

inventronics

Technical application guide

HubSense® –
wireless mesh network



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Please note:

All information in this guide has been prepared with great care. Inventronics, however, does not accept liability for possible errors, changes and/or omissions. Please check www.inventronics-light.com or contact your sales partner for an updated copy of this guide. This technical application guide is for information purposes only and aims to support you in tackling the challenges and taking full advantage of all opportunities the technology has to offer. Please note that this guide is based on own measurements, tests, specific parameters and assumptions. Individual applications may not be covered and need different handling. Responsibility and testing obligations remain with the luminaire manufacturer/OEM/application planner.

1 Introduction

From conventional to intelligent: HubSense®

With HubSense®, we offer the possibility of transforming existing lighting systems into a flexible, wirelessly communicating lighting infrastructure during modernization. How does this work? Without great effort! Because HubSense® is simple and intuitive. This easily scalable retrofit solution makes the planning, configuration and commissioning of wireless lighting control easier than ever before – from convenient planning with the web app to commissioning via smartphone and mobile app to simple operation of the system – for individual offices, corridors, conference rooms or open-plan offices.

With the HubSense® system, you work more cost-effectively in every project phase – from planning and installation to handover and use.

1.1 The principle

Three simple steps:

1. Planning

Thanks to reliable Bluetooth® Mesh wireless technology, the scalable retrofit solution can do without control lines and gateways, and can also be planned and precommissioned from anywhere using the web app. Information is pre-stored in the cloud.

2. Installation

The existing infrastructure can not only be used without costly and time-consuming rewiring, but there is also no need for gateways or other complex IT elements. For installers, the system is particularly attractive because it can easily be used to retrofit existing luminaires. Thanks to standardized Bluetooth® Networked Lighting Control (NLC) wireless technology, no structural work is necessary.

3. Commissioning and testing

On-site commissioning can be carried out by several installers at the same time. Simple luminaire localization and zone assignment can be done via the mobile app. All relevant information is provided by the cloud. Compared to wired systems, this significantly reduces the time needed for commissioning. Moreover, thanks to standardized qualified Bluetooth® mesh wireless technology, no structural work is required.



1 Planning
(off-site)



2 Installation
(on-site)



3 Commissioning and testing
(on-site)

1.2 The benefits



Building owner

- Easy to adapt to new space usage (new tenants)
- Gradual updates/refurbishment of a building/project possible
- Reduced downtime during refurbishment of an existing lighting infrastructure
- Maximum savings in existing buildings through motion detection and daylight control
- Robust and transparent security concept by design, including system user management



System installer

- Complete solution offering (hardware and software) from a single source
- Pre-commissioning service possible to allow division between basic and enhanced work (cost optimization)
- Simultaneous multi-installer commissioning (reduced working hours)
- Real scalable solution without the need for a gateway (one tool, less training effort)
- Gateway-less operation possible: Reduced complexity during system set-up, no single point of failure, reduced planning effort (number of luminaires per gateway)



Solution provider

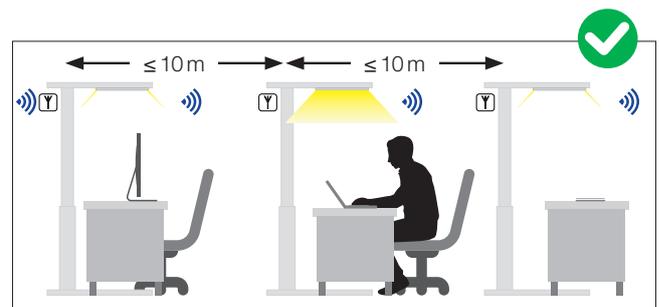
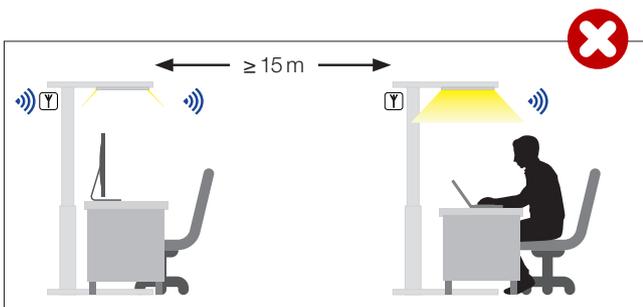
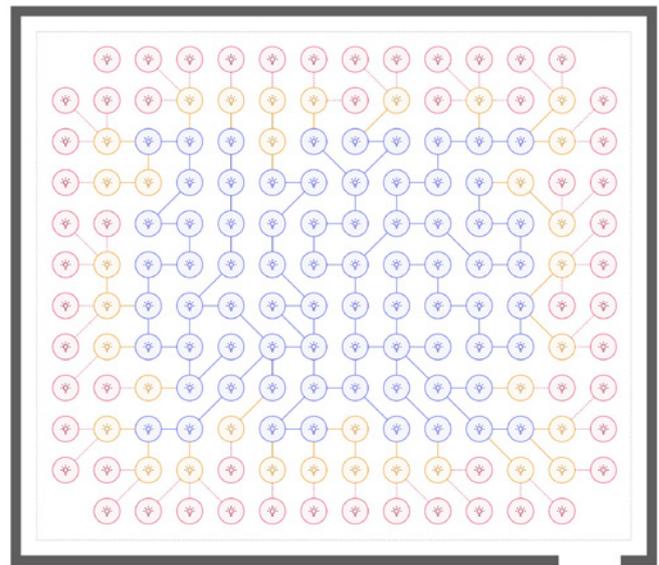
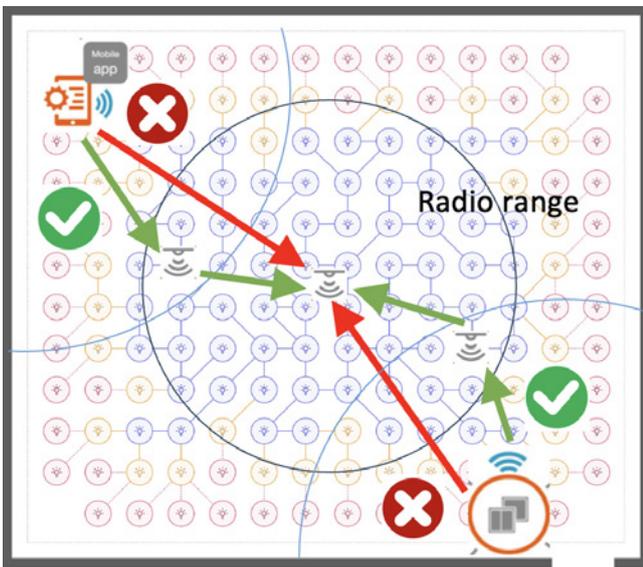
- Complete solution offering (hardware and software) from a single source
- Remote commissioning service possible
- New commissioning experience enables new project opportunities
- Sustainable investment due to an open standard
- Real scalable solution without the need for a gateway (one tool, less training effort)

2.4 General installation notes

Although wireless lighting control can be “quick and easy,” it is still recommended to always plan projects in advance, while considering wireless communication requirements. In many typical cases of wireless node distribution (e.g. “standard” offices) there would likely be a very low risk of mesh connection issues, even without any special planning. However, it is always worth reviewing the project plans so you are aware of potential issues and therefore be prepared to take risk mitigation measures. For example, metal-walled elevator shafts or metal-mesh ceiling panels in the application could become a communication blocker requiring work-around measures.

The following points are general guidelines for control placement to optimize the stability and effective range of the Bluetooth/wireless connection:

- Preferable installation on systems free from metal obstructions or materials that significantly weaken the radio frequency signal (e.g. fiber-reinforced plastic).
- Do not completely enclose wireless LED drivers inside metal boxes!
- Keep a distance of at least 1 cm between the antenna area and the mounting surface.
- Do not wire cables (mains voltage, LED supply wires) near the antenna area.
- Consider an installation height above the furniture and human obstacles (e.g.: 1.6 m from the floor).



Function validation:

To validate the assembly, the construction must be checked and the connection stability and connection distance tested. The check should be done using:

- The HubSense® Commissioning app, available for iOS and Android
- A mobile device for testing the mesh network quality

Please note:

The result of the validation is not an index of replicability in all environments and application situations.

