Best Practices

Lux Sensors

CASAMBI

Introduction

Lux sensors, also known as light sensors or illuminance sensors, are used in a variety of lighting control applications. These devices are photosensors designed to detect and measure the intensity of light in a given area, allowing us to make decisions regarding lighting, optimize energy usage, enhance security, and improve overall comfort.

This best practice document aims to provide a comprehensive guide on the placement and configuration of lux sensors within a Casambi lighting control system. By following the guidelines outlined in this document, you will be better equipped to address common challenges and find effective solutions when specifying Casambi, ensuring the optimal performance of your lux sensor within your lighting control system.

This document is a valuable resource that must be used as a complement to the lux sensor manufacturer documentation.

Lux sensor placement considerations

To ensure the best results in a daylight harvesting system, it's vital to carefully choose where you position your lux sensors. The effectiveness of your lighting control system is entirely contingent on the sensor's field of vision. This becomes especially critical in scenarios where side-lighting, reflected light, diffused daylight, or direct sunlight can impact sensor performance. Even a minor adjustment in sensor position or orientation has the potential to significantly impact the overall system's performance.

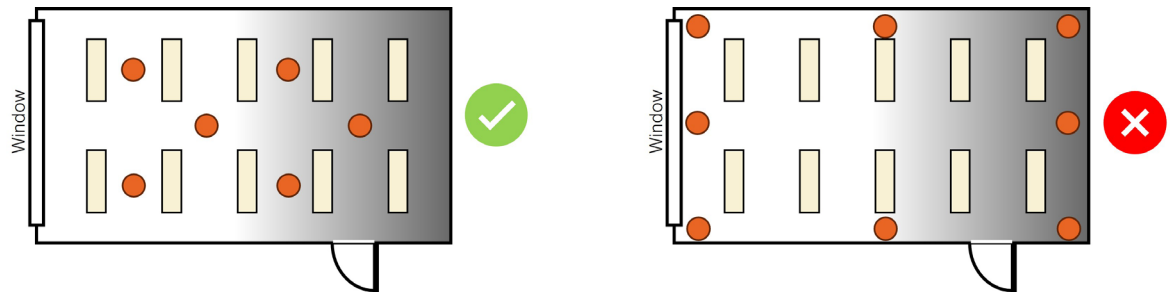
Consider using a separate lux meter to measure light levels in potential locations before choosing the final position for the daylight sensor.

Position and orientation

For optimal performance, sensors should be positioned and orientated in a way that they are shielded from any direct glare and sunlight.

Indoor sensors should not normally be placed next to a window. Instead, position them so that they receive only indirect daylight illumination.

It is important to position the lux sensor to capture a representative sample of the available daylight in the respective area, avoiding zones with restricted field of view or dark corners.



Sensor specification

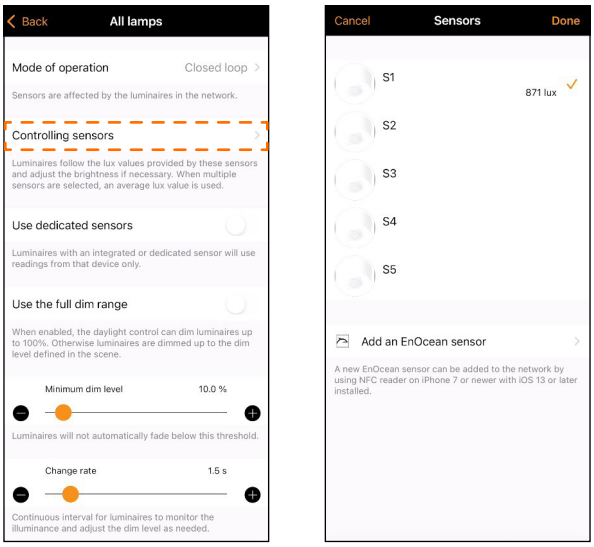
Understanding the sensor specifications is helpful for optimal sensor placement:

- A too wide field of view may result in detecting direct sunlight or illumination from light sources outside of the controlled zone.
- A too narrow field of view can make the sensor too sensitive to local changes in brightness.

