White Paper

Dual Technology Sensors

By Bryan Palmer, ETC Architectural Market Manager

Dual technology occupancy and vacancy sensors have become standard specification items for most architectural and commercial projects. While most sensors that implemented a secondary technology were similar early on, there are now multiple technologies used, which offer advantages and disadvantages depending on their use and implementation. This document identifies the common technologies used and where they work best.

Passive Infrared and Single Technology Sensors

When motion detectors were brought to market more than 50 years ago, they were based on Passive Infrared (PIR) technology. This technology was advanced for the time and over the past 50 years the technology has remained relevant.

The general method in which PIR functions is by detecting heat generated by a person or object. This heat signature registers to the emitted IR beam and as that object moves in a space it breaks multiple IR beams to trigger occupancy. Sensors with better higher sensitivity have more IR zones emitted. Because PIR is based on heat and movement, they are mostly immune to false triggering of occupancy.

PIR sensors rely on line of sight for detection and movements that break more than on PIR zone. PIR works well for initial occupancy detection since a person entering a room is a large movement. They can be ineffective and inaccurate at vacancy detection by assuming a room is unoccupied when people are still present but not moving around. They are not always sensitive enough for some applications and are especially prone to issues in large rooms and spaces where people are stationary or produce little movement. For this reason, most modern sensors implement a secondary technology.

Secondary Technologies and Dual Technology Sensors

Dual-technology sensors are commonly built using PIR combined with a second technology. While some advanced sensors utilize newer technology like video, most cost-effective sensors utilize Ultrasonic, microphonic or acoustic technologies because they are cost-effective to deploy. These technologies vary in their acceptance based on how they were implemented by the manufacturer.

Normal functionality utilizes PIR for occupancy detection in a space to turn lighting on, requiring a person to enter a room for detection. Once the lighting is on, both PIR and the secondary technology are used to maintain the occupancy state. Both technologies must report an unoccupied state for the lighting to turn off. For the case where a room is detected vacant and the lighting is turned off with an occupant still present, a grace timer will allow either technology that then detects occupancy within a small time frame (usually 30m seconds) to turn the lights back on while still meeting energy code requirements.

Microphonics

Microphonics utilizes a microphone to listen to sounds in a space actively. This technology is sensitive and can be used in spaces that have partition walls or partial walls that interfere with the line of sight detection required by PIR.

Microphonics uses a setting called gain control to determine the sensitivity of the internal microphone to increase or decrease the detection sensitivity. Some sensors make this adjustment automatically over time to help reduce false detections

Because this method is based on sound, it can also be prone to false detection of occupancy when noises not made by a person are detected within a space. The technology is extremely sensitive, and should commonly be used for vacancy detection only. This means that A Dual Technology Sensors that uses Microphonics will commonly use PIR for occupancy detection, and a combination of PIR and Microphonics detection to determine if the room remains occupied. Using microphonic for initial occupancy detection will commonly result in light turning on in an unoccupied room, or when a person walks past an unoccupied room.

Because Microphonics is a passive technology that listens to a space, it does not emit any noise or frequency into the space like ultrasonic. This reduces the potential for interference and consumes less power for operation.

Ultrasonic

Ultrasonic sensors transmit high-frequency sound waves into a space, which are received back by the sensor and evaluated for Doppler Shift to detect occupancy. Their primary advantage is the ability to detect occupancy over wall partitions and around some corners and solid walls. This significant increase in sensitivity also results in potential false triggers from banners, air current, and small animals. Ultrasonic sensors that are not properly configured can even detect movement through ceilings, into hallways and through windows resulting in false triggering.

Because Ultrasonic sensors are based on an active technology that emits noise into a space, they require more power for operation which reduces their energy-saving capabilities. This noise produces can also cause interference with other sensors and equipment within a space,

Acoustic

Acoustic technology is similar to Microphonics in using a microphone to detect occupancy, however, this technology is tuned to specific frequencies, patterns, and amplitudes that reflect noise that is commonly made by people performing common tasks. This significantly reduces false triggering and detection.

This is an advancement of the microphonics applications that can sometimes be rejected from projects because past experiences have resulted in a sensor that is too sensitive.

ETC offers PIR only and dual-technology sensors in all of our control product lines. Dual technology sensors utilize PIR and Acoustic detection to provide the best performing occupancy sensor possible with extremely precise detection.