This design and application guide will help you in selecting, laying out, specifying, installing and commissioning a switch sensor lighting management solution.

14 Detailed design steps for implementing room controller - 2 outputs

16 Products selection chart

17 Legrand lighting management solution overview

Legrand experts are available for design support and assistance. Do not hesitate to contact your local office.
Although there are several steps involved in implementing sensor controls (outlined on the following pages), this flow chart offers a quick way to determine which sensor technology is best for your application.
Following these rules help to ensure that the sensors work effectively, providing comfort for occupants while saving money for the facility. Be sure to review the following pages for detailed product selection guidance.

**Do**

- Use ultrasonic sensors in areas screened by partitions or furniture
- Use PIR in enclosed spaces
- Create zones controlled by different sensors to manage lighting in large areas
- Use dual technology sensors for areas with very low activity levels
- Install sensors on vibration-free, stable surfaces
- Position sensors above or close to the main areas of activity in a space
- Integrate sensor use with other control methods (i.e. time scheduled control)
- Educate occupants about the new devices and what to expect

**Don’t**

- Use ultrasonic sensors in spaces with heavy air flow/air conditioned
- Install ultrasonic sensors in spaces where the ceiling height exceeds 4 m
- Use PIR sensors in spaces where there are fixtures or furniture that obstruct a clear line of sight
- Install sensors within 2 to 3 metres of HVAC outlets or heating blowers
- Control emergency or exit lighting with sensors
- Install PIR sensors in spaces where there are extremely low levels of occupant motion
Switch Sensors - 1 output

Identifying the ideal sensor for a particular application involves the consideration of several factors that are equally critical to an effective lighting management solution.
Step 1 - Evaluate space characteristics

Space characteristics

To evaluate the application’s characteristics, designers should become familiar with:

- Room/space size and shape
- Location(s) of occupant activity and non-activity
- Location of walls, doors, windows and drapes
- Ceiling height
- Partition height and location
- Location of shelves, book cases, file cabinets, and large equipment
- Large objects that would block or alter a sensor’s coverage
- Location of HVAC ducts and fans
- Areas with available sunlight for added light level sensing
- Location of desk/workspace – orientation with regards to walls, partitions and other obstacles

Special attention should be paid to high levels of vibration and/or air flow, extreme temperature conditions, and unusually low levels of activity because these issues may help identify the best technology solution.
Step 2 - Match technology to application

### Passive infrared (PIR) technology
Passive infrared technology detects occupancy by reacting to infrared energy sources, such as a human body, in motion.

### Ultrasonic (US) technology
The sensor emits ultrasonic sound waves that bounce off objects in the covered space, and then measures the amount of time it takes for the waves to return.

### Dual technology (DT)
Sensors that employ PIR + US sensing technologies are usually referred to as “dual technology”. Our Dual technology ensure maximum sensitivity and coverage in tough applications for optimal reliability and energy saving.

The matrix below summarizes these technologies and the space characteristics that would favour the use of one technology over another. Also use the flow chart on Page 3 to help determine which technology is ideal for your application.

<table>
<thead>
<tr>
<th>Coverage type</th>
<th>Passive infrared sensors</th>
<th>Ultrasonic sensors</th>
<th>Dual technology sensors</th>
</tr>
</thead>
<tbody>
<tr>
<td>Best applications</td>
<td>- Line of sight</td>
<td>- Volumetric</td>
<td>- Complete coverage</td>
</tr>
<tr>
<td></td>
<td>- Cut off</td>
<td>- No clear cut off</td>
<td>- Cut off</td>
</tr>
<tr>
<td></td>
<td>- Enclosed offices where sensors can have a clear view of the entire area</td>
<td>- Enclosed offices, larger conference rooms</td>
<td>- Classrooms</td>
</tr>
<tr>
<td></td>
<td>- As a wall switch replacement</td>
<td>- Areas up to 150 square metres that can be considered enclosed</td>
<td>- Computer rooms</td>
</tr>
<tr>
<td></td>
<td>- Areas with high air flow A/C: computer rooms, laboratories, cold rooms, etc</td>
<td>- Storage areas with cabinets and shelving</td>
<td>- Large conference rooms</td>
</tr>
<tr>
<td></td>
<td>- Warehouses, hallways, high-ceiling-mount applications</td>
<td>- Bathrooms (ultrasonic waves will bounce off the partitions)</td>
<td>- Open office spaces with defined aisles</td>
</tr>
<tr>
<td></td>
<td>- Areas that require direct line-of-sight viewing</td>
<td>- Open office spaces and areas that require 360° coverage</td>
<td>- Lunchrooms</td>
</tr>
<tr>
<td></td>
<td>- Spaces that need to mask off unwanted detection in certain areas</td>
<td>- Hallways that are completely enclosed</td>
<td>- Areas with high ceilings</td>
</tr>
</tbody>
</table>