Follow the sensor manufacturer's specifications and installation instructions, as well as placement guidelines, irrespective of the chosen sensor or intended mode of operation.

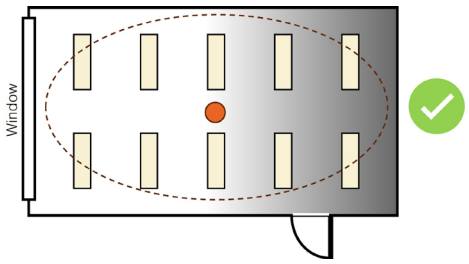
Controlling Lux sensors considerations

In the Daylight scene configuration, you should choose the sensor(s) responsible for providing lux values to adjust the lux level of luminaires controlled within that scene.

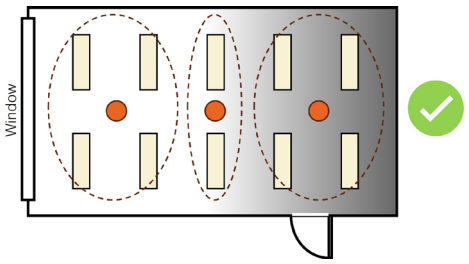


It is advisable to plan and select only those lux sensors that contribute to optimal performance when associating them, especially when multiple luminaires are chosen, as an average lux will be taken into account.

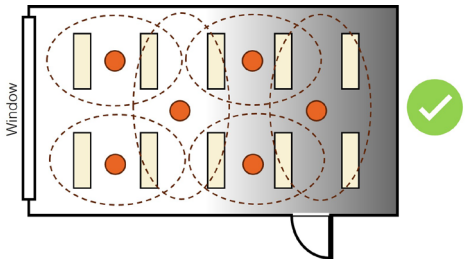
The following pictures represent some situations and recommendations when selecting the lux sensors:



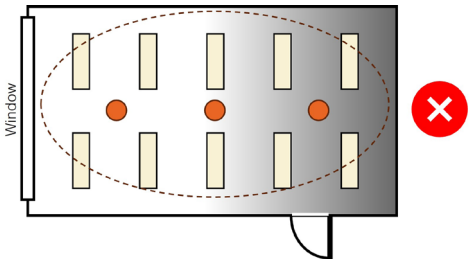
One sensor for all luminaries.



Sensors dedicated to controlling certain luminaires.



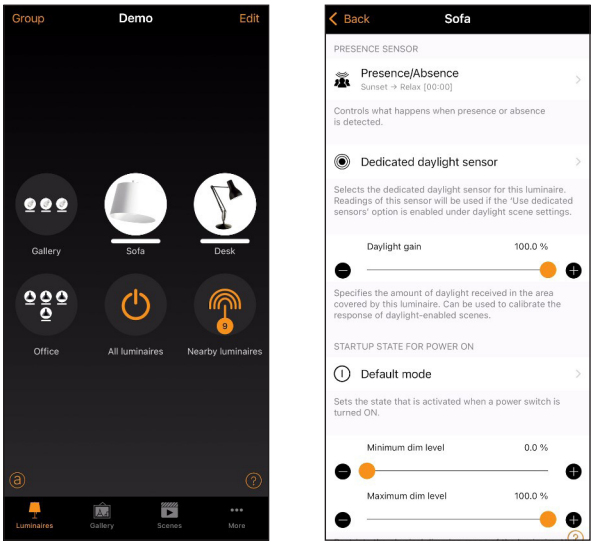
Overlap of controlling sensors. Left luminaires only have ONE controlling sensor assigned. Top 2nd and 3rd column have top left sensor and central left sensor assigned.



3 sensors each controlling all luminaires, so average lux is taken. This might not give the best result.

Luminaire settings

In Luminaire properties, you can configure features related to daylight. To edit the control properties of individual luminaires, double-tap the luminaire icon you wish to modify in **Luminaires** tab. Alternatively, tap **Edit** at the top of the screen and select the luminaire you want to edit. A separate window will then display the configurable properties, including Dedicated daylight sensor and Daylight gain.



Dedicated daylight sensor

This option enables you to choose a dedicated daylight sensor that can influence the luminaire. The readings from this sensor will be utilized when the **Use dedicated sensors** option is enabled in the daylight scene settings.

