

February 2020

Silvair

Daylight harvesting

Application note

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SILVAIR

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Daylight harvesting

What is daylight harvesting?

Daylight harvesting is a lighting control strategy where the electric light is automatically adjusted based on the availability of daylight in order to reduce the energy consumption while maintaining desired light level in the space. This results in improved occupant comfort as the daylight is the main source of illumination in the space and it's never too bright or too dark, so there's no need to manually adjust the light level.

Closed-loop approach

Silvair's daylight harvesting is controlled by a closed-loop method. The closed-loop method uses light sensors that measure the light from both daylight and electric light to adjust the intensity of the light fixtures until desired level is achieved. The changes in light level are constantly adjusted in response to changing daylight availability. The closed-loop systems are used mostly in indoor installations.

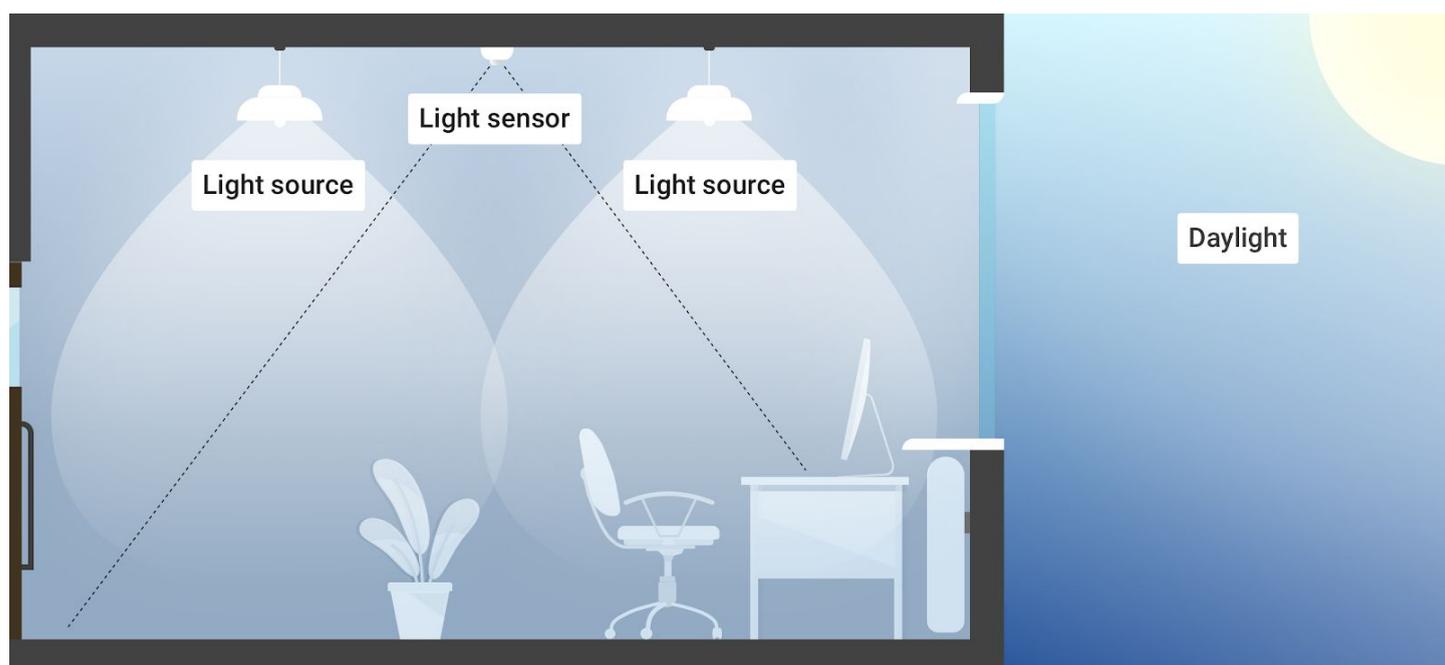


Image closed-loop daylight harvesting

How does the Silvair Commissioning support daylight harvesting?

