

1 General Application Notes

Occupancy sensors use different technologies to detect the presence or absence of people in a space, including passive infrared (PIR), ultrasonic, and dual-technology — each of which has its own advantages and disadvantages. Regardless of which sensor type is selected, it should activate the lights as soon as the person enters the room, but should not monitor the area outside the door to avoid nuisance switching. Additionally, the door swing should not obstruct the view of the sensor.

PIR sensors sense the difference in heat emitted by humans in motion from that of the background space. These sensors detect motion within a field of view that requires a line of sight; they cannot “see” through obstacles and have limited sensitivity to minor (hand) movement at distances typically greater than 15 feet. The sensor is most sensitive to movement laterally across the sensor’s field of view, which can be adjusted.

PIR sensors are most suitable for smaller, enclosed spaces (wall switch sensors), spaces where the sensor has a view of the activity (ceiling- and wall-mounted sensors), and outdoor areas and warehouse aisles. Incompatible application characteristics include low motion levels by occupants, obstacles blocking the sensor’s view, mounting on sources of vibration, or mounting within 6 feet to 8 feet of HVAC air diffusers.

Ultrasonic sensors use the Doppler principle to detect occupancy through emitting an ultrasonic high-frequency signal throughout a space, sense the frequency of the reflected signal, and interpret change in frequency as motion in the space. These sensors do not require a direct line of sight and instead can “see” around corners and objects, although they may need a direct line of sight if fabric partition walls are prevalent. In addition, ceiling-mounted sensor effective range declines proportionally to partition height. They are more effective for low motion activity, with high sensitivity to minor (hand) movement, typically up to 25 feet. The sensor is most sensitive to movement to and from the sensor. Ultrasonic sensors typically have a larger coverage area than PIR sensors. The sensor’s view cannot be adjusted.

Ultrasonic sensors are most suitable for open spaces, spaces with obstacles, restrooms, and spaces with hard surfaces. Incompatible application characteristics include high ceilings (greater than 14 feet), high levels of vibration or air flow (which can cause nuisance switching), and open spaces that require selective coverage (such as control of individual warehouse aisles).

Dual-technology sensors employ both PIR and ultrasonic technologies, activating the lights only when both technologies detect the presence of people, which virtually eliminates the possibility of false-on, and requiring either one of the two technologies to hold the lights on, significantly reducing the possibility of false-off. Appropriate applications include classrooms, conference rooms, and other spaces where a higher degree of detection may be desirable.

A leading cause of application problems is improper coordination between required coverage area and required sensitivity. The designer must determine range and coverage area for the sensor, based on the desired level of sensitivity.

Manufacturers publish range and coverage area for sensors in their product literature, which may be different for minor (hand) motion and major (full-body) motion. Various coverage sizes and shapes are available for each technology. In a small space, one sensor may easily provide sufficient coverage. In a large space, it is recommended to partition the lighting load into zones, with each zone controlled by one sensor. The sensors are networked together by low-voltage wiring. When creating zones, sensor coverage should overlap by 20%.

Proper sensor location ensures the smallest opportunity of nuisance switching, that the lights will turn on as soon as a person enters the space, and that the sensor maintains an unobstructed line of sight to task areas at all times. In addition to location, the sensor must also be oriented. Ultrasonic sensors, for example, should be oriented toward the area of greatest activity in the space. In addition, the designer must determine whether or not the sensor will be installed at the wall switch, wall/corner, ceiling, or task.

Ceiling-mounted sensors are appropriate for large areas that feature obstacles such as partitions, in addition to narrow spaces such as corridors and warehouse aisles. Units can be networked for control of areas that are larger than what can be controlled by a single sensor. These sensors typically present a two to three times higher installed cost than wall switch sensors, but can be very economical if controlling large zones.

High wall- and corner-mounted sensors are similarly appropriate for coverage of large areas that feature obstacles.

Wall switch (wall-box) sensors, relatively inexpensive and easy to install, are appropriate for smaller, enclosed spaces, such as private offices with clear line of sight between sensor and task area.

Commissioning begins during the design process, in ensuring that the right sensor technology was selected, and that it was placed correctly on the plans. For example, if an ultrasonic sensor is placed near a source of high airflow, it can experience false “ONs.” Similarly, if a PIR sensor is placed in such a way that it has a blind spot in part of the room, it will not detect occupancy in that part of the room and produce false “OFFs.”

The first step for the installer in performing field commissioning is to ensure that the wiring connecting the sensor or power pack to the power and loads is correct. Occupancy sensors must be installed according to manufacturer instructions and wiring diagrams. The next step is to verify proper placement and, if applicable, orientation of the sensors, so that they match the specifications and construction drawings.

