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Occupancy Sensors

Introduction

The International Energy Conservations Code (IECC) and ASHRAE standard 90.1 require an automatic shutoff of all lighting for buildings larger than 5,000 sq. ft. and all spaces to have a device to control the lighting with manual-on or auto-on to 50% or less. Occupancy sensors are one way to achieve this goal.

Energy used by artificial lighting is significant in the building's total energy consumption. Occupancy sensors, when appropriately specified, installed and commissioned, can offer a wide range of energy reduction. Appropriate applications for occupancy sensors to control lighting include private offices, classrooms, copy rooms, restrooms, storage areas, conference rooms, warehouses, break rooms, corridors, filing areas, and other similar spaces which are intermittently occupied.

A power strip with an occupancy sensor placed under a workstation can be set to automatically shut down nonessential devices -- such as a task light -- when the user steps away from the desk. Occupancy sensors can also be used to turn off equipment not in use.

Available Technologies

Currently there are four available technologies for occupancy sensors

- Passive Infrared (PIR) – These sensors are designed to detect motion from a heat-emitting source such as a person within its field-of-view and automatically switch lights ON and OFF. Since these are line-of sight sensors, the sensor must be able to have a direct line-of-sight to the person making the motion.
- Ultrasonic (US) – Ultrasonic sensors use the Doppler principle. These sensors produce low intensity, inaudible sound and detect changes in sound waves caused by motion. They are volumetric in nature and therefore not line-of-sight dependent. They are much more sensitive to smaller motions.
- Dual Technology – Dual technology is the combination of PIR and US into one sensor and is the ultimate sensing solution available today. This pairing helps to eliminate false activations (both ON and OFF) thus saving additional energy use. Dual Technology sensors ensure the greatest sensitivity and coverage for tough applications without the threat of false triggers.
- MicroSet Self-adjusting Technology - Continuously adjusts to conditions by adjusting sensitivity and time delay in real-time. By adjusting sensitivity and time delay automatically, the sensor is maximizing the potential energy savings that are available.

Key Aspects for Design and Construction

For successful implementation of automatically controlling lighting using occupancy sensors, following design and construction aspects should be considered.

- Choosing the sensor technology – Appropriate sensor technology should be specified based on the best way to sense the presence of a person entering the space.
- Coverage pattern – Manufacturer provided coverage patterns should be used to decide number of sensors.
- Location of the sensor(s) - Based on technology chosen, sensor(s) should be located such that there are no false activations.
- Specification of required features – Features such as line voltage, self-calibration, manual-on-off operation, bi-level switching, daylight switching, combination dimmer/occupancy sensor, isolated relay and connectivity to digital network, etc. should be specified based on the application.
- Installation and Commissioning – Occupancy sensors should be installed per manufacturer's installation instructions. Commissioning should verify the following items.
  - Proper wiring connections
  - Placement and orientation of sensors match the specification and drawings
  - Settings such as time delay, sensitivity to movement or light level sensitivity may require adjustment
- User training to minimize overriding controls - often times the users are not informed of all the features of the occupancy sensors. Due to this reason users override the automatic controls and the energy savings to be realized as planned are lost.

Lessons Learned

Following lessons learned are from observations at construction sites and information from manufacturers.

- Professional installers are needed for proper installation and commissioning.
- Open areas should have adequate number of sensors so the entire space is adequately covered.
- Installers must carefully select the location based on furniture layout.
- If sensitivity is turned down during commissioning or re-commissioning, the time delay should be increased to compensate for the reduced sensitivity.

Conclusion

By choosing the appropriate occupancy sensor technology based on the application and placing them in the right location, considerable energy can be saved.

References

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