- Daylight harvesting is supported in both vacancy and occupancy sensing scenarios and can be implemented at the level of zone¹
- A selected light sensor is used to control the light level of all the fixtures in the zone in a closed-loop to maintain desired conditions
- Minimum light output of the luminaires can be specified so that they never dim below that level

Required items

To use daylight harvesting in your project, you must have:

- At least one Bluetooth mesh light sensor and a controller installed in the space for each daylight zone



Danlers CEFL sensor - example

- Access to the project in the [Silvair Commissioning web](#) & mobile apps
 - The Silvair Commissioning mobile app should be installed on an iOS device
- A lighting zone with daylight harvesting profile selected in the Silvair Commissioning
- To calibrate daylight harvesting: a light meter

¹ For more information about sequence of operation and example applications check [Silvair lighting control - application guide](#)

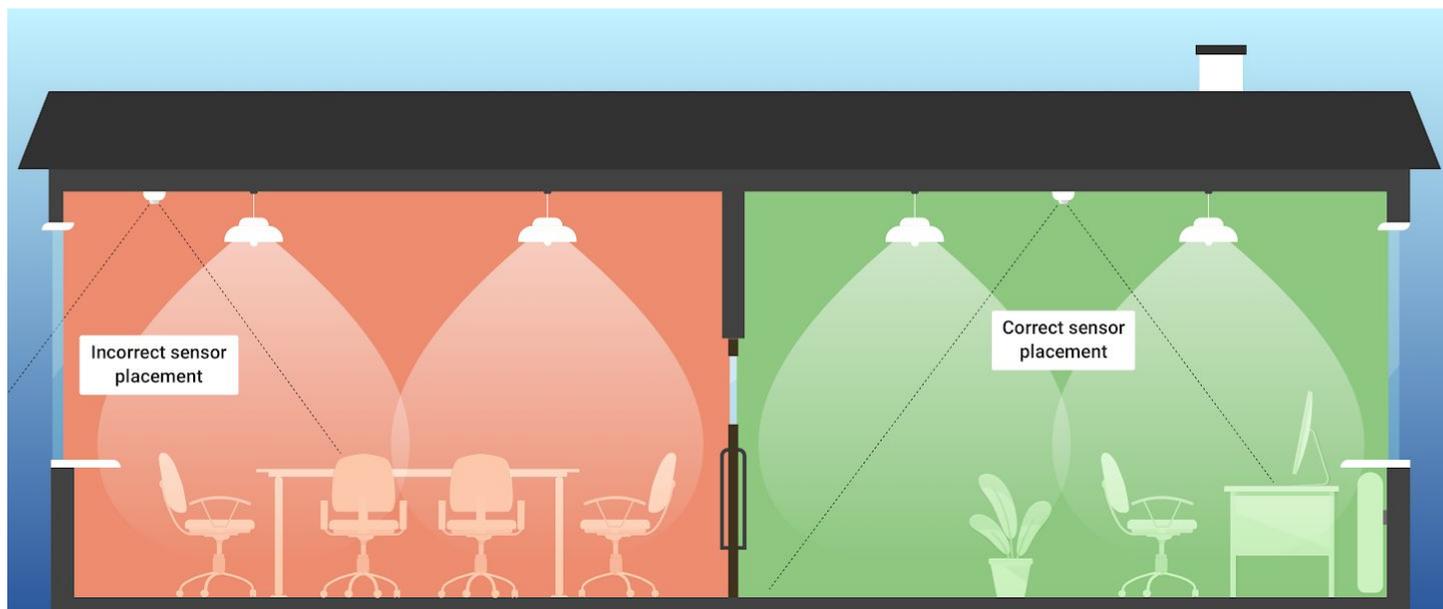
Light sensor recommendations

The choice and placement of the light sensors are highly application dependent and critical for the proper functioning of daylight harvesting. Please follow the manufacturer's recommendations. You may consider using the manufacturer's application support including project layout and sensor location services.

Choice of the sensor

To have the right quality of daylight control the closed-loop approach requires accurate tracking of the light level changes in the space illuminated by the controlled luminaires. The light sensor should see only the light contributing to the desired field of view while the influence of the light falling on the sensor from the angles outside this field of view should be limited to the maximum. Please contact the manufacturer and make sure that the sensors selected to be installed in the project will have adequate spatial response, i.e the right angle of view and ideally cut-off sensitivity for the angles outside.

Placement of the sensor



Please follow some general rules for sensor placement:

- Make sure that the sensor is located directly above the surface where you want to maintain the desired level.
- Make sure there is no direct sunlight falling on the sensor and the influence of the sunlight on the sensor is eliminated by mounting the sensor at the appropriate distance from the window.