Daylight gain

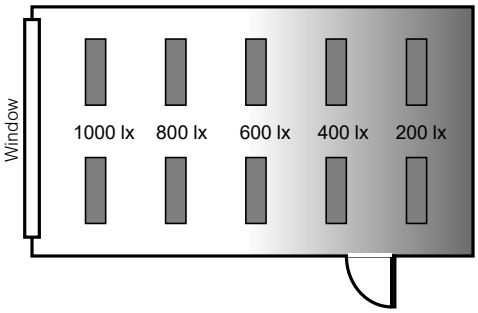
When configuring daylight control for an area, it is important to consider whether luminaires may need to be configured with a daylight gain offset to optimize the achieved dimming conditions. Daylight gain is mainly used, for example, if there are multiple luminaires in an area being controlled by a single daylight sensor.

Daylight gain is an estimate of the amount of available natural light that can be present in the same area that is illuminated by a single luminaire. For example, a luminaire installed next to a window may be in a position where the most natural light is available, and therefore achieve a daylight gain of 100%. A luminaire that is further from the window will not receive as much natural light that can affect the area being illuminated and will therefore have less daylight gain.

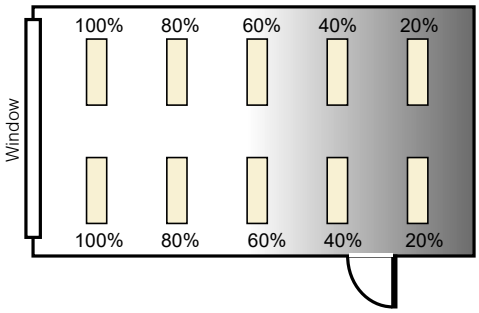
Configuring different daylight gains for the luminaires in an area would have the effect of providing a more consistent illumination throughout a room, if controlled by a single lux sensor. Luminaires installed near a window will dim to a lower level than luminaires situated further inside the room, but users of the area will perceive that there is a similar amount of total light available throughout all areas across the entire room.

A recommended method to determine the estimate of daylight gain for different areas would be to use a lux meter and take readings at different points without any artificial illumination being active (i.e., only natural light is available). The highest lux value can then be taken as 100% daylight gain and lower daylight gain percentages can be calculated on that basis.

If you wish, you can define a separate daylight gain for each luminaire in a Casambi network. By default, the daylight gain for luminaires is set to 100%.



Measured lux (luminaires off)



Applied daylight gain (Luminaire properties)

Daylight Sensor settings

Sensor parameters can be adjusted to match specific project requirements since optimal settings may differ. This includes configuring the Minimum sensor reporting time, Sensitivity, and Tolerance.

Minimum sensor reporting time

In the **Performance & Security** section, you will find the **Min sensor reporting time** parameter, which controls how often lux sensors report data to the network.

The default value is 0 seconds, but it's advisable to increase the interval to reduce network traffic, especially in networks with many sensors.

Sensitivity

You can configure the **Sensitivity** of a daylight sensor in the **Sensors** list in the **More** tab.

The Sensitivity defines how quickly the sensor will react to changes in illumination. The higher the sensitivity, the faster the reaction time. Lower sensitivities are usually chosen to avoid possibly annoying situations of luminaires dimming up and down every time a cloud happens to cover the sun for a few seconds.

The default setting is 80%, which is ideal for testing. For regular use, it is recommended to decrease the sensitivity.

Tolerance

Within the **Sensor** settings, you can also configure the **Tolerance** parameter.

The Tolerance defines how large the changes in measured lux value need to be before the sensor will react and adjust the lighting. For example, with a target of 500 lux and a 10% tolerance, no changes occur within the range of 450 to 550 lux.

The default tolerance is set at 5%. For standard use, it's advisable to select a higher tolerance, as a larger value necessitates more significant lux variations.

