

Silvair

Daylight Harvesting

Application note

16 November 2023	SN-209 rev. 7.1
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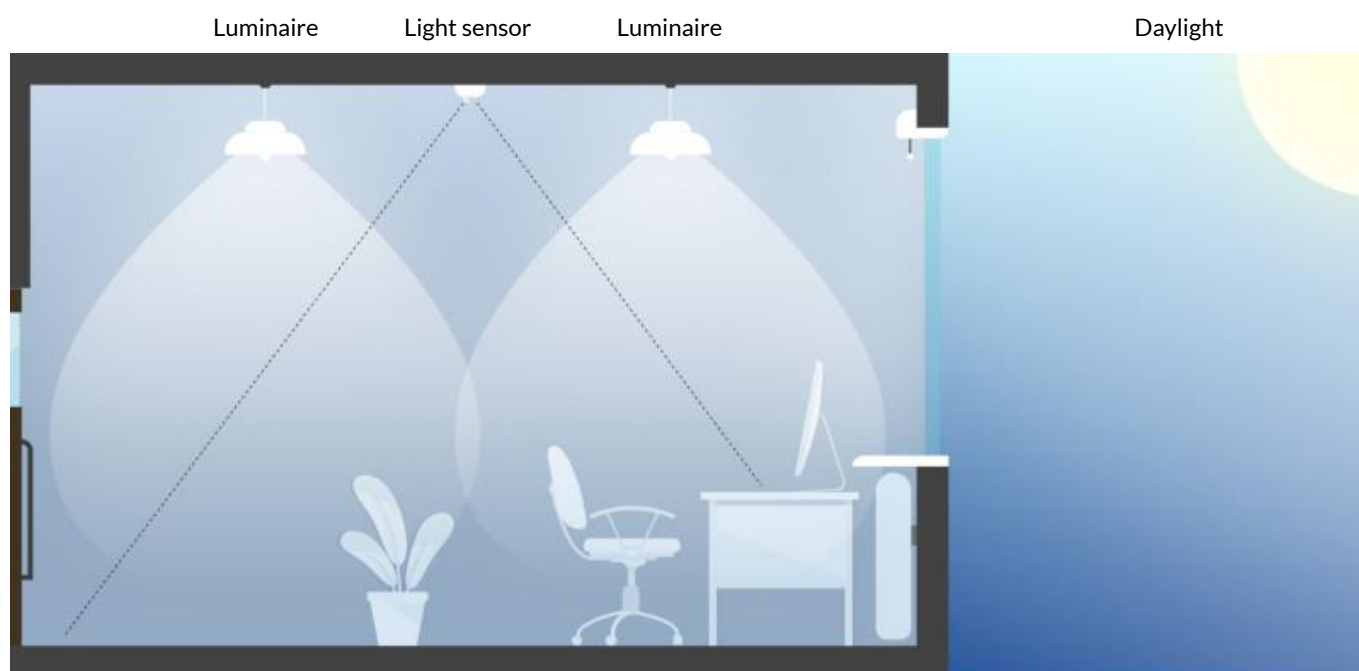
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1. Introduction

Daylight harvesting is a lighting control strategy used to maintain the required light level in the work area and reduce energy use. Luminaires adjust their light level automatically in response to changes in daylight.

1.1 Operation

Daylight harvesting is based on a closed-loop method which uses sensors to constantly monitor the light level in the room. The sensors send the measured light level to all controllers in the zone. The controllers then adjust the light level of the luminaires to maintain the level defined by the user. The user can also specify that the luminaires maintain a minimum light level even if there is enough daylight available.



1.2 Requirements

- Access to the project in the [Silvair web app](#).
- Silvair mobile app installed on an iOS or Android mobile device.
- At least one daylight zone configured with a control profile based on a daylight harvesting scenario¹.
- A Bluetooth mesh light sensor and a controller installed in each zone.
- A light meter to calibrate daylight harvesting.

¹ For examples of daylight harvesting applications, see [SN-211 Silvair Lighting Control](#).

2. Light sensor recommendations

i Selecting the correct light sensor and its position is necessary for the correct work of daylight harvesting.