3 Functions and system features

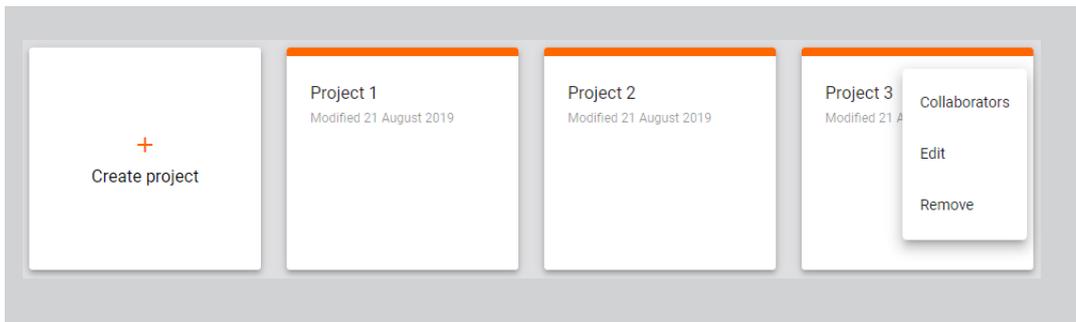
Before you start, please make sure you've got everything you need:

- A HubSense® account (register via the HubSense® Commissioning web app or HubSense® Commissioning mobile app. After signing up, please check your e-mail inbox and locate the confirmation e-mail (subject: "HubSense®. Verify your e-mail"). Follow the steps in the e-mail to confirm your e-mail address. Please make sure to also check your junk e-mail inbox.
- A floor plan or a site plan, if required (as a "png", "pdf" or "jpg" image file only, up to 10 MB)
- The lighting control behavior for your space

3.1 Standard functions

Starting with the HubSense® Commissioning web app available at <https://platform.hubsense.eu>

3.1.1 Project creation and collaborators



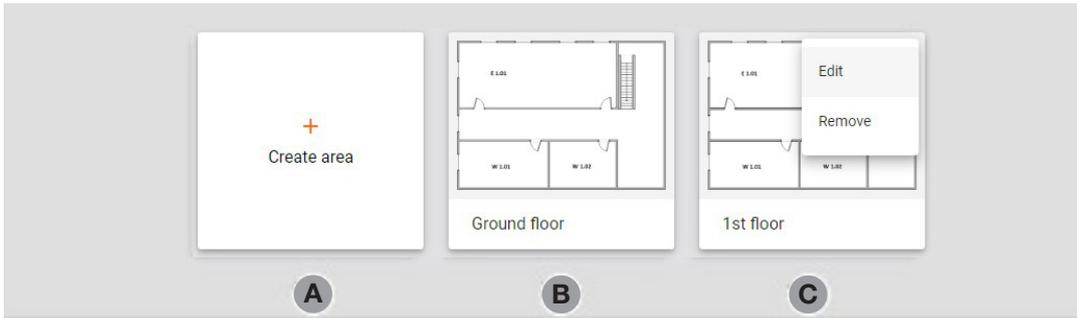
Step 1: Create a project and add collaborators

- A) "Create project": Click the "+" button to add a new project.
- B, C) "Projects" can represent a single room, a floor or an entire building. Each project is a single mesh network.
- D) "Collaborators": Click the ⋮ button to edit or remove your project or to add collaborators. To accelerate commissioning, you can share your project with others and let them participate in the process. Click the "Collaborators" button to send invitations to all contributors who should be involved.

Collaborator roles and rights:

- Manager: Can manage collaborators, make changes in the project, add and manage devices.
- Installer: Can make changes in the project, add and manage devices.
- End user: Can only view the project and control the lights. Cannot make any changes.

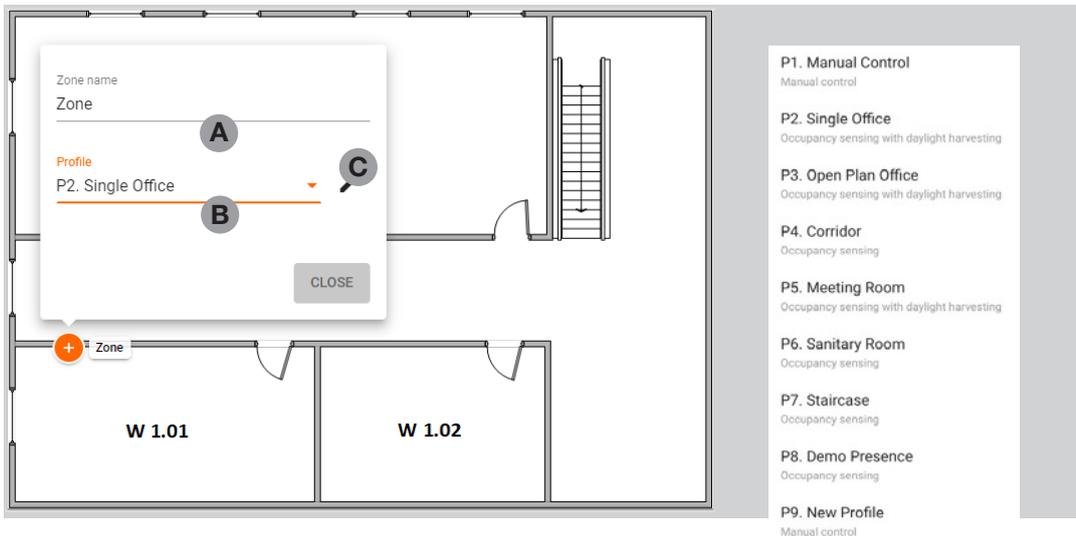
3.1.2 Area creation and floor plan upload



Step 2: Create areas and upload floor plans

- A) “Create area”: Click the “+” button to create an area. During area creation, you can upload a floor plan (optional) by selecting an image. An area should not contain more than 200 devices.
- B, C) “Add plans”: Plans are “jpg” or “png” visualizations of areas on your site. There can be more than one area in a project (e.g. each floor in a building is a separate area).
- C) “Edit”: Click the button on the plan to edit or remove a plan.

3.1.3 Light zone creation and control profile definition



Step 3: Add lighting zones and define control profiles

Click on the floor plan where you want to add a new zone. If required, click again for adding a new zone or, if you need to remove a zone, you can do so with a right click on the zone and select “Remove”. You can click and drag zones to the right place on the plan anytime.

- **A) Add the zone name:** A zone is a group of devices that operate with a selected profile. It doesn’t have to be a physical space (e.g. a room), as a room may contain one or more zones, e.g. multiple daylight zones. More than one zone can be added to the same plan.
- **B) Select a control profile:** A control profile is a set of lighting behavior settings. You are able to choose from different predefined control profiles. You must select one for the zone to function.
 - Please note:** Choose a profile based on functionality requirements! If you need "Daylight harvesting" function, you need to choose a profile with active daylight harvesting, like the "Single Office" profile.
- **C) Customize/edit a profile (optional):** Each profile can be customized for the needs of your project.
 - Please note:** Changes made to a profile will affect all zones in all areas of a project where this profile is used.
- **D) Add a customized profile template (optional):** Expand the list of profiles (B) and select “New profile” from the profiles dropdown. A new profile panel will open.

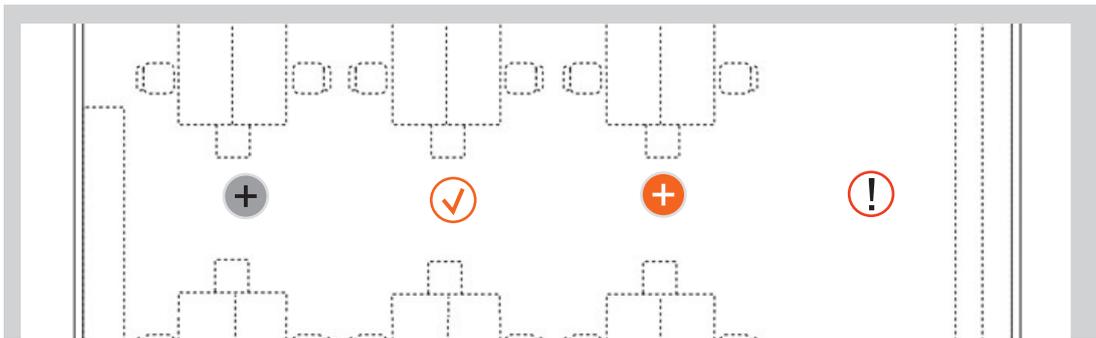
You can use the customized profile template/s in multiple zones across your projects.

