

ENOCEAN STM 550 / EMSI AS TABLE/SEAT OCCUPANCY SENSOR IN BUILDING SPACE UTILIZATION MANAGEMENT

EnOcean STM 550 / EMSI as table/seat occupancy sensor in Building Space Utilization Management

REVISION HISTORY

Version	Author	Reviewer	Date	Major Changes
1.0	CB		14.06.2021	First draft

Additional helpful information:

https://www.enocean.com/en/products/enocean_modules/iot-multisensor-emsia-oem/
<https://www.enocean.com/en/products/multisensor/>
<https://www.enocean.com/en/products/enocean-software/enocean-tool/>
https://youtu.be/rfqTBIPfd_Q
<https://www.enocean.com/en/applications/iot-solutions/>
<https://blog.enocean.com/the-internet-of-things-from-the-sensor-to-the-application-via-the-cloud/>
<https://www.enocean-alliance.org/>
<https://www.enocean-alliance.org/eep/>
<https://www.enocean-alliance.org/sec/>

Important!

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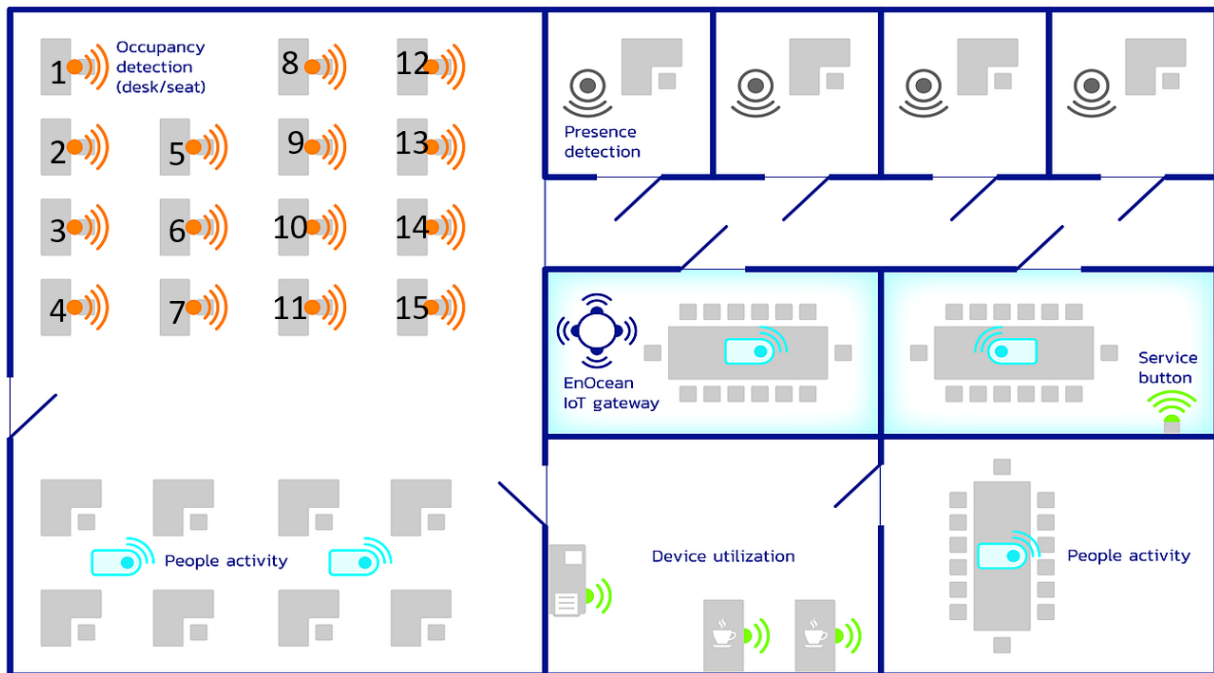
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1 STM 550 as table/seat occupancy application in Office

Space Utilization Management



EnOcean's new Swiss knife, STM 550 is a flexible self-powered multi-sensor device capable of measuring temperature, humidity, illumination, magnet contact status, and acceleration. It enables the easy implementation of energy harvesting wireless sensors for building or industrial control systems communicating using the EnOcean radio standard. It has an NFC interface for easier and faster customer configuration and commissioning in the field. The STM 550 devices are available for different radio frequencies specific to regional worldwide radio certification requirements.

