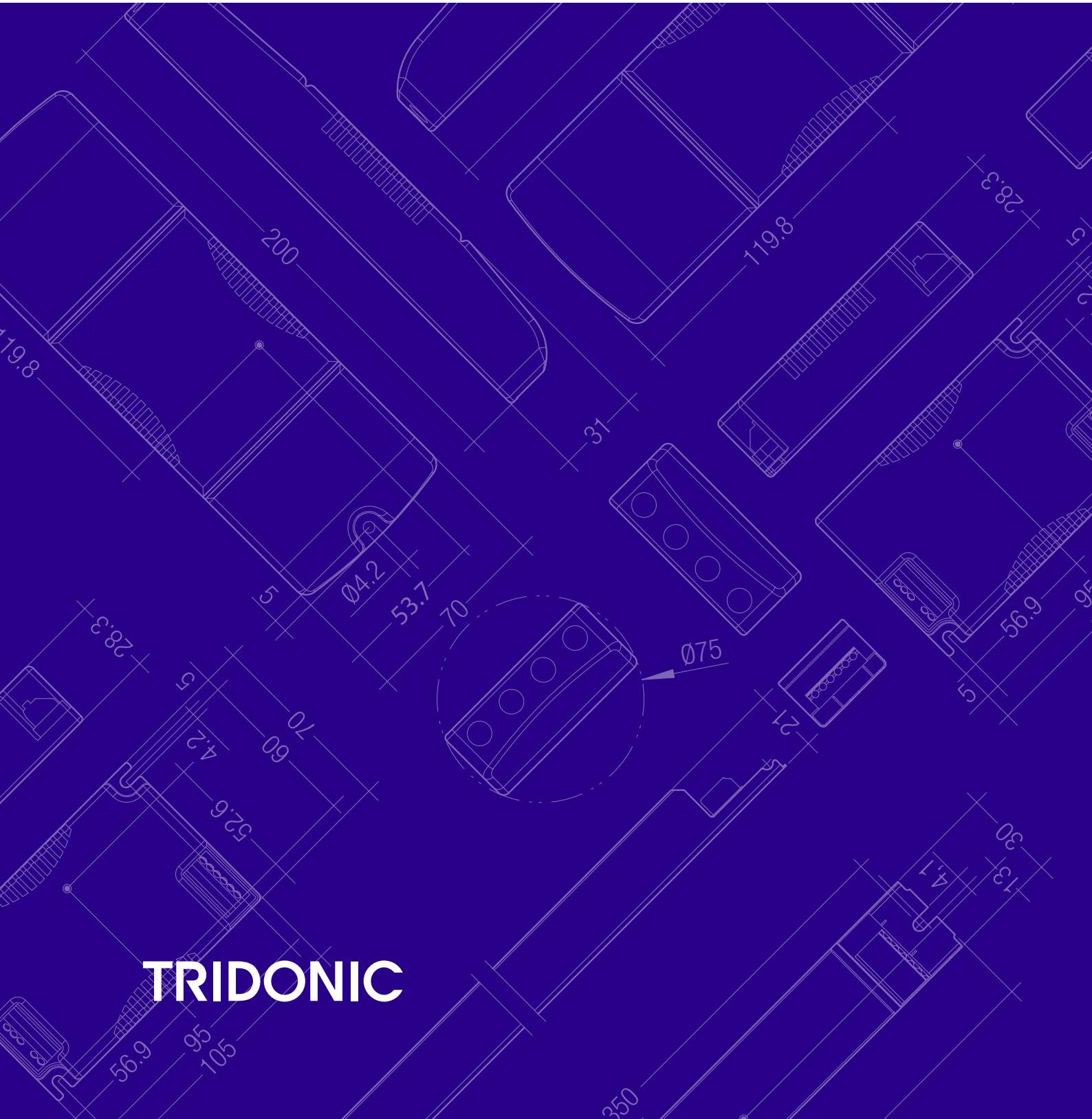
LCAI ECO / LCI TOP

Product manual



TRIDONIC

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Scope of documentation

1. Validity

These operating instructions are valid for LED Driver of the LCAI ECO and LCI TOP series.
If a reference is made to one of the two versions then the descriptions are valid only for that version.

In total the series comprises three versions. However, the third version LCI TEC is not covered in detail within this documentation.

TRIDONIC GmbH & Co KG is constantly striving to develop all its products. This means that there may be changes in form, equipment and technology.
Claims cannot therefore be made on the basis of information, diagrams or descriptions in these instructions.
The latest version of these operating instructions is available on our home page.

1.1. Copyright

We are always open to comments, corrections and requests. Please send them to info@tridonic.com

1.2. Imprint

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2. Safety instructions

The instructions in this section have been compiled to ensure that operators and users of LED Driver LCAI ECO and LCI TOP from Tridonic are able to detect potential risks in good time and take the necessary preventative measures.
The operator must ensure that all users fully understand these instructions and adhere to them. This device may only be installed and configured by suitably qualified personnel.

2.1. Intended use

2.1.1. Proper use

Operation of LED light modules. The device may only be used for this intended purpose.

2.1.2. Improper use

Outdoor use. Extensions and modifications to the product.

⚠ WARNING!

Improper use could result in injury, malfunction or damage to property.
It must be ensured that the operator informs every user of existing hazards.

2.2. Dangers associated with the operation of the system

⚠ DANGER!

Danger of electrocution
Disconnect the power to the entire lighting system before working on the lighting system!

2.3. Environment

⚠ DANGER!

Not to be used in corrosive or explosive environments.

⚠ CAUTION!

Risk of damage caused by humidity and condensation

_ Only use the control device in dry rooms and protect it against humidity!

_ Prior to commissioning the system, wait until the control device is at room temperature and completely dry!

2.4. Additional instructions

⚠ CAUTION!

Electromagnetic compatibility (EMC)
Although the device meets the stringent requirements of the appropriate directives and standards on electromagnetic compatibility, it could potentially interfere with other devices under certain circumstances!

3. Description and key features

3.1. Description of Key Features

LCAI ECO and LCI TOP is a portfolio of LED Driver. It has been optimised and simplified to meet the typical requirements of LED solutions.