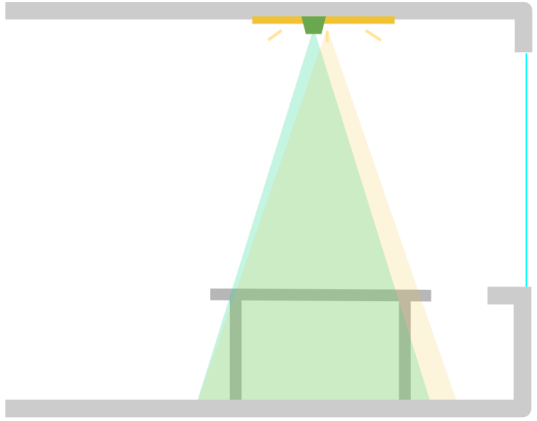
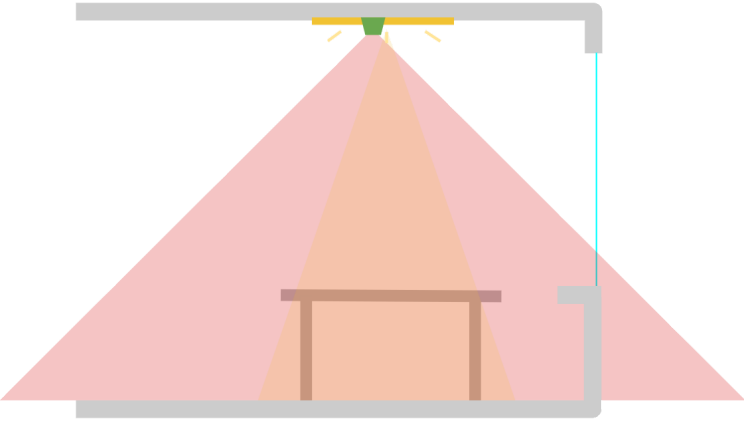
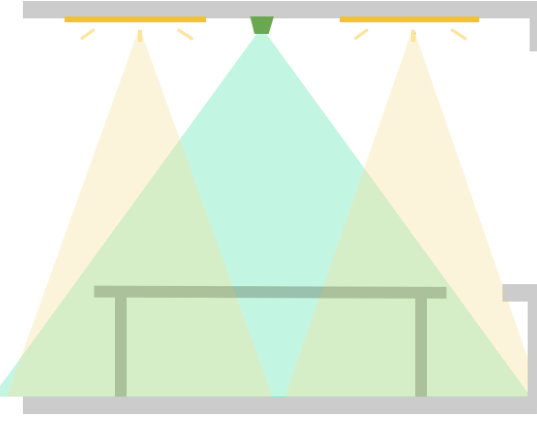
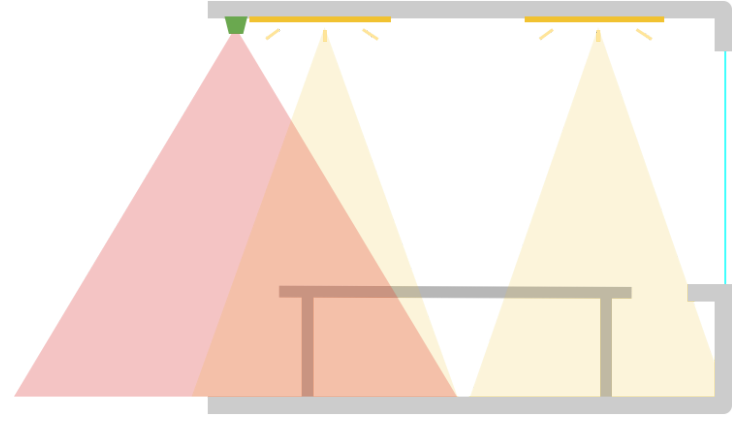
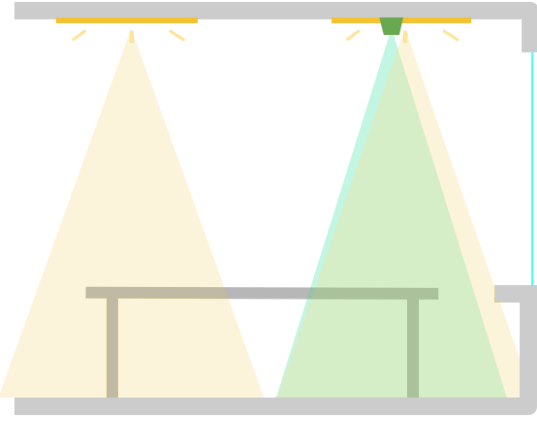
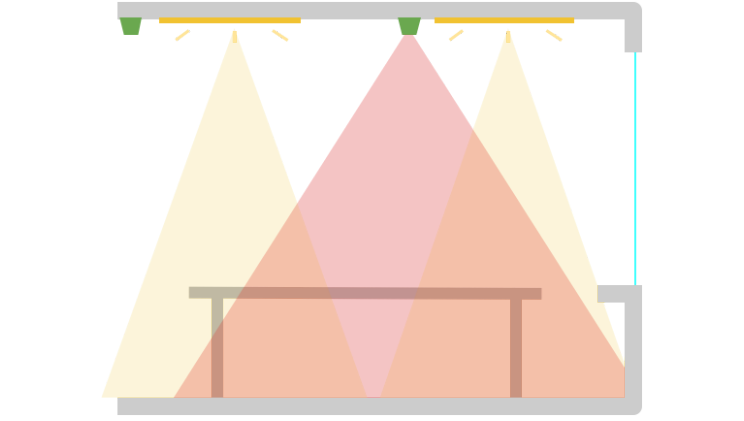
2.1 Selecting the sensor

