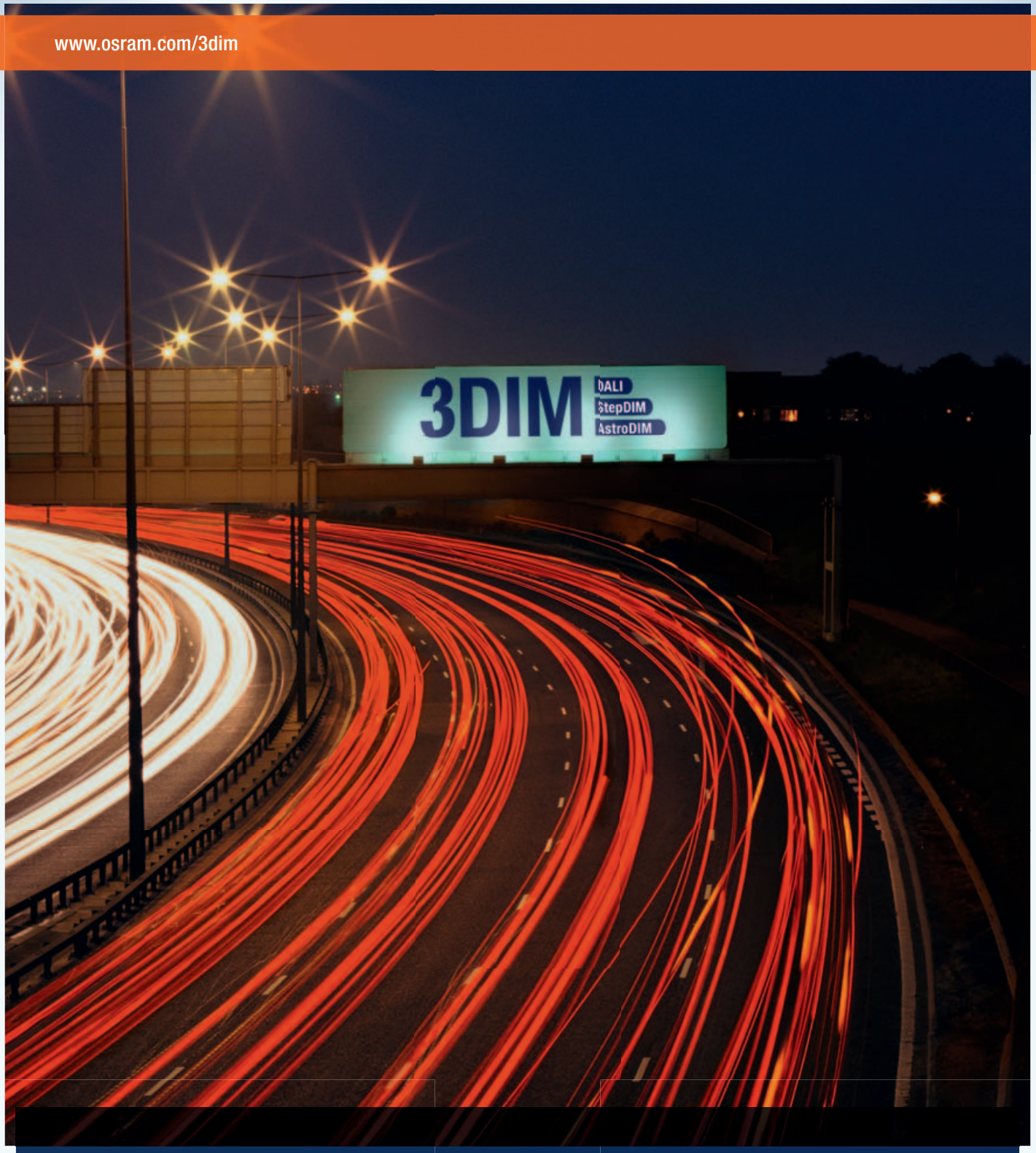
www.osram.com/3dim



Technical application guide
3DIM feature: DALI®, StepDIM, AstroDIM

SEE THE WORLD IN A NEW LIGHT

OSRAM

Control the night with 3DIM

OSRAM's 3DIM feature helps to flexibly adapt street and outdoor lighting to the varied nightlife of cities and municipalities and enables big energy savings.

The feature has been implemented in a number of electronic control gears from OSRAM:
- POWERTRONIC® 3DIM ECGs for HPD lamps
- OPTOTRONIC® 3DIM ECGs for LED modules

It offers three different control and dimming functions in one electronic control gear:
- DALI® – digital interface for bi-directional communication
- StepDIM – dimming with the help of a dedicated control line
- AstroDIM – autonomous two-level dimming

Purpose of technical application guide
The purpose of this technical application guide is to help installing, configuring and programming 3DIM ECGs.

What you need to configure and program the 3DIM control gears towards the specific application needs:

1

Hardware:
DALI® magic device for USB to DALI® connection

2

Software:
3DIM Tool software for tailor-made StepDIM and AstroDIM configurations

3

Manuals:
Manual to operate the 3DIM Tool

www

Please find all nescessary software and manuals here:
http://www.osram.com/3DIM

HW set-up for 3DIM Tool
To use the 3DIM Tool, the following system requirements have to be met:

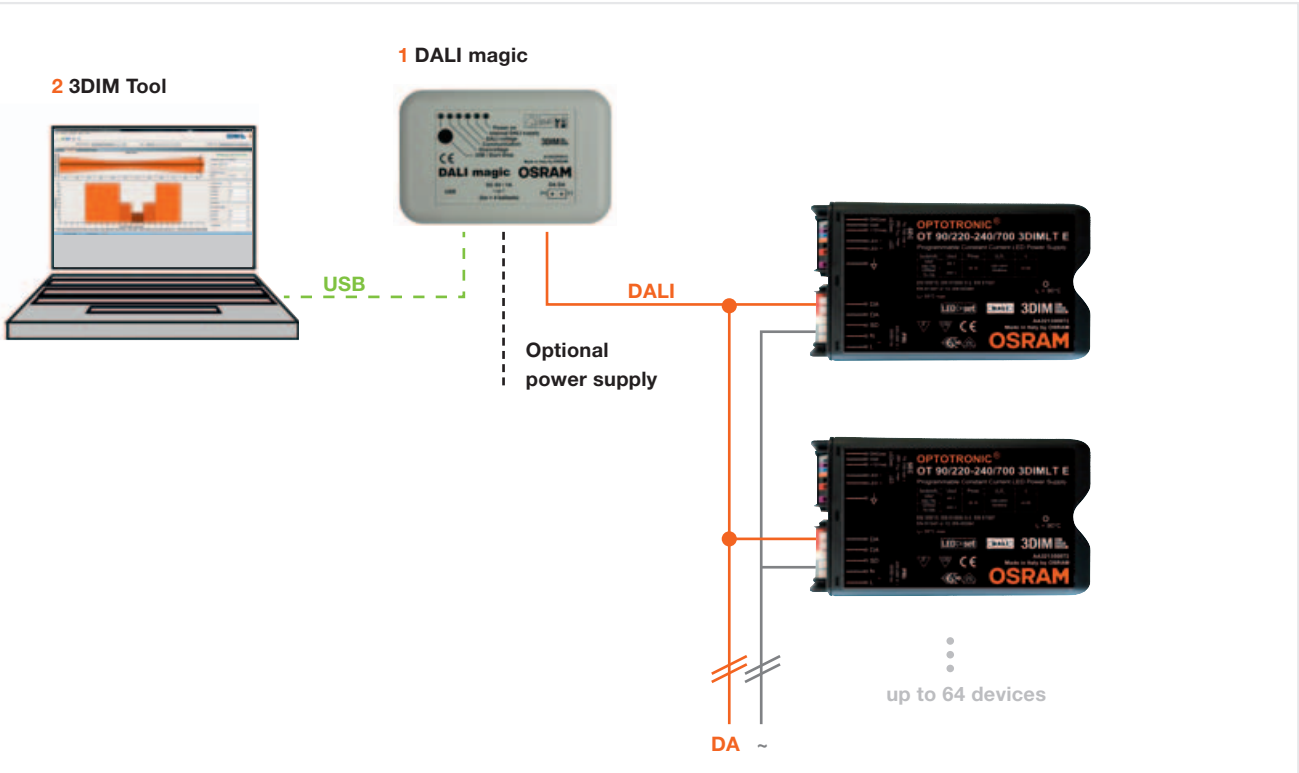
- OSRAM DALI magic including USB cable
- A PC with the following specifications:
  – Pentium M processor
  – 1 GB main memory
  – Windows XP, Windows Vista or Windows 7 (both 32 and 64-bit)
  – 40 MB hard disk memory
  – Monitor with a resolution of 1024x768 or 1024x600 pixels, the recommended zoom factor is 100 %
  – A free USB 2.0 port

Connections
Before making the necessary connections, disconnect the 3DIM ECG from the mains supply.

The PC must be connected to the DALI magic interface with a standard USB cable. The DALI® outputs of the DALI magic interface are then directly connected to the DA terminals of the ECG. Without additional power supply, up to four ECGs can be connected in parallel to the DALI magic interface. If more than four ECGs have to be adjusted, an additional power supply of 6 V is required. This allows the configuration of up to 64 ECGs at the same time.

WWW

For more information, please go to:
www.osram.com/lms-magic



Connections required for using the 3DIM Tool.

Content

1. Description

The 3DIM feature offers three control and dimming functionalities in a single electronic control gear.

While the DALI® interface is used for integration into bi-directional telemanagement systems, the StepDIM function utilizes an external control line to switch between two lighting levels. This enables an easy replacement for half-night switch solutions (Bi-Power) of conventional control gears. The third option – the autonomous, self-adjusting AstroDIM function – reduces the lighting level without any external control signal. The control software executes a dimming profile preset by OSRAM or specified by the user via the 3DIM Tool.

OSRAM has implemented the 3DIM feature in two control gear families, covering the main fields of application:
- POWERTRONIC® (PTo) for HPD lamps
- OPTOTRONIC® (OT) for LED modules

3DIM ECGs can be integrated into existing infrastructures at no added cost (see figure 1).