_ State-of-the-art dimming technology:
The combination of two dimming techniques provides stepless dimming from 100 % to 1 % (ECO only)

_ Broad range of casing shapes:
Different casing shapes (compact, independent, low profile) and sizes for different built-in versions

_ Adjustable output current:
Simple option for setting current and voltage values transition-free (ECO and TOP) allows the device to be used with virtually all light modules

_ Same functions as for fluorescents:
Familiar functions (e.g. dimming, DALI, DSI, switchDIM, corridorFUNCTION) are fully usable and make it easier to switch to LED lighting

3.2. Three-part layer structure

The three layers LCAI ECO, LCI TOP and LCI TEC differ as follows:

	Portfolio	ECO	TOP	TEC
Dimming	Amplitude + PWM dimming	✅		
	PWM frequency	500 Hz		
	Dimming range	1-100 %		
	DALI DT6	✅		
	DSI	✅		
	switchDIM	✅		
	corridorFUNCTION	✅		
DC operation	supporting EN 50172	✅	✅	
	DC level fixed		✅	
	DC level adjustable	✅		
Current adjustment	Adjustable	✅	✅	
	Via resistor or plug	✅	✅	
	Via DALI	✅		
	current resolution	1/25/50 mA	25/50 mA	
	current tolerances	+/- 3 %	+/- 5 %	+/- 7.5 %
Functions & Performances	CLO function	✅		
	Intelligent temperature guard	✅	✅	✅
	Intelligent temperature management	✅	✅	
	Standby losses	<0.2 W		

Layer structure

	Rated supply voltage	220-240 V	220-240 V	220-240 V
	Lifetime @ T_a max	50,000	50,000	30,000
	T_a range	-25...+55 °C	-25...+55 °C	-25...+55 °C

3.2.1. ECO - top performer in efficiency and versatility

_ Dimming: Can be dimmed from 100 % to 1 % via DALI, DSI, switchDIM and corridorFUNCTION
_ Casing shapes: Three different casing shapes (compact, independent, low profile)
_ Output current: The output current can be set steplessly to any value via DALI or a resistor (150 - 400 mA, 350 - 900 mA, 900 - 1750 mA)
_ Functions/features:
  _ Dimming: corridorFUNCTION, DSI, switchDIM, DALI, power-up fading
  _ Normal operation: Constant Light Output, Over The Life
  _ Emergency mode: DC detection, dimming on DC
  _ Protection: Intelligent Temperature Guard, Intelligent Temperature Management

3.2.2. TOP - optimum performance and a high degree of flexibility

_ Dimming: Non-dimming
_ Casing shapes: Three different casing shapes (compact, independent, low profile)
_ Output current: The output current can be set via a resistor in steps of 25 mA or 50 mA (150 - 400 mA, 350 - 900 mA, 900 - 1,750 mA)
_ Functions/features:
  _ Emergency mode: DC detection
  _ Protection: Intelligent Temperature Guard, Intelligent Temperature Management

3.2.3. TEC - simply reliable and reliably simple

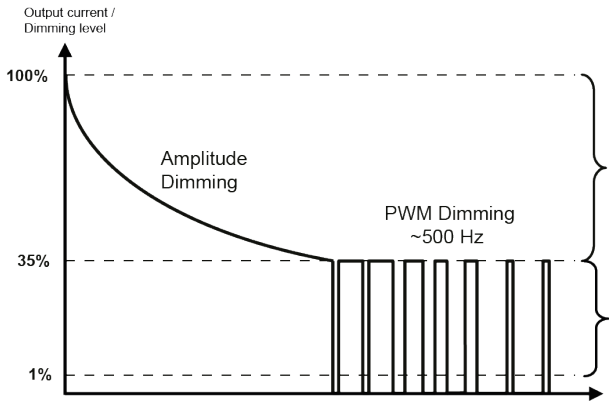
_ Dimming: Non-dimming
_ Casing shapes: Three different casing shapes (compact, independent, low profile)
_ Output current: Different output currents that are fixed and cannot be changed (350 mA, 500 mA, 700 mA, 1,050 mA, 1,400 mA, 1,700 mA)
_ Functions/features:
  _ Protection: Intelligent Temperature Guard

Layer structure

NOTICE

The TEC layer is mentioned in certain parts of the documentation but not described in full detail.

3.3. Dimming technology



The dimmable ECO devices can be dimmed between 100% and 1%. Two dimming methods are combined in order to cover this wide range:

_ Current amplitude dimming:
The dimming range between 100 % and 35 % is controlled by adjusting the amplitude of the current. The current value specified for the device corresponds to a dimming level of 100 %. The amplitude of the current is reduced to reduce the dimming level.

_ Dimming by pulse width modulation (PWM):
The dimming range between 35 % and 1 % is controlled by pulse width modulation. After the minimum possible current amplitude has been reached, corresponding to a dimming level of 35 %, the output current is pulse width modulated to achieve even lower dimming levels.

Dimming is stepless. The transition between the two dimming methods is seamless and is imperceptible to the human eye.

3.4. Housing variants

All the layers are available in three different housing variants: compact, independent and low profile.

Image	Description
	Housing variant compact _ Compact shape for installation inside the luminaire casing (in-built) _ Typical area of application: Spotlights, Downlights
	Housing variant independent _ Long and small shape for installation outside the luminaire casing (remote) _ Typical area of application: Spotlights, Downlights _ Special characteristic: Full loop-through capability of mains and interface (DALI) cables
	Housing variant low profile _ Flat shape for a space-saving installation inside the luminaire casing (in-built) _ Typical area of application: area lighting, linear lighting

3.5. Adjustable output current, voltage and power

LCAI ECO and LCI TOP allow for different combinations of power and current based on the standard lumen packages available on the market.

3.5.1. Output current

All the layers cover different output currents. The output currents are fixed or adjustable depending on the layer:

ECO:

- Adjustable values
- Adjustable via resistor, I-Select plug and DALI / masterCONFIGURATOR
- 3 types:
  - Low current: 150 - 400 mA
  - Mid-current: 350 - 900 mA
  - High current: 900 - 1,750 mA

TOP:

- Adjustable values
- Adjustable via resistor and plug
- 3 types:
  - Low current: 150 - 400 mA
  - Mid-current: 350 - 900 mA
  - High current: 900 - 1,750 mA

TEC:

- Fixed values (350 mA, 500 mA, 700 mA, 1,050 mA, 1,400 mA, 1,700 mA)

Adjustable output current

Adjustment of the output current via different resistance values

The output current of the LED Driver can be changed by setting different resistances.The resistance values are taken from the E96 series. Depending on the particular device used, the settings are made in steps of 25 mA or 50 mA.
The following values apply to LED Driver LCAI 20W 350mA-900mA ECO C and LCAI 20W 350mA-900mA ECO SR.