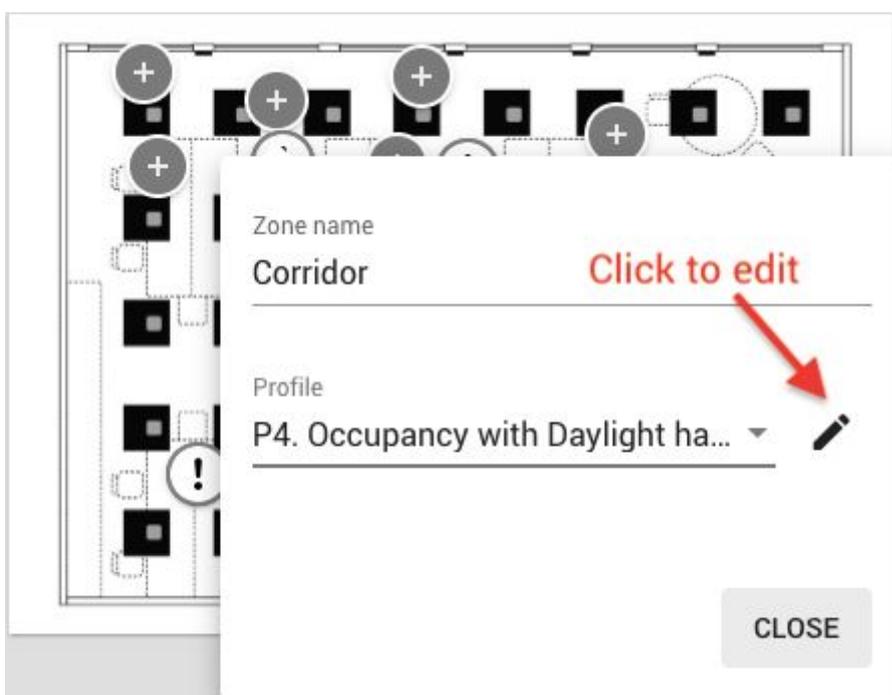
- Make sure that the sensor field of view is as close as possible to the surface covered by the controlled light fixtures and the sensor controls only the light contributing to the field of view.
- Avoid direct influence of the light from the luminaire on the light sensor. The angle of the light sensor and the light distribution of the corresponding luminaire must be taken into account.
- Sensors should not be installed above a highly reflective surface.
- Make sure that the view of the sensor is not obstructed.
- Install at least one sensor per daylight zone.

Commissioning

To be able to use daylight harvesting, you must use the Silvair commissioning web and mobile apps.

Silvair web app

1. Determine lighting zones. Consider defining a zone for each daylight zone. Please refer to the appropriate energy codes that apply to your project.
2. Profile selected for the zone needs to be daylight harvesting scenario (Occupancy sensing with daylight harvesting, or Vacancy sensing with daylight harvesting).
3. Click [pencil button] to adjust the parameters of the profile²



4. Fill in the settings³ (Occupied, Prolonged,... and other modes) and add light levels.
5. Save the profile.
6. Make sure that all daylight zones that will operate with daylight harvesting scenario have relevant profile selected.

² More information about available parameters you can find in [Silvair Commissioning user manual](#)

³ Always use "Keep the light above the min. value" with at least 1% in Occupied and/or Prolonged for projects version < 201903 with Silvair firmware version < 2.13