To select the correct sensor and its position for your application, follow the recommendations of the manufacturer. Contact the manufacturer for help with your project layout and sensor locations. Make sure that the sensor has the correct field of view, which can be different for different orientations of the sensor, and that it does not monitor light from outside this field.

2.2 Positioning the sensor

- Install the sensor so that it is vertically above the surface where you want to maintain the required light level.
- Install the sensor far enough from windows so that no direct sunlight falls on the sensor. Take the field of view and height of the sensor into account.
- Make sure that the light from the luminaires does not fall on the sensor. Take the light distribution of the luminaires into account.
- Do not install the sensor above highly reflective surfaces.
- Make sure that the sensor monitors only the light from the surface covered by the controlled luminaires.
- Make sure that nothing blocks the field of view of the sensor.

2.3 Examples of good and bad positioning

 <p>The sensor monitors only the light from the surface covered by the controlled luminaires.</p>	 <p>The sensor also monitors light from the outside.</p>
 <p>The sensor monitors only the light from the surface covered by the controlled luminaires.</p>	 <p>The sensor monitors the light from only part of the surface covered by the controlled luminaires as well as light from the outside.</p>
 <p>The sensor monitors the light from the surface covered by the controlled luminaires.</p>	 <p>The sensor monitors the light from the surface covered by luminaires controlled from a different sensor.</p>

3. Commissioning

3.1 Creating and configuring the zones

1. Define lighting zones. Refer to the appropriate regulations that apply to your project. See [SN-211 Silvair Lighting Control](#) for examples of daylight harvesting applications.

Silvair web app

2. In the [Silvair web app](#), go to the project and area.
3. Click on the floor or site plan to add a zone that will use daylight harvesting.
4. From the **Profile** list, select a control profile based on the *Occupancy sensing with daylight harvesting* or *Vacancy sensing with daylight harvesting* scenarios.

5. Click and edit the profile².
6. To reduce the energy use, you can lower the maximum light level. To do this, set a lower **Max.** value for the **Low/high-end trim**.

The light level will not go above the **Max.** value when in auto mode.

If you want to use manual control, do not set **Max.** too low because the light level will not go above **Max.**, for example, when using a wall switch.