Profile definition:

Profile	Scenario	Default	Occupied		Prolonged		Vacant	
		Light level	Timeout	Light level	Timeout	Light level	Timeout	Light level
P1. Manual Control	Manual control	100 %						
P2. Emergency	Manual control	100 %						
P3. Single Office	Occupancy sensing		15 min	100 %				
P4. Single Office	Occupancy sensing with daylight harvesting		15 min	500 lux				
P5. Open Office	Occupancy sensing		15 min	100 %	60 min	20 %		
P6. Open Office	Occupancy sensing with daylight harvesting		15 min	500lux	60 min	150 lux		
P7. Meeting / Classroom	Occupancy sensing		15 min	100 %	5 min	20 %		
P8. Meeting / Classroom	Occupancy sensing with daylight harvesting		15 min	500 lux	5 min	150 lux		
P9. Corridor	Occupancy sensing		5 min	100 %			Infinite ∞	10 %
P10. Staircase	Occupancy sensing		5 min	100 %	1 min	50 %		
P11. Sanitary Room	Occupancy sensing		15 min	100 %	5 min	30 %		
P12. High Bay	Occupancy sensing with daylight harvesting		15 min	200 lux	10 min	100 lux		
P13. Multiple Scenes and Scheduling	Multiple Scenes / Scheduling	tbd						
New Profile	Free to choose							

Meaning of the “circle indicators”

When you create a zone, it is marked on the plan with a circle indicator. There are four different zone indicators that reflect the status of the zone:



- 
“Draft”: The zone is created, but it does not have an assigned profile. Select a profile for the zone in the HubSense® Commissioning web app.
- 
“Ready to be commissioned”: The zone has been assigned a profile, but no devices have been added yet. Send someone to the site to commission the zone.
- 
“Commissioned”: Devices in the zone have been successfully commissioned using the HubSense® Commissioning mobile app. If you use another commissioning app, this will not be registered within HubSense® Commissioning.
- 
“Warning”: This indicator appears when the “zone has been commissioned but requires reconfiguration (e.g. settings were changed in the web or mobile app, but have not yet been transferred to the devices). The indicator is visible only after devices have been commissioned using the HubSense® Commissioning mobile app.

3.1.4 Adding network devices

Your planning is complete, and your project is ready for on-site commissioning!

- You should now have a plan with defined zones and profiles.

Remember: You can always come back to your project and change the zone position, name or profile, add or delete zones or change the floor plan images.

Before you start, please make sure you've got everything you need:

- Your installation is ready for commissioning: All required devices are properly installed, powered and **on**.
- You have installed the HubSense® Commissioning mobile app
- You have a HubSense® Commissioning account and access to the project in the HubSense® Commissioning app.
- When you are on site, please make sure you have internet access (WiFi or cellular (minimum 3G)) and Bluetooth® enabled on your mobile device.

Continuing with the HubSense® Commissioning app

Step 1: Go to the place where your devices are physically installed

The project you created earlier in the HubSense® Commissioning web app will be accessible on your HubSense® Commissioning mobile app. Make sure that the devices in the zone you wish to commission are **powered and on**.

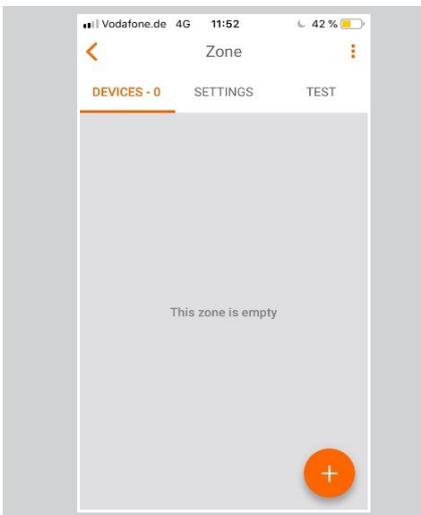
You need to be within range (approx. 10 m, depending on the device type) of a device to commission it.

Step 2: Use the HubSense® Commissioning web app

Open the HubSense® Commissioning mobile app on your iOS device.

Select “Project” → “Area” → and then the zone that represents your current location.

Step 3: Add devices

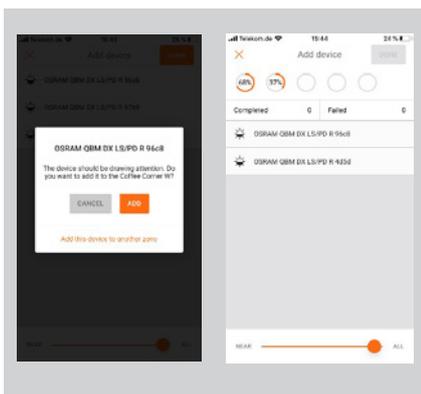


Press “+” at the bottom of the screen to add devices.

A list of devices will appear. Choosing one will force it to identify itself by flashing. If this is the right device for the zone, select “Add device”. If not, move on to the next device.

Please note:

For zones where multiple sensors are used to control daylight harvesting, the **first** device added will perform the primary light measurement.



- **A) Slider:** To help manage the number of available devices displayed, move the slider to the left. This filters them by signal strength and may be useful on large installations.
- **B) Other zones:** You can add devices to zones other than the one you are currently commissioning.

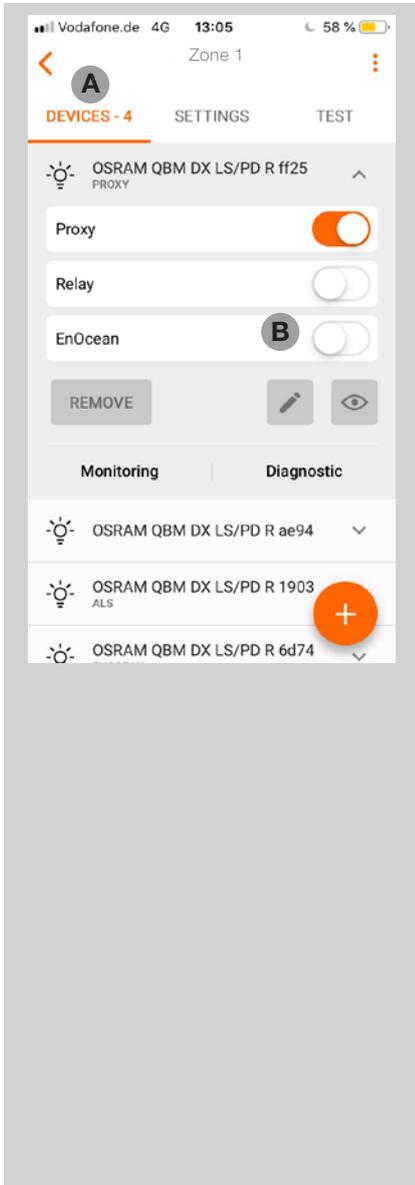
Now select “Add this device to another zone” and then choose the desired zone from the floor plan.

Please note:

Each device can only be added to one zone.

Step 4: Add an Easyfit Bluetooth® switch (optional)

You can control the lights in a zone via an Easyfit Bluetooth® switch by setting up one of the devices in the zone to act as an EnOcean adapter (see “Application note EnOcean switch” which can be downloaded from the [HubSense Commissioning web app](#) → “My projects” → “Release notes”



Select one of the devices already added to the zone to be the EnOcean adapter (we recommend choosing the nearest one)

- A) “Devices”: Click on a device and expand the device attributes.
- B) “EnOcean”: Swipe the EnOcean toggle to the right to activate this device as EnOcean adapter

The mobile device camera will be switched on automatically. Use it to scan the QR code included with the EnOcean switch. The EnOcean switch (double switch version) will now control this zone:

Top left

- **Short press:** All **on**/Auto **on** (switches automation **on** if set up in the planning phase)
- **Long press:** Dim up

Bottom left

- **Short press:** All **off**
- **Long press:** Dim down

Top right

- **Scene A** (if configured)

Bottom right

- **Scene B** (if configured)

Please note:

After enabling the EnOcean switch, please test it. For more information on EnOcean switch settings and mesh network performance for best practices, please check under “**Release notes**” in the web app.

3.1.5 Daylight calibration and scene setup

Step 5: Set up “Daylight calibration”

For zones utilizing the “Daylight Harvesting” scenario, you must perform sensor and controller calibration for each zone.

Please note: Failure to do so will result in erratic lighting control performance.

If a certain lux value is specified for the light setup, you will need a light meter to perform calibration.

Please note:

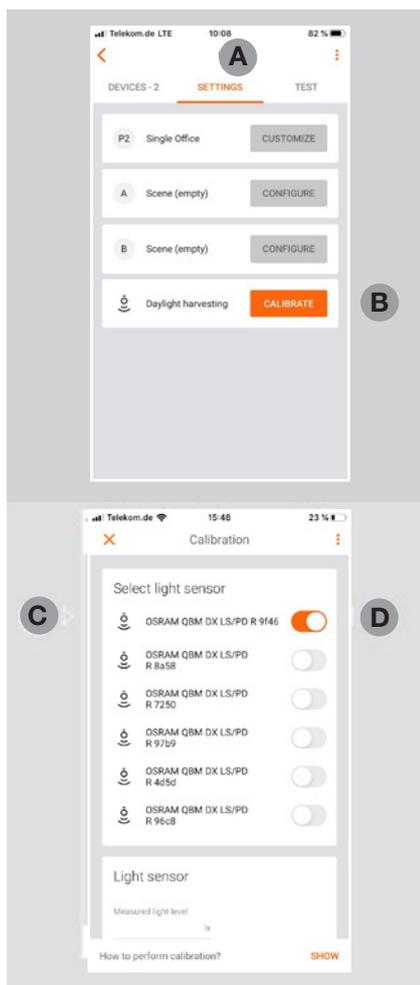
You can easily check the scenario selected for a zone in the HubSense® mobile app by selecting: “Project” → “Plan” → “Zone” → “Settings”

Warning:

Do not position the light sensor too close to window areas, but also not too far inside the room. Avoid any interference with the daylight sensing area during the calibration (e.g. movement/shadows). The calibration process should be done during twilight as influence of naturally occurring daylight shall be kept at an absolute minimum.