Output current	Forward voltage range	ISET resistance value
350 mA	22 - 50.0 V	Offen
375 mA	22 - 50.0 V	71.50 kΩ
400 mA	22 - 50.0 V	66.50 kΩ
425 mA	21 - 47.5 V	61.90 kΩ
450 mA	20 - 45.0 V	57.60 kΩ
475 mA	18 - 42.5 V	53.60 kΩ
500 mA	18 - 40.5 V	49.90 kΩ
525 mA	17 - 38.5 V	45.30 kΩ
550 mA	16 - 36.5 V	42.20 kΩ
575 mA	15 - 35.0 V	38.30 kΩ
600 mA	15 - 33.5 V	35.70 kΩ
625 mA	14 V 32.5 V	32.40 kΩ
650 mA	13 - 31.0 V	28.70 kΩ
675 mA	13 - 30.0 V	26.10 kΩ
700 mA	12 - 29.0 V	22.00 kΩ
725 mA	12 - 28.0 V	17.40 kΩ

Adjustable output current

750 mA	12 - 27.0 V	15.00 kΩ
775 mA	11 - 26.0 V	12.40 kΩ
800 mA	11 - 25.5 V	10.00 kΩ
825 mA	10 - 24.5 V	7.68 kΩ
850 mA	10 - 24.0 V	5.36 kΩ
875 mA	10 - 23.5 V	3.16 kΩ
900 mA	10 - 22.5 V	Short-circuit (0 Ω)

Adjustment of the output current via I-Select plugs

TRIDONIC supplies I-Select plugs for the most common output current values. These plugs are listed as accessories in the data sheet and can be ordered at the same time as the LED Driver.

NOTICE

Please note that the resistor values for I-select 2 are not compatible with I-select (generation 1). Installation of an incorrect resistor may cause irreparable damage to the LED module(s).

Resistors for the main output current values can be ordered from Tridonic. Further information about accessories can be found on the TRIDONIC homepage and in the data sheet at "accessories" (see Reference list, p. 64).

Devices with a current range of 150 - 400 mA

Output current	I-Select-Plug
150 mA	open
300 mA	blue, 0300
350 mA	blue, 0350
400 mA	grey, max

Adjustable output current

Devices with a current range of 350 - 900 mA

Output current	I-Select-Plug
350 mA	open
500 mA	green, 0500
700 mA	green, 0700
900 mA	green, max

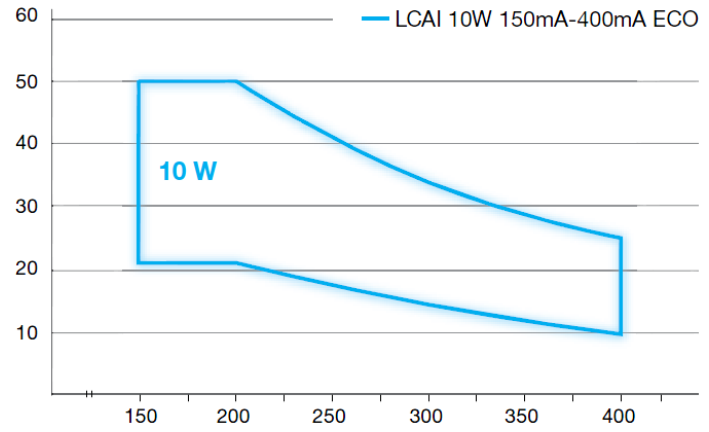
Devices with a current range of 900 - 1.750 mA

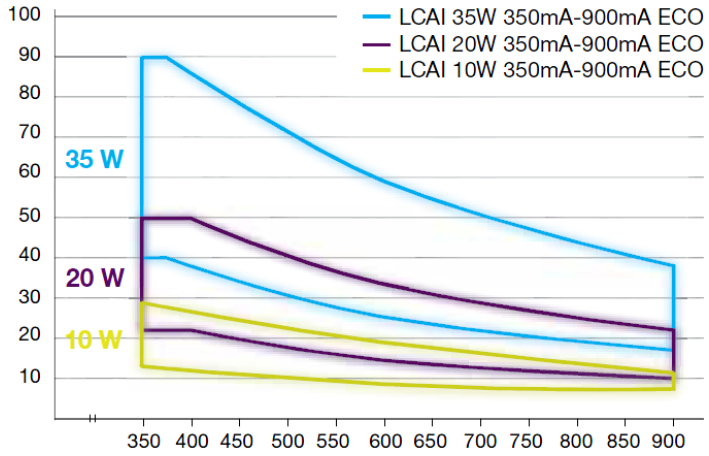
Output current	I-Select-Plug
900 mA	open
1.050 mA	brown, 1050
1.400 mA	brown, 1400
1.700 mA	grey, max

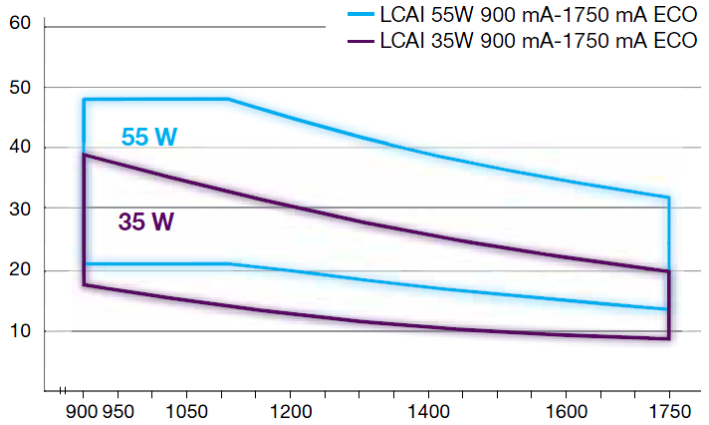
Adjustable output current

3.5.2. Output voltage

The output voltage range results from the current selected. For more information see the data sheet.
The following graph shows the relationship between output voltage [V], x-axxis and output current [mA], y-axxis







4. Compatibility between LED module and LED Driver

There are two stages involved in the check for compatibility between the LED module and the LED Driver.

_ The requirements for operating together can be checked by comparing the data sheets

_ Subsequent practical tests can ensure that there are no unexpected problems during actual operation

4.1. Comparison of data sheet values with a 5-point guideline

Different values for the two components need to be considered when comparing the data sheets. The following table shows which values are involved and which requirements they must meet.

Comparison of…	Value in LED module		Value in LED Driver	Detailed procedure
(1) Current	I_{max}	=	Output current	_ Determine forward current of LED module _ Check whether LED Driver can be operated with the same output current _ Check whether max. DC forward current of LED module is greater than or equal to output current of LED Driver (including tolerances) **⚠ CAUTION!** The max. DC forward current can be temperature dependent! Refer to the derating curve of the LED module data sheet.
	Max. DC forward current	≥	Output current + tolerances	
(2) Voltage	Min. forward voltage	>	Min. output voltage	_ Check whether voltage range of LED module is completely within the voltage range of LED Driver
	Max. forward voltage	<	Max. output voltage	**⚠ CAUTION!** The forward voltage is temperature dependent! Refer to the Vf/t_p diagram in the data sheet.

