marketplace, and the offerings were typically not the same level of quality, sensor technology, or sophisticated bi-level function of the original Lamar LED Occu-smart® system with its customized ultrasonic design featured in the widely publicized studies. Most stairwells in multi-family residential and commercial buildings are considered emergency paths of egress. In cases of power failures, fires, or other emergency situations, the stairwells are likely to be the only safe passage out of the building. This is not the place to be looking at cost savings and potentially inferior technology. In fact, it should be the exact opposite. Only the best performing motion sensors controlling a bi-level LED fixture made with high quality components built by the company with the most experience in the field should be installed.

Since not all motion sensors work in the same manner extreme care should be put into the product selection process when lighting emergency stairwells. It's important for the specifier or building owner to understand the differences and realize that safety and product performance should be the most important concern over choosing the lowest cost alternatives. First, we should compare the different types of motion sensor technology.



MOTION SENSOR CONTROL OPTIONS

ULTRASONIC SENSORS

Ultrasonic Sensors are active high frequency sensors that generate sound waves in the ultrasonic frequency range, typically around 40 kilohertz (kHz). They use the Doppler effect to detect motion by sending out an inaudible sound wave and listening for that sound wave to bounce back. They should not be thought of as sound detection sensors, and they don't pick up voices or other low frequency sounds. Ultrasonic sensors are ideal for use in areas where detection in the line of sight is not always possible such as stairwells, restrooms, enclosed corridors and in spaces requiring a higher level of sensitivity. One of the main benefits of using these sensors in stairwells and corridors is that strong air movement will be detected by the sensor. This can be the rush of air when a stairwell door is opened which will typically be detected by fixtures on the floors above and below the point of entry. People walking up or down the stairs will be detected even before being able to see the sensor due to the air movement from the person moving through the space. It should be noted that there are some poorly designed luminaires with ultrasonic sensors which are not placed to optimize the detection pattern. Lamar LED's Occu-smart® fixtures are engineered and proven to offer industry leading performance.



MICROWAVE MOTION SENSORS

Microwave motion sensors for lighting applications emit very high frequency microwave signals at approximately 5.8 GHz at a low power level to ensure safety. They are often referred to as HF or High Frequency Sensors. Operating on the Doppler principal, they emit the signal and measure the time taken for the signal to be reflected to the sensor, this is known as the echo time. A person moving into the detection zone causes a disruption in the microwave beam pattern changing the echo time and triggering the lights. Although their detection range can be wide, the frequency is so high that it can detect motion through sheetrock walls, wood, and glass. As such, they should only be used in areas with hard dense surfaces such as concrete or steel. They may also trigger through vibrations such as in a parking garage deck or installed in a chain hung fixture that may move in the breeze from outside. They should not be used in interior spaces with sheetrock walls such as in residential corridors or closets as they will trigger even when a person walks by a closed wood door. They are not as sensitive to air movement as ultrasonic and less likely to detect movement out of the line of sight to the sensor.



PASSIVE INFRARED SENSORS

Passive infrared sensors, commonly referred to as PIR, work by detecting infrared energy within its field of view. Infrared is a form of electromagnetic radiation with wavelengths longer than visible light. Living beings be it human or animal emits some low-level radiation, the hotter something is the more radiation that is emitted. Movement can only be detected once objects enter the field of view or detection area of the sensor.

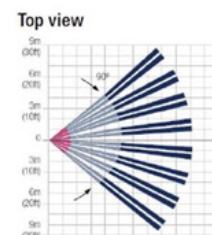
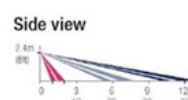


This PIR sensor's domed lens is made up of Fresnel lenses, and manufacturers may offer several different lenses with different detection patterns all using the same internal pyro which is the IR detection element behind the lens. The pyro detects the change in infrared energy which is typically the movement of a person. The sensor will not detect changes in ambient temperature or airflow.

The coverage pattern to the right is an example of a wide range pattern used in lighting applications. The center dark sections are more sensitive to minor motion and the light-colored outer sections will detect major motion. The white areas in between the detection zones are dead zones, and the sensor will typically not be able to detect motion in those areas.



This next sensor pattern to the right is from a wall sensor, and although covering out to 12m, there are wider gaps with potentially no coverage.



ENERGY SAVINGS WITHOUT SACRIFICING SAFETY

The energy savings can be significant when outdated fluorescent lighting is replaced with LED bi-level lighting.

FLUORESCENT T8 FIXTURE
USES 57-62 WATTS
100% OF THE TIME

LED BI-LEVEL FIXTURE
USES ONLY 4-6 WATTS
~97% OF THE TIME

**SAVING UP TO 58
WATTS PER FIXTURE**

FLUORESCENT T8 FIXTURE
COSTS \$98+/YEAR
TO LIGHT*

LED BI-LEVEL FIXTURE
COSTS \$12.50/YEAR
TO LIGHT*
at 10% standby light level using
6 watts during unoccupied times

**SAVINGS OF OVER
\$85/YEAR PER FIXTURE**

As high-rise buildings have at least one fixture per floor, and in many cases a fixture at the mid-landing, replacing outdated stairwell lighting can offer a very timely pay back and continued reduced electrical costs.

The real benefit is that the building is providing a safer path of egress with increased light levels when needed.

**Assuming a cost of 20 cents per kwh, and 23.28 hours per day unoccupied*

SELECTING THE RIGHT SENSOR & LENS

It's quite important to select the correct sensor and lens type based on the desired coverage pattern and characteristics of the detection area. Although PIR sensors may be suitable for corridors and some stairwells, they cannot offer the sensitivity or detection outside of their detection pattern or line of sight.

Bi-level luminaires come in many different configurations and can vary widely in the quality of components, range of adjustments, method of bi-level lighting, and of course sensor type. Methods of bi-level lighting vary from simply switching an LED array on and off to true bi-level control whereby the driver dims the LED array to a low level and the sensor triggers to high. Some units only offer a fixed level such as 50% dimming which does not offer the energy savings of units with variable light levels, typically as low as 5-10%. Some premium units also offer high-end adjustability in case the full output is too high or not needed for the application. Bluetooth programming via a smartphone app makes these programming options very simple and configurable on an individual fixture basis.

Units with PIR sensors tend to be on the lower end of the price range, and those with ultrasonic sensors are at the higher end of the price range with HF sensors falling in between the two. For most stairwell applications, safety over cost should be the primary concern in emergency paths of egress.

Lamar LED's Occu-smart® with ultrasonic technology offers superior detection and performance and should be the first choice when choosing egress stairwell lighting. The latest version now includes broad commissioning and adjustment options with Bluetooth technology and an easy-to-use smart phone app. With these latest advancements, light levels and time delay can be customized for both the occupied and unoccupied modes offering even more options for maximizing both energy savings and safety.

Units with PIR sensors tend to be on the lower end of the price range, but simply cannot offer the range and benefits of a fixture like the Lamar LED Occu-smart® Voyager.

VOYAGER Series | VOL Ultrasonic Motion Detector



“ONE OF THE BEST PRODUCTS WE’VE EVER WORKED WITH.”

We are using Lamar LED's Occu-smart® system in several of our clients' facilities and have been able to increase their lighting levels where needed for both safety and comfort while decreasing their energy consumption. It is undoubtedly one of the best products we have ever worked with.

Bill - Envirolite Systems, Inc.



1150 Motor Parkway Central Islip, NY 11722
631-777-7700 • sales@lamarLED.com • www.lamarled.com