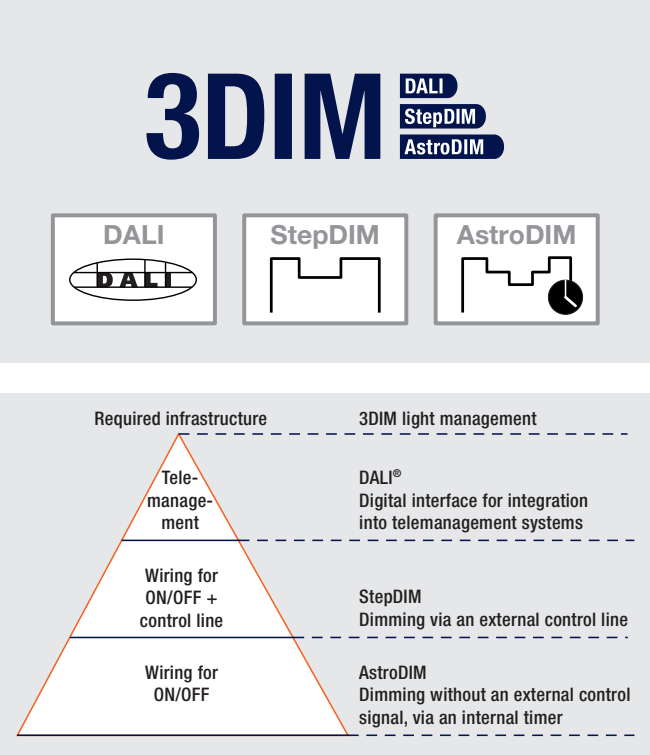


Figure 1: Suitable infrastructures for the use of 3DIM ECGs.

	Operating modes		
3DIM DALI StepDIM AstroDIM	DALI	StepDIM	AstroDIM
Energy saving through dimming	✓	✓	✓
Integration into existing installations	(✓) 2)	✓	✓
Flexibility to control different light points	✓		
Bi-directional communication in telemanagement systems	✓		
Autonomous dimming			✓
Use of existing Bi-Power approach of CCGs (half-night switch)		✓ 1)	

Figure 2: Comparison of the 3DIM functionalities.

1) In mixed installations, special measures need to be taken in the setup of the luminaire (see chapter 4.2 StepDIM).
2) DALI must be already available in the existing installation to use the DALI mode of the 3DIM ECG.

1.1. DALI® – digital addressable lighting interface

DALI® is an international standard communication protocol for electronic control gears. It is defined by the standard IEC 62386. In street lighting applications, DALI® is used for bi-directional communication between the ECG and tele-management systems, which allow for fully customized lighting and monitoring of individual light points.

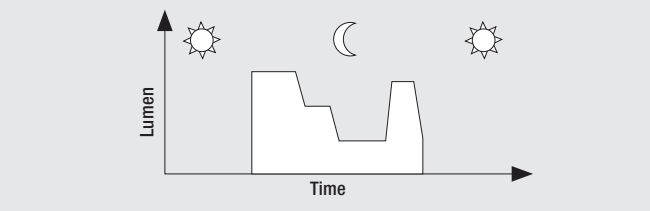


Figure 3: DALI® operation – light output over time (example).

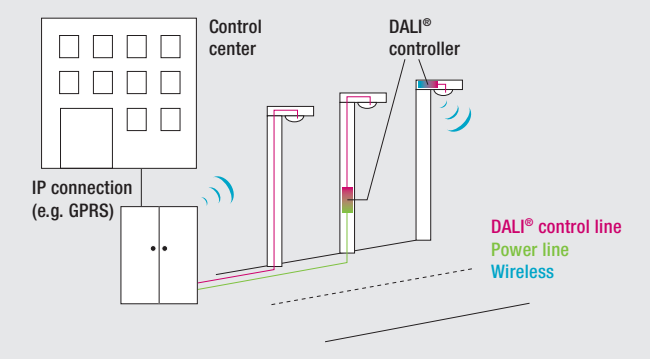


Figure 4: DALI® installation.

1.2. StepDIM – midnight step-down/ half-night switch

StepDIM is used in installations where a dedicated control line (switched phase) is available in addition to the power line. The switched phase is connected to the SD terminal of the 3DIM ECG and an external actuator is used to start and end dimming. The dimming parameters (e.g. dim levels and fade times) are preset by OSRAM and can be modified via the 3DIM Tool.

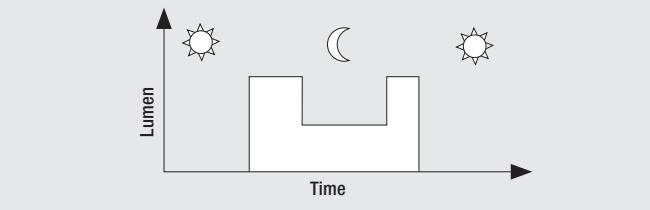


Figure 5: StepDIM operation (one dim level) – light output over time (example).

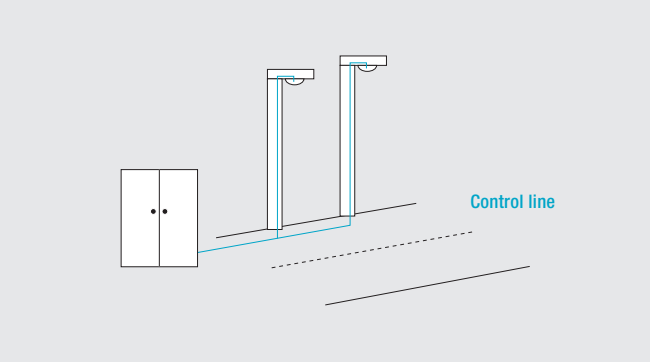


Figure 6: Installation with external control line for StepDIM operation.

1.3. AstroDIM – autonomous dimming without external control

AstroDIM is designed for dimming without any external control wiring. Therefore, AstroDIM helps to save energy and reduce light pollution, even if only a power line is available. In AstroDIM operation, the ECG executes a preset dimming profile, which can be reconfigured via the 3DIM Tool. The autonomous dimming is regulated by an integrated timer (no real-time clock), which adjusts the dimming profile according to the previous night (operation from switch-on to switch-off). With the 3DIM Tool, it is possible to activate two independent dim levels.

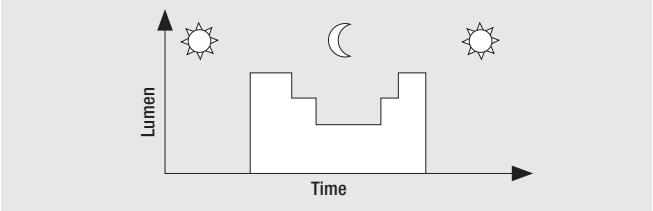


Figure 7: AstroDIM operation (one or two dim levels) – light output over time (example).

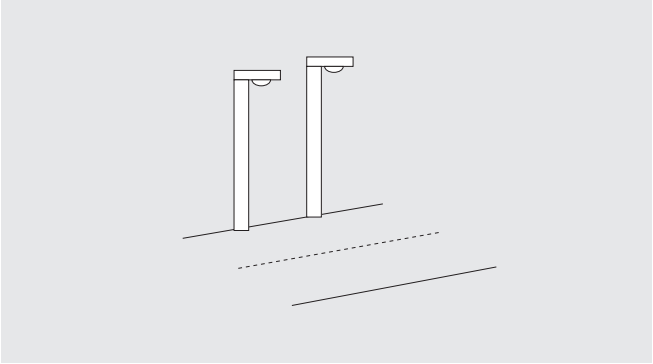


Figure 8: Installation without external control line for AstroDIM operation.

2. 3DIM interface (ECG terminals)

The wiring depends on the desired functionality (DALI®, StepDIM or AstroDIM) and purpose of use (operation or configuration). The different wiring options are described in chapter 5. All 3DIM ECGs have a terminal block for connection. The individual terminals are marked as shown in table 1.

Table 1: Designation of terminals*

DA	DALI®	Terminals for DALI® connection
DA		
SD	StepDIM	Terminal for StepDIM or AstroDIM operation
L	Line	Terminals for power supply
N	Neutral	

*The order of the terminals depends on the ECG type. Please refer to the datasheet of the selected ECG.

3. Mode selection

All 3DIM ECGs are able to perform only one mode (DALI®, StepDIM, StepDIM inverse or AstroDIM) at a time.

For comissioning of the ECG it is possible to select the mode **via external wiring** or **with the 3DIM Tool**.
By default, the ECG is operated according to the so-called "StepDIM/AstroDIM/DALI (wiring selection)".

3.1. Via wiring selection (factory settings)

- **DALI®** is always supported and has priority over the other functions (even if AstroDIM or StepDIM are executed). As soon as a valid DALI® command is sent to the ECG, it switches immediately to DALI® operation. During this switch, the output level of the ECG is not changed unless initiated by another DALI® command.
  Note: After a DALI® command has been received, the ECG stays in DALI® operation until it is switched off.
- The **AstroDIM** function is selected by establishing a permanent connection between phase (L) and the SD terminal of the ECG inside the luminaire compartment (see chapter 4.3.). It is activated as long as no DALI® command is received.
- **StepDIM** is operated via a dedicated control line or a switched phase (see figure 18a/b), which is not powered during the start-up phase of the ECG (at least 1 s).

3.2. Via 3DIM Tool software

The following operating modes can be selected via the 3DIM Tool:

- "StepDIM/AstroDIM/DALI (wiring selection)"
- "AstroDIM/DALI"
- "StepDIM/DALI"
- "StepDIM inverse/DALI"
- "DALI"

For more details go to chapter 4.

Notes:

- The factory settings can vary depending on the specific ECG.
- Not all ECGs are able to run all operating modes.
- A typical half-night switch application (Bi-Power) requires the "StepDIM inverse/DALI" mode, which can only be set with the 3DIM Tool.

For more details, please refer to the datasheet or instruction sheet of the respective ECG.

4. Wiring and configuration of the ECG

4.1. DALI® – digital addressable lighting interface

4.1.1. Wiring

For DALI® operation, the 3DIM ECG (OPTOTRONIC® for LED modules or POWERTRONIC® for HPD lamps) is connected to the mains and to a DALI® controller or DALI® bus. The SD terminal is left unconnected. The LED module or HPD lamp is connected to the output terminal of the respective ECG.

Note: DALI® connection has to be considered at the interface between luminaire head and pole.

Up to 64 DALI® electronic control gears can be controlled via a 2-wire control line – individually, jointly or in up to 16 groups. All of them are connected in parallel to the two wires (see chapter 4.1.2.). DALI® connections are not polarized. Therefore, plus and minus poles do not have to be checked.