7. Click **Save** to save the profile.
8. Repeat steps 3–4 to create more zones in this area that should be controlled using this behavior and assign this daylight harvesting profile to each zone.
9. Repeat steps 3–8 to create zones in this area that should be controlled using a different daylight harvesting behavior.
10. Go to the remaining areas and repeat steps 3–9 to create zones and assign a daylight harvesting profile to each zone.


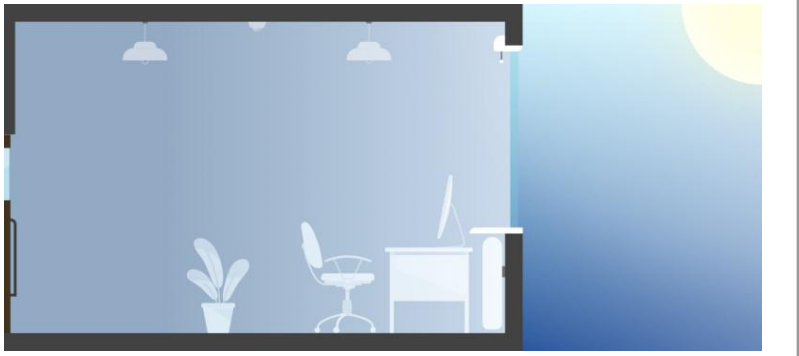

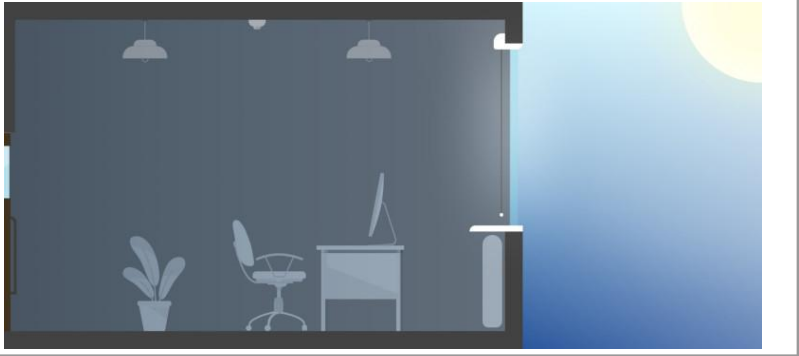

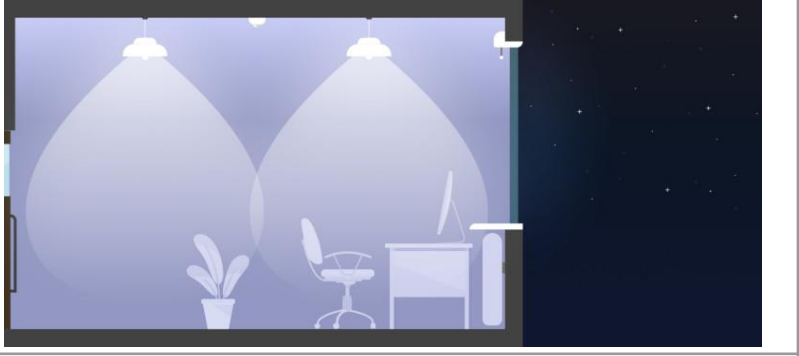

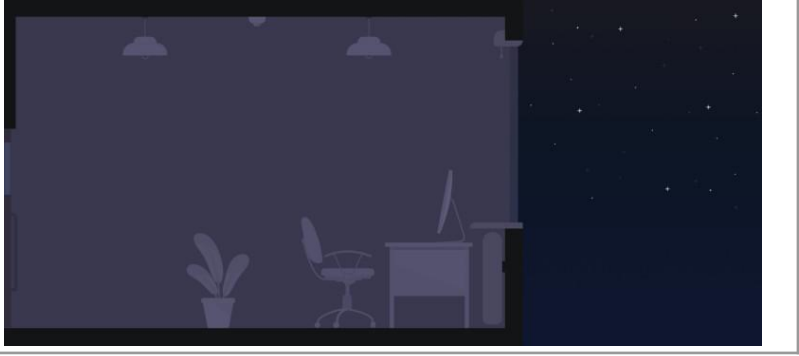
² For information about parameters, see [SN-200 Silvair Commissioning user manual](#).