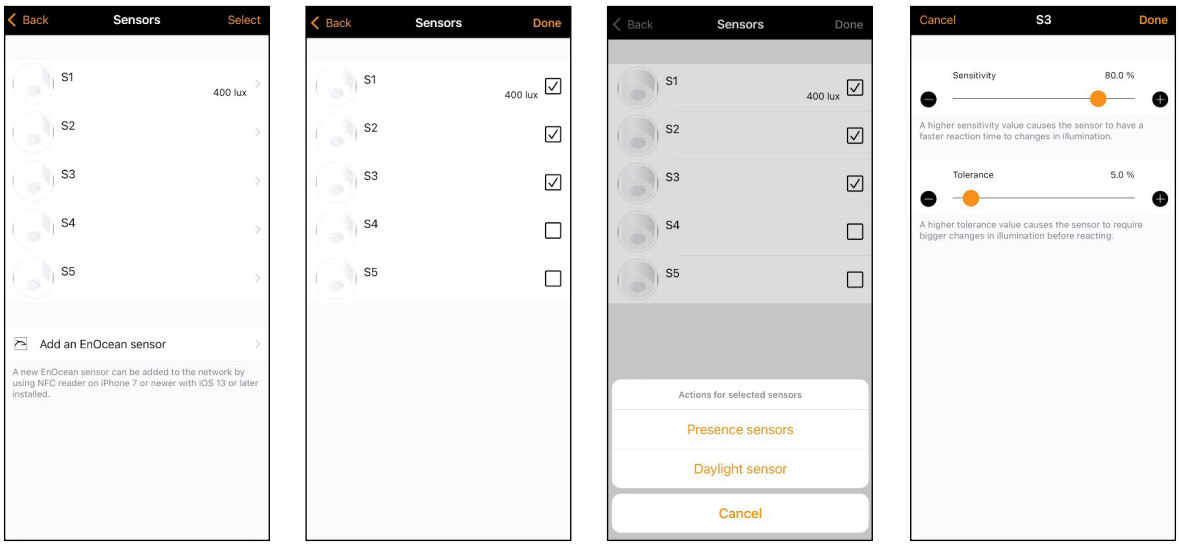
Configuring settings for multiple sensors simultaneously

If desired, you can simultaneously adjust the **Sensitivity** and **Tolerance** settings for multiple daylight sensors.

⚠ Simultaneous calibration of multiple sensors is not possible.

To configure the settings for multiple sensors simultaneously, tap on **Select** in the **Sensors** view and choose all required sensor (tick box). Tap on **Done** when all required sensors are selected. Then select **Daylight sensor** settings.

Set the parameters as desired. Tap on **Done** when finished and you will see a confirmation message of how many sensors have been configured. Tap on **OK** to continue.



Daylight sensor calibration

In most cases, calibrating a daylight sensor may not be necessary, as the sensor technology is typically accurate. However, site-specific variations arising from differences in sensor specifications, locations, orientations, and the presence of natural and artificial lighting can necessitate calibration for Casambi-enabled sensors. Calibration ensures that the lux value measured by the sensor is accurately interpreted by the Casambi system, providing a corrected lux value for the specific application.

If calibration is required, the first step is to determine whether the sensor should be calibrated for measuring incidental or reflected light. Depending on this, you should select the appropriate calibration method. For a detailed, step-by-step guide on how to calibrate a sensor, please refer to the Casambi App User Manual.

Sensor calibration for incidental (direct) light

The process of calibrating a sensor for incidental (direct) light in the Casambi app involves adjusting the lux reading to accurately reflect the total amount of light received by the sensor.

To calibrate, place a lux meter as close as possible to the lens of the Casambi-enabled sensor and measure the amount of light. Then access the app's daylight sensor settings, and input the measured lux value as the "Current value".

Sensor calibration for reflected light

Calibrating a Casambi-enabled sensor for reflected light is important for maintaining a specific amount of light on objects or surfaces opposite the sensor lens.

For accurate calibration:

1. Place a lux meter on the object's surface opposite the sensor lens.
2. Measure the light received by the lux meter.
3. Input the lux value in the Casambi app's Daylight sensor settings ("Current Value").