The lighting can be switched and dimmed via the DALI® control line. Additional status information can be read out and exchanged between the ECG and the control unit. The type of status information that can be exchanged depends on the ECG or the control unit.

WWW

More details about DALI® can be found at the following websites (or in the corresponding standard IEC 62386):
www.osram.com/dali
www.osram.com/3dim

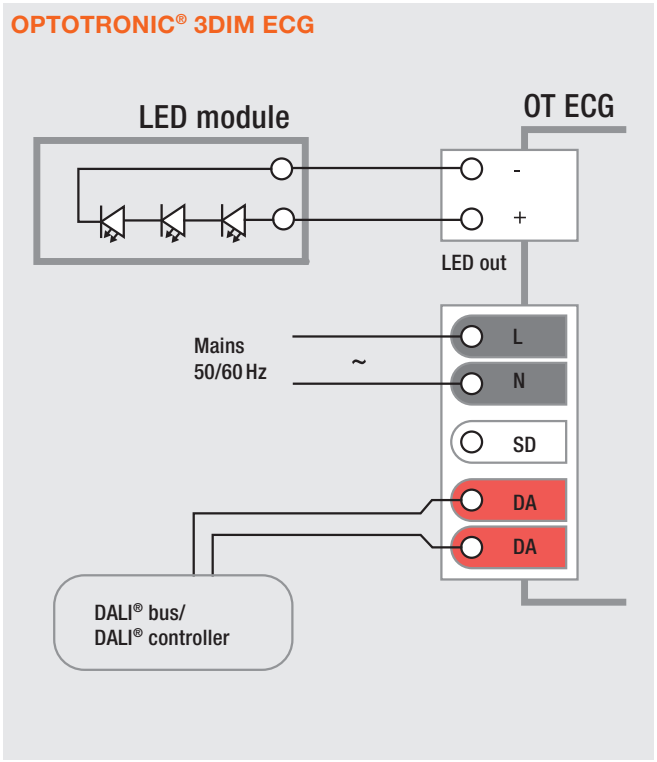


Figure 10: DALI® installation with OPTOTRONIC® 3DIM ECG.

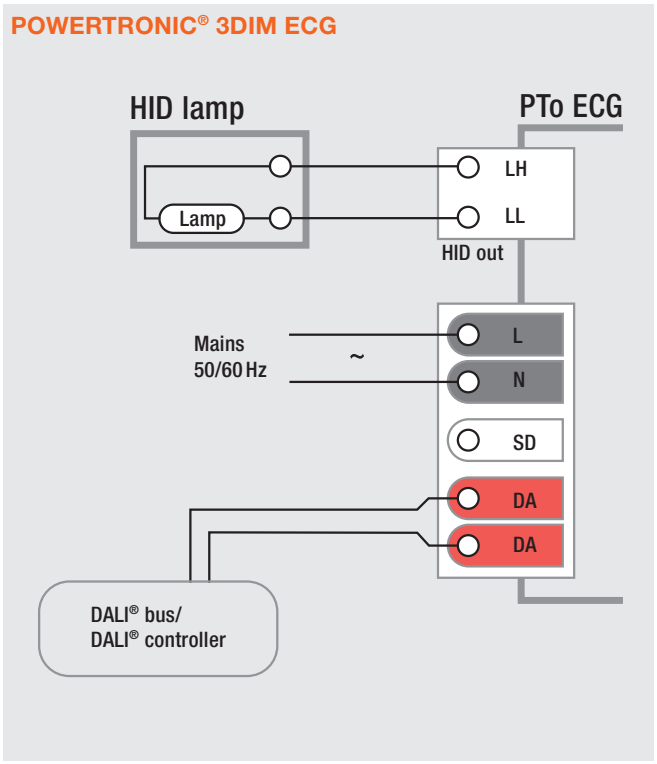


Figure 11: DALI® installation with POWERTRONIC® 3DIM ECG.

4.1.2. Control line – cable requirements

The maximum total cable length of a DALI® control line is 300 m. When selecting a cable, it must be ensured that the voltage drop on the control line does not exceed 2 V at 250 mA.

The following table can be used as a quick reference guide for selecting the correct cable cross-section.

Table 2: Recommended cable cross-sections			
Cable length	up to 100 m	100 to 150 m	150 to 300 m
Cable cross-section	0.5 mm²	0.75 mm²	1.5 mm²

Note: For reasons of clarity, it is recommended to use the black and gray wire of the cable for the DALI® connection (see figure 12).

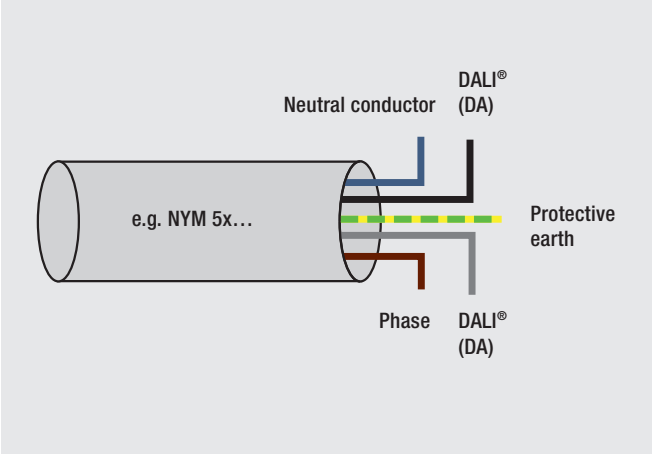


Figure 12: Individual wires of a DALI® control line.

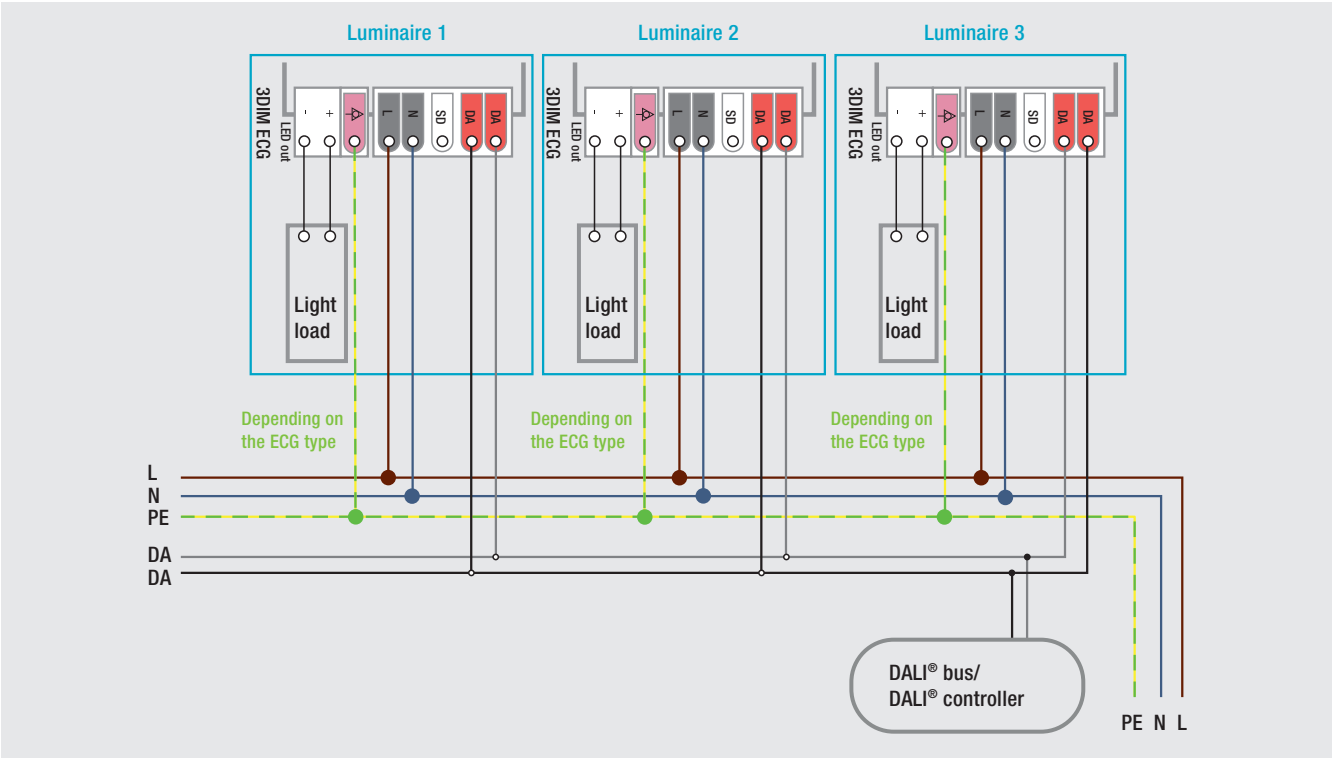


Figure 13: Connection of multiple 3DIM ECGs via DALI® control line.

4.1.3. Connection via power-line converter

If the power line is used to transmit the DALI® signal to the luminaire, a power-line-to-DALI® converter is required to control the 3DIM ECGs.

In order to ensure proper power line communication, a filter might be necessary to decouple the low mains input impedance of the ECG from the power-line-to-DALI® converter.

Note: The used power line to the DALI® converter should provide at least the same surge withstand capability as the 3DIM ECG.

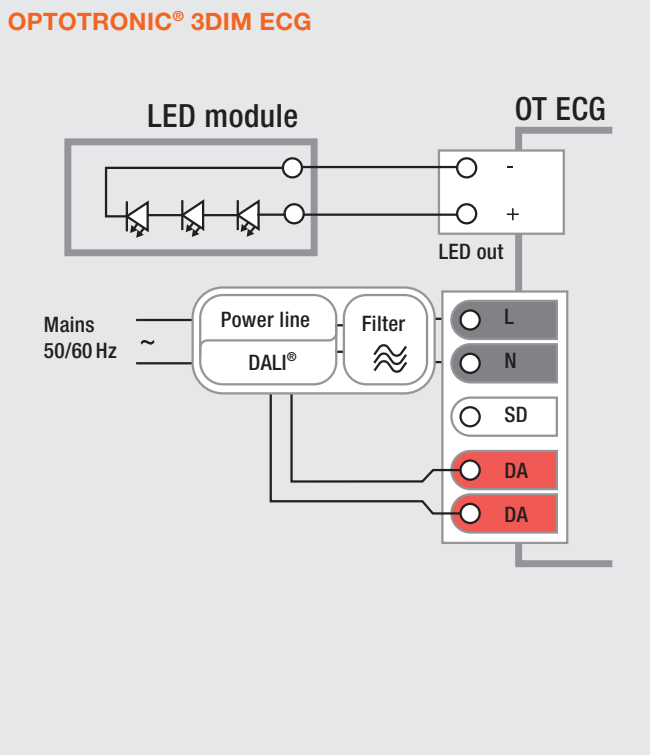


Figure 14: DALI® connection via power-line converter – OPTOTRONIC® 3DIM ECG.