A typical application of the integrated acceleration sensor in space utilization management is the individual table/seat monitoring in buildings. Attached to tables or seats, the accelerometer sensors monitor over a customized central application the current place utilization in buildings. This enables, for example, social distancing providing a graphical overview of the available free spaces in meeting rooms as shown in the picture above. It also provides information about central building management enabling local light and climate automation. Using the STM 550 sensors, a central EnOcean gateway/network in range wide, and an appropriate tracking system such as a visual control panel unit.

The sensors each have a unique ID and can be addressed/numbered on an ad hoc basis, while local placed EnOcean Gateways collect and forward the bundled signals thru any existing BMS to a supervising unit.

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1.1 Outline product variants

STM 550 is available in two different product outline variants:

- STM 550 is the multi-sensor module in the original PTM module form factor, intended for integration into OEM housings (Fig. 1 left)
- EMSI Easyfit contains the STM 550 device in a design frame, also includes a magnet (for optional magnet sensor functionality) and an adhesive tape, packaged as a ready to use finished product (Fig. 1 right)



Figure 1 – STM 550 module standalone (left) and as EMSI Easyfit finished product (right)

2 Functional overview

The STM 550 operates as a fully self-powered unit when sufficient available ambient light is available (long-term averaged > 200 Lux for 6 hours per day.) In this configuration, STM 550 operates fully maintenance-free. For cases where sufficient long-term ambient light is not available, there is the option to mount a CR1632 backup battery.

3 EnOcean Equipment Profiles (EEP) and SIGNAL telegrams

3.1 STM 550 supported EEP

The default EEP used by the STM 550 is **D2-14-41** (VLD Telegram with 9 byte payload.) Depending on the application it is possible to select a different supported EEP via the NFC configuration interface described in user manual. For example, the single "Vibration Detector" functionality requires the EEP **A5-14-05** (4BS Telegram with a 1 bit payload).

For details about the EEP data content, see <http://tools.enocean-alliance.org/EEPViewer/#1>

3.2 STM 550 Signal telegram

The default setting is that the enabled SIGNAL telegram type will be transmitted once every 32 standard EEP telegrams transmissions, i.e. default STM 550 will provide an update about internal stored energy level approximately once every 32 minutes. Parameters may be also configured by NFC.

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4 STM 550 External Interfaces

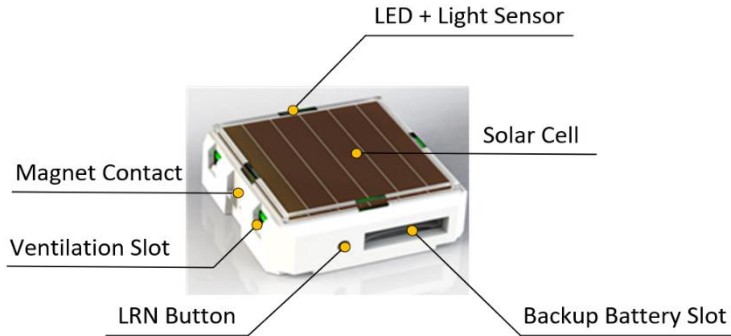


Figure 2 – STM 550 product external interface (front side)

4.1 Functional modes from interest for the specific application

Out of the box, the STM 550 is in “deep sleep” mode to conserve energy during transport and for long storage times (Transport Mode.) Upon an initial setup the STM 550 has to be set to “standard” operation mode by either pressing the LRN button shortly or via integrated NFC interface, as described below.

4.2 Standard operation mode

During standard operation the STM 550 wakes up periodically and reports the current sensor status using data telegrams. The STM 550 wake-up timer is, by default, configured to wake-up approximately every minute. The reporting interval can be customer configured via NFC.