3.2 Preparing for calibration

3.2.1 Recommendations

- Install all interior finishes, furniture, and equipment.
- Make sure that there are normal daylight conditions and turn off all luminaires in adjacent zones.
To decrease the calibration error, the measured light level must be at least 75% of the light level set in the zone and at least 100 lx.
- Do not stand next to the light meter when you read the values and calibrate.
- Make sure that windows and skylights are not covered.

3.2.2 Examples of good and bad conditions

	<p>Good conditions (enough daylight, no artificial light).</p> <p>Measured light level is close to the level set in the profile selected for this zone and at least 100 lx.</p>	
	<p>Bad conditions (not enough daylight, no artificial light).</p> <p>Windows are covered. Not enough light in the room.</p>	
	<p>Bad conditions (night, artificial light).</p> <p>The room will most likely be underlit during the day.</p>	
	<p>Bad conditions (night, no artificial light).</p> <p>Not enough light in the room.</p>	

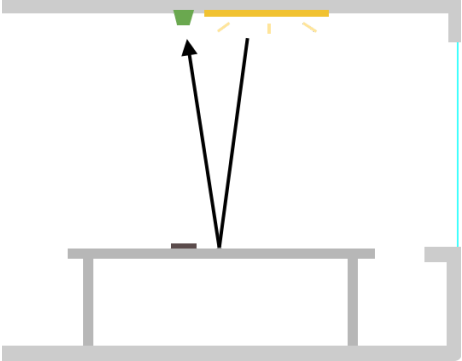
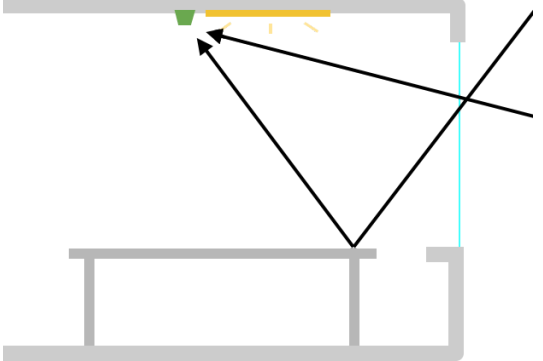
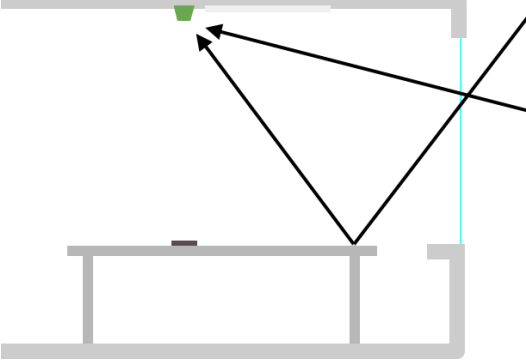
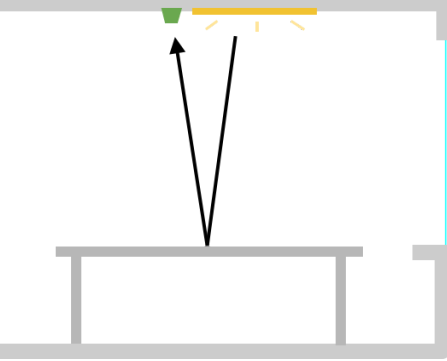
3.2.3 Principle of calibration

Calibration calculates the coefficient A that defines the relation between the light level on the monitored surface and the light level measured by the sensor:

$$A = \frac{\text{light level measured by the meter on the monitored surface}}{\text{light level measured by the sensor}}$$

The Silvair app adjusts the light level measured by the sensor using coefficient A so that the sensor displays the light level that is expected to be on the surface.

For best performance, calibrate during the day when the light level is close to the light level set in the profile selected for the zone. The figures show how daylight harvesting works when conditions are much different than when the sensor was calibrated.

