

# Switch sensors

## Design & installation Guide



PUTTING A STOP TO ENERGY WASTE

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

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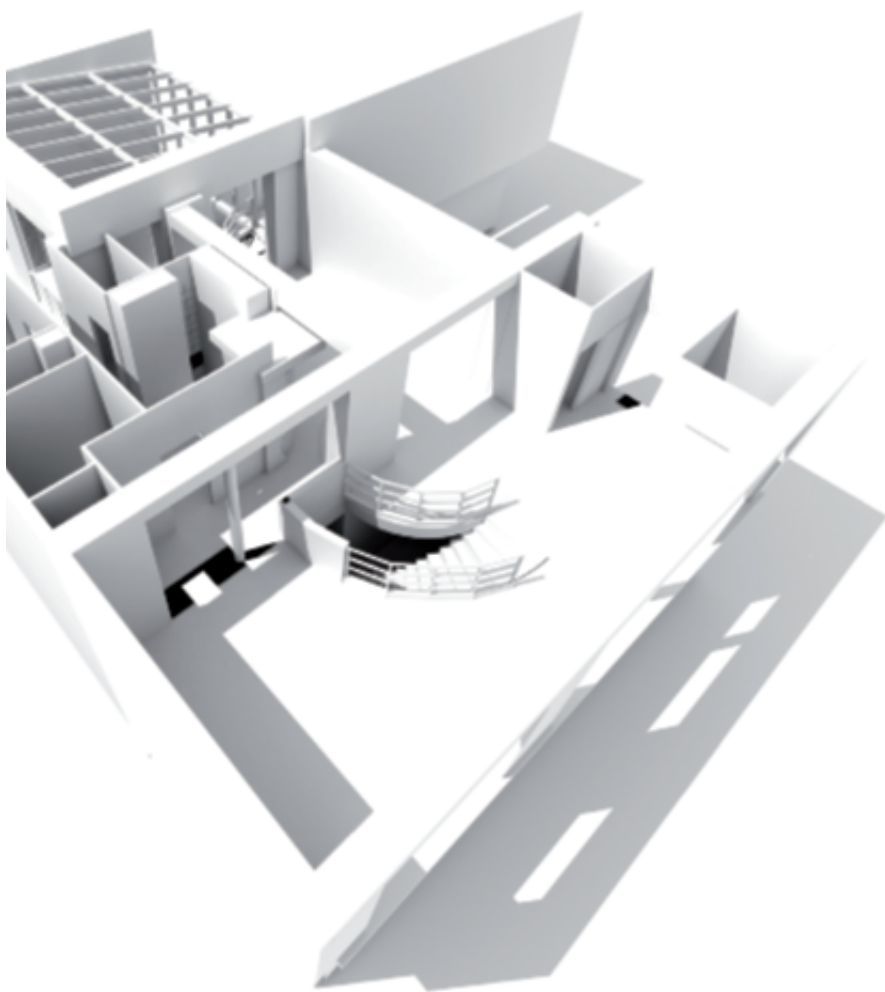
### **Detailed design steps for implementing room controller - 2 outputs**

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Legrand lighting management solution overview