For details, see the “HubSense® Commissioning Tools User Manual”.

Step 5.1: Select the sensor



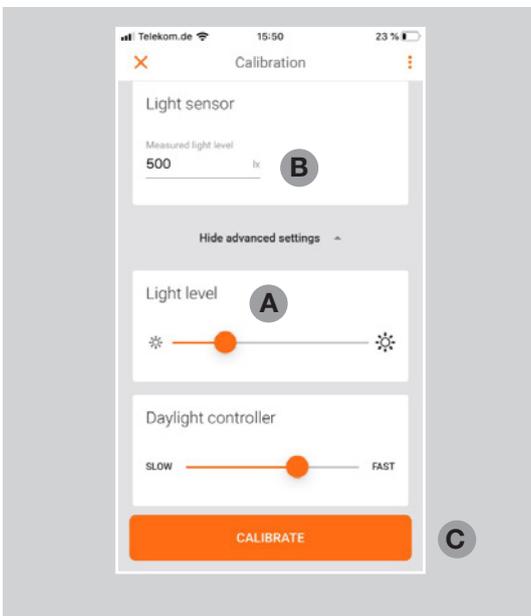
- A) “Settings”: Open “Settings” in the zone.
- B) “Calibrate”: Press the “Calibrate” button.

- C) To quickly identify the luminaire, press the “sensor” icon ☺. The luminaire with the integrated sensor will start flashing.
- D) Select the light sensor, which is supposed to control the zone (swipe the “on/off” toggle next to the light sensor to the right).

Step 5.2: Prepare the ambient conditions

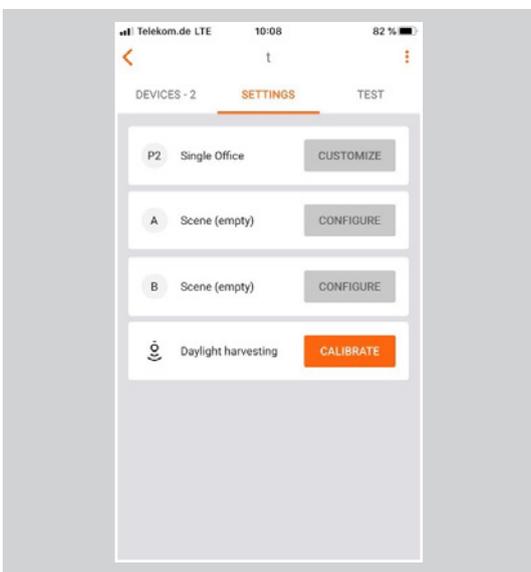
- Place a light meter on the surface where you want to maintain the desired light level.
Please note: The light meter is relevant as you want to measure the light where it is needed, e.g. on the desk. The light level at the sensor is different, as it is measured by the sensor itself at its mounting position, e.g. at the ceiling.
- Switch **on** the light (“Advanced settings” → “Light level” = ☀️). Verify on your light meter if the target light level (e.g. 500 lux) is exceeded. If not, a calibration is not possible.
- Switch **off** the light (“Advanced settings” → “Light level” = ☁️) and verify on your light meter if the measured light level is above 50 lux and below the target light level (e.g. 500 lux). If not, a proper calibration is not possible.
- If the required light level cannot be achieved due to incoming light levels or light reflections, adjusting the blinds in this zone can be helpful during calibration.

Step 5.3: Calibration



- **A) “Light level”:** In the “Advanced settings”, adjust the light level to the desired target value for this zone, as measured with the light meter.
- **B) “Light sensor”:** Enter the **lux value** measured by the light meter in the “Measured light level” field.
- **C) “Calibrate”:** Press “Calibrate” to start the calibration and save the settings for the zone.

Step 6: Add a light scene (optional)



- **A) “Settings”:** Click on the “Settings” of a device and expand the settings menu.
- **B) “Configure”:** Click on “Configure” to start the setup process for “Scene A” and/or “Scene B”.

Please note:

Scenes can also be activated via the EnOcean switch.

Read more about how to set up scenes in our **“HubSense Commissioning User Manual”**.

3.2 Advanced functions

3.2.1 Zone linking and scheduling

The HubSense® Commissioning web app allows you to implement more advanced features like **zone linking** or **scheduling**!

→ Find out more in the **HubSense Commissioning Tools User Manual**, which can be downloaded from the Help Center in the **HubSense® Commissioning web app**.

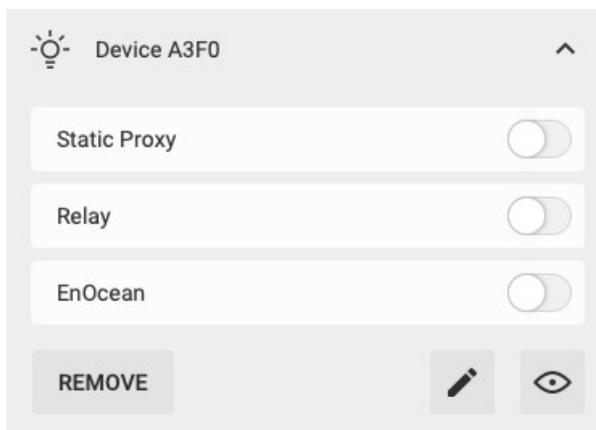
3.3 System features

Automatic mesh network configuration

The HubSense® Commissioning app offers an automatic mesh network configuration feature that facilitates “Relay” and “Mobile device proxy” configuration.

- In projects using an auto-proxy feature, all devices are configured to become proxy on demand when requested by the mobile app. In other projects, static proxies are configured during commissioning to provide connectivity to the mesh network in the whole project, by enabling the static-proxy feature in devices not supporting the auto-proxy feature if there are no other proxy devices nearby.
- The mesh network is automatically configured while the user adds a new device to a zone. This mechanism runs in the background and sets approx. 10 % of all devices added to the zone/s as relays.
- In a situation when some network issues occur, we recommend checking the relay network settings and to add relays or change the position of existing relays manually.
- After reconfiguring any network settings, it is recommended to check the lighting behavior in the selected zones, e.g. by observing if the pre-set options and settings work correctly or by running the connection quality test.

Manual network setting



To enable “Relay” manually:

- Go to the “Devices” tab.
- Select the device.
- Tap the toggle labelled “Relay” to enable it.

To enable “Static Proxy” manually:

- Go to the “Devices” tab.
- Select the device.
- Tap the toggle labelled “Static Proxy” to enable it.

To ensure optimum performance, it is generally strongly recommended that no more than one mesh network option (relay, proxy for mobile devices, EnOcean adapter) is enabled on a mesh device at the same time.

For more information, please refer to chapter 4.4: Network optimization

Relay nodes:

- Relay nodes in a Bluetooth® mesh forward received packages. Within small zones, all nodes can be installed within range of each other (a range of 10 to 15 meters between nodes is reasonable) and there is no need to have relay-enabled nodes.
- Larger zones of more than 20-30 mesh devices usually require flagging some nodes as relays in order for the mesh network to function reliably. In larger installations, it is recommended that approximately 10 % of the total nodes should be enabled as relays in order to maintain reliable message delivery between nodes.

Mobile device proxy:

The mobile device proxy (or “proxy”) allows the mobile device running the Commissioning mobile app to connect to the mesh network and to configure devices.

- When proxy is enabled in the particular device, the mobile app can send and receive messages from the mesh network.
- One proxy device can support only one simultaneous mobile device (iPad/iPhone) connection. If you need to use two mobile devices simultaneously, there need to be at least two mobile device proxies enabled in the mesh network, each within the range of the mobile device.
- In order to maintain the mesh network (projects), at least one device in a mesh network must have the proxy enabled. Without a proxy device in the network, the mobile app will not be able to connect to the network and manage devices. The mobile app prevents removing or disabling the only proxy device in the network before removing remaining devices or enabling proxies in other devices.

