

## Daylight Harvesting based on EnOcean Finished Products

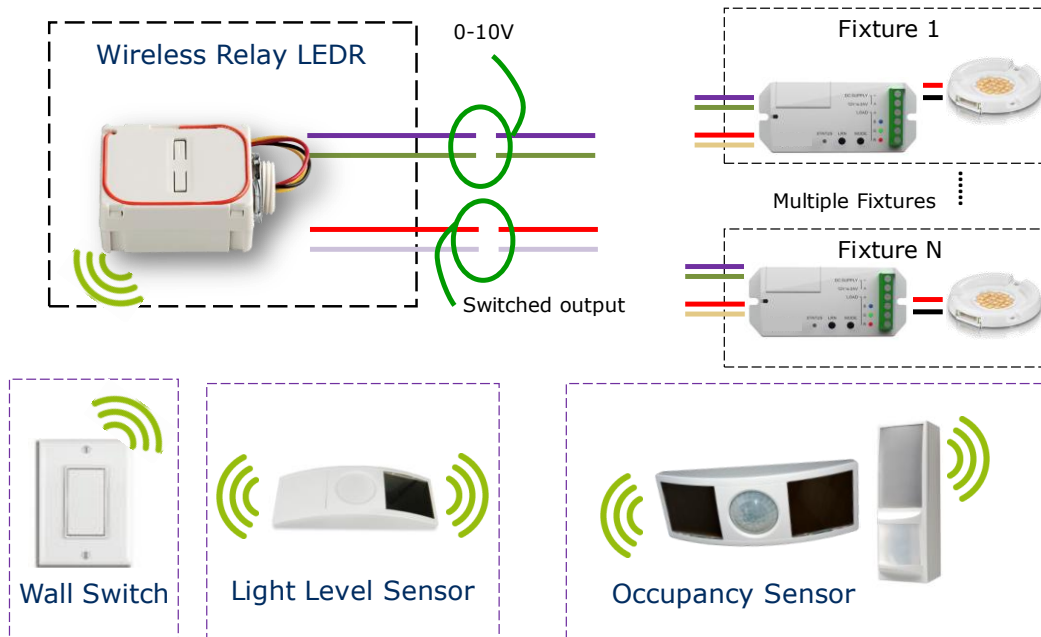
**Daylight harvesting is a great way to combine energy savings, cost savings, and physical and mental well-being of workers in a building. Lighting control systems employing this technique measure natural light available in a building and only add as much artificial light as necessary. With the new LED controller LEDR, EnOcean adds a key component enabling daylight harvesting to the offering of finished products.**

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### Overview

Worldwide about 20% of the total energy production is used for electric lighting. With a modern lighting control system it is possible to save about 20-30% in a typical building. Daylighting is required by an increasing number of industry standards such as ASHRAE 90.1-2010 or governmental energy code requirements such as Title 24 in California.

### EnOcean-based daylight harvesting system



An EnOcean-based daylight harvesting system consists of a wireless relay controller LEDR, one or more energy harvesting wireless occupancy sensors, a light level sensor, and one or more wall switches as shown in the figure above. The controller communicates via the EnOcean radio standard in 902 MHz. This allows setting up a system using maintenance-free batteryless sensors and switches which are highly flexible to position.

LEDR receives the wireless telegrams from all linked switches and sensors and adjusts its outputs accordingly. It provides a switched output for the supply of connected loads as well as a 0-10V control output to dim connected loads. Multiple fixtures can be daisy-chained, e.g. 20 each 30W fixtures or 10 each 60W fixtures.

## Operating Modes

LEDR supports several operating modes. In a very simple configuration only light (rocker) switches will be connected. In this case there is only manual control of the lights. If desired, it is possible to configure an auto-off timer, which turns the lights off after a certain amount of time as usually used in stairways.

In another scenario only occupancy sensors will be connected to LEDR. In this case the system will automatically switch on the lights when occupancy is detected and switch off after a while if no motion is sensed. It is also possible to set values different from 100% and 0% for "on" and "off" state. In this case the signal from the occupancy sensor can be used to switch between a high and a low illumination level, for example a minimum dim level of 40% in hallways where some minimum illumination is required for safety purposes.

If occupancy and rocker switches are connected, the system defaults to manual on via the switches and automatic off via the occupancy sensors. Light will be automatically turned back on if occupancy is detected within a certain period after an auto off event. In the same way as above it is possible to define values different from 100% and 0% for "on" and "off" based on occupancy sensor signals. In this case the occupancy sensor can be used to switch between a high and a low illumination level and the switch can be used to switch lights off completely. Employing EnOcean's Navigan remote commissioning software, it is also possible to configure the system to auto on, auto off.

In more advanced scenarios a light level sensor is added to the system configuration. In this case daylight harvesting with open loop dimming is activated. In an open loop dimming system, the light level sensor detects the amount of available daylight and needs to be positioned facing a skylight or window. The lighting controller will then only add as much artificial light as needed. In the simple (default) configuration the system will then switch between two levels, a minimum dimming level and a maximum dimming level, depending on light levels reported by the light level sensor and of course based on signals from occupancy sensors and switches.

In addition it is possible to set up a more sophisticated daylight harvesting scenario which supports continuous dimming based on five sampling points which can be defined via Navigan remote commissioning software.

In all cases "switching" between two illumination levels does not occur instantly. Illumination will smoothly change via ramp speeds which can be configured independently for manual changes via rocker switches and automatic changes based on sensor signals.

## Setup Interface

LEDR only provides a very simple manual user interface for configuration and linking of devices. The setup interface has two buttons, LRN and DIM. LRN has a corresponding 2-color LED (green, red). This simple interface is used to link and unlink sensors and switches, to dim up and down manually, and to set the minimum dimming value.

## **Navigan Remote Commissioning**

More advanced settings, such as thresholds, dimming levels, ramp speeds, or timers have to be changed wirelessly via EnOcean's Navigan remote commissioning interface. Employing a Windows-based laptop computer equipped with a remote commissioning tool consisting of a Navigan USB stick and PC-software, an installer can locate wireless devices throughout the facility, create links, and configure settings in the LEDR over the air, without physical access to the LEDR.

## **Central Controller**

It is also possible to link LEDR up to a central controller or – via a gateway – to a building automation system like BACnet. With telegrams from the central controller it is possible to override all other logic, for example to turn off or dim all LEDRs at set times or holidays.

## **Demand Response**

Electrical generation may not always meet peak energy demand requirements. In this case utilities can impose load shedding in affected areas in order to prevent blackouts. LEDR supports such load shedding on reception of a demand response telegram and will reduce the light's output level accordingly. After the demand response timeout it will automatically return to the previous state.

## **Repeater Function**

The EnOcean lighting control solution employs a robust 902 MHz transceiver ideally suited for installation in commercial buildings, residences and industrial facilities. For applications requiring extended range, or to increase redundancy of signals, the LEDR provides the option to activate a one or two level repeater function for EnOcean radio telegrams in order to optimize radio coverage in a building. This function has to be used with care – in environments with too many repeaters system performance may also go down.

## **Outlook**

Another product coming soon is the LEDD, an LED controller with 0-10V output but without an internal relay. An increasing number of LED drivers are now supporting the provision of a 12V auxiliary supply voltage output. LEDD will be supplied by the output of such a driver and feed back the 0-10V control signal. This makes LEDD a very cost attractive solution as it will neither need an internal relay nor an internal 110V-277V power supply.