## FLOW CHART

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

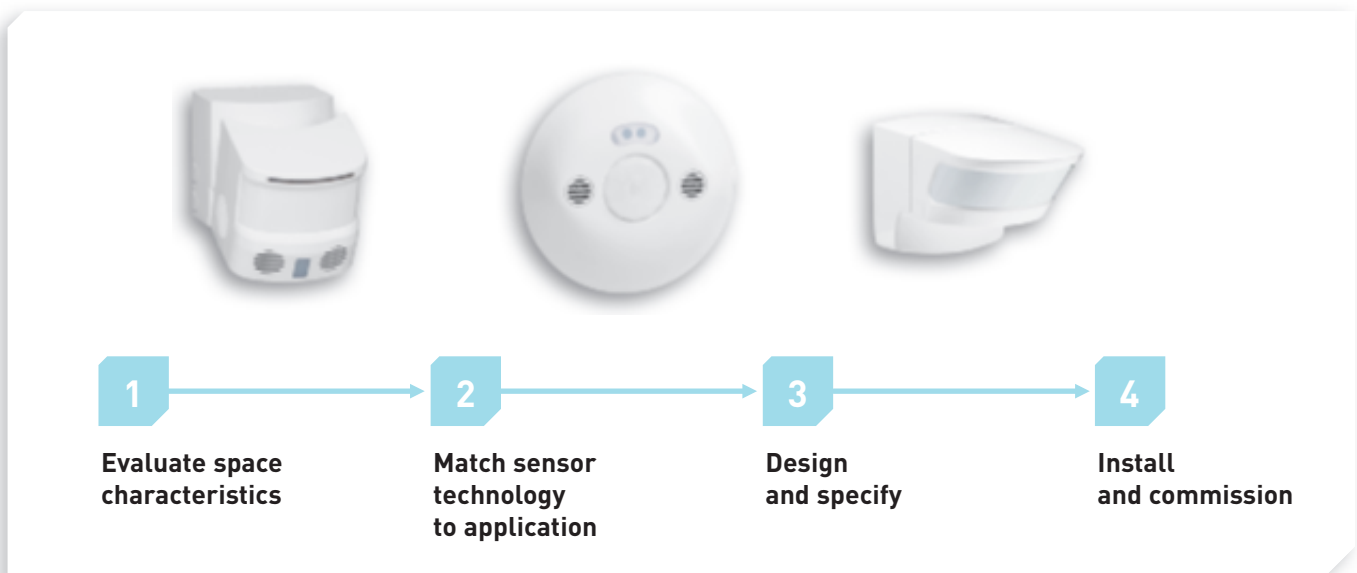
- Use ultrasonic sensors in areas screened by partitions or furniture
- Use PIR in enclosed spaces
- Create zones controlled by different sensors to manage lighting in large areas
- Use dual technology sensors for areas with very low activity levels
- Install sensors on vibration-free, stable surfaces
- 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

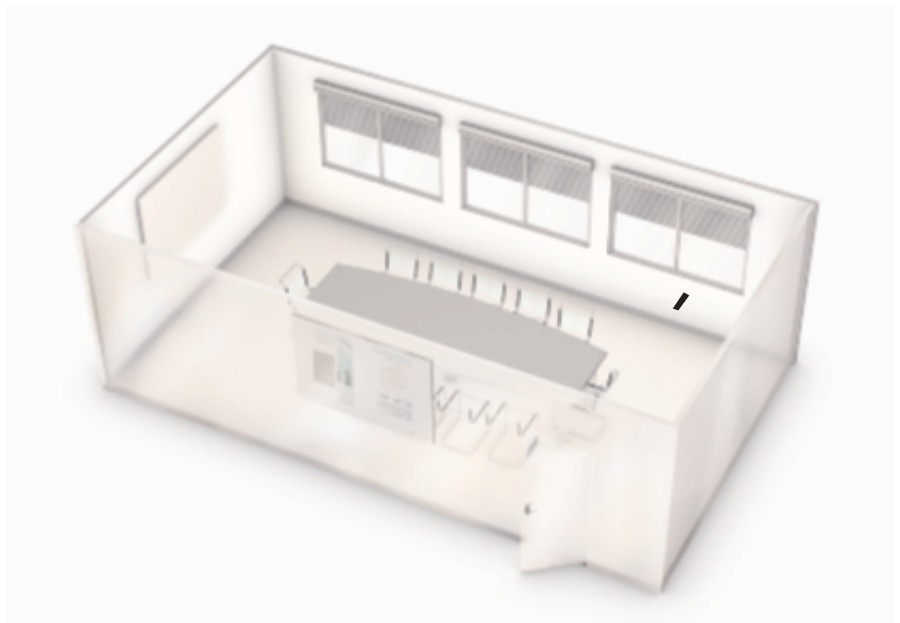
Location of shelves, book cases, file cabinets, and large equipment

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



### TIP !

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.