Compatibility between LED module and LED Driver

(3) LF current ripple	Max. permissible LF current ripple	≥	Output LF current ripple (< 120 Hz)	_ Check whether max. permissible LF current ripple of LED module is greater than or equal to output LF current ripple of LED Driver
(4) Max. peak current	Max. permissible peak current	>	Max. output current peak	_ Check whether max. permissible peak current of LED module is greater than max. output current peak of LED Driver
(5) Power (pertinent for multi channel control gear)	Min. power consumption	>	Min. output power	_ Check whether power range of LED module is completely within output power range of LED Driver
	Max. power consumption	<	Max. output power	

Compatibility between LED module and LED Driver

4.2. Application of the 5-point guideline

The compatibility check with the 5-point guideline is shown here using two examples.

4.2.1. Example 1

Comparison data for LED Driver

LED Driver	
Designation	LCI 20W 350mA-900mA TOP C
Manufacturer	TRIDONIC

Data sheet values of LED Driver	
Output current	500 mA
Output current tolerance	± 5 %
Min. output voltage	18 V (1)
Max. output voltage	40 V (1)
Output LF current ripple	± 2 %
Max. output current peak	600 mA
Output power	20.0 W

(1) Values at 500 mA

Compatibility between LED module and LED Driver

Comparison data for LED module

LED module	
Designation	Fictitious LED module
Manufacturer	Other manufacturer

Data sheet values of LED module	
Forward current	500 mA
Max. DC forward current	1,050 mA
Typ. forward voltage	33 V +/-10 % (1)
Min. forward voltage	29.7 V (1)
Max. forward voltage	36.3 V (1)
Max. permissible LF current ripple	630 mA
Max. permissible peak current	1,500 mA
Power draw	16.4 W

(1) Values at 500 mA

Questions

_ Are the two components mutually compatible?

_ Can the required luminous flux of 1,510 lm be achieved with this combination?

Compatibility between LED module and LED Driver

Procedure

Comparison of data sheet values

Comparison of…	Value in LED module		Value in LED Driver	Result	Explanation
(1) Current	500 mA	=	500 mA	✅	_ To produce a luminous flux of 1,510 lm the LED module must be operated with a forward current of 500 mA. _ The LED Driver can be set so that it delivers precisely this value of 500 mA as the output current (with a resistance of 49.90 kΩ).
	1,050 mA	≥	525 mA	✅	_ The output current of the LED Driver including tolerances (500 mA + 5 % = 525 mA) is less than or equal to the max. DC forward current of the LED module (1,050 mA).
(2) Voltage	29.7 V	>	18 V	✅	_ The voltage range of the LED module (29.7 V - 36.3 V) lies completely within the voltage range of the LED Driver (18 V - 40.0 V).
	36.3 V	<	40 V	✅	
(3) LF current ripple	630 mA	>	535.5 mA	✅	_ The Output LF current ripple (2 % of output current plus tolerances: [500 mA + 5 %] x 1.02 = 535.5 mA) of the LED Driver is less than the max. permissible LF current ripple of the LED module (630 mA).
(4) Max. peak current	1,500 mA	>	600 mA	✅	_ The max. output current peak of the LED Driver (500 mA + 20 % = 600 mA) is less than the max. permissible peak current with which the LED module can be operated (1,500 mA).
(5) Power	16.4 W	<	20.0 W	✅	_ The power draw of the LED module (16.4 W) is less than the output power of the LED Driver (20.0 W).

Result

All the values meet the requirements. The components are mutually compatible.

Compatibility between LED module and LED Driver

4.2.2. Example 2

Comparison data for LED Driver

LED Driver	
Designation	LCI 20W 350mA-900mA TOP C
Manufacturer	TRIDONIC

Data sheet values of LED Driver	
Output current	500 mA
Output current tolerance	± 5 %
Min. output voltage	18 V (1)
Max. output voltage	40 V (1)
Output LF current ripple	± 2 %
Max. output current peak	600 mA
Output power	20.0 W

(1) Values at 500 mA

Compatibility between LED module and LED Driver

Comparison data for LED module

LED module	
Designation	Fictitious LED module
Manufacturer	Other manufacturer

Data sheet values of LED module	
Forward current	500 mA
Max. DC forward current	1,050 mA
Typ. forward voltage	39.5 V +/-10 % (1)
Min. forward voltage	35.55 V (1)
Max. forward voltage	43.45 V (1)
Max. permissible LF current ripple	630 mA
Max. permissible peak current	1,500 mA
Power draw	19.75 W

(1) Values at 500 mA

Questions

_ Are the two components mutually compatible?

_ Can the required luminous flux of 1,800 lm be achieved with this combination?

Compatibility between LED module and LED Driver

Procedure

Comparison of data sheet values

Comparison of…	Value in LED module		Value in LED Driver	Result	Explanation
(1) Current	500 mA	=	500 mA	✅	_ To produce a luminous flux of 1,800 lm the LED module must be operated with a forward current of 500 mA. _ The LED Driver can be set so that it delivers precisely this value of 500 mA as the output current (with a resistance of 49.90 kΩ).
	1,050 mA	≥	525 mA	✅	_ The output current of the LED Driver including tolerances (500 mA + 5 % = 525 mA) is less than or equal to the max. DC forward current of the LED module (1,050 mA).
(2) Voltage	35.55 V	>	18 V	✅	_ The voltage range of the LED module (35.55 V - 43.45 V) is **not** within the voltage range of the LED Driver (18 V - 40.0 V)
	43.45 V	<	40 V	❎	
(3) LF current ripple	630 mA	>	535.5 mA	✅	_ The Output LF current ripple (2 % of output current plus tolerances: [500 mA + 5 %] x 1.02 = 535.5 mA) of the LED Driver is less than the max. permissible LF current ripple of the LED module (630 mA).
(4) Max. peak current	1,500 mA	>	600 mA	✅	_ The max. output current peak of the LED Driver (500 mA + 20 % = 600 mA) is less than the max. permissible peak current with which the LED module can be operated (1,500 mA).
(5) Power	19.75 W	<	20.0 W	✅	_ The power draw of the LED module (19.75 W) is less than the output power of the LED Driver (20.0 W).

Result

One of the values **does not** meet the requirements. The components are **not** mutually compatible.

4.3. Practical tests

Practical tests are used to ensure fault-free operation of the LED module and LED Driver. The following aspects must be checked.