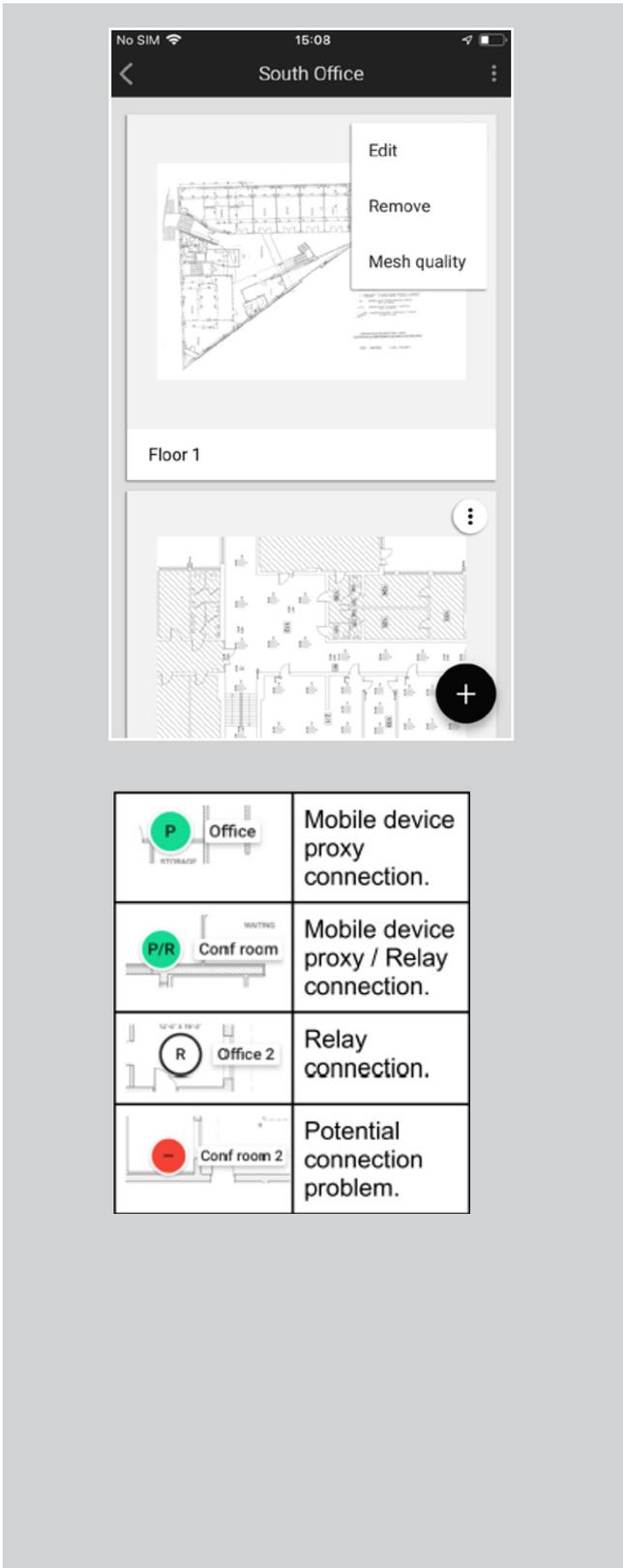
Proxy devices are configured automatically by the commissioning mobile app. In some specific cases, users may need to adjust the default automatic settings.

Mesh network quality test

The mesh quality test allows users to check the availability and quality of the mesh connection between zones and shows the result as a visual mesh network connection quality map.

In the following cases, it is recommended to test the mesh network quality in your zone or linked zones:

- After commissioning the zone/s, or after making changes in linked zones
- After discovering some unexpected lighting behavior in your zones (e.g. the lamps do not light up in one of linked zones)
- After changing something that may affect the radio propagation environment in the commissioned zones which may adversely affect mesh network performance



- Open the HubSense® Commissioning mobile app and go to the projects list to select an area.
- From the menu , select “Mesh quality”.
- Press the “Start test” button.
- Once it finishes, you will see the mesh connection quality test result.

Additionally, the test shows mesh network indicators on your project’s floor plan, such as: “Relays”, “Mobile device proxy” and places between zones that require network improvements (this can be done by, e.g.: “**Manual network settings**”). The quality of connection in the network is indicated by the circles’ colors:

- **Green:** The connection is good. This was tested by sending three messages to three nodes, and all the messages were accepted.
- **Red:** The connection requires attention, as there is a potential problem. This was tested by sending three messages to three nodes, and at least one of three messages was not accepted.

For more information, please refer to chapter 4.4: Network optimization

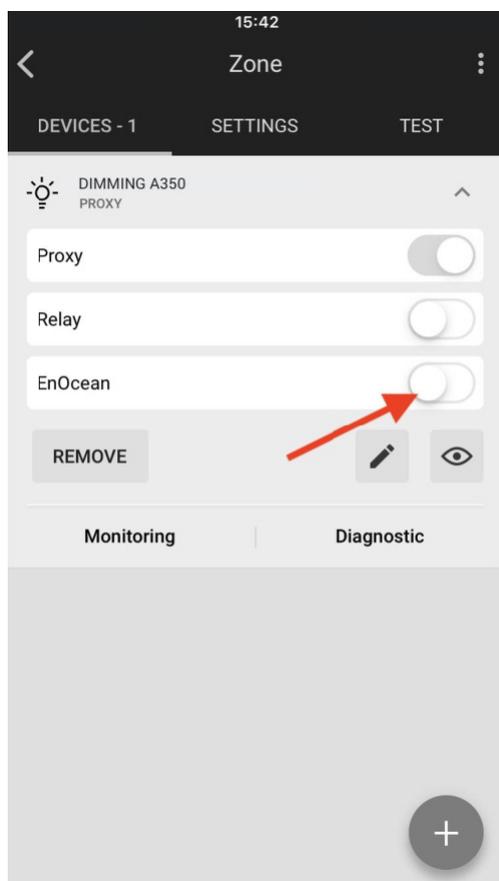
4 Applications and settings

Different applications have different functional requirements and therefore need different system settings. Here are some application use cases with the respective functional settings:

4.1 EnOcean switch integration and multiple scenes scenario

Registering an EnOcean switch in the **HubSense® Commissioning app**:

- Once you have selected the optimal device, tap the “EnOcean” toggle to enable the EnOcean adapter for that device. The app may ask for permission to access the camera. Select “OK”.



- Point the camera at the QR code on the back of the EnOcean switch or on its packaging. The app will read the QR code and configure the EnOcean switch.
- When the pairing succeeds, test the EnOcean adapter connection by pressing the EnOcean switch and observing the behavior of the luminaires in the target zone.

Please note:

If the EnOcean switch is physically too far from the selected EnOcean adapter device, the devices within the zone will not respond.

Attention:

Do **not** attach the EnOcean switch to the wall before commissioning, as the required QR code for pairing is printed on the back of the EnOcean switch!

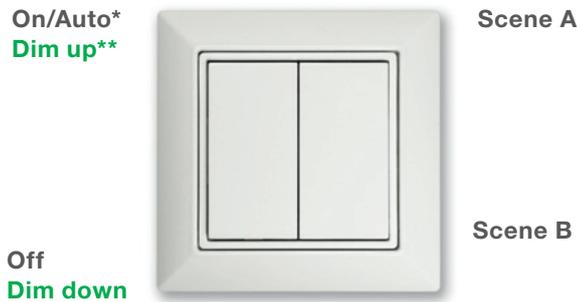
The self-powered EnOcean switch has a predefined configuration:

The **left rocker** is used for manual control and dimming:

- **Short press up:** On/Auto
- **Short press down:** Off
- **Long press up:** Dim up
- **Long press down:** Dim down

The **right rocker** is used to trigger scenes and control color temperature (if available), scenes must be configured:

- **Short press up:** Scene A
- **Short press down:** Scene B



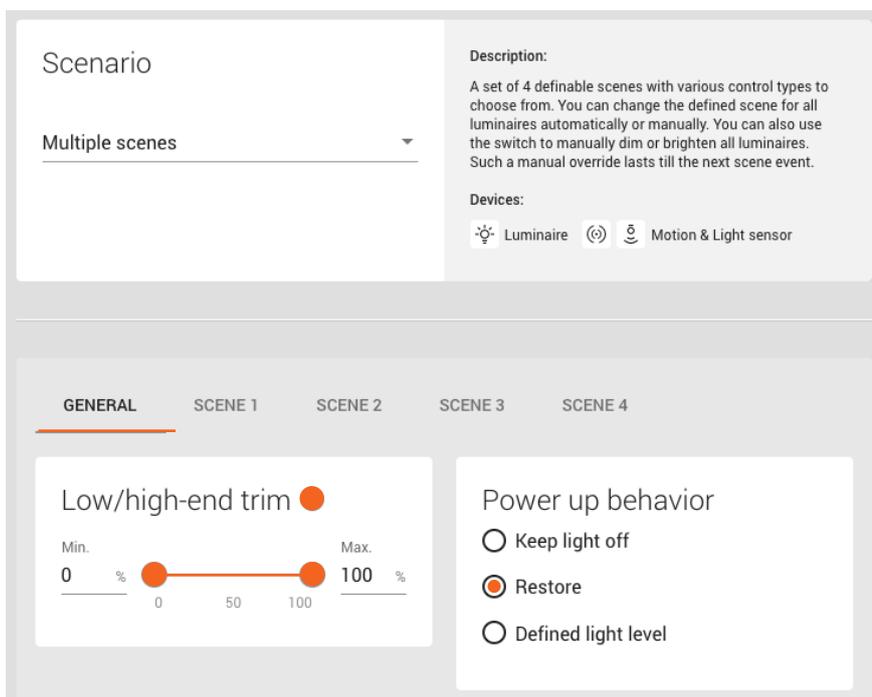
*) Short press actions indicated in **black**
) Long press actions indicated in **green

Please note:

Color temperature control applies only to zones where compatible Tunable White (TW) luminaires and appropriate firmware have been added.