	Passive infrared sensors	Ultrasonic sensors	Dual technology sensors
Coverage type	<ul style="list-style-type: none"> <li>- Line of sight</li> <li>- Cut off</li> </ul>	<ul style="list-style-type: none"> <li>- Volumetric</li> <li>- No clear cut off</li> </ul>	<ul style="list-style-type: none"> <li>- Complete coverage</li> <li>- Cut off</li> </ul>
Best applications	<ul style="list-style-type: none"> <li>- Enclosed offices where sensors can have a clear view of the entire area</li> <li>- As a wall switch replacement</li> <li>- Areas with high air flow A/C: computer rooms, laboratories, cold rooms, etc</li> <li>- Warehouses, hallways, high-ceiling-mount applications</li> <li>- Areas that require direct line-of-sight viewing</li> <li>- Spaces that need to mask off unwanted detection in certain areas</li> </ul>	<ul style="list-style-type: none"> <li>- Enclosed offices, larger conference rooms</li> <li>- Areas up to 150 square metres that can be considered enclosed</li> <li>- Storage areas with cabinets and shelving</li> <li>- Bathrooms (ultrasonic waves will bounce off the partitions)</li> <li>- Open office spaces and areas that require 360° coverage</li> <li>- Hallways that are completely enclosed</li> </ul>	<ul style="list-style-type: none"> <li>- Classrooms</li> <li>- Computer rooms</li> <li>- Large conference rooms</li> <li>- Open office spaces with defined aisles</li> <li>- Lunchrooms</li> <li>- Areas with high ceilings</li> <li>- Areas requiring 100% cut-off and/or small motion sensing</li> <li>- Spaces with low motion levels by occupants</li> </ul>
Poor applications	<ul style="list-style-type: none"> <li>- Bathrooms (sensors cannot see in the partitioned areas)</li> <li>- Open office space with ceilings under 4 metres, requiring 360° coverage</li> <li>- Larger enclosed spaces - the infrared zones get to be too large</li> <li>- Areas where storage areas, cabinets and shelving can block the view</li> <li>- Areas where very small motions must be sensed</li> </ul>	<ul style="list-style-type: none"> <li>- Spaces that have lots of air turbulence</li> <li>- Areas that requires ceiling mounting heights over 4 metres</li> <li>- Spaces that are not considered enclosed</li> <li>- Spaces with areas of unwanted detection</li> <li>- Spaces with high ceilings</li> <li>- Spaces with high levels of vibration or air flow</li> </ul>	<ul style="list-style-type: none"> <li>- Spaces with high levels of air flow</li> <li>- Warehouses</li> </ul>

## 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



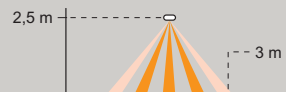


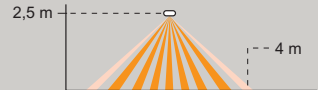

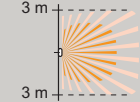
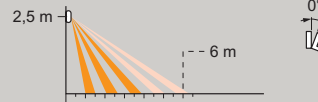

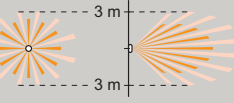
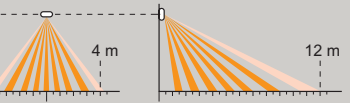


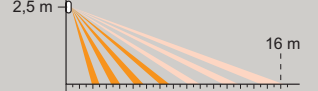


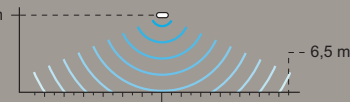


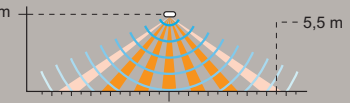

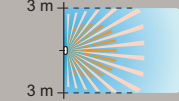
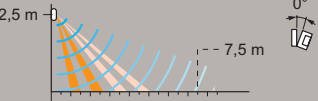
### Coverage patterns

#### 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.

Technology	Mounting / Shape	Detection range	Length (m)	Coverage zone
PIR	 Ceiling mount small size	360° 		25 m <sup>2</sup>
	 Ceiling mount	360° 		45 m <sup>2</sup>
	 Corner mount	180° 		45 m <sup>2</sup>
	 Outdoor	360° 		45 m <sup>2</sup>
	 Outdoor	270° 		180 m <sup>2</sup>
US	 Ceiling mount	360° 		150 m <sup>2</sup>
DUAL TECH	 Ceiling mount	360° 		90 m <sup>2</sup>
	 Corner mount	180° 		90 m <sup>2</sup>