Calibrating the sensor for reflected light has been shown to produce less optimal results in Closed loop mode. It is better to set the target value in a closed loop scene to be the lux value actually measured by the sensor. For example, if you want to configure a closed loop scene to achieve 500lx on a surface:

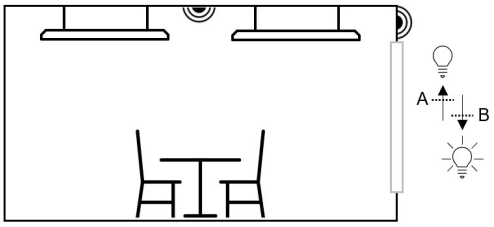
1. Place a lux meter on the surface below the sensor.
2. Dim the lighting to achieve the desired lux on the surface (500lx).
3. In the Casambi app, read the lux value being measured by the sensor (this may be, for example, 400lx).
4. Use the sensor lux value (400lx) as the "Target lux value" in the Closed loop daylight scene.

When calibrating for artificial light control, minimize natural light. Ideally there should be no natural light. Also try to finalize the installation as much as possible for accurate results.

Daylight scene modes

Daylight scenes utilize information provided by lux sensors to automatically adjust the scene lighting level based on the amount of light available. There are 4 daylight scenes mode available: Basic, Closed loop, Open loop and External.

Basic (ON/OFF)



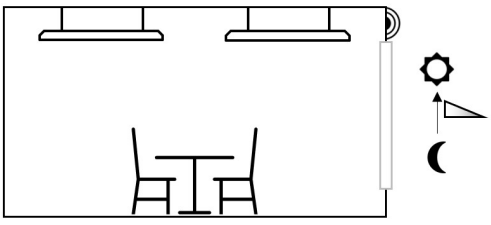
Luminaires in an active scene will fade ON or OFF based on two configurable Lux threshold levels:

- If the measured lux is below the “Switch ON at” setting, the lights will be ON.
- If the measured lux is above the “Switch OFF at” setting, the lights will be OFF (or at the Minimum dim level setting, if this is not 0%).

⚠ This mode does NOT turn the scene itself on and off.

Configure lux threshold values to be far enough from each other to avoid repeated or unwanted on/off operation. The Minimum dim level is relative to the scene dim level (i.e. if Minimum dim level is 10% and the scene is at 70% then the minimum dim level will be 7%).

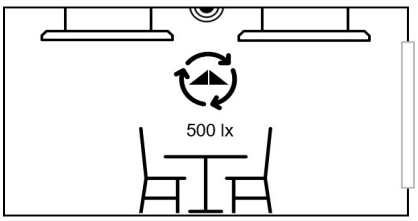
Open loop



Luminaires in an active scene will have their output level adjusted by comparing the sensor’s lux reading against a response graph.

⚠ Sensors should not be affected by any light from the luminaires in the network. Examples: Luminaires controlled by a sensor installed in a separate location to the luminaires (outdoor sensor) or controlled by a sensor that is facing towards a window away from the luminaires.

Closed loop

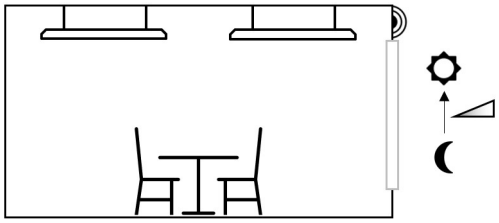


The sensor actively adjusts the luminaires in the active scene to try to reach and maintain a target lux level via a feedback loop (by observing the results of its own changes). This mode is for “constant light” scenarios.

An Activation level graph can be configured to define the scenes starting dimmed level in relation to the actual lux value in the area when the scene is triggered.

⚠ Sensors are affected by light from the luminaires in the scene. Example: Luminaires controlled by a daylight sensor that is in the same area as the luminaires.