4.3.1. Technical aspects

_ Transient behaviour
_ Colour shift
_ Connection during operation
_ Parasitic capacitance

4.3.2. Visual aspects

_ Flickering
_ Stroboscopic effect (video applications)
_ Dimming behaviour
_ Colour change/stability
_ Luminous flux

4.3.3. Conditions

When conducting the tests the following conditions must be considered:

_ All tolerances
_ Entire temperature range
_ Different output voltage ranges (incl. no load)
_ Entire dimming range
_ Short circuit

NOTICE

If the values are slightly over or under the specified threshold values or if there are any other concerns or questions please contact Technical Support: techservice@tridonic.com

5. Installation notes

NOTICE

The cabling, wiring and mounting for a LED Driver varies depending on the design and manufacturer of the LED module.
The following description should therefore not be viewed as comprehensive installation instructions but merely as important general information.

To obtain further information, proceed as follows:

_ Read the documentation provided by the lamp manufacturer. Follow the guidelines and instructions of the lamp manufacturer!

_ Observe all relevant standards. Follow the instructions given in the standards!

5.1. Safety information

WARNING!

_ Comply with the general safety instructions (see Safety instructions, p. 5) !

_ To avoid failures due to ground faults protect the wiring against mechanical loads from sharp-edged metal parts (e.g. cable penetrations, cable holders, metal frames, etc.

_ Electronic control gear from Tridonic are protected for a maximum of 1 hour against overvoltage of up to 320 V. Make sure that the control gear is not exposed to overvoltages for long periods!

_ Electronic control gear LCAI ECO, LCI TOP and LCI TEC from Tridonic have type of protection IP 20. Comply with the requirements for this type of protection!

5.2. Function of the earth terminal

An earth connection can improve the following unwanted behaviour:

_ poor interference properties
_ residual LED glow on standby
_ transfer of mains transients to the LED output.

For modules that are installed on earthed luminaire components or on heat sinks and which therefore have a high capacitance with regard to earth it is generally recommended that the device be also earthed.
If an earth connection is used it must be a protective earth (PE).

5.2.1. Avoiding residual LED glow on standby

Residual LED glow on standby may occur as a result of capacitive leakage currents from the LED module onto earthed luminaire parts (such as the heat sink). This mainly affects high-efficiency LED systems with large surface areas installed in luminaires with protection class 1.

The topology of LED Driver in the LCAI ECO series has been improved so that residual LED glow can be virtually eliminated by earthing the devices.

NOTICE

If the LED Driver cannot be earthed or if earthing is not desired, residual LED glow can be minimised by adequate insulation (for example by using heat-conducting double-sided insulation foil).

5.2.2. Avoiding the transfer of mains transients to the LED output

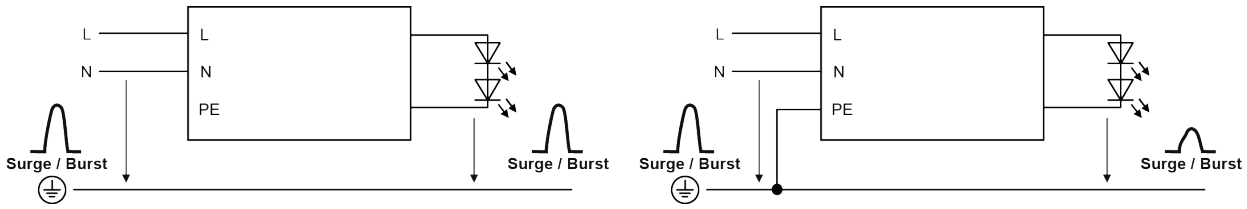
The transfer of mains transients to the LED output presents a problem for many LED Driver topologies currently on the market, and TRIDONIC devices may be affected.

Voltage peaks at the input of the LED Driver may be transferred to the output of the device where they lead to differences in potential between the LED output and earthed luminaire parts. These differences in potential may result in flashovers if the insulation is inadequate or if the creepage and clearance distances are too small. Flashovers will cause the LED module to fail.

Earthing the LED Driver attenuates voltage peaks and reduces the likelihood of flashovers. The precise degree of attenuation depends on the capacitance of the LED module with respect to earth. A factor of 0.5 is a good approximation.

Installation notes

Figure: Voltage peaks for LED Driver without earthing (left) and with earthing (right)



NOTICE

Irrespective of whether the LED Driver is earthed or not, LED modules must be insulated in accordance with the requirements of the luminaire protection class. Improved insulation of the LED module can also reduce the likelihood of flashovers.

5.3. Routing the wires

5.3.1. Tests

NOTICE

The performance of the prescribed tests and compliance with relevant standards are the responsibility of the luminaire manufacturer.
The following descriptions merely indicate the most important tests and are no substitute for a full research of the relevant standards.

5.3.2. Insulation and dielectric strength testing of luminaires

LED Driver for lamps are sensitive to high-voltage transients. This must be taken into consideration when subjecting luminaires to routine testing during manufacture.

According to IEC 60598-1 Annex Q (for information only!) and ENEC 303-Annex A, each luminaire should be subjected to an insulation test for 1 second at 500 V DC. The test voltage is applied between the linked phase/neutral conductor terminal and the protective earth terminal. The insulation resistance must be at least 2 MOhm.

As an alternative to measuring the insulation resistance, IEC 60598-1 Annex Q describes a dielectric strength test at 1500 V AC (or 1.414 x 1,500 V DC). To avoid damaging electronic control gear, this dielectric strength test should be performed exclusively for type testing. This test should certainly not be used for routine testing.

NOTICE

Tridonic recommends performing an insulation test because a dielectric strength test may damage the device irreparably.

5.3.3. Type testing

Type testing of the luminaire is performed according to IEC 60598-1 Section 10.
The wiring for protection class 1 luminaires is tested at a voltage of 2xU + 1,000 V. In order not to overload the control gear all the inputs and outputs of the control gear are connected to one another.
U_{out} is used for measuring the voltage for luminaires with control gear with U_{out} > 250 V:
For U_{out} 480 V the voltage for the type test is 2000 V. (Routine testing is always performed at 500 V DC)

5.3.4. Wiring

Wiring guidelines

_ The cables should be run separately from the mains connections and mains cables to ensure good EMC conditions.

_ The LED wiring should be kept as short as possible to ensure good EMC. The max. secondary cable length is 2 m (4 m circuit), this applies for LED output as well as for I-select and temperature sensor.

_ Depending on the design of the luminaire it may be possible to improve the radio interference properties by earthing the device at the earth connection.

_ The LED Driver has no inverse-polarity protection on the secondary side. Wrong polarity can damage LED modules with no inverse-polarity protection.