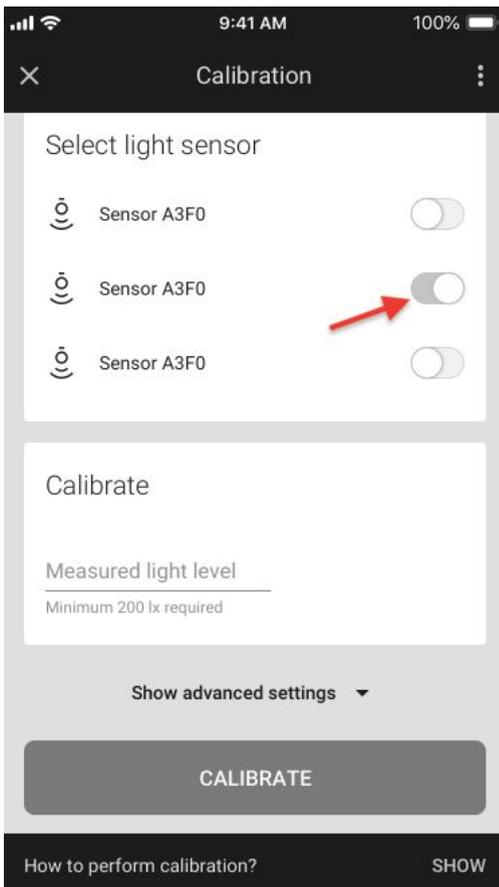
Silvair mobile app

1. Go to the space where you will be using daylight harvesting.
2. Open the project, select the desired area and zone with the Silvair mobile app.
3. After adding all devices to the zone⁴, you must perform calibration. You can calibrate devices by pressing **CALIBRATE** button in the **DEVICES** or in the in the **SETTINGS** tab

NOTE

- Calibration is critical as poorly calibrated daylight harvesting can eliminate any of the daylight harvesting benefits.
- Daylight harvesting calibration should be performed when all devices have been added to the zone and have been properly configured (no errors marker in the zone). Otherwise calibration may lead to errors in light control.

4. Select light sensor.



Manually select a light sensor which will control the light in the selected zone (switch the toggle next to the light sensor to the right).

NOTE: If you change / replace the sensor in a fixture, you must do the daylight harvesting calibration again!

HINT: After pressing the sensor icon

 a device starts blinking. It helps to quickly identify the luminaire.

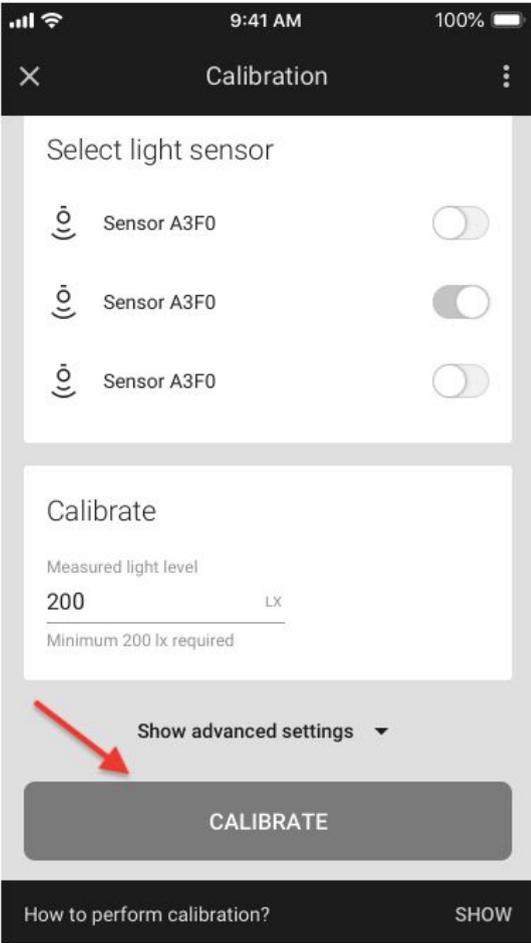
⁴ For more information on commissioning on-site, check [Silvair Commissioning user manual](#)

5. Place a light meter below the sensor on the surface where you want to maintain the desired light level.
6. Enter the LUX value measured by the light meter in the **Measured light level** field. Make sure the light level in the space meets the required minimum value displayed below the input field in order to reduce the calibration error.

If the minimum light level conditions cannot be achieved (e.g. you need to perform calibration in the night) adjust the light level of the luminaires in the zone using the slider available in the advanced settings below.

Note that the selected calibration parameters will be applied **only** to the selected sensor in that zone. Additionally, each controller in the zone will be calibrated.

7. Confirm action by pressing the **CALIBRATE** button at the bottom of the screen.

	<p>Calibration of the light sensor will start immediately. Expand Show advanced settings to access Light level and Daylight controller sliders.</p>
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8. If there are any issues with the calibration or the daylight control check Troubleshooting section below in the document.

Calibration recommendations

In order to have properly working daylight harvesting it needs to be calibrated in each zone after all devices have been installed and added.