| Poor applications | - Bathrooms [sensors cannot see in the partitioned areas] | - Spaces that have lots of air turbulence | - Spaces with high levels of air flow |
|                   | - Open office space with ceilings under 4 metres, requiring 360° coverage | - Areas that requires ceiling mounting heights over 4 metres | - Warehouses |
|                   | - Larger enclosed spaces - the infrared zones get to be too large | - Spaces that are not considered enclosed | |
|                   | - Areas where storage areas, cabinets and shelving can block the view | - Spaces with areas of unwanted detection | |
|                   | - Areas where very small motions must be sensed | - Spaces with high ceilings | |

**NOTE**

“Cut off” refers to the ability to clearly define or limit sensor coverage so that detection capability will not intrude into adjacent spaces.
**Step 3 - Design and specify the project**

**Coverage patterns**

**Select coverage patterns**

A coverage size and shapes is available for each sensor technology. While a small application is easily covered with one sensor, larger applications benefit from grouping controlled lighting into zones (with each zone controlled by a sensor). Familiarity with these coverage patterns will help designers specify the right product, ensuring the greatest sensor accuracy and occupant comfort. The matrix below summarizes the coverage patterns for each technology.

<table>
<thead>
<tr>
<th>Technology</th>
<th>Mounting / Shape</th>
<th>Detection range</th>
<th>Length (m)</th>
<th>Coverage zone</th>
</tr>
</thead>
<tbody>
<tr>
<td>PIR</td>
<td>Ceiling mount</td>
<td>360°</td>
<td>2.5 m</td>
<td>25 m²</td>
</tr>
<tr>
<td></td>
<td>Corner mount</td>
<td>180°</td>
<td>2.5 m</td>
<td>45 m²</td>
</tr>
<tr>
<td></td>
<td>Outdoor</td>
<td>360°</td>
<td>2.5 m</td>
<td>45 m²</td>
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<td>Outdoor</td>
<td>270°</td>
<td>2.5 m</td>
<td>180 m²</td>
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<td>US</td>
<td>Ceiling mount</td>
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<td>DUAL TECH</td>
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<td>Corner mount</td>
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For a proper light control it is recommended to place the detector at a maximum distance equal to twice the height of the window. Example: for a ceiling height of 2.8 m and a maximum window height of 2.5 m, the sensor should be placed at a maximum distance of 5 m from the window.
Example (Dual technology coverage)
In a large space, such as a large hall, dual technology sensors provide coverage that suits the variable level of motion present. Here, 2 x Cat.Nos 488 06 (Dualtech ceiling mount switch sensor) with 360° coverage, welcome desk area 1 and waiting area 2.
Cat.No 488 07 (PIR ceiling mount switch sensor) completes the coverage and controls the stairs area 3 (movement area).

Do occupants engage in major motions, such as walking, or fine motions, such as typing or reading? Coverages change depending on motion type.

Example (Ultrasonic coverage)
In an open, partitioned office, designers select ultrasonic sensors. To adequately cover the entire space, multiple sensors are positioned to cover a specific zone.

When creating zones of coverage, such as the coverage illustrated in the example above, take care to ensure that sensor coverages overlap by 20%.
Step 3 - Design and specify the project

Product features

Lighting designers should also consider specific features, which can add functionality and flexibility to the control solution.

Vacancy/Occupancy mode selection
Most of Legrand sensors can work using occupancy mode (by default) or vacancy mode.

Occupancy mode means that lights are automatically turned on or off according to occupancy.

Vacancy mode means that lights are manually turned on and automatically turned off. The vacancy mode offers extra energy savings.

Walk-through Mode
For extra energy savings, walk-through mode switches lights off three minutes after an area is initially occupied if no motion is detected after the first 20 seconds. This function is activated by default.

When enabled, this function works in the following manner: when a person enters the room, the lights go ON. If the person leaves the room within 20 seconds, the sensor will turn the lights OFF 3 minutes after the initial detection. If the person stays in the room longer than 20 seconds, the set time delay of the sensor applies.

Alerts
Audible alerts warn occupants of impending shutoff. Audible alerts preventing lights to turn off on the occupant to comply with design for all rule.