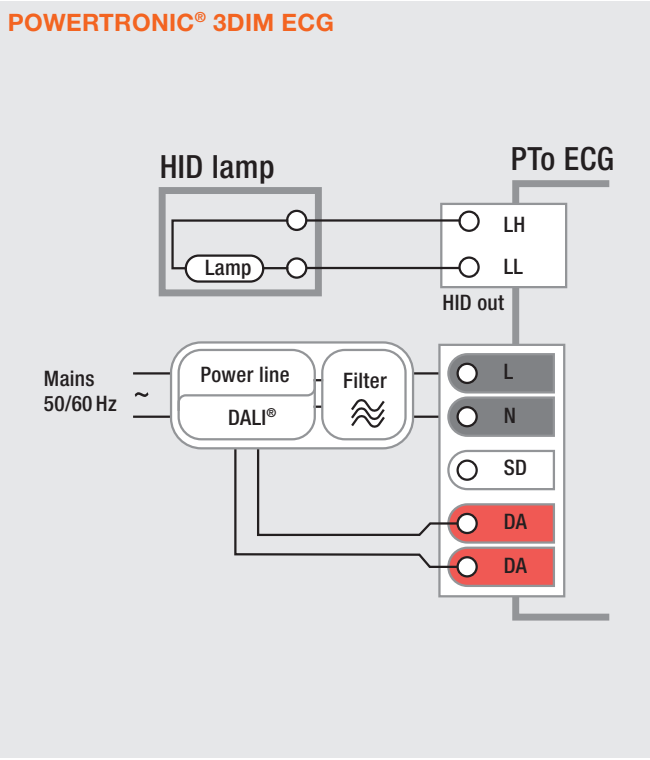


Figure 15: DALI® connection via power-line converter – POWERTRONIC® 3DIM ECG.

4.2. StepDIM – midnight step-down/ half-night switch

4.2.1. Wiring

For StepDIM operation, the ECG is connected to the mains. The DALI® terminals are left unconnected. The dedicated SD terminal is connected to a control line or a switched phase.

Note: SD connection has to be considered at the interface between luminaire head and pole.

Dimming is activated by a control switch. The SD control states HIGH and LOW are defined as shown in table 3. If in the “StepDIM/DALI” mode the switch is closed and phase voltage is applied to the SD terminal, the state HIGH is set and the dim level is reached by the ECG. Leaving the SD terminal floating (i.e. no voltage is applied), the state LOW is set and dimming is not activated.

For “StepDIM invers/DALI”, the behavior is inverted. The “StepDIM inverse/DALI” mode, which is the most commonly used one, can be selected via the 3DIM Tool.

Notes:

- The control line or the switched phase to activate the StepDIM should only be connected to the SD port of the 3DIM ECGs. In all other cases, it is recommended to use a relay in between (figure 18b).
- The ECG can be used for StepDIM operation in common installations with a control line length of up to 1.5 km and a pole distance of up to 150 m.

Table 3: Definition of SD control states

SD control state	Physical control signal at SD terminal	SD control switch status	Output “StepDIM/ DALI”	Output “StepDIM invers/DALI”
HIGH	L potential to SD	CLOSED	Dimming	No dimming
LOW	SD terminal floating	OPEN	No dimming	Dimming

OPTOTRONIC® 3DIM ECG

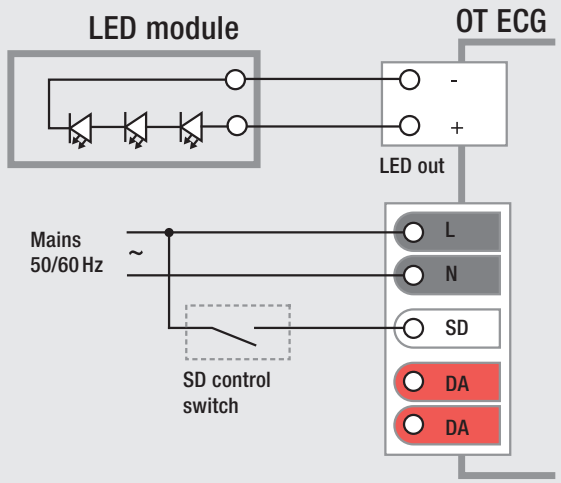


Figure 16: Wiring for StepDIM operation – OPTOTRONIC® 3DIM ECG.

POWERTRONIC® 3DIM ECG

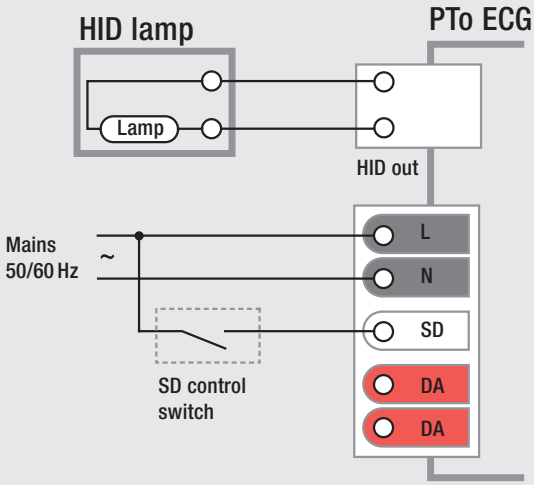


Figure 17: Wiring for StepDIM operation – POWERTRONIC® 3DIM ECG.

Figure 18a shows the setup if only 3DIM ECGs are connected to the SD control switch. In case other ballasts or loads are supplied via the SD line (e.g. L2) or an external surge protection device is connected to this port, an additional relay needs to be used within each luminaire (see figure 18b), unless something different is mentioned in the product-related documents (data sheet or instruction sheet). The used relay should be suitable for low switching currents < 1 mA (mostly gold plated contacts).

The SD control switch shown in figures 18a/b can be a relay connected to a timer with a remote HIGH/LOW voltage signal.

For details, please refer to the 3DIM Tool manual.

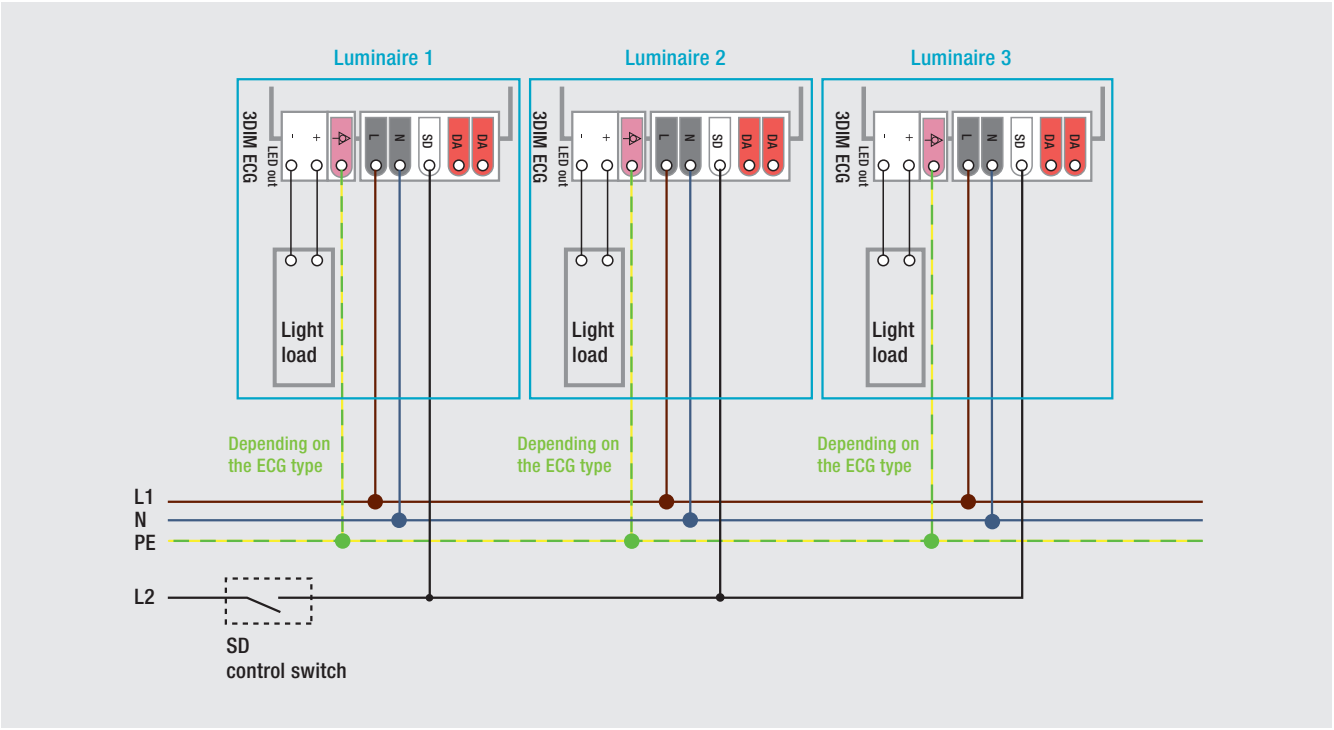


Figure 18a: StepDIM activation for a group of 3DIM ECGs by the same control switch (example).