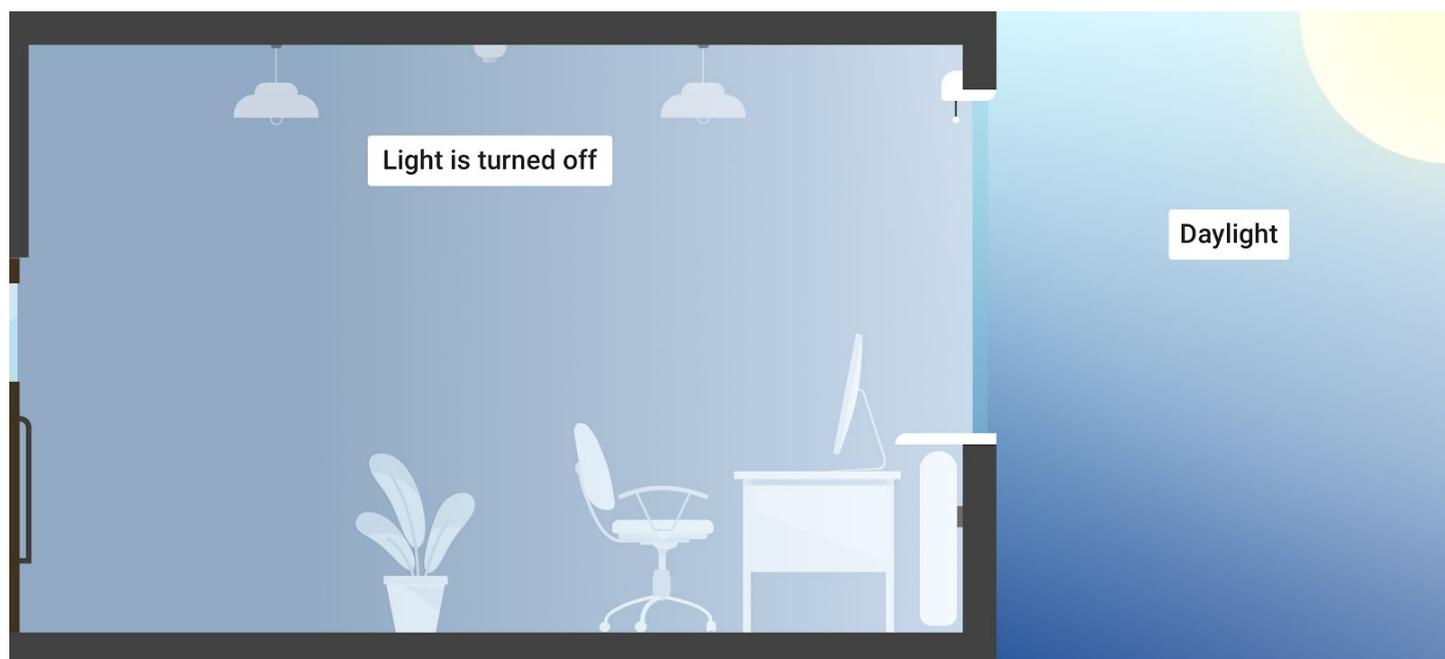
Make sure the following conditions are met:

- Calibration should be performed after all furniture, interior finishes and materials have been installed and the building has been occupied. Please repeat each time after making a significant change in the space layout or anything that may affect light distribution.
- Make the calibration adjustments at a distance from the sensor & light meter. Step away for a time before taking the readings as your body will interfere with light levels.
- Make sure to calibrate under normal daylight conditions with all lights switched off and do not perform calibration in complete darkness. There should be at least 100 lux measured by the light meter on the worktop to reduce the calibration error.
- Make sure windows and skylights are uncovered and clean.

