

Occupancy Sensor Microphonics vs. Ultrasonic vs. Microwave Technology

Product: Occupancy Sensors

Article ID: 121423-aa-23

Date: December 12, 2023

Summary: This document defines and compares the different sensing technologies—PIR, ultrasonic, microwave, and microphonics.

Information: Passive Infrared (PIR) sensing technology measures infrared light radiating from objects in its field of view. The same technology can be found in thermal imaging devices such as telescopes, infrared cameras and more. PIR sensors are designed for a variety of small settings like small bathrooms, meeting rooms, and storage closets.

Ultrasonic (U/S) is an active sensing technology and can be used as a standalone sensing technique, facilitating detection in spaces that do not have line-of-sight to motion. U/S sensors detect major and minor motion within a space, making them ideal for applications requiring sensitivity such as offices, libraries, single-stall restrooms, and study areas.

Microwave sensors are active devices that use high frequency waves to detect frequency (Doppler) shifts from motion in a space. They can be mounted in most building materials and work like a radar gun to sense the speed and size of motion. They are designed for installation in a variety of settings including any space used by a multi-tech sensor, behind objects made of plastic or glass, open office cubicles, wall sconces and wall packs, warehouse and conference rooms.

Microphonics is an audio technology that uses a microphone inside of an occupancy sensor to hear sounds indicating occupancy. It is designed to be used in conjunction with passive infrared (PIR) sensing within a space. Microphonics is a passive technology and performs well in spaces that do not have direct line-of-sight to motion, such as open office cubicle areas, multi-occupancy restrooms/bathrooms, conference rooms, filing or storage rooms, alcoves, stairwells, hallways, and corridors.

Advantages and Disadvantages

PIR sensors can detect motion in light and dark spaces and can be used in environments with irregular heat cycles. PIR sensors do require a direct line of sight between the sensor and any motion in a space to function properly. Because of this, PIR sensors cannot be used in open spaces or areas with barriers, walls, or large objects.

Microwave sensors detect slight movement with added benefits over PIR technology. When using microwave sensors, placement and application are key as they do not penetrate metal and objects blowing in the wind can trigger false alarms. Microwave sensors are capable of the following:

- Detecting motion through low density materials and can be mounted inside most lighting fixtures
- Having a wide detection area
- Adjustable time delay and daylight threshold

U/S sensors do not have the extent of interference concerns that microphonic sensors do, which include noise from outside traffic, HVAC rumbles, compressors turning ON/OFF, refrigeration equipment, radios, telephones, alarms, etc. U/S occupancy and motion detection have been multi-technology sensor technology for over 20 years.

Leviton multi-technology PIR and U/S sensors, are also capable of the following:

- **Automatic gain control**—sensors look at the nuisance tripping from PIR and U/S at different times during a 7-day period and make micro-adjustments to enhance operation for optimal energy savings and to prevent false-ON/OFF
- **Auto-adapt time delay**—sensors look at the trigger points in the first 25% and last 25% of a vacancy trigger and make decisions to increase or decrease the time-out period, providing additional energy savings and preventing false-ON/OFF
- **Auto-filter sensitivity**—looks at any consistent nuisance triggers and reduces U/S sensitivity. In addition, set to turn lights OFF in conditions where a PIR trigger is not detected for 31 minutes

Microphonics are a historically proprietary system and not standard in either the lighting or security industries. Microphonics uses advanced technology to distinguish sounds made by humans and ambient noise. It masks out sounds such as HVAC systems, air currents, and more to keep the lights ON when a space is occupied and OFF when unoccupied.

The Leviton multi-technology PIR and microphonic sensors are capable of the following:

- Adapt to the environment by filtering out background noise
- Detects human activity
- Does not require direct line-of-sight
- Uses advanced acoustic filtering to prevent the continued presence of ambient noises such as clocks, radios, and televisions from triggering the sensor

Please reference the appropriate occupancy sensor data sheet for more information.

For more information, contact Leviton Lighting & Controls Technical Support at (800) 736-6682.