4.3 Factory reset mode

The STM 550 can be reset to its standard settings using the factory reset mode. Upon entering this mode the STM 550 will reset all configuration registers to their default settings and then restart operation in standard operation mode. Factory reset mode can be selected using the LRN button or via NFC as described in user manual.

5 LRN Button functionality

Almost all STM 550 device parameters can be configured via the NFC Interface Tool. Some functions can also be configured using the LRN Button, typically used for cases where the NFC interface configuration is not desired. In this case make sure the LRN Button is accessible during installation and commissioning. Below some relevant LRN Button action possibilities. Further details are in the STM 550 user manual.

Type	LRN Button Action	STM 550 Response	LED Feedback
1 x Short	< 1s Press	Exit from Sleep Mode Send Learn Telegram	Success: 1 short blink Error: No feedback
1 x Long	3s < Press < 5s	Enter Sleep Mode (Disable LED and Radio)	Success: 3 short blinks Error: No feedback
2 x Long	3s < Press < 5s, < 1s Release,	Enter High Security Mode	Success: 2 short blinks Error: No feedback
	3s < Press < 5s		
Very Long	> 8s Press	Factory Reset	Success: 5 short blinks Error: No feedback

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5.1 Commissioning alternatives (LRN Button, NFC Reader or QR Reader)

With a short push on the LRN Button, the STM 550 enters the Learn mode and transmits a special Learn telegram to communicate its source address (EURID), the EnOcean Equipment Profile (EEP) that it currently uses and – if applicable – the security mode and security information to a receiver. After this transmission, the device will return (and remain) in standard operation mode transmitting periodically its status, even in box. (no Airplane mode anymore!) The learn mode can be initiated by either pushing the LRN button as described above, or using the provided NFC Interface Tool. (<https://www.enocean.com/en/products/enocean-software/enocean-tool/>).

Additionally each STM 550 contains an optically readable Quick Response (QR) Code which identifies both its ID and Security exchange key. This code can be read by a suitable commissioning tool (e.g. smartphone), which is already part of the network which the STM 550 will be commissioned. The commissioning tool communicates these parameters to the intended receiver of STM 550.

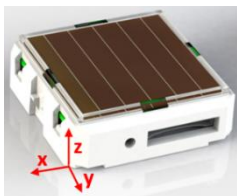
6 Integrated acceleration sensor

The STM 550 integrates an acceleration sensor which provides two types of data:

- Acceleration vector orientation which determines the direction into which the STM 550 is either accelerated (moved) or permanently oriented.
- Acceleration vector change which determines if the STM 550 is moved or shaken

The latter case (acceleration vector change) is used to determine the presence or absence of small vibrations (acceleration vector changes.) Example use cases causing such small vibrations would include desk vibrations (detecting desk occupancy.)

Figure 3 – Acceleration sensor orientation



6.1 Wake on acceleration

If acceleration exceeding the preconfigured threshold is detected for the first time after a period without exceeding this threshold the STM 550 wakes up (wake on acceleration event) and immediately triggers the transmission of a message when an item moves or starts to vibrate. The default threshold for the "wake on acceleration" feature is adjustable via the NFC.

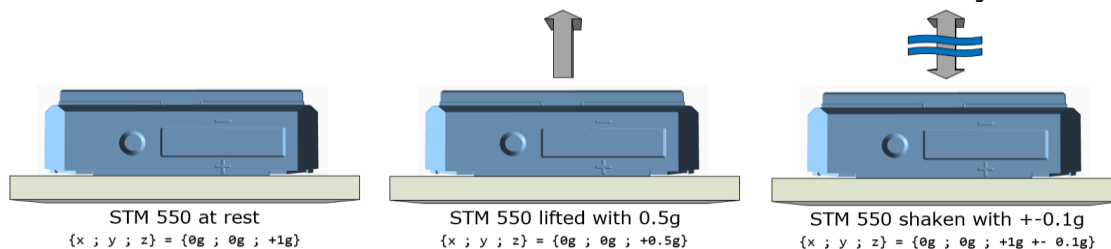


Figure 4 – Acceleration vector changes based on motion or vibration

This principle can be used for different use cases such as utilization of an object (a machine that is running, a chair/table that is occupied) that can be tracked based on the characteristic vibration pattern associated with this utilization.