EnOcean switch support for “Multiple scenes” scenario

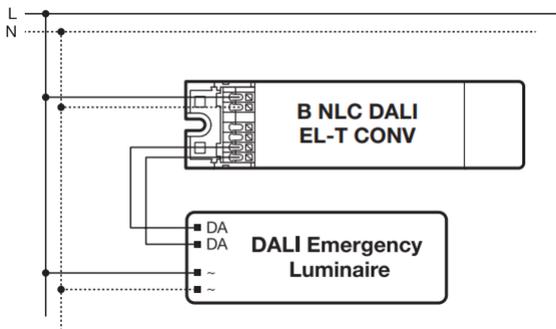
The “**Multiple scenes**” scenario allows users to define up to four scenes to recall. The users can change light control behavior from one automatic scenario to another, e.g. with different levels to maintain. Scenes set in the “**Multiple scenes**” scenario can be triggered by scheduling or by pressing the EnOcean wall switch. The image below shows an example setup for a multiple scenes scenario in the **HubSense® Commissioning web app**:



4.2 Emergency Lighting integration

The HubSense® system is capable of Emergency Lighting integration by integrating dedicated EL-T converters into the HubSense® mesh network.

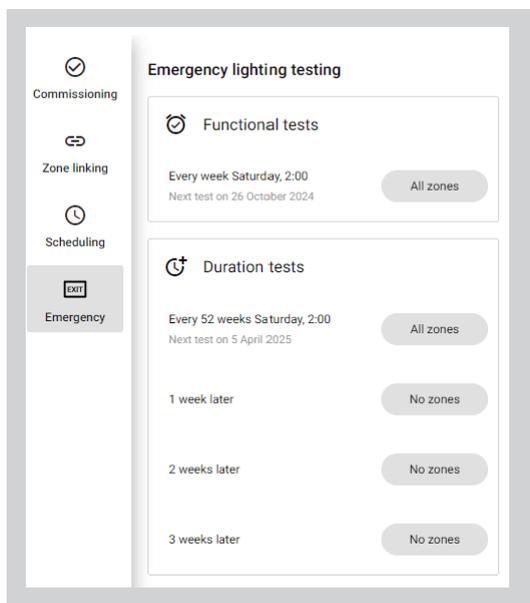
Installation scheme:



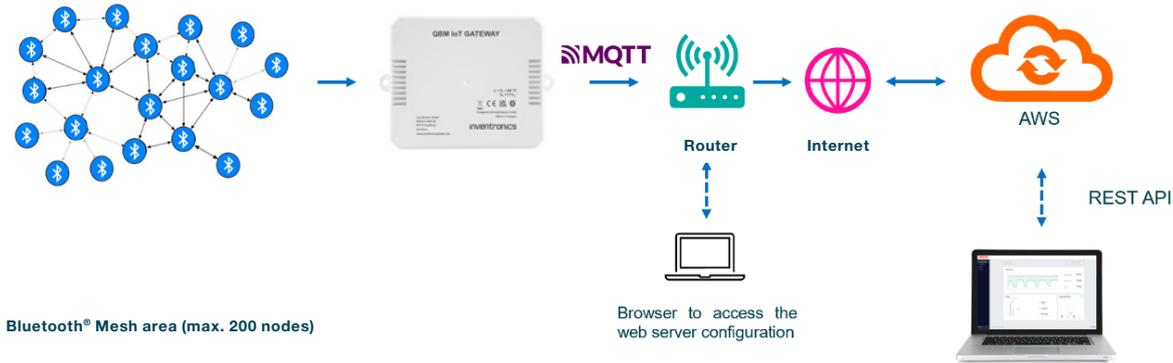
Emergency system compatibility list

Product name	Manufacturer
XYLUX LR4/D1	Mackwell
MIDI55/3W/D1	Mackwell
EMpowerLED 1W PRO EZ-3	Tridonic
Tridonic EMpower PROset E1D	Tridonic
Tridonic EMpower PROset E3D	Tridonic
SYLSAFE IP65 LED	Sylvania
RouteLED DALI	Concord
SYLSAFE XSpot OA R EM3 NM DA	Sylvania
Emergency Pack DALI 50V-200V	Sylvania

By using the HubSense® Commissioning web app, the Emergency Light installation can be tested (function test/ duration test) and the data monitored based on preset schedules:



4.3 IoT gateway for Energy Monitoring (EM) and Emergency Lighting (EL) status



Bluetooth® Mesh area (max. 200 nodes)

QBM IoT gateway

The gateway is the basis of the IoT lighting system and connects the luminaires to the cloud via the Internet. The gateway connects with the luminaires and establishes a secure wireless Bluetooth® connection to a mesh of up to 200 light points (nodes), distributed in up to 50 zones per area.

Web server

The web server is a tool for executing basic functionalities on the QBM gateway, such as commissioning, IP addressing, data download, etc. The web server can be used only locally, that means you can access its functionalities only if the user PC is connected to the same local network where the QBM gateway operates. No remote connection to the QBM gateway web server is possible. To open the web server interface with a browser, the user first needs to identify the QBM gateway IP address. Please refer to “Setup instructions.”

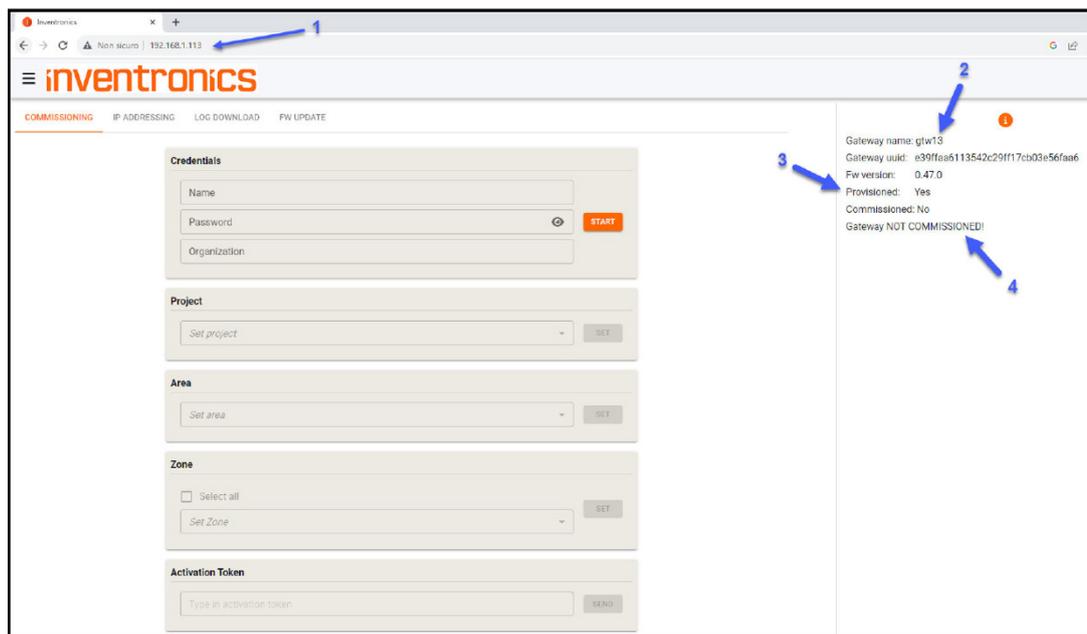
Setup instructions

Connect the QBM gateway to a network with Internet access and power it up. Wait a few seconds for the QBM gateway to be up and running. Please note: While the connection between the NLC and the cloud is being established, the **red LED** flashes quickly (30 ms **on**, 200 ms **off**). If the connection is not possible, the **red LED** flashes slowly (1 s **on**, 3 s **off**). For additional information, please refer to the chapter “Gateway: LED signals and button functions”.

By default, the QBM gateway is in DHCP mode. Therefore, after power-up, it receives an IP address from the local DHCP server. To access the web server functions, the user must call up the IP address assigned to the QBM gateway. This can be done in several ways:

- By accessing the local network router setup page and by checking the list of devices present.
- By asking your IP department to identify the QBM gateway IP address for you.

Once you have the QBM gateway IP address, you can type it into your favorite web browser (Edge or Chrome suggested). The following page will appear:



Please note the following points on the screenshot above:

1. IP address of the QBM gateway
2. Name of the QBM gateway
3. The QBM gateway is provisioned, i.e. it has been added to a BT mesh network by means of a dedicated mobile app.
4. The QBM gateway is not commissioned yet, i.e. it does not have the information (number of nodes, models implemented, etc.) of the network it belongs to.

Important note:

If your browser cannot open the page, please make sure to clean the cache. It is suggested to open a new page in “InPrivate” (Edge) or in “Incognito” mode (Chrome).