NOTE

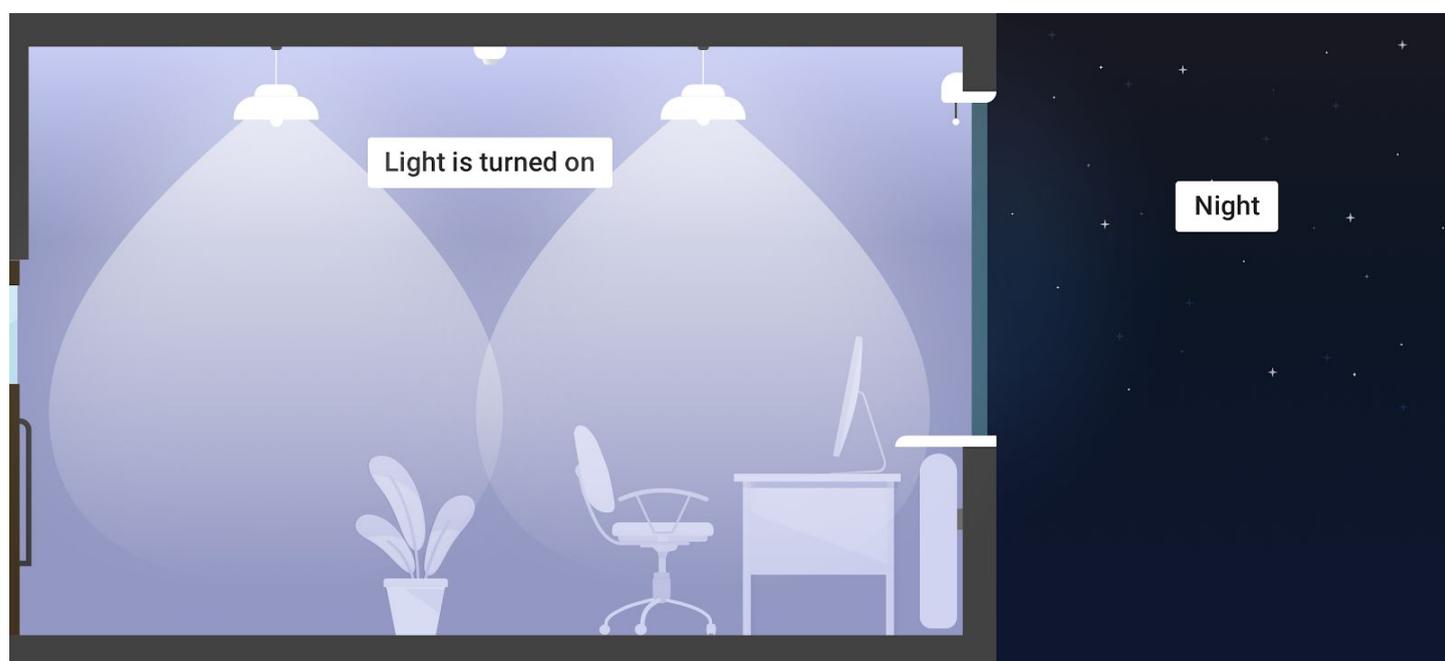
If you change / replace the sensor in a fixture, you must do the daylight harvesting calibration again!

The illustrations below present good and unwanted daylight harvesting calibration conditions.