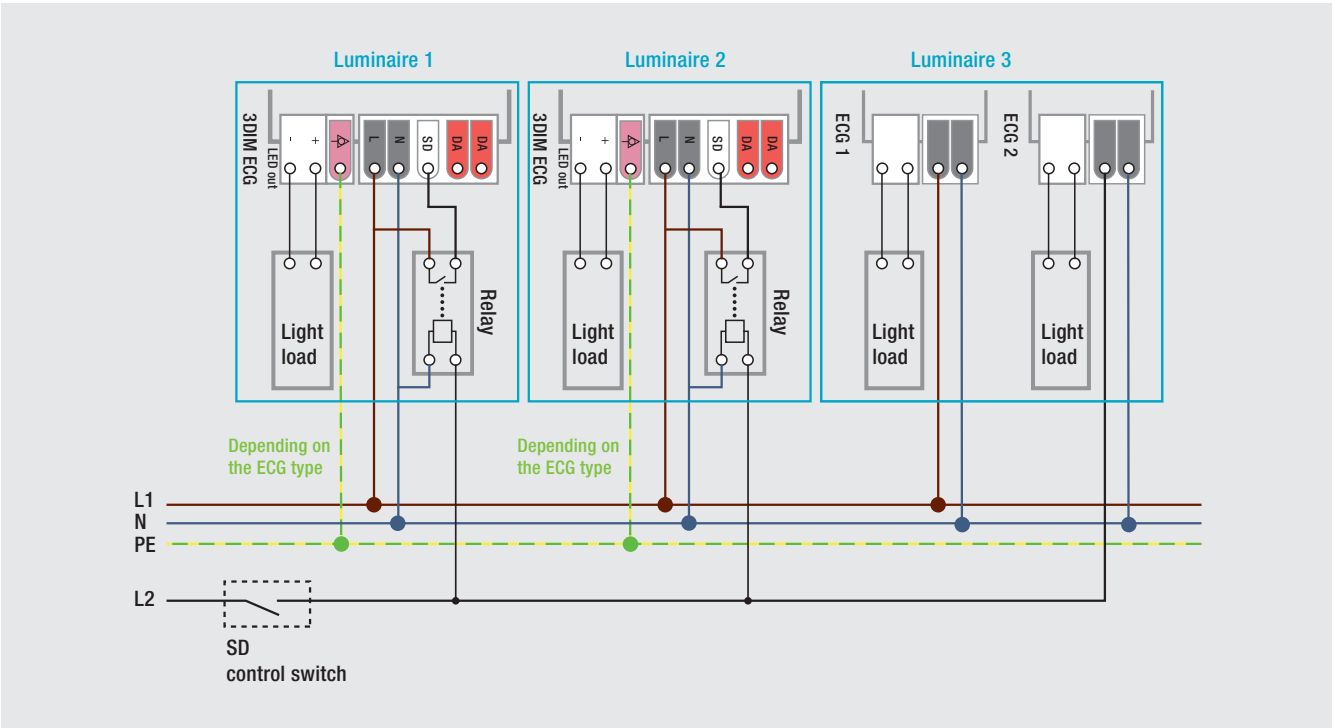


Figure 18b: StepDIM port set-up inside luminaire for mixed installation (Phase L2 is used to activate SD and also to supply other ballasts or loads).

4.2.2. Parameter setting via 3DIM Tool

The StepDIM operation is defined by three parameters: power-on level, dim level and dim fade time. In addition, StepDIM can be operated according to two different signal logics.

The SD control states HIGH and LOW refer to the different output power levels of the ECG. By default, LOW means that the ECG provides the power-on level and HIGH means that the ECG provides the dim level (see figure 19).

Via the 3DIM Tool, it is possible to select the “StepDIM inverse/DALI” mode, which reverses the logical relation between the SD control state and the ECG output power level (see figure 20).

The power-on level and dim level are set as a percentage of the nominal output current or power (depending on the output type of the ECG).

Note: The power-on level and dim level depend on the nearest admissible DALI® value. Setting an intermediate value results in a rounding to the nearest admissible value (see table below).

Table 4: StepDIM parameters

Parameter	Description
Power-on level	Output power level of the ECG (in % of the nominal value of the ECG/ lamp combination) after switch-on via the mains.
Dim level*	Output power level of the ECG (in % of the nominal value of the ECG/ lamp combination) after the SD state has changed.
Dim fade time**	Transition time between power-on level and dim level.
StepDIM signal logic	
StepDIM polarity	The polarity of the input signal used for dim activation can be changed → “StepDIM inverse/DALI” mode.

* Please note that the dim level is also referred to as “Dim level 1” in the 3DIM Tool.

** Can only be set for OPTOTRONIC® 3DIM ECGs.

Table 5: DALI® logarithmic dimming curve*

8-bit arc power level	Arc power (%)	3DIM level (%)
254	100.000	100
253	97.307	97
252	94.686	95
251	92.135	92
250	89.654	90
249	87.239	87
248	84.889	85
247	82.603	83
246	80.378	80
245	78.213	78
…	…	…

* See IEC 62386-102, table 9.1.

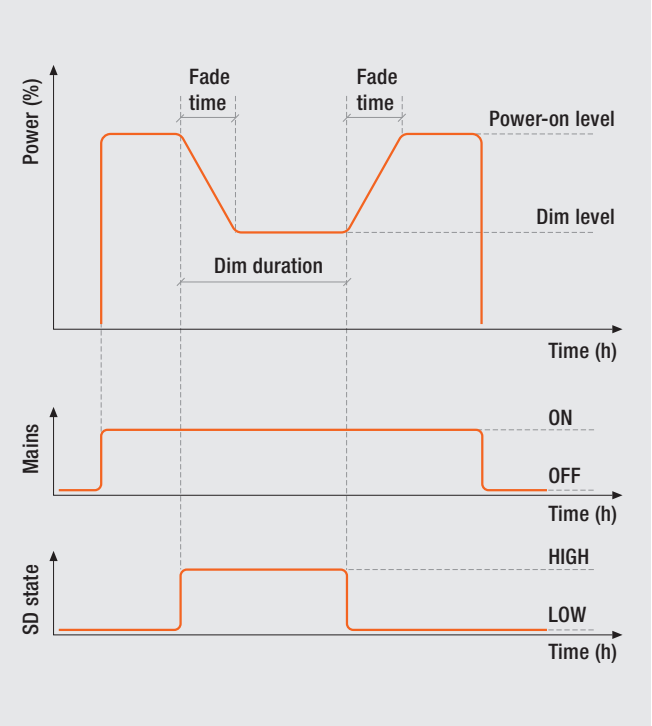


Figure 19: StepDIM behavior – “StepDIM/DALI” mode (factory settings).

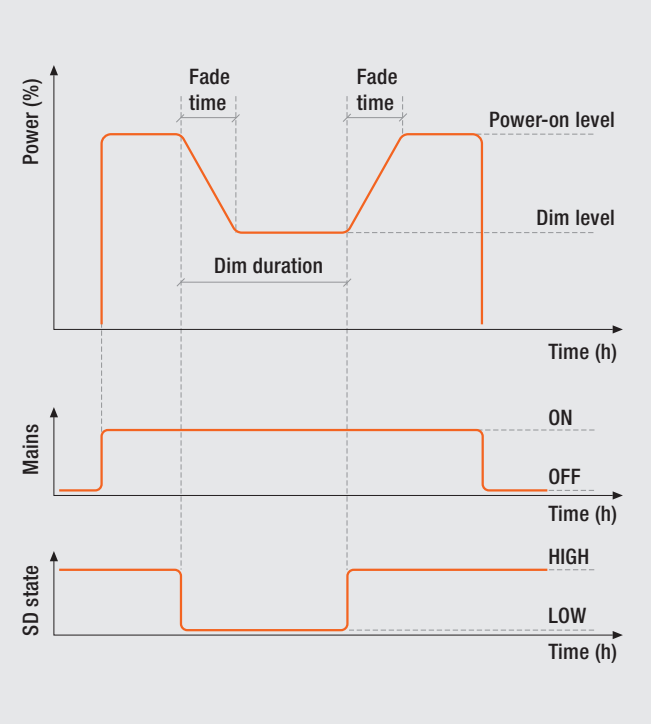


Figure 20: StepDIM inverse behavior – “StepDIM inverse/DALI” mode.

The StepDIM parameters (power-on level, dim level and dim fade time) are preset by OSRAM and stored in the ECG. Notes on the factory settings can be found in chapter 3.1.

For exact factory settings, please refer to the datasheet of the respective ECG.

The factory settings can be modified by the user via the 3DIM Tool. In principle, the power-on level can be set lower than the dim level. The minimum dim level, however, is limited by the ECG.

Table 6: StepDIM operating modes

Operating mode	SD control state		Note
	HIGH	LOW	
AstroDIM/ StepDIM/DALI (wiring selection)	Dim level	Power-on level	Figure 19 – factory settings
StepDIM/DALI	Dim level	Power-on level	Figure 19 – setting via 3DIM Tool
StepDIM inverse/DALI	Power-on level	Dim level	Figure 20 – setting via 3DIM Tool

Note: “Low” signal means the SD port floating, neither neutral nor phase are connected to this port.

4.3. AstroDIM – autonomous dimming without external control

4.3.1. Wiring

When the AstroDIM function is selected by providing a permanent connection (jumper wiring) between line (L) and the SD terminal of the ECG (see figures 21 and 22), the ECG starts and ends dimming on its own (autonomous operation). It is controlled only by the mains power switch and no additional control lines are required.

There is no need to configure the ECG before AstroDIM operation. The ECG starts operating with the default parameters of the AstroDIM function when the power is on. The AstroDIM parameters, e.g. dim levels and fade times, can be modified via the 3DIM Tool by connecting a PC to the DA terminals of the ECG via an OSRAM DALI magic hardware interface.

External wiring between L and the SD terminal can be avoided if the “AstroDIM/DALI” mode is selected via the 3DIM Tool (see figure 23b).

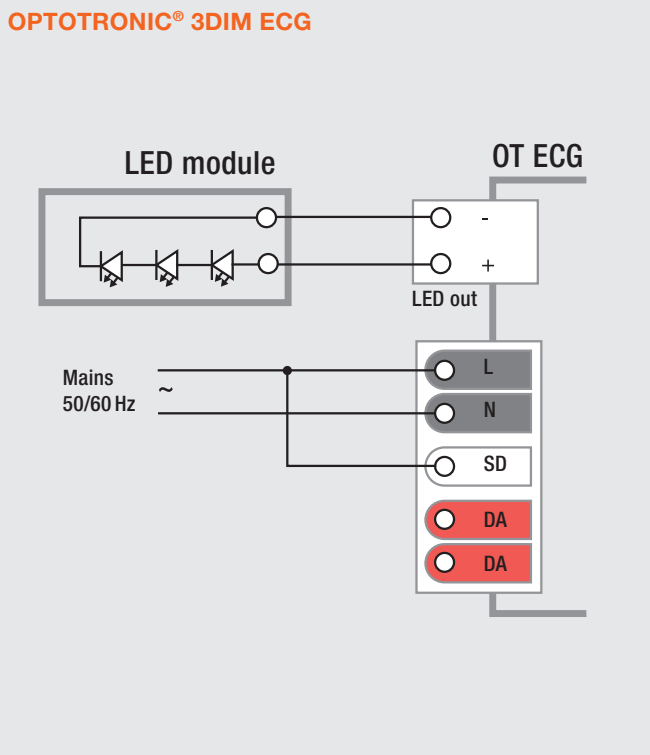


Figure 21: Wiring for AstroDIM operation – OPTOTRONIC® 3DIM ECG.