Commissioning instructions

The commissioning phase is designed to provide the QBM gateway with all the information required for operation within the Bluetooth® mesh network to which it has been assigned.

Please fill in all the required fields (refer to the screenshot above) starting from:

- **Credentials:** Use your HubSense® Commissioning credentials. These credentials are neither saved nor retained by the QBM gateway. They are just used to access the cloud and download the required data.
- **Project:** Select the project of interest from the drop-down menu.
- **Area:** Select the area of interest from the drop-down menu.
- **Zone:** Select one or more zones of interest. Any data published by a device of an unselected zone is ignored by the QBM gateway.
- **Activation Token:** Type in the activation token received with the QBM gateway.

After a few seconds, a message will appear that says that the QBM gateway is now commissioned. The information on the right panel will be updated, turning the commissioning state to “Yes”. In case of commissioning success, the **red LED** will flash twice (30 ms **on**, 1 s **off**).

Important note:

Every time a network topology is changed (device added or removed from network, device moved to a different zone, etc.), the Gateway commissioning process via web app must be performed again.

Important note:

If any error occurs during the commissioning process, the user must wait at least 1 minute before repeating the procedure. This is a limitation imposed by the cloud to reduce uncontrolled access. In case of persistent error, please reload the page.

Possible causes of commissioning failure:

- Wrong credentials.
- Connection drop. When Internet connection is missing, the QBM gateway is not able to reach the cloud.
- Wrong activation token.
- Gateway already commissioned on a different project.
- Timeout. The commissioning process resets if the user takes too long to proceed through the commissioning steps.

Gateway: LED signals and button functions

The tables below summarize the meaning of the LEDs’ signals:

Green LED	Signal
Node attention command	0.5 s on , 0.5 s off
Node is provisioned	One flash 30 ms on , 2 s off
Node is un-provisioned	One flash 30 ms on , 0.3 s off
Ping reply is missing from radio module	On

Red LED	Signal
Fault condition	On
Cloud connection not established with gateway not commissioned	One flash 1 s on , 3 s off
Cloud connection established with gateway not commissioned	One flash 30 ms on , 0.2 s off
Cloud connection not established with gateway commissioned	One flash 30 ms on , 1 s off
Cloud connection established with gateway commissioned	Two flashes 30 ms on , 1 s off

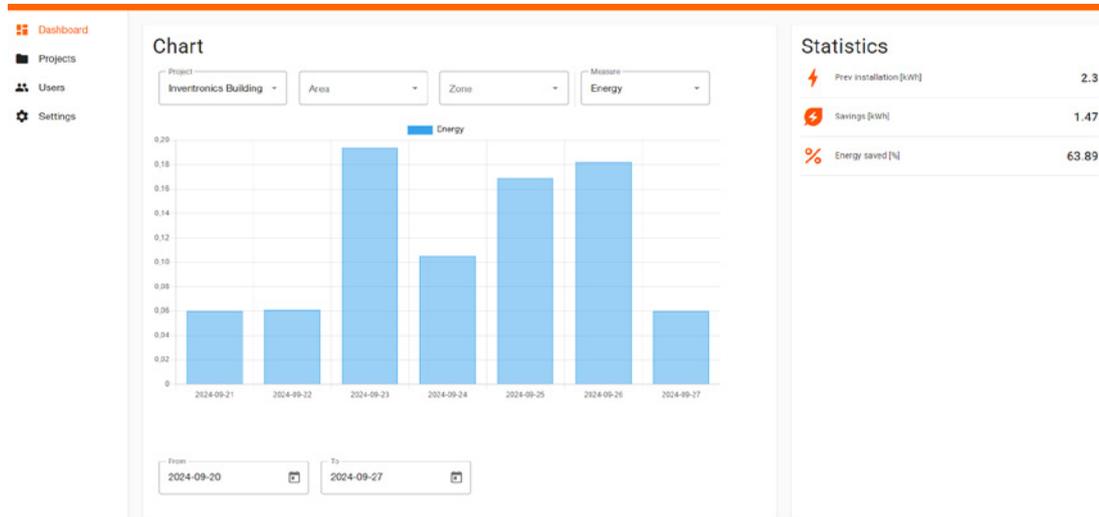
The following table explains the button functions:

Function	Action	Wait for	Confirm	Confirmed
System reset	Long push	5s	None	None
Un-provisioning	Long push	10s	Green LED on	Two short pushes within 10 s

IoT gateway for Energy Monitoring (EM) and Presence Detection (PD)

The gateway exports data from the network nodes into the cloud. Through the REST API, the following information is available and visualized on a dashboard:

- Project info (project, area, zone, time stamp, etc.)
- Data monitoring (energy, presence), historical data saved
- System status (input voltage, current, power consumption, lux level, etc.), last value saved



IoT gateway for Emergency Lighting (EL)

The gateway exports data from the network nodes into the cloud. Through the REST API, the following information is available and visualized on a dashboard:

- Emergency Lighting (EL) status (functional and duration testing data, battery status, etc.)
- Malfunctioning (alert system for maintenance need)
- Remote control (on/off, dimming)
- Secure communication over MQTT by using TLS v1.2 protocol
- Precise timing from NTP server

4.4 Large installations (>200 network nodes) and linear installations

A large installation is not necessarily one that physically occupies a big space or has a large number of nodes. It is determined in part by the following factors:

- The number of nodes added to the network
- The distances between the nodes and their spatial distribution
- The lighting control profiles used in the project

The performance of a mesh network depends on the complexity of lighting profiles used in the project. For example, for a very simple lighting profile used in the network (e.g. manual **on/off**), a project consisting of more than 200 nodes may work fine, but in the case when more advanced lighting profiles are used (e.g. occupancy with daylight harvesting), such a network is prone to failures. In general, if you have an installation with nodes not distributed in a grid (linear installation type), or an installation consisting of approximately >200 nodes, follow the tips described in this document.

Use of subnets in large installations

Subnets can be compared to “logical walls” that divide a single, large installation into smaller areas. Dividing a large network into separate areas improves the quality of the mesh network by increasing the delivery rate for all nodes. The term “areas” is analogous to “subnets”. Each area in the HubSense® Commissioning is treated as a subnet. The subnet mechanism in mesh networks enables the creation of large projects by splitting them up into multiple areas that form a lighting installation.

- Each area has a plan (floorplan) and contains multiple zones, each with a different profile.
- Nodes from one area cannot control lighting in other areas through zone linking or other mechanisms.
- Zones can be linked only with other zones inside the same area (cross-area zone linking is impossible).

Subnet configuration recommendation

Installations consisting of more than 200 nodes are treated as large installations that must be split into smaller areas within one project.

Examples:

- An installation (project) of 300 nodes is split into two areas of approx. 150 nodes each.
- A 400 nodes installation is split into two areas of 200 nodes per each area.
- A 600 nodes installation is split into three areas of 200 nodes each, or four areas of 150 nodes each, etc.

Remember that zone linking works only within a single area (cross-area linking is not supported).

How to set up subnets in new projects:

No special actions are required.

HubSense® Commissioning web app

Design the project using multiple areas so that a single area contains less than 200 devices.

HubSense® Commissioning app

Add devices to the separate areas created via the web app (e.g. 150 devices in area “Floor 1” and another 150 devices in area “Floor 2”). Do not add more than 200 devices per area.

Linear installations

As mentioned at the beginning of this document, a large installation is not necessarily an installation that physically occupies a big space. The size of an installation is mostly determined by the number of nodes added to the network, their distribution density as well as the lighting control profiles used in the project.

The shape of the installation is linear, thus the communication between nodes is one-directional and goes in a straight line. In linear installations, the distance separating individual nodes can also be considerable, for example 30 meters. Such long distances between nodes require the manual enabling of relays on individual devices.

The role of relays in a lighting installation is vital. They act as accelerators in delivering mesh messages between nodes and transmit the messages further into the zone. If the relays are improperly placed and the nodes aren't within range of at least one relay, the mesh network will be disjoined, and the zone will not function correctly.

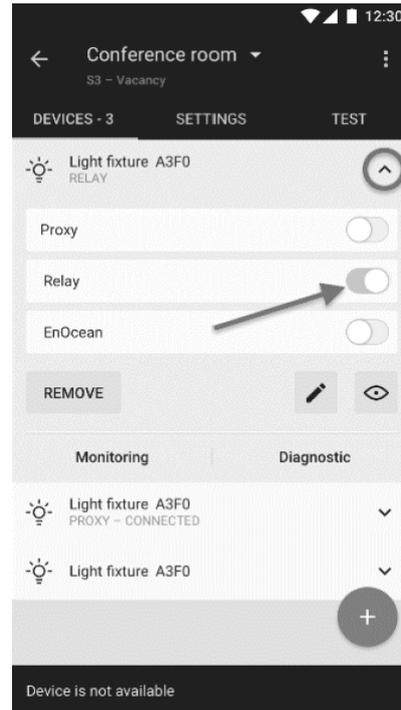
Automatic relay mechanism

The mesh network is automatically configured while the user adds a new device to a zone. This mechanism runs in the background and sets approx. 10 % of all devices added to the zone/s as relays.