#### NOTE

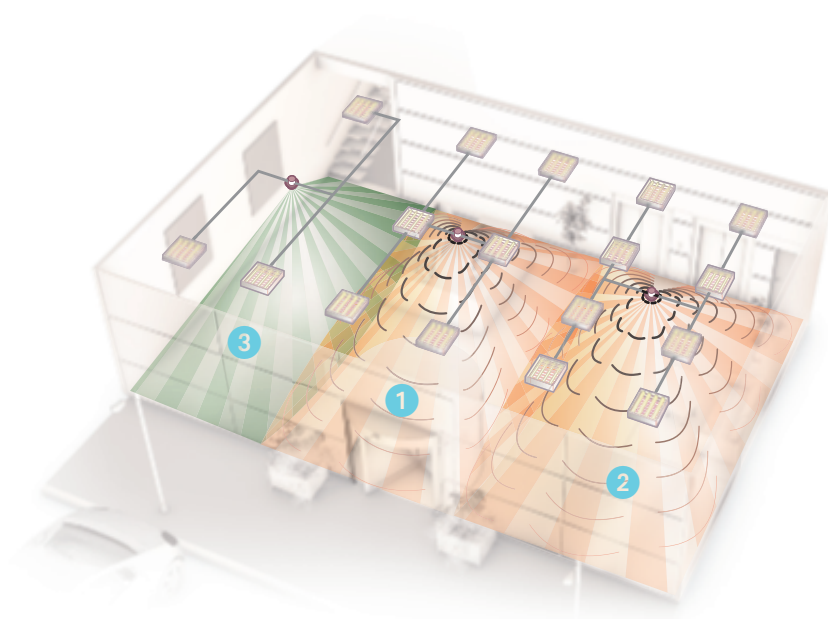
For a proper light control it is recommended to place the detector at a maximum distance equal to twice the height of the window. Example: for a ceiling height of 2.8 m and a maximum window height of 2.5 m, the sensor should be placed at a maximum distance of 5 m from the window.



### 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).

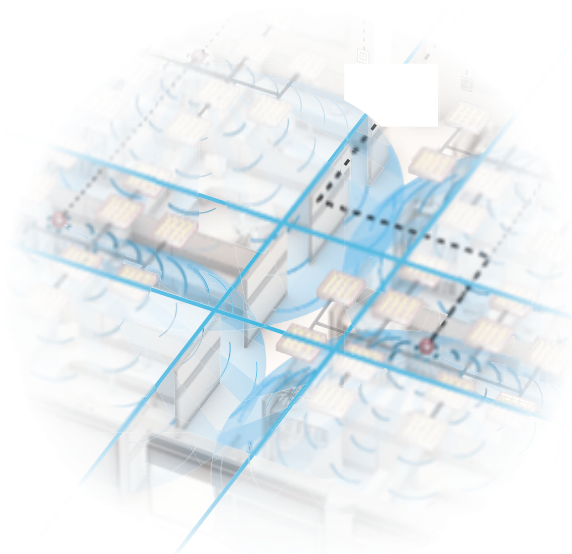


### TIP !

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.



### TIP !

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:

	Time	Lux	Sensibility
Ceiling mount sensors	15'	500	PIR 100% , $\Delta T$ (PIR 100%, US 75%), US (75%)
Wall mount sensors	15'	300	PIR 100% , $\Delta T$ (PIR 100%, US 75%)

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 LEGRAND 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

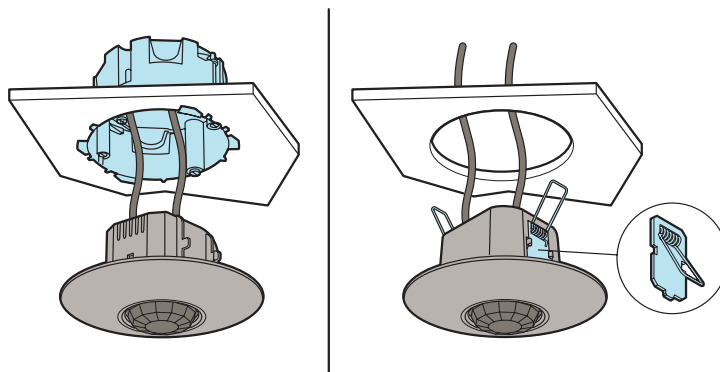
### Mounting configuration

Legrand switch sensors are available in two basic mounting configurations:

#### Ceiling mounting



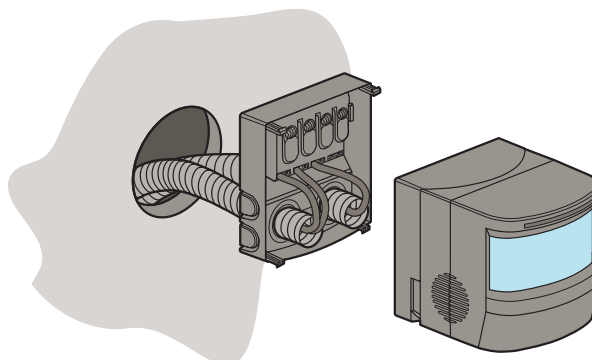
All sensors have built-in bracket systems that enable ceiling mounting. Most sensors are suitable for standard EU boxes (diam 65). This is important for applications where the ceiling is unavailable for sensor installation. Only one Cat.No for two ways of mounting.



#### 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:



Cat.No 882 35

- 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:



Cat.No 882 30

- 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

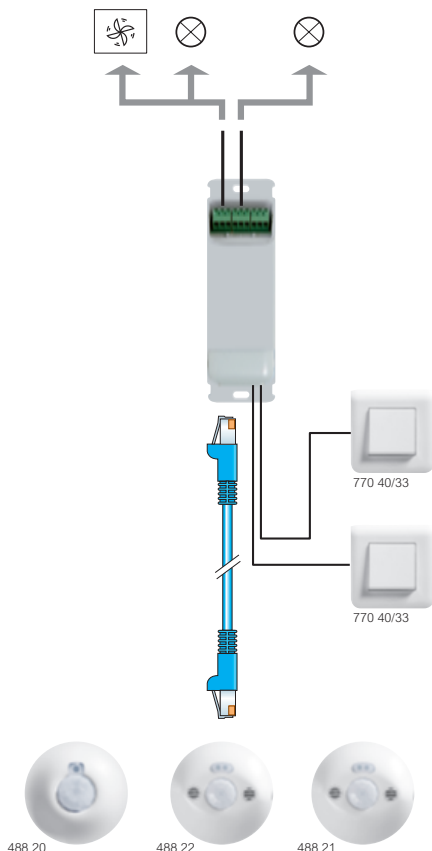
# Room controller - 2 outputs

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

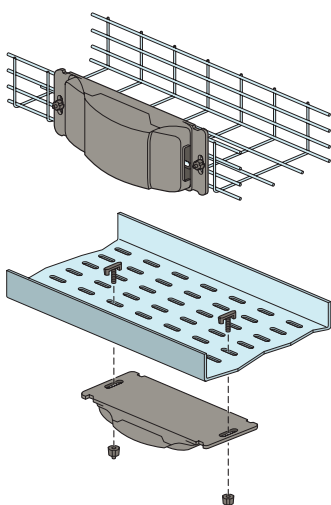
The room controller offers the possibility to enable the daylight function on 2 outputs or only 1 output. This option allows you to create 2 control zones in the same room. For example in a classroom the window side is managed by daylight brightness and presence. The corridor side is managed according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

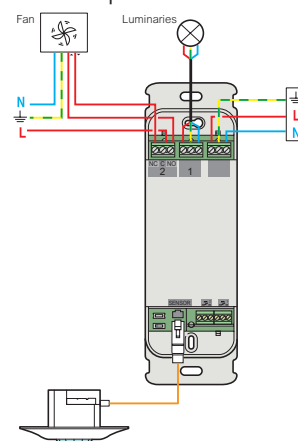
Room controllers can be mounted on cable tray or directly in the false ceiling.