Calibration at night with artificial light	Operation during the day
 <p>The relation (coefficient A) between the light level on the surface and light level measured by the sensor is calculated.</p>	 <p>The sensor measures more light than only the light on the surface. The relation between the light level on the surface and the level measured by the sensor is then lower than when calibrated. As a result, the app decreases the light level. The surface will be underlit.</p>
Calibration with daylight	Operation at night
 <p>The relation (coefficient A) between the light level on the surface and light level measured by the sensor is calculated.</p>	 <p>The sensor measures only the light on the surface. The relation between the light level on the surface and the level measured by the sensor is then higher than when calibrated. As a result, the app increases the light level. The surface will be overlit.</p>


3.3 Calibrating the zones

1. Go on site to a daylight harvesting zone.

Silvair mobile app

2. In the **Silvair mobile app**, open the project, area, and zone.
3. Add devices to the zone.

 - ! Make sure that there is no warning on the **Devices** tab. If there is a warning, tap **Configure all** or **Repair**.

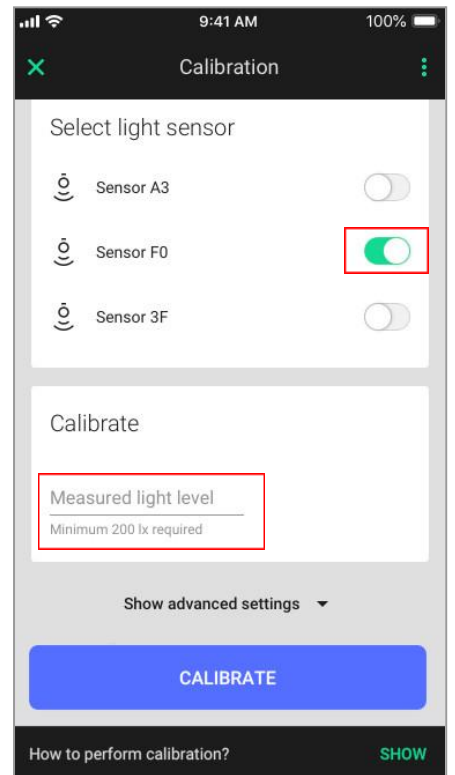
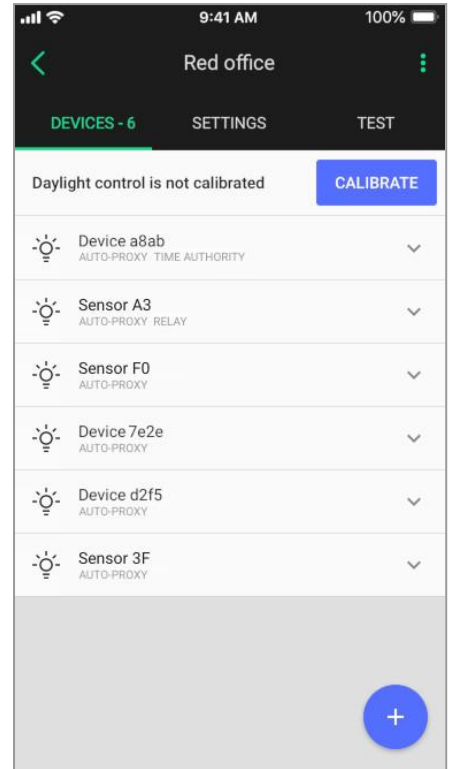
4. On the **Devices** or **Settings** tab, tap **Calibrate**.
5. Tap a toggle switch to select the correct sensor for the zone. To find the sensor, tap  next to a sensor name to make sure that the correct sensor flashes.
6. Put a light meter so that it is vertically below the sensor on the surface where you want to maintain the required light level.
7. In the **Measured light level** field, enter the value shown on the light meter in lux (lx). Make sure that the measured light level is at least the minimum shown below the **Measured light level** field.

 - i For best performance, calibrate when the measured light level is close to the level set in the profile selected for this zone.
 - i Follow [Calibration recommendations](#) to make sure that daylight harvesting will work correctly.