High performance lens
High-performance detection with IR lens Fresnel technology. Injection moulded lens, using IR 4 material

Smart factory set
Legrand ceiling mount sensors are shipped with factory pre-set. This function assures the constructor and investor that the sensor will provide energy savings as soon as it is installed without any commissioning. The factory pre-sets are:

<table>
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<tr>
<th>Time</th>
<th>Lux</th>
<th>Sensibility</th>
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<tbody>
<tr>
<td>15'</td>
<td>500</td>
<td>PIR 100%, ΔT (PIR 100%, US 75%), US (75%)</td>
</tr>
<tr>
<td>Wall</td>
<td>300</td>
<td>PIR 100%, ΔT (PIR 100%, US 75%)</td>
</tr>
</tbody>
</table>

Of course these settings are adjustable using commissioning tools.

Daylight set point = Regulation

The light level feature holds lighting OFF when natural light levels rise above a pre-set level. This setting is adjustable and can be overridden. This function is enabled by default.

Calibration
For precise lux measurement, most Legrand sensors permit to modify the lux seen by the sensor with commissioning tools, as the colour of the floor, the furniture etc... have an influence on the lux measurement.

Test mode
Test mode allows to check and modify the coverage pattern of the sensor.

Zero crossing
Zero Crossing Circuitry ensures that switch sensor switching takes place at the beginning of the voltage wave very close to zero volts. This reduces stress on the relay and increases sensor life.

ZigBee® communication
In renovation, it is sometimes difficult to make a vertical cabling between the wiring devices and the sensor. To meet this specific requirement, Legrand offers detectors equipped with technology ZigBee®. This makes it easy to connect your control devices to your sensors without any wiring!

ZigBee®: Radio communication protocol

Terminal wiring
Legrand sensors offer several types of terminal wiring to make installation quick and easy:
- Automatic terminal for single relay sensor.
- RJ 45 connectors for a sensor in combination with a room controller.

IP
To comply with all installation and environment constraints, LEGRND sensors offer a wide range of IP Protection IP 20, IP 42 & IP 55

Low profile
Many applications call for lighting controls that don’t take up a lot of space and that leave the ceiling looking uncluttered. Legrand sensors are designed to be extremely low profile and compact.
Step 4 - Installation and commission

Mounting configuration

Legrand switch sensors are available in two basic mounting configurations:

Ceiling mounting

All sensors have built-in bracket systems that enable ceiling mounting. Most sensors are suitable for standard EU boxes (diam 65). This is important for applications where the ceiling is unavailable for sensor installation. Only one Cat.No for two ways of mounting.

Wall mounting

Wall mount sensors have a mounting base. For easy and quick mounting the base has to be fixed against the wall, the wires connected to the automatic wiring block. Then the sensor part is fitted onto the base.
Step 4 - Installation and commission

Sensor placement, installation and settings

Sensor placement
Installers should position the sensor so it has the best view of the entire coverage area. Care should be taken to minimize the possibility of false ONs or OFFs due to sensor location. For instance, an ultrasonic sensor should not be positioned near an open doorway, since a passer-by could trigger lighting ON.

Installation
When installing the sensor, the contractor should wire it according to manufacturer’s instructions to eliminate any functional problems or sensor damage.

Settings
Most sensors feature Smart Factory Set technology, adjustments are typically not needed after installation.

If adjustments need to be made (due to last minute changes in furniture or fixture placement), sensitivity and time delays should match the activity levels of the monitored spaces.

Two commissioning tools can be used to adjust settings:

For standard configuration:
- Time level: 3, 5, 10, 15, 20 mn
- Lux level: 20, 100, 300, 500, 1000 lux
- Occupancy, occupancy walkthrough, vacancy, modes
- PIR & US detection sensibility: low, medium, high, very high
- test mode

For advanced configuration:
This commissioning tool enables a very precise commissioning of your sensors.
- Time: from 0 seconds to 60 mn
- Lux: from 1 lux to 1275 lux
- Detection mode: occupancy, occupancy walkthrough, vacancy modes
- PIR & US detection sensibility: low, medium, high, very high
- It also provides access to advanced functions such as calibration, alarms, choice of mode of detection [initial detection, maintain detection, retrigger], daylight function
- It also allows to download sensor parameters, to save these parameters in folders, to duplicate them
Room controller - 2 outputs

When you need to cover a large zone or control 2 outputs (2 lighting circuits or 1 lighting circuit and of fan system 1 circuit) the SCS sensors can be combined with room controllers. This association allows to command more than one output and offers a finer degree of control over the different loads in a building.

