

# EnOcean Occupancy Sensor Operational Description

Revision 1.2

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## REVISION HISTORY

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## Introduction

This document describes the operation of the EnOcean Wall and Ceiling Occupancy Sensors.

The Occupancy Sensors main purpose is to detect a person's motion via a PIR sensor and transmit this information wirelessly using The EnOcean Radio Protocol. The Occupancy Sensors are solar powered and have special requirements for power up and charging of the onboard energy storage capacitors. In order to save energy the sensors are usually in a low power sleep mode and only wake up periodically or in response to certain events in order to transmit the appropriate telegram.

The sensors transmit the EnOcean Equipment Profile (EEP) A5-07-01 as defined by EnOcean Alliance. In addition to occupancy state, the sensors transmit the voltage on the long term storage capacitor to inform the receiver about situations with insufficient power supply where the occupancy sensor might stop working.

The sensors include a walk test mode to validate the sensors ability to detect occupancy and a light level test to determine the suitability of an installation location.

## User Interface

The user interface consists of two buttons and three LEDs.

The button with no indent is the "Menu" button; the button with the indentation is the "Set" button.

A green LED is located adjacent to the link button and a red LED is adjacent to the test button. These two LEDs and an additional red LED beneath the lens provide user feedback from the sensor.

## Startup Mode

Startup is defined as the transition from a sensor not operating to a sensor operating due to an increase in energy available allowing the circuitry to operate.

This mode occurs when the sensors are removed from their initial packaging or after the sensors had been operating under insufficient light level.

As soon as the sensor powers up, it will start-up the motion sensor circuit and wait for a period of 120 seconds to allow the motion sensor circuit to stabilize. After that, the occupancy sensor is in operation mode as described below.

## Operating Mode

The occupancy sensor is in operating mode after it has successfully been initialized (as described above) and for as long as sufficient power (generated from ambient light and stored within the internal energy store) is available.

### *Linking (learning in) the occupancy sensor*

Pressing the menu button in normal operating mode will transmit a link (learn, teach-in) telegram. The green (link) LED will blink to indicate that a link telegram has been sent.

This link telegram identifies the ID of the occupancy sensor and the EnOcean Equipment Profile (EEP) used by the sensor (EEP A5-07-01). Based on this information, the receiver can properly react to subsequent data telegrams from the occupancy sensor

### *Occupancy Detection and Transmission*

If the occupancy sensor detects occupancy for the first time (after a period without occupancy) then it will immediately transmit of a data telegram indicating the detected occupancy.

After that immediate initial transmission, the sensor will continue to transmit data telegrams indicating the detected occupancy every two minutes for as long as occupancy is detected.

### *Unoccupied Transmission*

If - after a period with detected occupancy - the sensor does not detect occupancy anymore for 10 minutes then it will send a data telegram indicating that no occupancy is detected.

If the sensor still does not detect occupancy after another 20 minutes, a second data telegram will be transmitted indicating that no occupancy is detected. After that, no additional data telegrams will be sent to indicate that no occupancy is detected.

### *Heartbeat Transmission*

The occupancy sensor transmits its current status regularly (“heartbeat transmission”) during periods where no occupancy is detected. This mechanism allows the receiver to verify that the occupancy sensor is working properly.

The heartbeat transmission starts after the second data telegram has been transmitted which indicated that no occupancy is detected. It will continue indefinitely until occupancy is detected or the sensor has no more energy to operate.

The heartbeat transmission stops as soon as occupancy has been detected and the corresponding data telegram has been sent.

Heartbeat transmission functionality is optional and disabled by default. Enabling this functionality will reduce the operation time of the sensor without power supplied by ambient light (“dark time”).

### *LED blink on motion transmission (Red LED under PIR lens)*

The red LED underneath the PIR lens can blink whenever motion is transmitted. This feature is disabled by default.

### *Manual triggering of a data telegram transmission*

Pressing the set button in normal operating mode will cause the occupancy sensor transmit a data telegram which indicates the detected occupancy status and the supply voltage level of the energy store as defined by EEP A5-07-01.

The green LED will blink to indicate that the data telegram has been sent.

### *Walk Test Mode*

In walk test mode, the red LED and the lens LED will blink when motion is detected. Occupied and unoccupied telegrams are sent with a motion lockout and heartbeat of two seconds while in walk test mode.

To enter walk test mode, press and hold the set button when the sensor is in normal operating mode.

After five seconds of holding down the set button, the red LED and the lens LED will begin to blink. Release the set button while these LEDs are blinking and walk test mode will be entered.

The occupancy sensor will now transmit a data telegram indicating the occupancy sensor every two seconds. If occupancy is detected then the red LED underneath the PIR lens will blink to provide visual feedback.