## 2 wiring possibilities

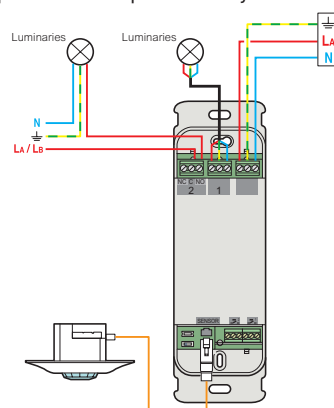
### > Standard

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

Relay	Coverage	Mounting	Techno	IP	A	Terminal wiring	Configuration	Factory smart set	Occupancy	Occupancy + walkthrough	Vacancy	Daylight function	Alerts	Test mode	Cat.Nos
1	45 m <sup>2</sup>	wall & ceiling	PIR 	55	8.5	screw	trim pot	NA <sup>(1)</sup>	✓	NA <sup>(1)</sup>	NA <sup>(1)</sup>	NA <sup>(1)</sup>	NA <sup>(1)</sup>	NA <sup>(1)</sup>	697 40
	45 m <sup>2</sup>	ceiling	PIR 	20	8.5	auto block	trim pot + basic com tool	NA <sup>(1)</sup>	✓	✓	✓	✓	✓	✓	488 01
	45 m <sup>2</sup>	ceiling	PIR 	20	8.5	fast connection	trim pot + basic com tool	NA <sup>(1)</sup>	✓	✓	✓	✓	✓	✓	488 02
	45 m <sup>2</sup>	ceiling	PIR 	20	8.5	auto block	trim pot	NA <sup>(1)</sup>	✓	NA <sup>(1)</sup>	NA <sup>(1)</sup>	NA <sup>(1)</sup>	NA <sup>(1)</sup>	NA <sup>(1)</sup>	488 03
	45 m <sup>2</sup>	ceiling	PIR 	20	8.5	fast connection	basic & advanced com tool	✓	✓	✓	✓	✓	✓	✓	488 07
	45 m <sup>2</sup>	ceiling	PIR 	20	8.5	auto block	basic & advanced com tool	✓	✓	✓	✓	✓	✓	✓	488 08
	45 m <sup>2</sup>	wall	PIR 	42	8.5	auto block	trim pot	NA <sup>(1)</sup>	✓	NA <sup>(1)</sup>	NA <sup>(1)</sup>	NA <sup>(1)</sup>	✓	NA <sup>(1)</sup>	488 11
	90 m <sup>2</sup>	ceiling	DUALTECH 	20	8.5	auto block	basic & advanced com tool	✓	✓	✓	✓	✓	✓	✓	488 06
	150 m <sup>2</sup>	ceiling	US 	20	8.5	auto block	basic & advanced com tool	✓	✓	✓	✓	✓	✓	✓	488 05
	180 m <sup>2</sup>	wall	PIR 	55	8.5	auto block	basic & advanced com tool	✓	✓	✓	✓	✓	✓	✓	488 10
ZigBee®	90 m <sup>2</sup>	ceiling	DUALTECH 	20	8.5	auto block	basic & advanced com tool	✓	✓	✓	✓	✓	✓	✓	488 35
	180 m <sup>2</sup>	wall	PIR 	55	8.5	auto block	basic & advanced com tool	✓	✓	✓	✓	✓	✓	✓	488 14
	180 m <sup>2</sup>	wall	PIR 	20	8.5	-	basic & advanced com tool	NA <sup>(1)</sup>	✓	✓	✓	NA <sup>(1)</sup>	NA <sup>(1)</sup>	✓	488 31
2	45 m <sup>2</sup>	ceiling	PIR 	20	16	RJ 45	basic & advanced com tool	✓	✓	✓	✓	✓	✓	✓	488 50 + 488 20
	45 m <sup>2</sup>	wall	PIR 	42	16	RJ 45	basic & advanced com tool	✓	✓	✓	✓	✓	✓	✓	488 50 + 488 24
	90 m <sup>2</sup>	ceiling	DUALTECH 	20	16	RJ 45	basic & advanced com tool	✓	✓	✓	✓	✓	✓	✓	488 50 + 488 22
	90 m <sup>2</sup>	wall	DUALTECH 	42	16	RJ 45	basic & advanced com tool	✓	✓	✓	✓	✓	✓	✓	488 50 + 488 23
	150 m <sup>2</sup>	ceiling	US 	20	16	RJ 45	basic & advanced com tool	✓	✓	✓	✓	✓	✓	✓	488 50 + 488 21
	180 m <sup>2</sup>	wall	PIR 	20	16	RJ 45	basic & advanced com tool	✓	✓	✓	✓	✓	✓	✓	488 50 + 488 30

[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

100-240 Vac 50/60 Hz



## BUS/SCS systems

BUS | SCS 27 V



## 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 level control



Vacancy-based 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).



PIR technology



Ultrasonic technology



Dual technology

## LIGHTING MANAGEMENT PRODUCTS & SYSTEMS

### Switch sensors

1 output



2 outputs



### BUS/SCS systems

controls



dimmers & actuators



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 projects. 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.



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