The room controller is a key component of the lighting control system. It provides low voltage power to SCS sensors. Several sensors, can be linked (up to 10). Only one Cat.No for several applications.

Product features

- Screw terminal block
- Auxiliary input for manual control by simple push
- 1 RJ 45 input for SCS sensors
- 16 A outputs for lighting and FAN

Daylight function control

The room controller offers the possibility to enable the daylight function on 2 outputs or only 1 output. This option allows you to create 2 control zones in the same room. For example in a classroom the window side is managed by daylight brightness and presence. The corridor side is managed according to presence only.

Occupancy / Vacancy mode selectable

This room controller also provides the possibility to control 1 output manually and the other automatically.

Mounting options

Room controllers can be mounted on cable tray or directly in the false ceiling.

2 wiring possibilities

- Standard
  To control 2 outputs on the same line.
- > 2 lines powered
  For security reason lights have to remain ON even if a problem occurs. With this configuration, if line 1 breaks output 1 will be turned off but not output 2 as it is powered by line 2.
### DESIGN STEPS FOR INSTALLATION | ROOM CONTROLLER

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(1) NA: Not Applicable

ZigBee®: ZigBee® certified product with Manufacturer Specific Profile
**Putting a stop to energy waste**

Our vision at Legrand is to provide products and services that make buildings more energy-efficient. We are committed to ‘putting a stop to energy waste’.

Legrand offers two types of solutions and proposes related services to ensure that your lighting management project saves energy and helps the environment.

Switch sensors

**WHY IMPLEMENT LIGHTING MANAGEMENT?**

Lighting is a significant consumer of energy in commercial buildings.

- 20% of total site energy is consumed by lighting in commercial buildings.
- Lighting is the first electricity end-user in a commercial building with up to 40% electricity consumed.

Each year, more organisations implement lighting management because they recognise its wide range of benefits:

- Energy savings
- Economic savings
- Code compliance
- Sustainability building practice

**REQUIREMENTS FOR IMPLEMENTING LIGHTING MANAGEMENT**

**Mandatory requirements**

Standards on energy savings

European Standard EN15193 provides a guideline for the energy performance of lighting systems. Legrand has chosen this standard as a basis to demonstrate the energy performance of its lighting solutions. This standard is widely recognized and provides a calculation methodology on energy savings according to the type of solution installed, the type of building and the type of room.

Putting a stop to energy waste

Legrand is committed to providing customers with comprehensive, transparent information on actual savings for its lighting management solutions: saving on energy + Green House Gas (GHG) emissions avoided. Look for this information in our best practice literatures.

**Voluntary programmes**

Green Building programmes

Green Building is an approach to building that considers the overall environmental impact of a building as well as the health and well-being of its occupants. Green Building programmes are voluntary, consensus-based programmes that provide guidelines. These programmes generally have an associated rating tool for assessing the environmental performance of the building and certifying its compliance with the standard. Green Building certification is awarded to differentiate sustainable building projects and give them credibility. Major Green Building programmes include LEED, BREEAM, HQE and GREEN STAR.

**HOW TO IMPLEMENT LIGHTING MANAGEMENT?**

Lighting management strategies

Lighting management strategies refer to the basic method that will be used to control lighting systems. This will include automatic operation of the lighting, taking into account the needs of the space’s occupants:

- Occupancy-based control
- Scheduled control
- Daylighting control
- Dimming control

Lighting management technologies

Lighting management technologies refer to the actual device that will be used to implement a specific strategy and the method the device will use to operate (passive infrared, ultrasonic or dual technology sensors, timers or dimmers).

**LIGHTING MANAGEMENT PRODUCTS & SYSTEMS**

Switch sensors

- 1 output controls
- 2 outputs dimmers & actuators

BUS/SCS systems

- room controllers software & accessories
- sensors radio & zigbee accessories

**RELATED SERVICES**

Local support

Our sales representatives are available to assist with all aspects of a lighting management project. Services include building walk-through, training, payback analysis reports and product demonstrations.

Technical support

Telephone technical support from our dedicated team offers personal guidance for application-related questions, installation assistance or troubleshooting.

Field services

Factory-trained assistance during the critical startup and commissioning stages to ensure optimal system performance.

Don’t hesitate to contact us.

*Energy end-use distribution greatly varies depending on the activity of the building and across geographical and climate regions
(Source : Energy Information Administration, USA)