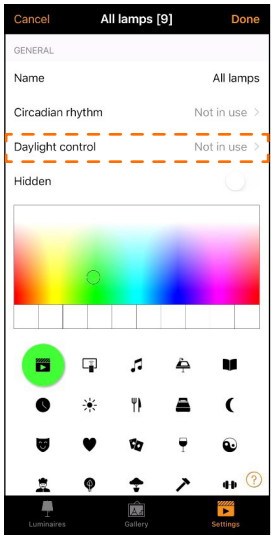
External

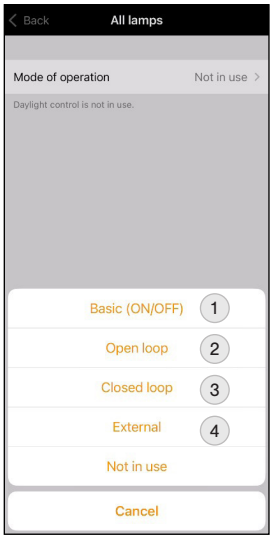


This is like the Open loop option, but it is based on a 0-100% dimming signal being sent from the sensor rather than a lux level. This option is designed to be used to combine a Casambi unit with a sensor which is not Casambi-activated (e.g. A DALI sensor).

Daylight scenes settings

When the desired Daylight scene mode has been selected, you will then need to set some parameters. The parameters to be configured will vary depending on the selected Mode of operation.





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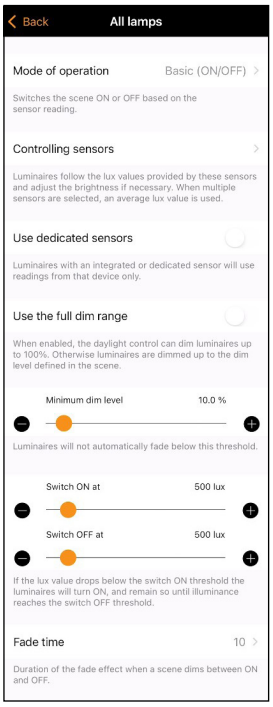

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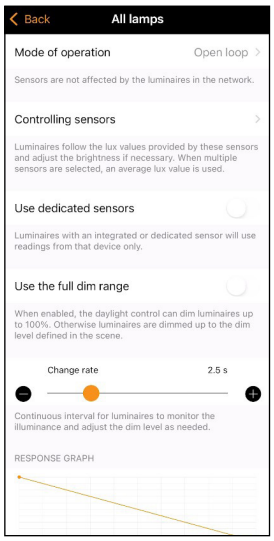

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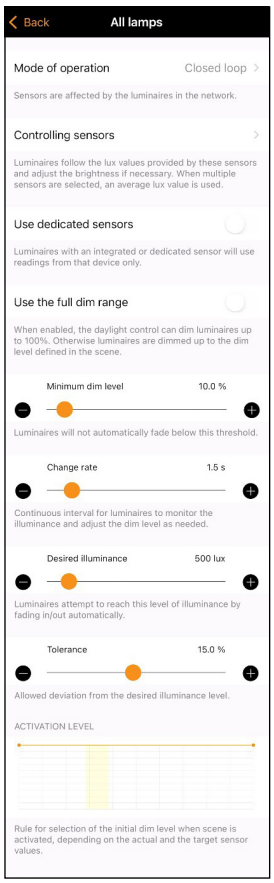

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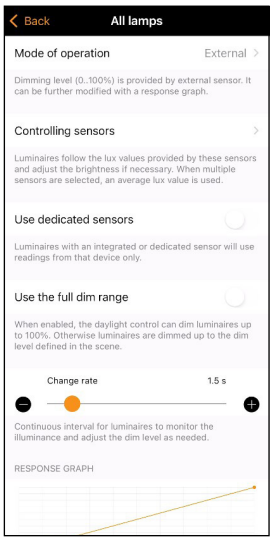


Controlling sensors

Luminaires follow the lux values provided by the sensor seleted and adjust the brightness if necessary. When multiple sensors are selected, an average lux value is used.

Up to 30 sensors can be configured to control the same luminaire in Evolution network.

You don't need to associate ALL lux sensors with the scene if some sensors are in a location which would not be beneficial for performance.

Dedicated daylight sensor

If a luminaire has a built-in daylight sensor, you may wish that luminaire to only respond to values from that
sensor. Alternatively, you may have a situation where you are using multiple daylight sensors, but you only wish to have one specific sensor affecting a particular luminaire. In such cases you can configure individual luminaires to react only to a specific sensor.