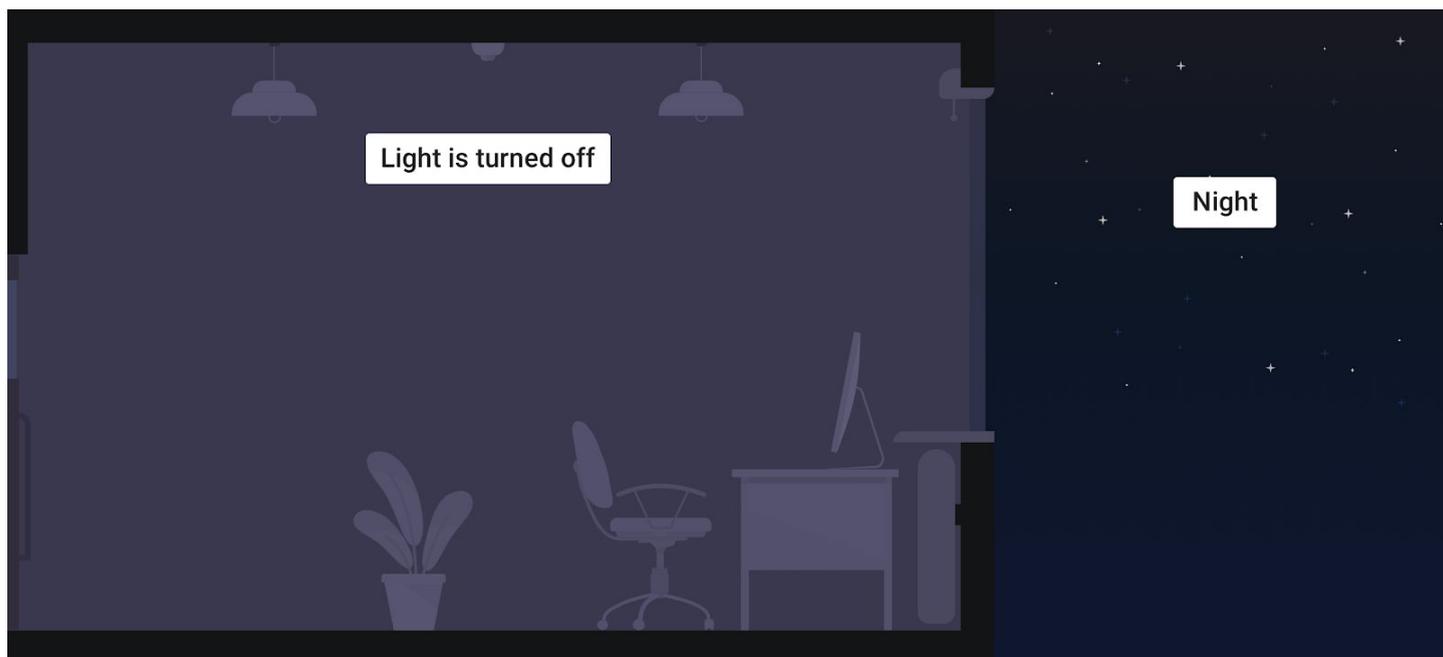
Good conditions - Desired conditions with daylight only

The daylight available in the space is sufficient and ideally it's near the desired conditions to be maintained by the daylight harvesting (light level is near the level defined in the profile selected for this zone) and at least 100 lux.



Bad condition 1 - Electric light only

Calibrating in space illuminated with electric lighting only may lead to space being underlit during daytime when the light sensor is affected by the light coming outside of the sensor field of view.



Bad condition 2 - Complete darkness

There's not sufficient light available which leads to incorrect light sensor calibration.



Bad condition 3 - Dusk conditions, e.g. windows covered

Even daylight is available, the windows are covered and there is not sufficient light level in the space. This may lead to an incorrect sensor calibration which may have high error rate in other conditions.

Considerations

Disclaimer

Depending on the actual space reflectance, sensor spatial response and its placement the measured light level may deviate from the actual value measured at the surface.

Unable to follow calibration recommendations

If you cannot perform calibration in recommended conditions, e.g. have to calibrate daylight harvesting during night, please follow these steps:

1. In the Calibration view expand **Show advanced settings**
2. Adjust light level in the space using the slider to achieve desired conditions
3. Enter the value of light provided by the light meter.
4. Press Calibrate button

NOTE

Calibrating the daylight harvesting in conditions other than recommended may lead to unexpected behavior and undesired light conditions in the space.

Energy saving adjustments

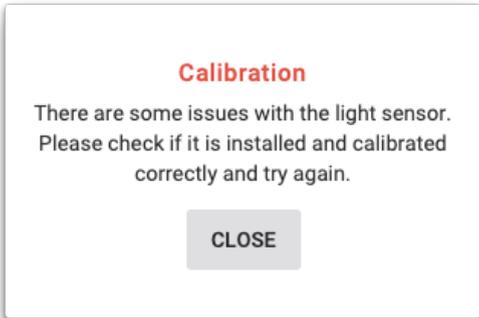
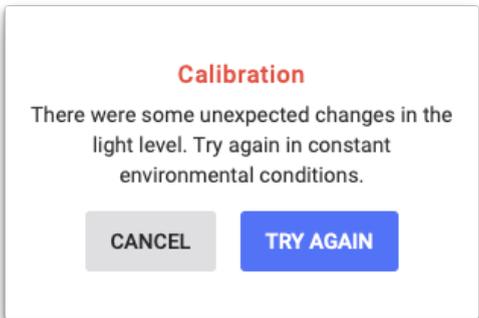
In order to optimise the energy consumption, you may set the **high-end trim**⁵, which defines the maximum level of light level that can be achieved. This would guarantee that the sensor during the light adjustment will not exceed the threshold light level.