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6.2 STM 550 as vibration detector, practical installation suggestions

The following points should be considered in order to maximize the reliability of the acceleration detection sensor:

- Every STM 550 should be firmly attached to the asset in order to avoid a mix-up and to ensure that only vibrations of the monitored asset will be detected. Make sure that there is no physical crosstalk (vibration transmission bridge) to other (e.g. neighbors desk) sensors.
- The device should be installed in a way that its solar cell will harvest sufficient energy, ideally a horizontal mount such as on a table top. In the case of insufficient light, a backup battery may be necessary. For further details about the STM 550 energy requirements see the user manual.

Below are illumination values that will help you to assess typical environments. The given numbers are for reference only.

Illumination Area	Type Destination / Workspace	Typical Brightness
Home	Usually	100 – 500 lx
Schools	Corridor	100 – 300 lx
	Classroom in general	300 – 750 lx
	Reading room, laboratory	500 – 1500 lx
Offices	PC room, working at PC	300 – 500 lx
	Meeting room	300 – 700 lx
	Canteen	150 – 300 lx
	Corridors	50 – 100 lx
	Reception	300 – 700 lx
Factories	Restroom	100 – 300 lx
	Production hall	500 – 1500 lx
	Development, office	400 – 750 lx
	Laboratory, inspection work	750 – 1500 lx
	Packaging of products	150 – 500 lx
Hospitals	Storage	100 – 300 lx
	Visitor room	300 – 500 lx
	First aid, surgery	500 – 1500 lx
	Bedroom	100 – 300 lx
Hotels	Wash rooms	150 – 300 lx
	Reception	200 – 500 lx
	Entrance area	100 – 300 lx
	Restaurant	150 – 300 lx
	Bars	50 – 150 lx
Stores	Staircases	50 – 150 lx
	Saleroom	300 – 1000 lx
	Show room	500 – 1500 lx
	Packaging area	200 – 300 lx
	Lounge	300 – 500 lx
Trade Show	Conference room	300 – 700 lx
	Booth	300 – 500 lx

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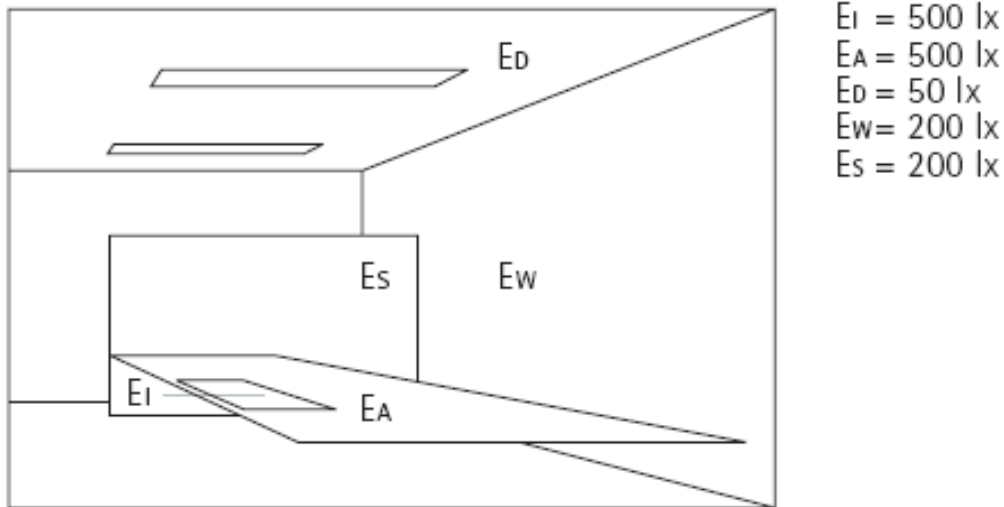


Fig. 5 - Typical brightness levels at different locations in an office (table = EA)

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NFC Interface Tool on smartphone screenshot example