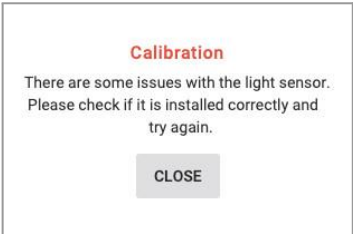

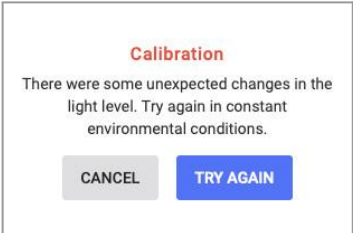
8. Tap **Calibrate**. The selected sensor and all controllers in that zone will be calibrated.



 - i After the calibration is completed, the calibrated zone goes to auto mode. All other linked zones go to their occupied light level.
 - ! If you change or replace the sensor, you must calibrate again.

9. Repeat steps 3–8 for each daylight harvesting zone.



4. Troubleshooting

Problem	Cause	Solution
“Calibrate” button does not appear.	A scenario other than the <i>Occupancy sensing with daylight harvesting</i> or <i>Vacancy sensing with daylight harvesting</i> is set up for the zone.	In the Silvair web app, set a profile based on the <i>Occupancy sensing with daylight harvesting</i> or <i>Vacancy sensing with daylight harvesting</i> scenarios for this zone.
	No light sensor available in the zone.	Add a light sensor to the zone.
	No light sensor selected in the zone.	Tap a toggle switch to select the sensor.
Calibration does not start when I tap “Calibrate”.	Measured light level is less than 75% of the level set in the zone or less than 100 lx.	Make sure that the light level in the control profile is not set too high.
		Wait for more sunlight.
		If the required minimum light level cannot be achieved, because for example you must calibrate at night, follow Calibrating in bad conditions .
	Light sensor is installed in a different zone or too far from the luminaires, or an incorrect light sensor has been selected.	Position the sensor so that the light from the luminaires is in the field of view of the sensor. Calibrate again.
		Select the correct light sensor for the zone. To find the sensor, tap  next to a sensor name to make sure that the correct sensor flashes. Calibrate again.
	Sensor malfunctioning or damaged.	Replace the sensor. Calibrate again.
	Sensor view is blocked.	Remove anything that blocks the view of the sensor. Calibrate again.
	Sensor not installed according to the recommendations of the manufacturer.	Follow the Recommendations for selecting the sensor .
	Clouds reduced the sunlight in the room.	Maintain constant light conditions in the room. Wait until clouds are not blocking the sunlight. Calibrate again.
	Curtains were being closed.	
	Sensor view was temporarily blocked by a person or object.	
	Light was reflected toward the sensor or from the surface below the sensor.	
Available daylight changes, but light output does not change.	Change in daylight was too small.	Wait until the light level on the monitored surface changes more from the required light level. The light of the luminaires may not be adjusted if the difference between the light level on the surface and the required light level is less than $\pm 8\%$.

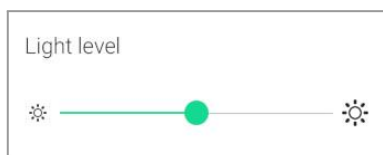
Problem	Cause	Solution
Required light level cannot be achieved.	Calibration was done in bad conditions.	Calibrate in good conditions. See Examples of good and bad conditions . If you must calibrate at night, follow Calibrating in bad conditions .
	Luminaires have degraded over time (lumen depreciation).	In the Silvair web app, go to the zone and click  . Then, increase the Max. value for Low/high-end trim . Calibrate again. <div style="border: 1px solid #ccc; padding: 5px; margin: 10px 0;"> Low/high-end trim ?  </div>
		Replace the luminaires. Calibrate again.
Daylight harvesting does not work correctly.	Calibration was done in bad conditions.	Calibrate in good conditions. See Examples of good and bad conditions . If you must calibrate at night, follow Calibrating in bad conditions .
	Light level measured by the sensor is different from the light level on the monitored surface.	Follow Light sensor recommendations and Calibration recommendations .
	Incorrect calibration or other cause.	Perform a calibration test .
Daylight harvesting worked correctly for some time but then stopped.	The light sensor has been replaced or a different sensor has been selected.	Calibrate again.
	Light distribution in the room has changed, for example as a result of changing the room layout or repainting.	
	A luminaire has been added to or removed from the zone.	