Wiring

The wiring procedure is the same for compact built-in devices (LCAI ECO C and LCI TOP C) and compact surface-mounted devices (LCAI ECO SR and LCI TOP SR). The difference is in the wire cross-sections required and in the length of the stripped off insulation.

	Wire cross-sections		Length of stripped off insulation	
	Input side	Output side	Input side	Output side
LCAI ECO C / LCI TOP C	0.5 - 1.5 mm²	0.2 - 1.5 mm²	8.5 - 9.5 mm	8.5 - 9.5 mm
LCAI ECO SR / LCI TOP SR	0.5 - 2.5 mm²	0.2 - 1.5 mm²	10 - 11 mm	8.5 - 9.5 mm

Wiring the plug-in terminal

_ Use solid wire or stranded wire with the correct cross-section

_ Strip off correct length of insulation; you may need to twist the tool slightly

_ If stranded wire is used: push onto the terminal from above to be able to insert the wire

_ Insert the bare end into the terminal

Detaching the plug-in terminal

_ Push onto the terminal from above to release the wire

_ Pull out the wire at the front

5.4. Maximum loading of circuit breakers

5.4.1. Importance of maximum loading

A circuit breaker is an automatically operated electrical switch that protects an electrical circuit from damage caused by overload or short circuit. Unlike a fuse that must be replaced if it triggers, a circuit breaker can be reset (either manually or automatically) and used further. Circuit breakers are available in different sizes and with different technical data.

The inrush current is a short increased peak current that occurs when an electronic control gear is switched on.

In electrical installations, numerous control gear are connected to one circuit breaker. The maximum loading of a circuit breaker indicates how many control gear can be connected to the circuit breaker without triggering the circuit breaker because of the summation of the different inrush currents. The value is calculated through simulation programs based on the circuit breakers characteristic.

Information about the maximum loading can be found in Tridonic data sheets:

Automatic circuit breaker type	C10	C13	C16	C20	B10	B13	B16	B20	Inrush current	
Installation Ø	1.5 mm^2	1.5 mm^2	2.5 mm^2	2.5 mm^2	1.5 mm^2	1.5 mm^2	2.5 mm^2	2.5 mm^2	I_{max}	time
LCAI 20W 150mA-400mA ECO Ip	60	80	100	140	60	80	100	140	6 A	45 µs

5.4.2. Calculation of maximum loading

Tripping characteristics of circuit breakers

The load at which a circuit breaker triggers is defined by the height and the duration of the applied current.
The following table shows exemplary values for different circuit breakers (B10, B13, B16, B20).

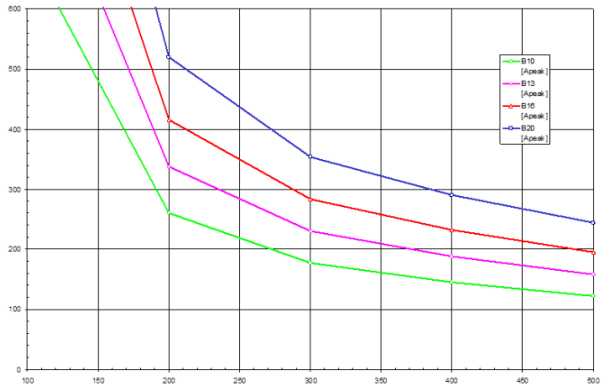
Duration [µs]	Current B10 [A_{peak}]	Current B13 [A_{peak}]	Current B16 [A_{peak}]	Current B20 [A_{peak}]
100	700	910	1,120	1,400
200	260	338	416	520
300	177	230.1	283	354
400	145	188.5	232	290

Installation notes

500	122	158.6	195	244
600	110	143	176	220
700	102	132.6	163	204
800	97	126.1	155	194
900	93	120.9	149	186
1,000	90	117	144	180

The combination of both parameters can also be displayed graphically. This results in the tripping characteristic for a certain circuit breaker.

Current [A]



Duration [µs]

NOTICE

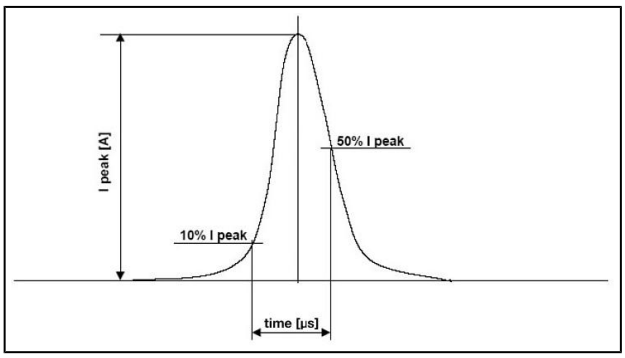
Information about the specific tripping characteristics of a circuit breaker must be requested from the respective manufacturer !

Calculation of the inrush current

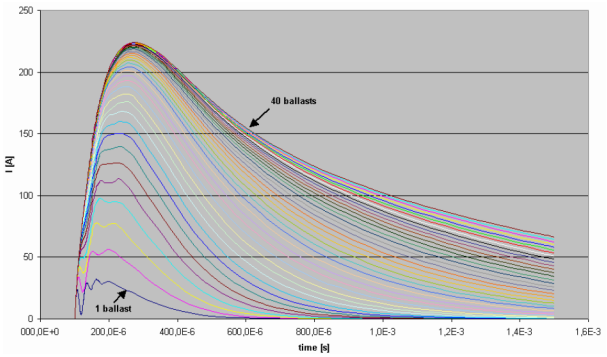
The inrush current of a control gear is also defined by its duration and its height. The duration is typically measured as the time between 10 % of maximum current (ascending) and 50 % of maximum current (descending).

The following illustration shows the inrush current of a single control gear:

Installation notes



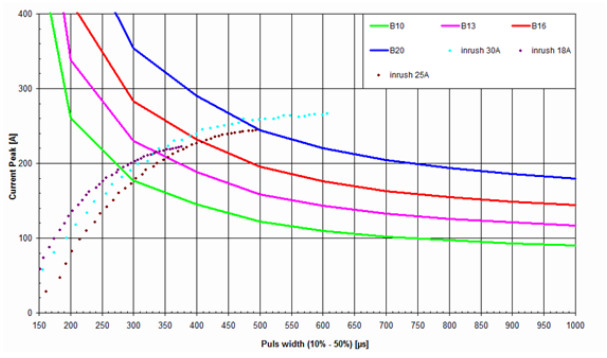
If several control gear are connected to one circuit breaker, the individual inrush currents add up.



Implementation of the simulation

The above-mentioned parameters, height and duration of the current pulse in both the circuit breaker and the control gear, are entered into the simulation program.