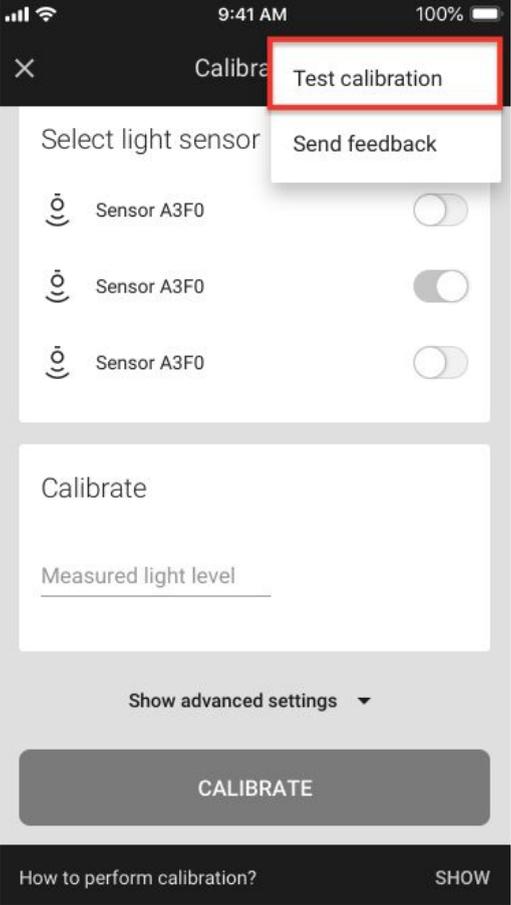
Notice: Setting high-end trim at low level is not recommended in spaces with manual control because it prevents occupants from adjusting manually the light level to desired levels.

⁵ This setting is available in the Silvair web app → project → edit profile → Scenario settings → Low → high-end trim

Troubleshooting

If there are any issues or unexpected light behavior including frequent on/off or oscillation please perform the calibration again. Errors may occur during devices' calibration. Some common errors in the Silvair mobile app and their explanations are provided below:

Issue	Description
 <p>Calibration</p> <p>There are some issues with the light sensor. Please check if it is installed and calibrated correctly and try again.</p> <p>CLOSE</p>	<p>This alert is presented only when sensor issues are detected. The issues may be caused by:</p> <ul style="list-style-type: none"> • Installation of a sensor has not been performed in accordance with sensor manufacturer's recommendations • Wrong sensor commissioning (e.g. a sensor has been mounted in a different space than the calibrated zone) • Using a broken sensor in the installation, or a factory damage of a sensor • Using a sensor that is: covered, unpacked, painted, sealed, which results in achieving an incomplete view • Breaking a sensor while pressing it inside a lighting fixture • Wrong installation: a sensor is installed too high • Wrong position (e.g. sensor's view is obstructed by a plant) • Choosing the wrong sensor (e.g. the sensor used in an installation is not an ALS sensor).
 <p>Calibration</p> <p>There were some unexpected changes in the light level. Try again in constant environmental conditions.</p> <p>CANCEL TRY AGAIN</p>	<p>Environmental conditions are changing during calibration. The adverse conditions include:</p> <ul style="list-style-type: none"> • A dark cloud outside a window that changes light intensity • Closing curtains, or covering a window placed close to the sensor • Temporary obstruction of a sensor by a person, or an object, which makes the sensor measurements inconsistent

	<ul style="list-style-type: none">● Strong light reflectance aimed at a sensor, or on the surface which is placed directly below the sensor.
	<p>If there are any issues or unexpected light behavior including frequent on/off, oscillation or the daylight control too slow / not reaching the desired level first run the CALIBRATION TEST to check whether the performance meets your requirements:</p> <ul style="list-style-type: none">● Press the context menu  in the top-right corner on the calibration screen and press CALIBRATION TEST● The testing mechanism will adjust the light level of the luminaires to the preset setpoint. <p>If the test shows any issues, you should try to simply redo the calibration. If the problems still occur perform the calibration again with adjusted Daylight controller responsiveness slider from the advanced settings:</p> <ul style="list-style-type: none">● If oscillations occur, position the slider to the left⁵● If daylight adjustment is too slow, position the slider to the right● Press CALIBRATE button● Check if the performance using CALIBRATION TEST.

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