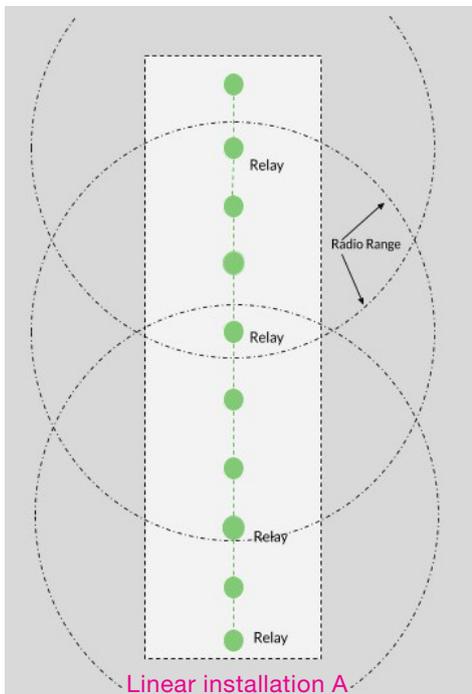
Important note:

Do not use the automatic relay mechanism in linear installations!

- In the case of linear installations, the automatic relay mechanism will not work, especially if the distance between individual nodes is considerable.
- The user should use the HubSense® mobile app to set relays manually on selected nodes in the zone.
- The “Relay” toggle is available in the mobile app
 - Project view → Zones view → Select device
 - Expand device settings → Enable relay



Relays play a very important role in linear, distributed installations types. If they are set up in a wrong way, the a mesh lighting installation may not work properly. Consider the examples below:



Linear installation A: Recommended relay placement

- The distance between each node in this installation is approx. 10 meters each.
- The radio range in this case is approx. 35 m.
- The relays are placed so that each relay is within radio range of the next relay.
- This ensures that messages can be forwarded through the network.
- Relays must be placed manually using the HubSense® mobile app. The installer **cannot** rely on the automatic relay selection mechanism.

4.5 Network optimization

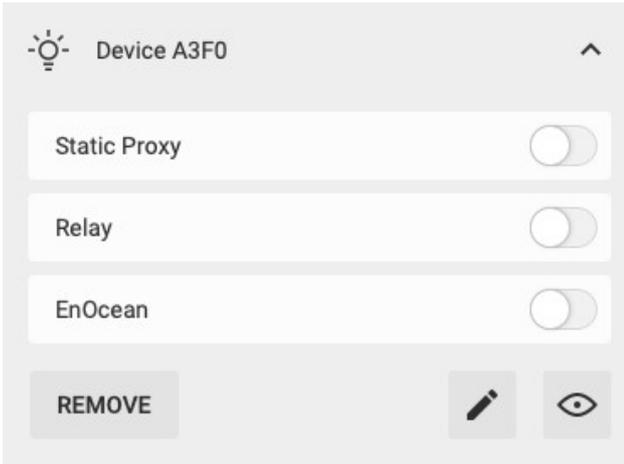
This document describes practical tips for mesh network settings, i.e.:

- Appropriate relay nodes placement in the mesh network
- Mobile device proxy and EnOcean adapter behavior

To ensure optimum performance, it is generally strongly recommended that no more than one mesh network option (relay, proxy for mobile devices, EnOcean adapter) is enabled on a mesh device at the same time.

To maintain **a fast and efficient performance** of the mesh network, use the following **best practices**:

- Do not flag more than 10 % of your nodes as relays. Doing so causes an enormous increase in mesh network traffic and will slow down and severely degrade the overall performance of the mesh network and lighting control.
- If possible, position relay nodes evenly across the mesh.
- If issues such as erratic, uneven, or delayed lighting control arise within the mesh network, try adding or removing relay nodes from the network.



To enable “Relay” manually:

- Go to the “Devices” tab.
- Select the device.
- Tap the toggle labelled “Relay” to enable it.

To enable “Static Proxy” manually:

- Go to the “Devices” tab.
- Select the device.
- Tap the toggle labelled “Static Proxy” to enable it.

Relay nodes

- Relay nodes in a Bluetooth® mesh forward received packages. Within small zones, all nodes can be installed within range of each other (a range of 10 to 15 meters between nodes is reasonable) and there is no need to have relay-enabled nodes.
- Larger zones of more than 20-30 mesh devices usually require flagging some nodes as relays in order for the mesh network to function reliably. In larger installations, it is recommended that approximately 10 % of the total nodes should be enabled as relays in order to maintain reliable message delivery between nodes.

Mobile device proxy

The mobile device proxy (or “proxy”) allows the mobile device running the Commissioning mobile app to connect to the mesh network and to configure devices.

- When proxy is enabled in the particular device, the mobile app can send and receive messages from the mesh network.
- One proxy device can support only one simultaneous mobile device connection. If you need to use two mobile devices simultaneously, there need to be at least two mobile device proxies enabled in the mesh network, each within the range of the mobile device.
- In order to maintain the mesh network (projects), at least one device in a mesh network must have the proxy enabled. Without a proxy device in the network, the mobile app will not be able to connect to the network and manage devices. The mobile app prevents removing or disabling the only proxy device in the network before removing remaining devices or enabling proxies in other devices.

Proxy devices are configured automatically by the commissioning mobile app. In some specific cases, users may need to adjust the default automatic settings.

Automatic proxy

The automatic proxy feature allows each device supporting it to automatically become a proxy on demand whenever the mobile app is around and requests connection to the mesh network. It’s automatically configured and handled in the background by the mobile app and devices.

Static proxy

- When device/s and project version do not support the automatic proxy feature, the standard static proxy feature is used where selected devices are constantly operating as proxy devices, thus allowing mobile apps to communicate with the mesh network.
- During commissioning, static proxy is automatically configured by the mobile app in order to provide access to the network in the entire project.
- Although it is not recommended, the static proxy configuration can be adjusted manually (enabled or disabled in selected devices).
- Do not enable the "Static Proxy" and "Relay" or "EnOcean" functions in the same node.
- In the above situation, after switching on the "EnOcean" switch, the node which has "Proxy" and "Relay" enabled will respond instantly, while other nodes will be switched on with a one-second delay.

Please note:

"Static Proxy" is used or can be used only when "Automatic Proxy" is not supported.

EnOcean adapter

- The EnOcean adapter option enables the manual control of Bluetooth® mesh lighting systems using EnOcean Bluetooth® wireless switches.
- Do not turn on the "Relay" or "Static Proxy" option on a device with the EnOcean adapter enabled.
- One EnOcean switch can be registered to simultaneously control two or more zones.
- We recommend having two EnOcean adapters enabled for each switch to mitigate the single point of failure issue (in case when the EnOcean adapter device fails). Please remember that increasing the number of EnOcean adapters increases the network traffic coming from the switch and may affect the quality of the mesh network.

4.6 Over-the-air (OTA) firmware updates

OTA firmware update for devices in the Bluetooth® mesh:

Step 1

- Select a project and an area where you would like to do the devices' update.



Step 2

- Press the  button on the area plan and choose "Update devices". This allows you to select devices added to the zones from that area.



OTA (over-the-air) firmware updates allow you to upgrade the firmware on your lighting devices using the HubSense® Commissioning mobile app. The firmware update is automatic (the new firmware is stored and downloaded from the cloud). To update external firmware (not related to Bluetooth® mesh), the user must have a firmware file (in a zip format) and upload it to the HubSense® Commissioning mobile app.

Please note: Light is flashing/turns off

When a device is selected for a firmware update and it is being updated via the HubSense® app, it always flashes and the light turns off after the firmware update starts. This is expected behavior and may last for a few seconds for each of the updated devices.

Important note:

While doing the OTA (over-the-air) update, please make sure the devices are powered on. Powering off the device during the update may render the device unusable.

The main features of the OTA update in the commissioning app are:

- The ability to update the firmware of devices that have already been added to the mesh network (provisioned).
- Updating and commissioning activities can be done using a single app.
- The update is simultaneous on up to four devices (e.g. the user selects 20 devices to update, the first four devices are queued and updated with new firmware, then the app selects the remaining devices and updates them in packages of four).
- The ability to update devices from the level of a single or multiple zones (the users first choose the zone/s where they would like to start the update and then select the devices to update).

Please note:

Devices updated with new firmware features must be recommissioned (i.e. first removed and then added to the project again) in order to activate those features.

Requirements to use the automatic OTA in the mobile app:

- An account in the Commissioning web app
- The Commissioning mobile app for iOS and Android
- Access to the project with devices to be updated
- A zip file with upgraded firmware which enables the update of devices with external firmware

Please note:

Once the device's firmware is updated, it is not possible to revert it to a previous version!

Use our contact form

www.inventronics-light.com/contact-us



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