4.1 Calibrating in bad conditions

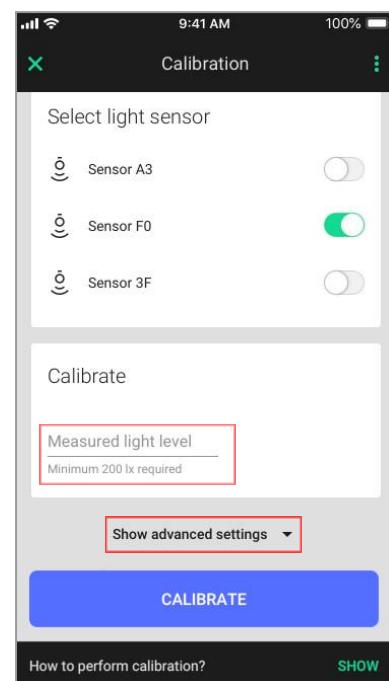
i Calibrating in bad conditions can cause daylight harvesting not to work correctly.

Silvair mobile app

1. On the **Settings** tab, tap **Calibrate** to go to the calibration view.
2. Expand **Show advanced settings**.
3. Move the **Light level** slider to the right so that the light meter shows a lux (lx) value that is at least the minimum specified below the **Measured light level** field.



4. Enter the measured value in the **Measured light level** field.
5. Tap **Calibrate**.



4.2 Testing the calibration (for iOS/iPadOS)

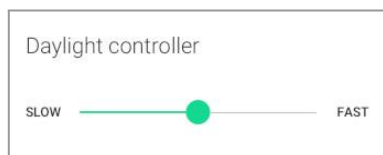
Silvair mobile app (for iOS/iPadOS)

1. In the **Silvair mobile app for iOS/iPadOS**, go to the **Settings** tab.
2. Tap **Calibrate** to go to the calibration view.
3. Tap **⋮** and select **Test calibration**.

i The light of the luminaires will be adjusted to the values set in the profile selected for this zone.

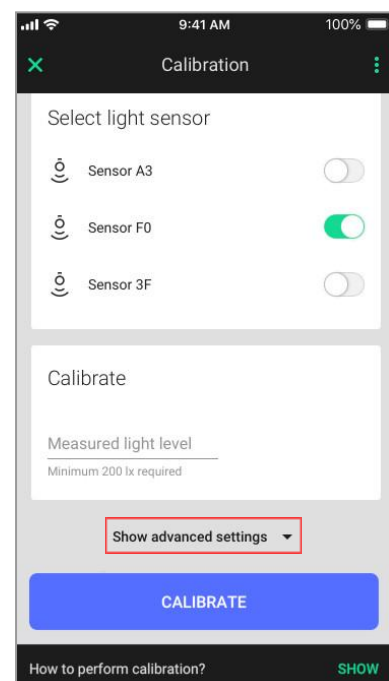
4. If the test shows any issues, follow [Calibration recommendations](#) and calibrate again.
5. If the problem persists, go to the calibration view again and tap **Show advanced settings**.

- a. If the luminaire light level oscillates, move the **Daylight controller** slider to the left.



- b. If the luminaire response is too slow, move the **Daylight controller** slider to the right.

6. Calibrate again.
7. Perform the calibration test again.



5. Document revisions

Revision	Date	Editor	Changes
7.1	16 November 2023	GM	Added information about the Android support. Clarified where the mobile app for iOS/iPadOS is required. Corrected links to external documents. Minor edits.
7.0	8 March 2023	GM	The entire document has been redacted. Added Examples of good and bad positioning , Examples of good and bad conditions , Principle of calibration , Calibrating in bad conditions , and Testing the calibration sections. Removed Disclaimer section. Improved Commissioning and Troubleshooting sections. Implemented template v. 1.2.
6.0	29 October 2020	PS, ZZ	Previous release.

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