After 180 seconds of entering walk test mode, it will automatically timeout and return to normal operating mode. Pressing either the teach button or the test button will force walk test mode to exit.

Walk test mode is only possible if the energy store is charged above 2.8V. Otherwise, the red LED will blink once immediately after holding the set button and walk test mode cannot be entered.

### Light Test Mode

Light test mode enables the installer to determine the approximate light level at the current location in order to choose a suitable installation location. The light level is indicated by means of blinking of the green, red and lens LEDs together.

To enter light test mode, press and hold the set button for 10 seconds when the sensor is in normal operating mode.

After five seconds of holding down the set button, the red LED and the lens LED will begin to blink (same as for entering walk test mode). Continue to press the set button for five more seconds until the green LED also begins to blink. Release the set button when the green LED is blinking and light test mode will be entered.

In light test mode the red, green and lens LEDs will blink a certain amount of times to indicate the amount of current being harvested from the solar panel.

Every second a pattern of 0-5 blinks will be shown. The number of blinks corresponds to a range of a reference current being provided by the solar cell as outlined in the table below.

Supply Current (I)	Number of Blinks
$I < 5\mu\text{A}$	0
$10\mu\text{A} > I \geq 5\mu\text{A}$	1
$20\mu\text{A} > I \geq 10\mu\text{A}$	2
$40\mu\text{A} > I \geq 20\mu\text{A}$	3
$80\mu\text{A} > I \geq 40\mu\text{A}$	4
$I \geq 80\mu\text{A}$	5

Installation in four and five blink areas is recommended to ensure proper charging of the energy storage system.

After 180 seconds of entering light test mode, it will automatically timeout and return to normal operating mode. Also pressing either the menu or the set button will cause the occupancy sensor to exit light test mode.

Light test mode is only possible if the energy store is charged above 2.8V. Otherwise, the red LED will blink once immediately after holding the set button and light test mode cannot be entered.

## Configurable functions

The occupancy sensors have two configurable functions:

- Lens LED blink on motion transmission
- Unoccupied heartbeat transmissions every hour

Both functions are disabled by default to save energy.

### *Changing the parameter settings*

The menu button is used to enable or disable the function by holding and releasing the menu button for a given time.

Changing parameter settings is only possible if the energy store is charged above 2.8V. Otherwise, the red LED will blink once immediately after holding the menu button and configuration mode cannot be entered.

Feedback about the updated status is given after releasing the menu button. Three blinks from the green link LED means the option is enabled while three blinks from the red test LED means the option is disabled.

<b>Function</b>	<b>Time to hold menu button</b>	<b>Visual Indicator to release menu button</b>	<b>Visual feedback on current setting</b>
Blink lens LED on telegram transmission	3 seconds	Green LED blinks once	3 blinks green: Enabled 3 blinks red: Disabled
Heartbeat telegram transmission	5 seconds	Green and red LEDs blink once	3 blinks green: Enabled 3 blinks red: Disabled

### *Lens LED blink on motion transmission (Red LED under PIR lens)*

To enable / disable the lens LED blinking on motion transmission, press and hold the menu button for 3 seconds (only the green LED will blink once after 3 seconds). Release the button immediately after the LED blink.

After that, the occupancy sensor will indicate the current LED blink on motion transmission setting as follows:

- LED blink on motion transmission enabled: 3 blinks from green LED
- LED blink on motion transmission disabled: 3 blinks from red LED

### *Heartbeat Transmission*

To enable / disable heartbeat transmission, press and hold the menu button for 5 seconds (both green and red LEDs will blink once after five seconds). Release the button immediately after the LED blink.

After that, the occupancy sensor will indicate the current heartbeat transmission setting as follows:

- Heartbeat transmission enabled: 3 blinks from green LED
- Heartbeat transmission disabled: 3 blinks from red LED

## Telegram specification

### *Link Telegram*

The occupancy sensor transmits link (teach-in) telegrams identifying the manufacturer as EnOcean (0x00B) and the EEP as A5-07-01. The content of the link telegram as follows:

Data Byte 3: 0x1C

Data Byte 2: 0x08

Data Byte 1: 0x0B

Data Byte 0: 0x87

### *Data Telegram (Occupied, Unoccupied and Heartbeat Telegram)*

The occupancy sensor transmits data telegrams according to EEP A5-07-01. Unused data fields are set to 0x00. The content of the data telegram is as follows:

Data Byte 3: Super Capacitor Voltage Level 0-250 (0-5V)

Data Byte 2: Not used (set to 0x00)

Data Byte 1: 0xFF (occupied) or 0x00 (unoccupied and heartbeat)

Data Byte 0: Not used (set to 0x00)