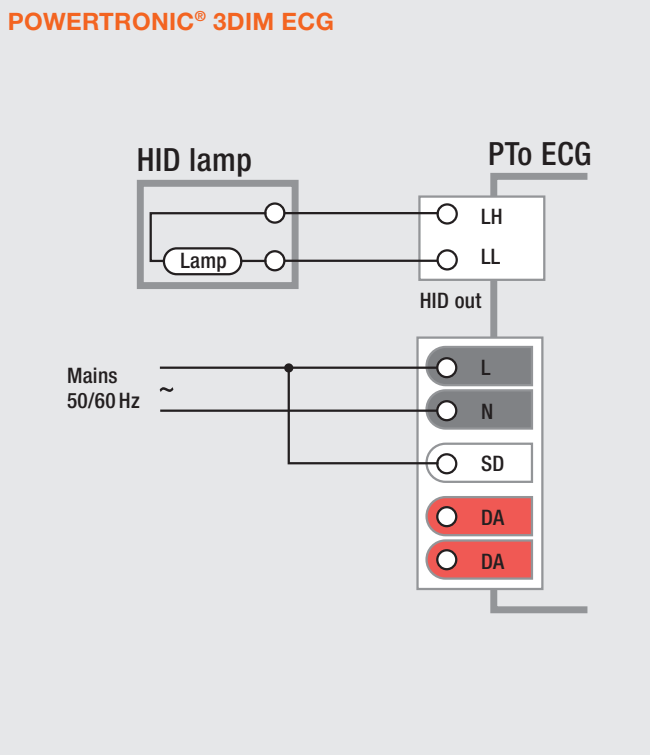


Figure 22: Wiring for AstroDIM operation – POWERTRONIC® 3DIM ECG.

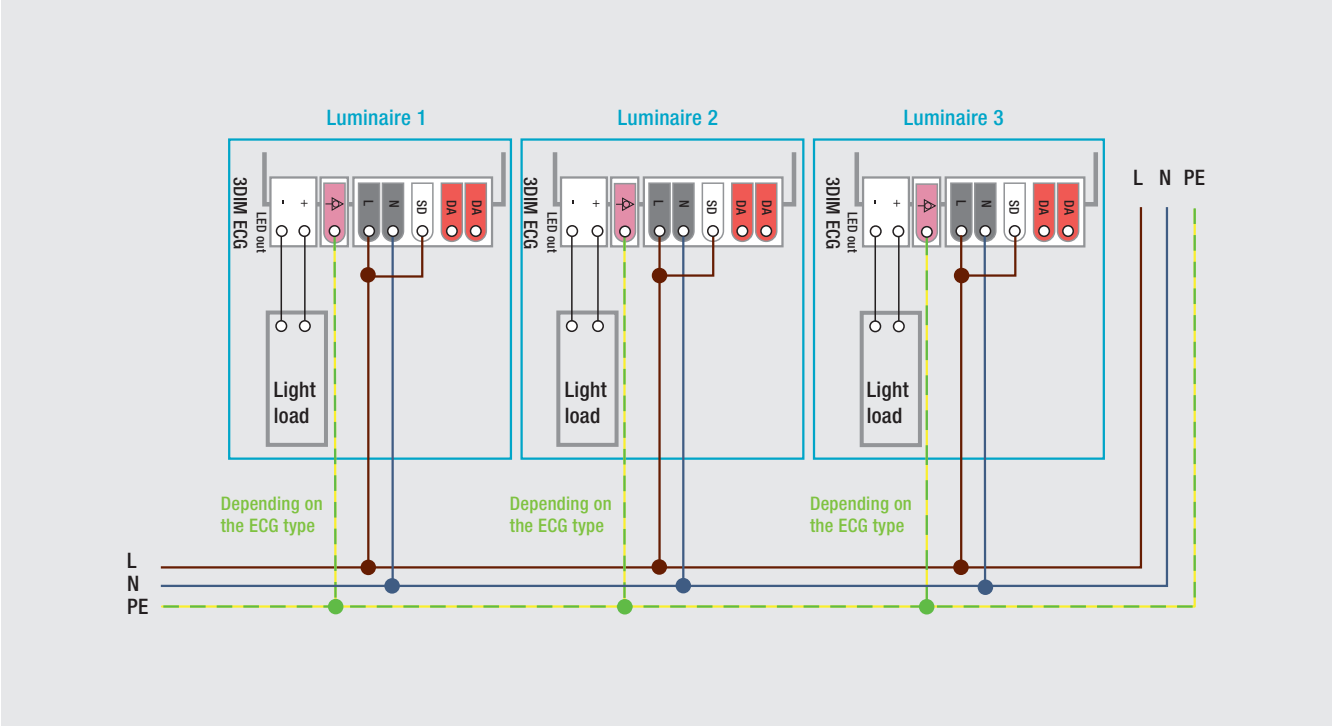


Figure 23a: AstroDIM operation via wiring selection. **Note:** For mixed installations, please consider possible fade times and dim levels.

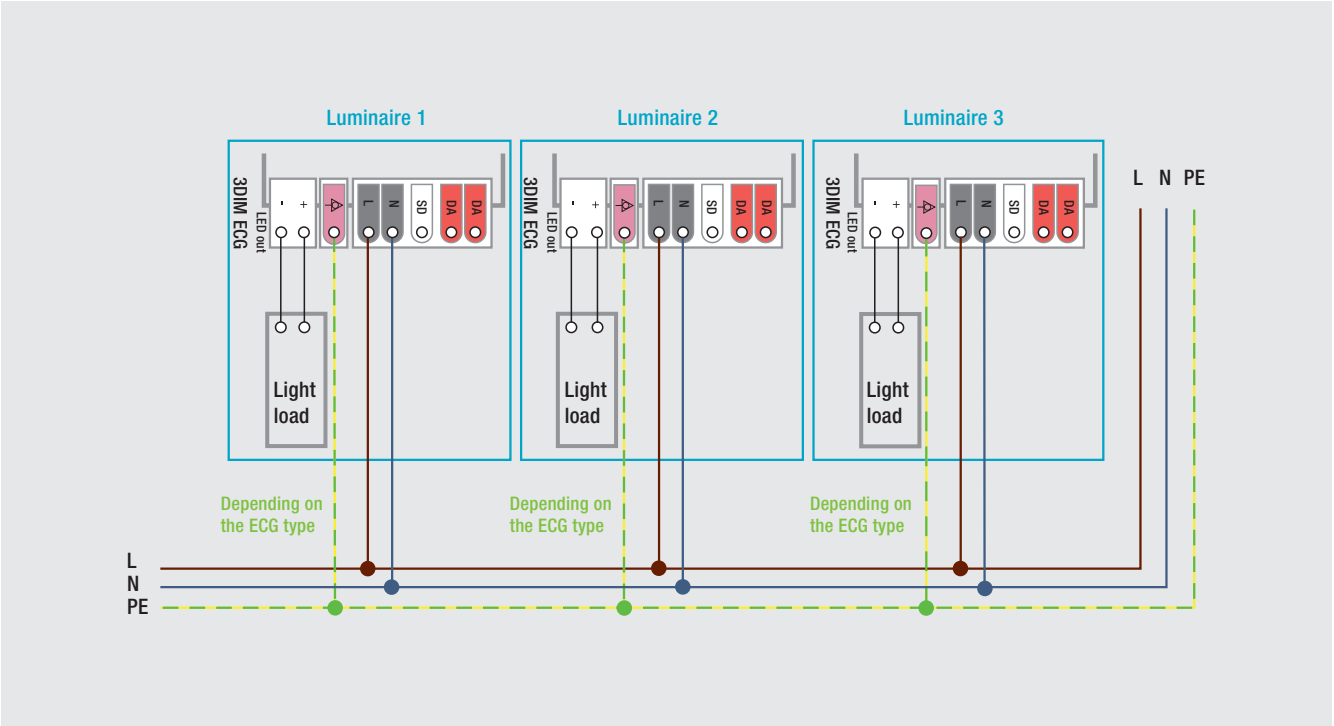


Figure 23b: “AstroDIM/DALI” mode set via 3DIM Tool. **Note:** For mixed installations, please consider possible fade times and dim levels.

4.3.2. Parameter setting via 3DIM Tool

The AstroDIM operation can be individually adjusted by means of the following parameters.

Table 7: AstroDIM parameters (dimming profile)

Parameter		Description
Power-on level		Output power level (in % of the nominal value of the ECG/lamp combination) after switch-on via the mains.
Dim level 1	**Dim level**	Output power level (in % of the nominal value of the ECG/lamp combination) during dimming step 1. The dim level can be set with the 3DIM Tool. The minimum set value is limited by the installed system or ECG (refer to the datasheet of the respective ECG).
	Start time	Time (24 h) on reference date at which the ECG starts the dim level.*
	End time	Time (24 h) on reference date at which the ECG changes to the next/previous level.*
Dim level 2 (optional activation)	**Dim level**	See dim level 1.
	Start time	See dim level 1.
	End time	See dim level 1.
Dim fade time		Transition time between power-on level and dim level 1 or between the two dim levels (logarithmic dimming change).
Half operating time		The arithmetic middle of the night, which rarely coincides with midnight on a clock.
Reference date		Date of start and end time.
Daylight saving time		Indicated if considered in start and end time calculation.
Location		Coordinates of ECG location to calculate sunset and sunrise.

* If the ECG is not switched on/off at the time of sunset/sunrise as indicated by the 3DIM Tool (see figure 24), the start and end time(s) of the dim level(s) also vary according to this deviation.

In case the ECG is switched on right after the calculated sunset and switched off right at the calculated sunrise, the arithmetic middle of the night is visualized by the 3DIM Tool as a yellow line and can be compared to midnight (see figure 24).