If **Use dedicated sensor** is enabled, a luminaire that has had a dedicated sensor assigned to it will only respond to values from that sensor. Luminaires that have not had any dedicated sensor assigned will be controlled by multiple sensors, if used. For example, if you have multiple lux sensors controlling the lighting in a room, luminaires without dedicated sensors assigned will respond to the average lux value from all sensors. Luminaires that have a dedicated sensor assigned will only respond to the lux value from the specific dedicated sensor.

In Luminaire properties you can select the dedicated daylight sensor for the especific luminaire.

Full dim range

When **Use the full dim range** is enabled, the daylight control can dim luminaires up to 100%. Otherwise, luminaires are dimmed up to the dim level defined in the scene.

Minimum dim level

This parameter is available for Basic ON/OFF and Closed loop modes.

The luminaires will not automatically fade below this threshold and % is relative to the maximum defined in the scene (i.e., a 50% scene will dim to 5% if minimum dimmed level is set to 10%).

Basic ON/OFF "Switch off at" lux threshold does not switch the lights off if "Minimum dim level" is not 0%.

Change rate

This parameter is available for Open loop, Closed loop and External modes.

Change rate corresponds how often luminaires adjust dimming to match the daylight scene target. This is in incremental steps. i.e. Dim up a bit, check lux, dim up a bit more, check lux again, until lux is target so no dimming is needed. Also, the same for dim down.

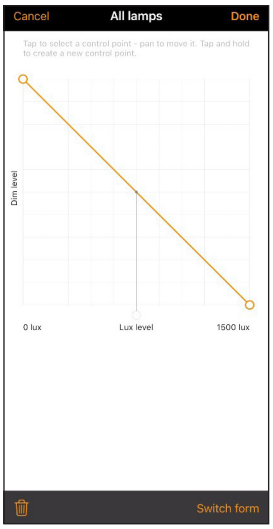
Response graph

For Open loop or External modes, you can configure the response graph. The affected luminaires will gradually change the dim level towards the desired target, comparing the sensor's reading against the response graph.

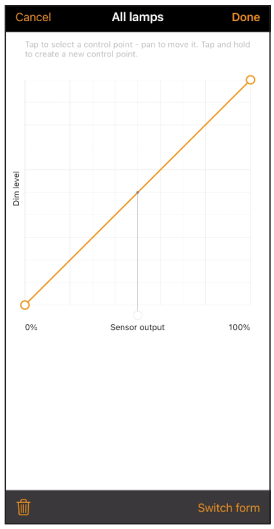
The response graph displays the dim level on the vertical axis and either lux levels or sensor output dim levels on the horizontal axis, depending on whether it is in Open loop or External mode, respectively.

You have the flexibility to customize the points on the response graph to meet your specific needs. You can add or remove points as necessary. To create a new control point, tap and hold on the graph at the desired location. You can also select an existing point to highlight it and then use the bin icon in the bottom left to delete the selected marker.

Additionally, you can switch between different graph forms by using the **Switch Form** option. This enables you to transition between a smooth graph and a stepped graph.



Open loop mode



External mode

Desired illuminance

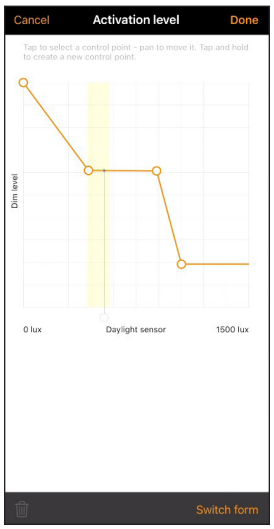
In the Closed loop mode, sensors actively adjust the luminaires in the active scene to try to reach and maintain the desired level via a feedback loop.

In cases where multiple sensors are controlling the scene, the average lux value of all sensors affecting the luminaires is the value used by the system.

Activation level

Activation level for Closed loop mode defines how the scene starts based on the lux already present in the area when the scene is activated. When the current lux levels exceed the target value, it may be desirable for the scene to activate at a lower dim level. This is done to prevent further increases in lux levels beyond the desired target, ensuring a smooth and controlled transition.

This graph can be configured in the same manner as the response graph by adding or removing control points as need. Additionally, you have the option to change its format from a smooth graph to a stepped graph using the **Switch Form** feature.



This document is based on App version 3.11.0 and Firmware version 40.8.

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