Deploying wireless integrated sensors for proper LED lighting: SensiLUM

Steve Taranovich - September 05, 2018

Lighting in commercial facilities can be very costly. There has been an ever-growing demand to lower costs by switching from incandescent lighting (sorry Edison!) to fluorescent lighting, also known as compact fluorescent lights (CFLs). One concern has always been Mercury in fluorescent lighting, albeit a small amount currently. If you break one of these bulbs, the Environmental Protection Agency recommends these steps for cleanup.

LED lighting

Enter the LED. Facility managers are always looking for ways to increase building efficiency and the IoT is here with great solutions.

There are so many good LED lighting companies in the market today. It’s no problem to find a great variety of LED light bulb solutions in the market arena. I am particularly impressed with Osram solutions that provide not only the LED light itself, but LED solutions like light ambience and spatial atmosphere, longevity and energy efficiency for offices, schools, hotels, leisure facilities, garages, warehouses, and retail space.

Osram brings together high quality and state-of-the-art technology for professionals, offering rapid installation and refurbishments with low mounting complexity because existing mounting points can still be used. The latest LED light technologies bring up to 85% less energy consumption. This company has pioneering technology ranging from control via an app to motion-sensitive outdoor lighting.

The wireless integrated sensor

A critical part of a successful luminaire design and deployment in a building are wireless integrated sensors that will enable the IoT. Each individual lighting device in an area becomes a data node on a
lighting system network. This enables the harvesting of critical data for the safe, successful, and efficient deployment of a modern lighting system (Figure 1).

![Figure 1](image.png)

**Figure 1** Every luminaire is a data point or node due to the wireless integrated sensor (Image courtesy of Osram)

The lighting system data is collected and processed for such amenities as simple control strategies like the adjustment of light levels in response to daylight and also dimming and switching lighting on or off depending on occupancy status. Future capabilities of such data, from each wireless integrated sensor, can be used for a range of operational activities, such as emerging non-lighting smart building applications like space optimization, conference room booking, desk hoteling, wayfinding, and other features that will emerge as this system matures with new developments in the future.

**SensiLUM**

In this article, I want to focus upon Osram’s SensiLUM, a multi-featured wireless integrated sensor. This device enables occupancy detection, daylight harvesting, and individual or group control of luminaires. SensiLUM is compatible with the [Encelium extend networked light management system (LMS)](https://www.enceleum.com/) (Figure 2).
DEXAL is an industry standard, bi-directional communication interface for power and data. It enables bi-directional communication between the LED driver and any device like SensiLUM or Lutron, etc., but the other parties would have to provide the software for their device. This enables wireless luminaire control and wireless data exchange between the luminaire and the cloud software or something like Osram’s Encelium Polaris 3D.

What kind of data do we need? Let’s look at a large building or space where the building manager wants to know how the lighting system is performing. Using DEXAL, we can see power consumption down to the luminaire level if needed. DEXAL drivers can power SensiLUM over the DEXAL+ and DEXAL- ports on the driver with no extra wires for power needed, or alternatively using the AUX output on the 0-10V drivers (Figure 3).
You could see driver temperature, which would help in assessing system performance and efficiency. Operating hours and the all-important fault conditions and diagnostics can also be seen (Figure 4).

The driver has internal memory where it would store all of this information. You can use Polaris 3D software or third party software to crunch that data for such things as periodic maintenance or when you are reaching end of life of a particular luminaire. All of these can be assessed through DEXAL.

SensiLUM can be used with one luminaire, up to four DEXAL luminaires, or up to 10 0-10V luminaires. Some applications could be occupancy sensing with a passive infrared (PIR) sensor, daylight harvesting, or DEXAL could access all the data points.

SensiLUM sensors have 0-10V dimming control or can use DEXAL control options. The DEXAL interface option enables bi-directional communication and power between the driver and the SensiLUM sensor; this makes it ideal for smart building applications that require exact luminaire-specific data, including power consumption, temperature profile, operating hours, and diagnostics.

**Communication**
Communication

This product enables wireless control of luminaires using the Zigbee wireless protocol. It also has a sensor for PIR detection and occupant detection as well as a photosensor for daylight harvesting. With Zigbee, the sensors can talk to the other sensors and the signal bounces back and forth. The back-end of all of this connects to a wireless wall station where you can control the system or use a wireless manager feed, which is connected to a server.

In older buildings with pipes in the ceiling and sheet metal above a drop ceiling, the wireless range may be slightly less, so it is recommended that the system be tested. Installers will need to see the instruction manual.