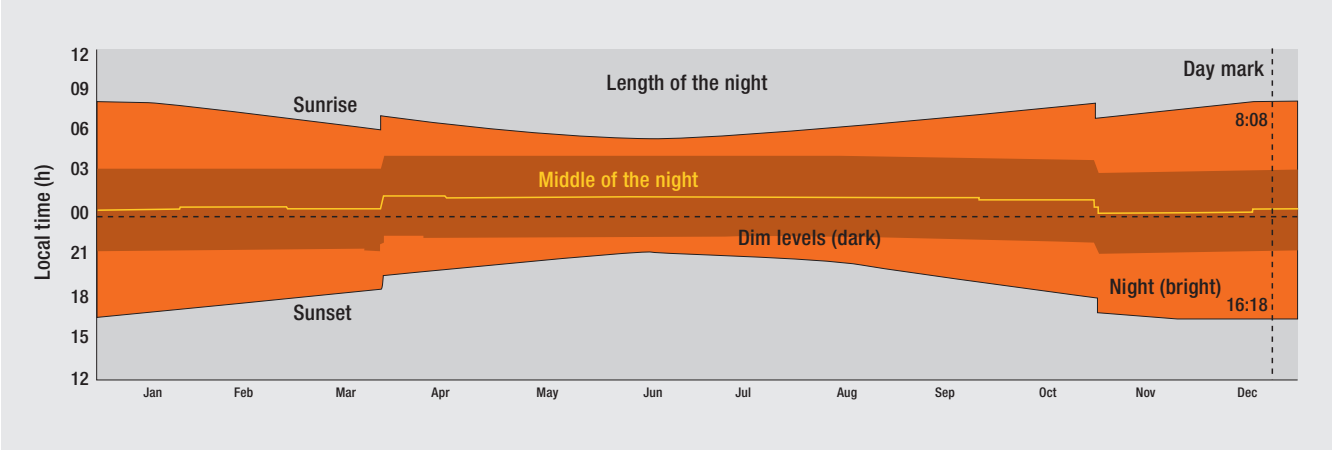


Figure 24: Length of the night over the year as visualized by the 3DIM Tool.

The AstroDIM dimming profile can be configured with just one or two dim levels.

Every night, the ECG-integrated timer measures the operating time of the ECG (time between switch-on and switch-off). Based on the measured operating times of the previous nights, the AstroDIM algorithm calculates the operating time of the coming night. Figure 26 shows four exemplary dimming profiles, displaying how the AstroDIM algorithm adapts the dimming to the actual length of the night, centering the dimming profile around the half operating time.

For correct operation and special cases, please see chapter 5.4. (FAQ).

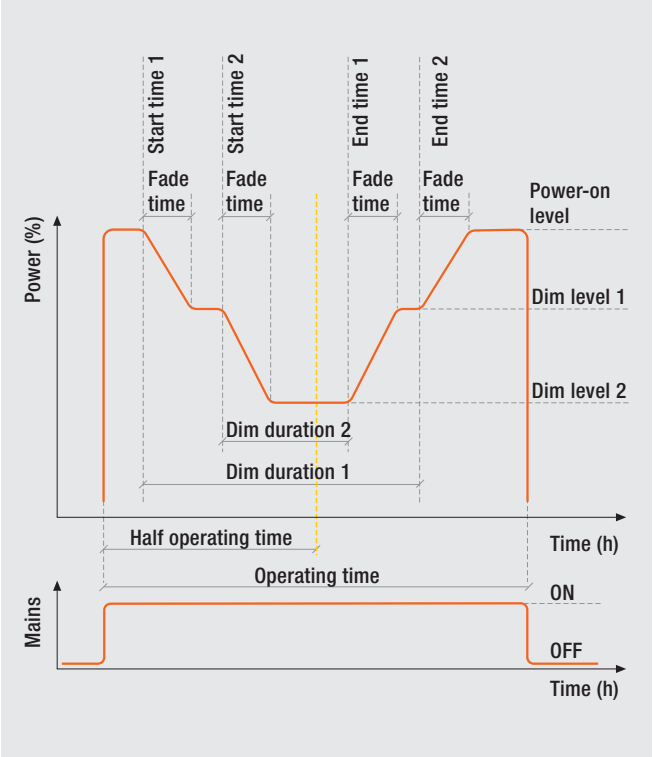


Figure 25: AstroDIM behavior – dim level 2 activated (example).

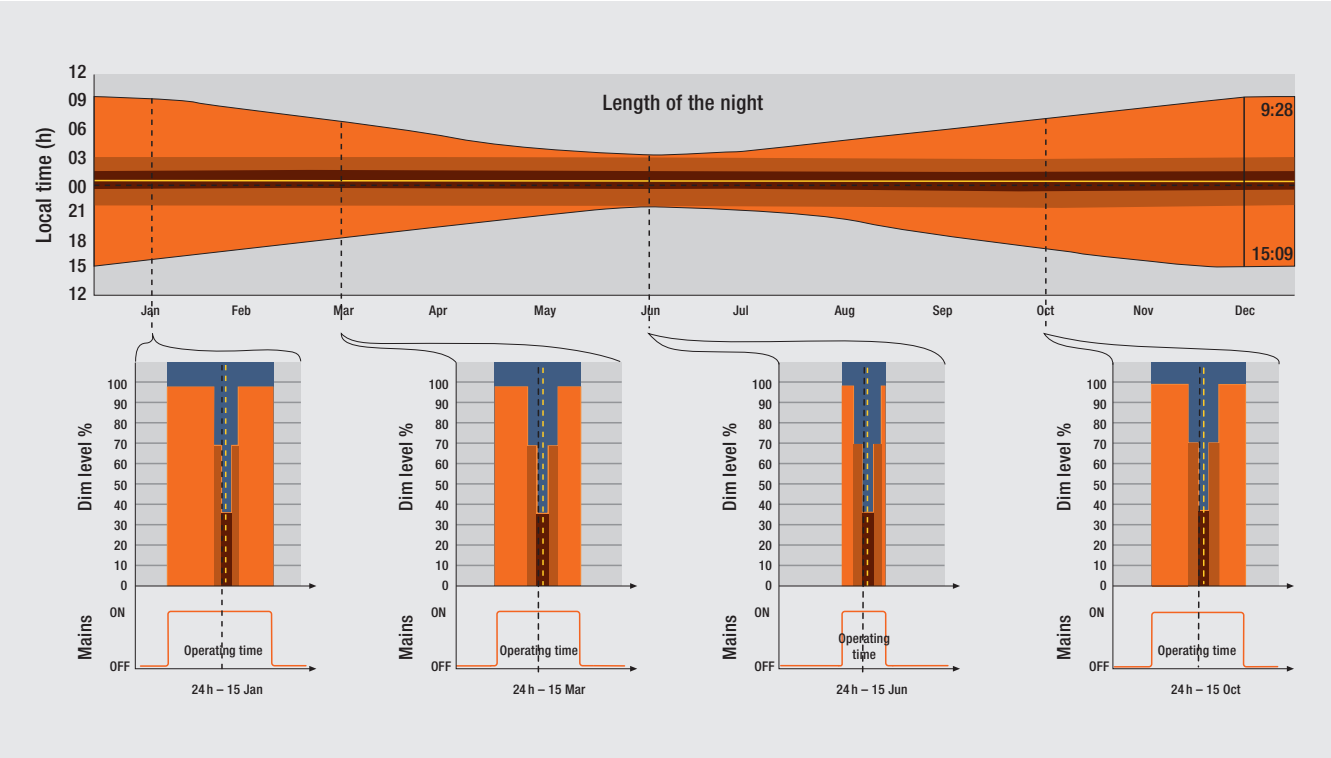


Figure 26: AstroDIM dimming profiles (examples).

5. Frequently asked questions (FAQ)

5.1. General questions

Can the operating mode be changed during operation?
This is not possible during StepDIM and AstroDIM operation. Only one mode can be activated at a time. However, it is possible to reset the ECG by a power off/on cycle and activate a different function.

What type of clamp can be used for the connection between L and the SD terminal to activate AstroDIM by wiring selection?
Any standard clamp that fulfills the luminaire standard IEC 60598 can be used. If an OPTOTRONIC® control gear with SELV-equivalent output is used, the required creepage distance, clearance and insulation thickness need to be considered.

5.2. Questions regarding DALI®

Are the DA terminals polarized (+ and - pole)?
No, the DA terminals are not polarized. Therefore, it is not relevant which wire is connected to which DA terminal.

5.3. Questions regarding StepDIM

What happens if a voltage dip occurs during StepDIM operation in the "StepDIM/AstroDIM/DALI (wiring selection)" mode?
When a 3DIM ECG is used in the "StepDIM/AstroDIM/DALI (wiring selection)" mode, a mains voltage dip can result in an unwanted ECG behavior. If the voltage dip takes longer than 200 ms, the ECG will reset itself. Once the mains power is back, two conditions can occur:

- If the SD state is LOW during the first 500 ms and then becomes HIGH, the StepDIM mode and state that was present prior to the voltage dip is restored.
- If the SD state is HIGH immediately after the ECG is switched on (at least for the first 500 ms), the AstroDIM function is activated. This malfunction is corrected automatically as can be seen in figure 27. The unwanted AstroDIM function does not modify any StepDIM parameters and stops as soon as the power is interrupted. When the power is switched on again, the ECG returns to regular StepDIM operation. This malfunction can be completely avoided if the "StepDIM/DALI" mode is selected and configured with the 3DIM Tool instead of the "StepDIM/AstroDIM/DALI (wiring selection)" mode.