The result of the simulation is presented in graphical form.



The different elements have the following meaning:

- Circuit breaker:
  B10, B13, B16, B20 (solid line) represent the tripping characteristics of different circuit breakers.
- Inrush current:
  The dotted lines represent different inrush currents.
  The index of a point signifies the number of control gear, that is, point 1 represents the result for 1 ballast, point 2 the result for 2 ballasts, etc.

The simulation results can be read as follows:

Installation notes

_ The crossing of the two lines shows the maximum value for the selected combination of circuit breaker and inrush current.

_ The index of the point at this maximum value shows the max. number of ballasts.

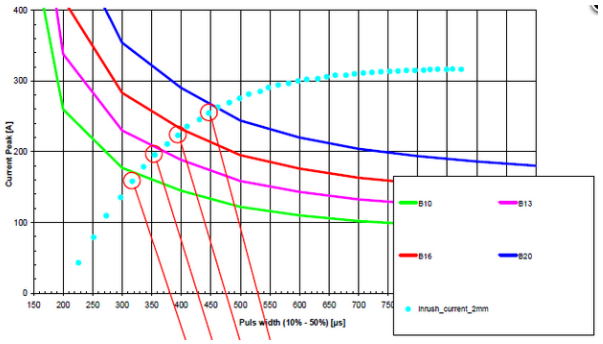
The following example shows the maximum number of control gear at four different circuit breakers:

_ max. 5 devices at circuit breaker B10 (green tripping characteristic)

_ max. 7 devices at circuit breaker B13 (pink tripping characteristic)

_ max. 9 devices at circuit breaker B16 (red tripping characteristic)

_ max. 12 devices at circuit breaker B20 (blue tripping characteristic)



NOTICE

The results of different simulations can only be compared if all of the relevant factors are the same. The following points can influence the results:

_ Tripping characteristic used for the circuit breakers

_ Definition used for the duration of the inrush current (Tridonic: 10-50 %)

_ Gear used for the measurement of the inrush current (especially important: Which electrolytic capacitor is installed in the control gear?)

_ Considering a safety buffer (Tridonic: +20 % for the electrolytic capacitor)

_ Considering different system impedances

_ Switch-on point used: should always be at max. input voltage

_ Adopted cable lengths and cable data (Tridonic: Cable length 40 cm; Resistivity: 0.0172 ohm * mm2 / m; inductance: 5nH / cm; terminal resistance: 2mOhm)

_ The modeling of the control gear is performed from the input to the bus voltage electrolytic capacitor . For inductance the saturation values must be used.

6. Functions

6.1. corridorFUNCTION (ECO)

6.1.1. Description

The corridorFUNCTION enables the illuminance to be linked to the presence or absence of people. A conventional relay motion sensor is connected. The luminous intensity is increased when a person enters the room. When the person leaves the room the motion sensor switches off after a certain delay and the luminous intensity is automatically reduced.

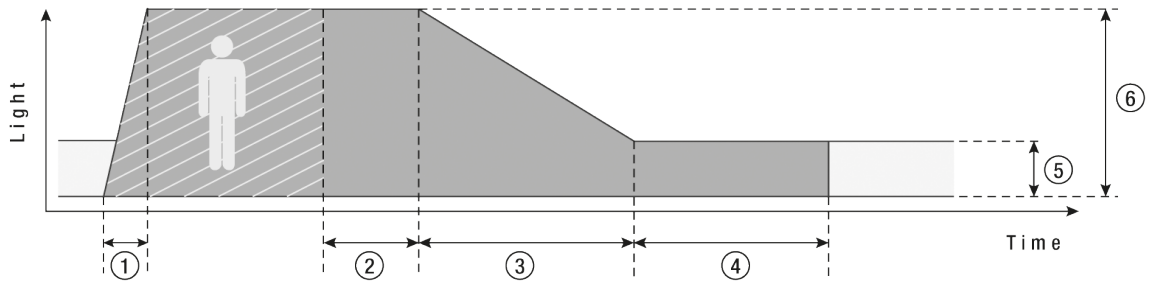
The corridorFUNCTION is particularly beneficial in applications in which light is needed round the clock for safety reasons, for example in public buildings, large apartment complexes, car parks, pedestrian underpasses and underground railway stations. Since the luminous intensity only has to be increased when there is a demand for light the corridorFUNCTION offers effective lighting management and helps saving energy and costs. Another benefit of the corridorFUNCTION is the enhanced convenience of automatic lighting control.

⚠ CAUTION!

To ensure correct operation a sinusoidal mains voltage with a frequency of 50 Hz or 60 Hz is required at the control input.
Special attention must be paid to achieving clear zero crossings. Serious mains faults may impair the operation of switchDIM and corridorFUNCTION.

Profile settings:

LED Drivers have different profiles so they can provide the best possible performance in a range of conditions. The profiles are defined by a series of values:



1. Fade-in time: the time that starts as soon as the presence of a person is detected. During the fade-in time the luminous intensity is faded up to the presence value.
2. Run-on time: the time that starts as soon as the presence of a person is no longer detected. If the presence of a person is detected again during the run-on time the run-on time is restarted from zero. If no presence is detected during the run-on time the fade time is started as soon as the run-on time expires.
3. Fade time: the time during which the luminous intensity is faded from the presence value to the absence value.
4. Switch off delay: the time during which the absence value is held before the lighting is switched off. Depending on the profile selected the switch-off delay may have different values or may not be defined.
5. Absence value: the luminous intensity when there is no person present

6. Presence value: the luminous intensity when persons are present

Variable switch-off times

The profiles and their values can be freely adjusted. The values can be adjusted via a connection to a DALI bus.

6.1.2. Installation

Requirements:

_ The LED Driver is correctly installed in the luminaire and cabled on the power supply side