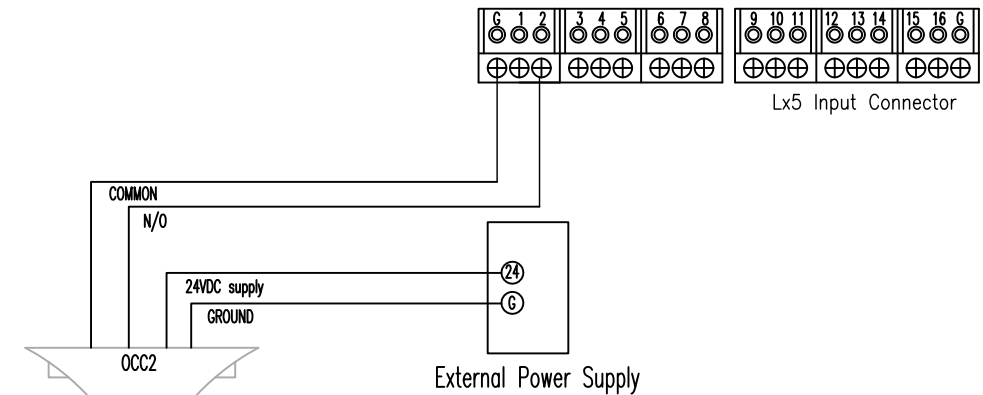
Otherwise, there are two or three possible primary adjustments that may need to be tuned in the field. This should be coordinated with furniture placement, as occasionally furniture or equipment may be moved or relocated, which can affect sensor placement and/or orientation.

1. The *time delay* provides control of the time in which the sensor will turn off the load after the room is unoccupied. While a lower time delay offers more energy savings, it might cause occupant dissatisfaction if the lights prematurely turn off. A longer time delay offers more assurances that the light will not turn off if there is little activity in the room. Generally, a 15-minute delay is recommended.
2. The *sensitivity setting* allows the installer a way of controlling the range and sensitivity to movement of the sensor.
3. The *light level setting*, available with models that offer a daylight-switching feature, allows the installer to hold off turning on the electric lights if the daylight level in the room is adequate.

The project may use self-calibrating and self-adaptive sensors, which automatically adjust their delay and sensitivity settings over time.

After commissioning is completed, users should be told about the intent and functionality of the controls. This is critical because if users do not understand the controls, they will complain and attempt to override or bypass them. Documentation and instructions should be given to the owner’s maintenance personnel so that they can maintain and re-tune the system as needed.

2 Lx5 Inputs – Dry Contact Typical for 4-wire Occupancy Sensor

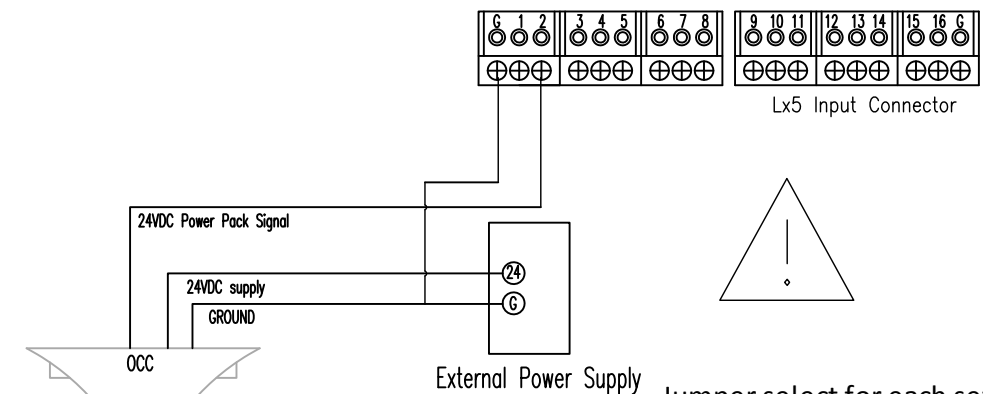


Wiring Recommendations:

Gauge: 18 AWG (non-twisted, un-shielded wire only)

Maximum Distance: 500 feet of wire between Input Connector and sensor location

3 Lx5 Inputs – Power Pack Input Typical for 3-wire Occupancy Sensor



Jumper select for each set of eight inputs must be dry or wet contact type, mixing wet and dry contacts on the same set of eight is not allowed. External voltage must be between 12 and 24 VDC.

Wiring Recommendations:

Gauge: 18 AWG (non-twisted, un-shielded wire only)

Maximum Distance: 1,000 feet of wire between Input Connector and sensor location



1800 Sandy Plains Ind. Pkwy., Suite 216
Marietta, Georgia 30066
Ph: 770-790-4880 Fax: 770-790-4883
<http://www.BRTINT.com>

Product: Occupancy Sensor Details

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Rev.	Date	By	Description

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