Digital data points in the ceiling

Osram’s goal in doing all of this was to turn every luminaire into a data point. Typical wireless data in the ceilings has one wireless sensor per conference room mounted in the ceiling and multiple across a floor in a building. However, using SensiLUM, you can have a sensor in every luminaire that allows the end user more flexibility.

Power drivers

How does SensiLUM integrate with the whole system? SensiLUM needs power and Osram makes those power drivers. SensiLUM can control the LED driver and can automatically detect the difference between an analog 0-10V LED driver and a DEXAL driver based on wiring. No additional settings are needed.

Mechanical features

SensiLUM fits into a ½-inch industry standard knockout in the luminaire; no screws are needed. I really like the simplicity of installation as well as the solid mounting design (figures 5 and 6).

Figure 5 SensiLUM installation (Image courtesy of Osram)
SensiLUM sensors, along with wall stations, communicate to a wireless manager. There can be multiple wired or wireless wall stations and multiple SensiLUM sensors tied to the wireless manager. Wireless managers today can support up to 100 nodes, including wall stations, sensors, and other control devices.

If there are multiple floors or a large floor plan you can use multiple managers (Figure 7).

SensiLUM features

SensiLUM has a unique mechanical shutter which helps avoid false triggering. One of the most common issues in optical sensing is false detection. If the sensor is installed in a high traffic zone, high activity in the area can give false triggering. The mechanical shutter can be adjusted to negate any false triggers. This was a customer ‘pain point,’ so Osram implemented it (Figure 8).
There is a small antenna on the device for extended wireless range and it is about as thin as a human hair so it’s just about invisible when the device is installed into a ceiling tile (Figure 9). These devices are amazingly small and light.

Figure 8 Main features of SensiLUM (Image courtesy of Osram)

Figure 9 The SensiLUM hair-thin antenna on the lower right side of the device is not very visible to the eye when installed in a ceiling tile. The mechanical shutter can be seen in this image as well. A small screwdriver can easily adjust it to the appropriate level. (Image courtesy of Osram)
Emergency and safety rating operation

SensiLUM is one of the very few sensors on the market that can support emergency operation. It is UL 924 listed for control of emergency lighting. UL 924 states that upon loss of power to the building, there needs to be at least one emergency fixture. Osram offers emergency LED drivers that look like the standard driver but can operate in an emergency mode.

It is also UL 2043 rated, the standard for fire test for heat and visible smoke release for discrete products installed in air-handling spaces.

End-of-line testing

Testing is important to ensure proper operation in the field along with making sure the luminaire manufacturer has wired the system securely. SensiLUM has a built-in end-of-line testing protocol, so that each time you cycle power to the luminaire, it goes through a defined test cycle:

- Upon power cycle, the luminaire turns ON and reaches its full lumen output.
- The sensor then cycles through the entire dimming range starting from 100% output level to OFF* two times. This confirms that the sensor is receiving power and is able to communicate the 0-10V dimming signals to the power supply.
- The blinking of the red LED on the sensor is also an indicator that the sensor has not been paired with an active network and that it is actively scanning for open networks. The end-of-line testing routine repeats at each power cycle.

An alternative way to test the sensors at a contractor’s job-site is the Osram key FOB test tool for field contractors.

- Osram Wiring Test Tool (FOB Key)
  - Luminaires in the vicinity will follow a pre-programmed OFF/ON/DIM Down/Up sequence
  - Occupancy is indicated by blinking red LED. Pattern is LED ON for 20 seconds; OFF for 10 seconds. This pattern is repeated as long as status is occupied. The sensor also incorporates an RGB LED to allow for future use cases (such as indicating by color which spaces require cleaning).

Most competitors do not have 60ºC ambient rating, meet UL 924 emergency, have adjustable field-of-view, and the small size that SensiLUM has.

Use cases

Space optimization: You can install plenty of SensiLUM sensors, but they are smart, and they don’t all need to be on when rooms are not occupied.

Daylight harvesting: For example, on a cloudy or rainy day, adjust lighting levels to save energy. Proper lighting fosters better productivity.

Localized and zone control of space: You can have one wall station controlling lights in one room or use the software to control the entire building.

The overall energy savings funds the investment of smart lighting. Going from incandescent or fluorescent to LED is a big savings, but adding a smart system is a new level of savings.
Steve Taranovich is a senior technical editor at EDN with 45 years of experience in the electronics industry.

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