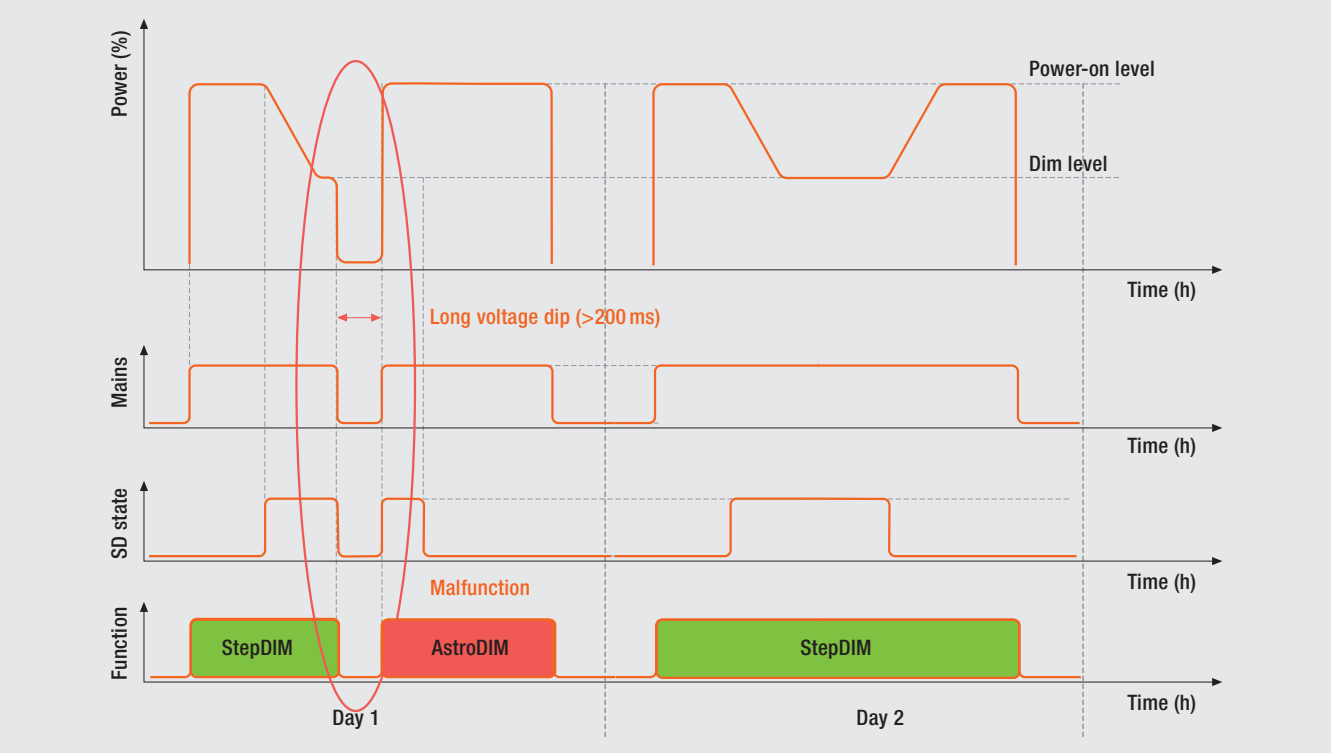


Figure 27: Long voltage dip – malfunction and ECG reset.

5.4. Questions regarding AstroDIM

What happens when AstroDIM is activated for the first time?

The AstroDIM function does not work autonomously without having a reference to calculate the operating time of the ECG. Since there is no operating time data available at the time of the first activation, the ECG does not execute a dimming profile, but remains on until the power supply is turned off.

The calculation of the operating time, however, is already available when the ECG is switched on for the second time. The internal timer of the ECG has measured the duration of the first operation and has saved it in its internal memory, thus allowing the smart AstroDIM algorithm to calculate the operating time for the coming night.

What happens if the voltage dip is shorter than 200 ms?

The mains power is likely to be subject to short voltage dips. 3DIM ECGs are designed to withstand at least voltage dips of up to 200 ms without affecting the dimming profile (voltage dips according to IEC 61547).

If a voltage dip shorter than 200 ms occurs, the load is switched off. However, as soon as the mains power comes back, the load is powered and supplies the same dim level as before the voltage dip. In any case, short dips do not affect the reliability of any 3DIM operation. In case of AstroDIM operation, the voltage dip does also not affect the calculation of the operating time.

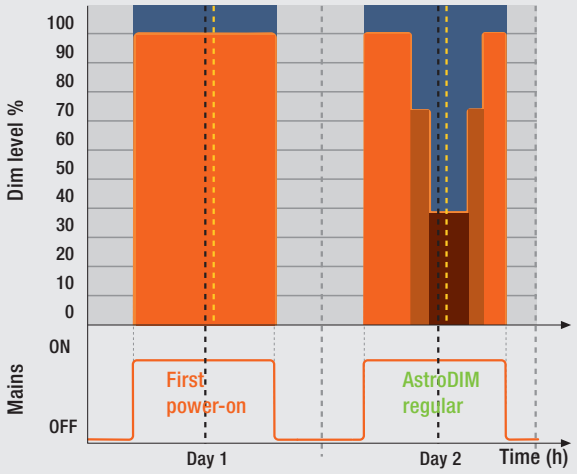


Figure 28: First and second activation of the AstroDIM function.

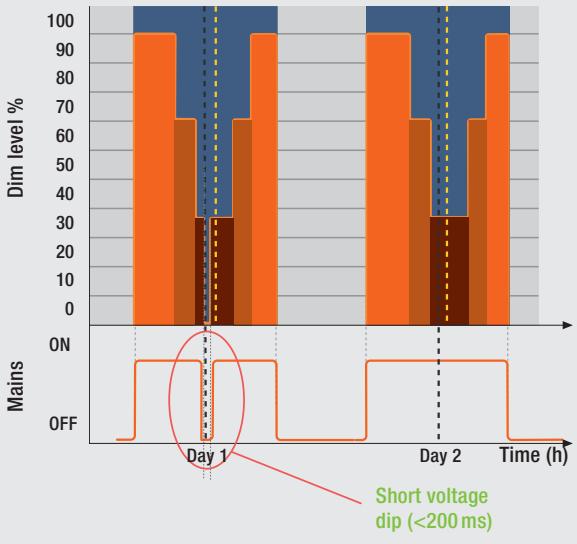


Figure 29: Operation after a short voltage dip.

What happens if the operating time in AstroDIM mode is shorter than 4 hours?
If the operating time of the ECG is shorter than 4 hours, it is not saved and therefore not used to calculate the next operating time. This situation can occur as a result of long voltage dips or during maintenance of the luminaire. Figure 30 shows that normal operation is restored in the following night.

What happens if the operating time in AstroDIM mode is longer than 24 hours?
If the operating time of the ECG is longer than 24 hours, it is not saved and therefore not used to calculate the next operating time. This can be the case when the system is installed or tested. Moreover, the dimming profile based on the last valid operating time (shorter than 24 hours and longer than 4 hours) is performed automatically every 24 hours if the ECG is not turned off.

Note: Continuous 24-hour operation is not recommended.

Is it possible to reset the AstroDIM operating time memory?
For maintenance of the installation, it is required to reset the AstroDIM operating time memory to restore the factory settings. This can be done with the 3DIM Tool.

What happens if a DALI® operation is stopped and the ECG is configured as "AstroDIM/DALI"?
The ECG does not switch to AstroDIM operation directly after DALI® disconnection. The power supply first has to be turned off and on again.

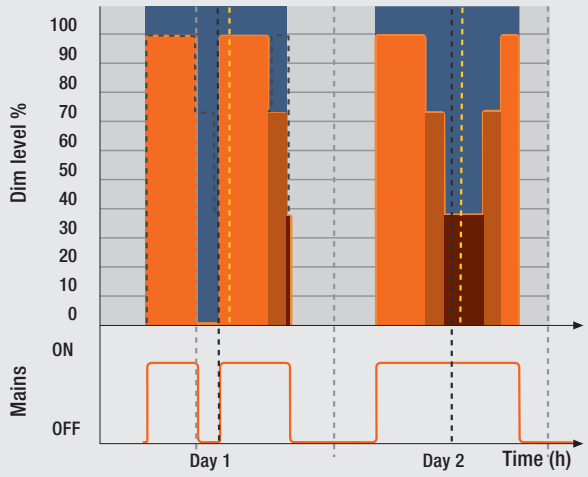


Figure 30: AstroDIM operation shorter than 4 hours.

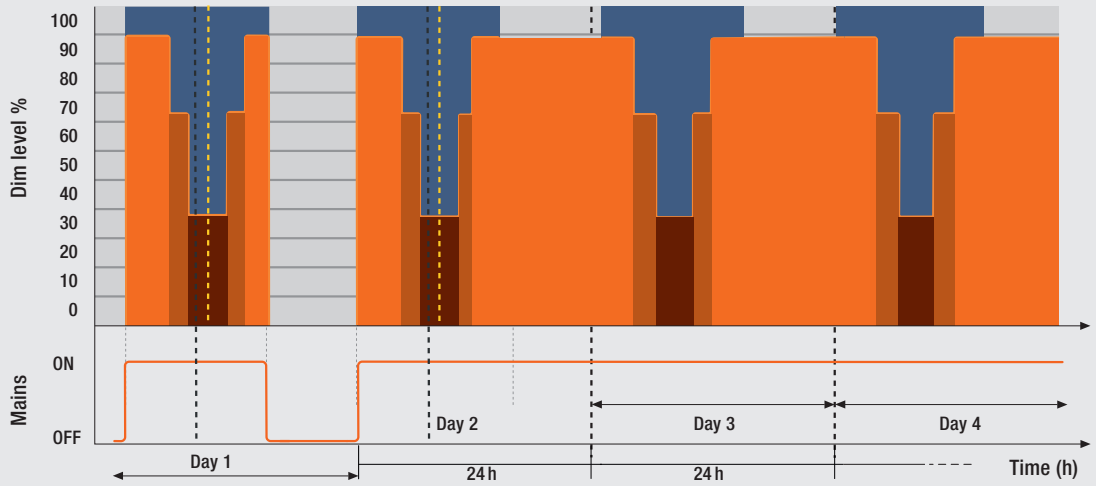


Figure 31: AstroDIM operation longer than 24 hours.

6. List of abbreviations and definitions

3DIM Tool	Windows-based software from OSRAM for 3DIM configuration
CCG	Conventional control gear (e.g. magnetic ballast)
DA	DALI® terminal
DALI®	Digital addressable lighting interface
DALI® controller	Master control of a DALI® installation – controls all DALI® ECGs
DALI magic	HW interface to connect a PC to a 3DIM ECG
ECG	Electronic control gear (electronic ballast)
HPD/HID lamp	High-pressure discharge lamp
HW	Hardware
LED	Light-emitting diode
OT	OPTOTRONIC® – ECG for LED modules
PC	IBM-compatible personal computer
Power-line-to-DALI® converter	For the conversion of power line commands into DALI® standard commands
PTo	POWERTRONIC® – outdoor ECG for HPD lamps
SD	StepDIM terminal
SW	Software

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