_ A motion sensor is installed in the lighting system

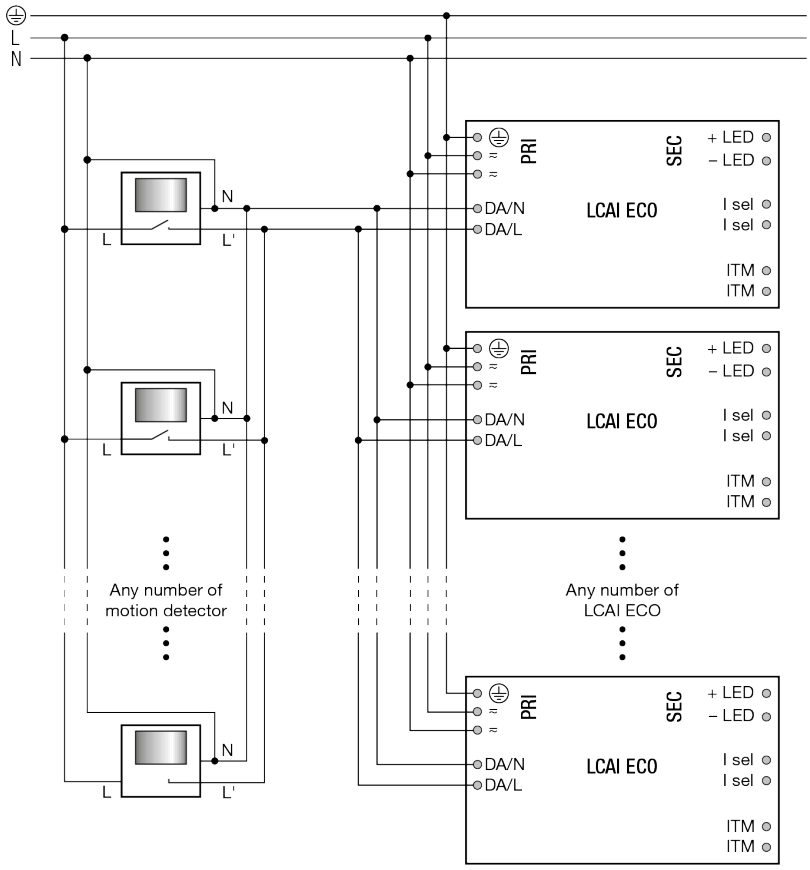
_ The motion sensor is connected to the LED Driver

Procedure:

_ Connect the neutral conductor (N) to terminal DA/N on the LED Driver

_ Connect the output of the motion sensor (switched phase) to terminal DA/L on the LED Driver

Wiring versions:



Benefits:

Control can be changed at any time to a digital control signal (DSI or DALI) without having to change the luminaire or provide an additional control line

⚠ CAUTION!

Use conventional relay motion sensors!
Electronic motion sensors (Triac) are not suitable because of their technical design.

⚠ CAUTION!

Do not use glow switches!
Glow switches may affect the control.

⚠ CAUTION!

Make sure that the control line (L') of the motion sensor is connected to terminal DA/L and the neutral conductor (N) to terminal DA/N.

⚠ CAUTION!

For five-pole wiring the neutral conductor must be connected to DA/N.
This prevents 400 V being applied between adjacent terminals if a different phase is used for the control input.

ⓘ NOTICE

For large installations, supply to the control gear may be split among several phases (L1, L2, L3).
Any phase can be used for the control input .
Any number of motion sensors can be connected in parallel.

6.1.3. Commissioning

Activating the corridorFUNCTION

Procedure by means of the mains voltage

Activating the corridorFUNCTION is simple. If an a.c. voltage of 230 V is applied to the digital interface of the control gear for a period of at least 5 minutes, the LED Driver detects the corridorFUNCTION and automatically activates it. Activation is required only once per device.
There are three procedures for activating by means of the mains voltage. The requirements are the same in each case.

corridorFUNCTION

Requirements:

_ The LED Driver is correctly installed in the luminaire

_ Input voltage is applied

_ A motion sensor is connected to information DA/N or DA/L

Procedure Version 1:

_ Remain in the activation range of the motion sensor for more than 5 minutes
→ The motion sensor detects movement and switches on
→ The corridorFUNCTION is activated automatically after 5 minutes
→ The light value switches to presence level (default: 100 %)

Procedure Version 2:

_ Set the run-on time on the motion sensor to a value greater than 5 minutes

_ Remain in the activation range of the motion sensor for a short time
→ The motion sensor detects movement and switches on
→ The corridorFUNCTION is activated automatically after 5 minutes
→ The light value switches to presence value (default: 100 %)

_ Reset the run-on time of the motion sensor to the required value

Procedure Version 3: Only possible if the motion sensor offers a manual override option

_ Set the slide switch on the motion sensor to the "Never-Off" function

_ Wait 5 minutes
→ The corridorFUNCTION is activated automatically after 5 minutes
→ The light value switches to presence value (default: 100%)

_ Reset the slide switch on the motion sensor to the "automatic" function

Procedure via the masterCONFIGURATOR

The corridorFUNCTION can also be activated via the masterCONFIGURATOR.

Further information can be found in the masterCONFIGURATOR manual (see Reference list, p. 64).

Deactivating the corridorFUNCTION

If the corridorFUNCTION is activated, the LED Driver is controlled only by motion. To operate the LED Driver via DALI, DSI or switchDIM, the corridorFUNCTION must be deactivated.

corridorFUNCTION

Procedure via mains

_ Connect mains voltage push button to the terminal marked DA/L

_ Connect neutral conductor to the terminal marked DA/N

_ Press the switch 5 times within 3 seconds

Procedure via DALI/DSI

_ Send 5 DALI or DSI commands within 3 seconds to the LED Driver

Procedure via masterCONFIGURATOR

If the corridorFUNCTION was activated via the masterCONFIGURATOR it can be deactivated as follows:

_ Send 5 DALI or DSI commands within 3 seconds to the LED Driver

Adjusting the values of the corridorFUNCTION

The values of the corridorFUNCTION can be individually adjusted. The values are set via a DALI USB on the bus and by entering special DALI commands via the masterCONFIGURATOR.

Further information can be found in the masterCONFIGURATOR manual (see Reference list, p. 64).

6.2. DSI (ECO)

6.2.1. Description

DSI (Digital Serial Interface) enables DSI control gear to be controlled. The DSI line can be wired separately via a two-core cable or together with the mains cable in a five-core cable. Communication is not impaired by the mains cable. In contrast to DALI, there is no individual addressing of the ballasts with DSI.

DSI offers a series of benefits:

_ Expansion options via submodules, for example in combination with daylight control or additional switch modules
_ Wiring: Simple wiring with five pole standard cables and line length of up to 250 metres
_ Wiring: Polarity-free control lines can be used for mains and control lines
_ Wiring: Multiple wiring possibilities (star, series and mixed wiring)
_ Unaffected by electrical interference
_ Uniform light level from the first to the last light source

The main benefits of DSI are the optimisation of energy consumption of extensive groups of luminaires (e.g. in sports stadiums and factories).

6.2.2. Commissioning

NOTICE

If the corridorFUNCTION is activated the LED Driver is controlled only by motion. To operate the control gear via DALI, DSI or switchDIM the corridorFUNCTION must be deactivated.

Further information can be found in the DALI Handbook (see Reference list, p. 64).

6.3. switchDIM (ECO)

6.3.1. Description

With the switchDIM function it is possible to use the mains voltage as a control signal.
The phase of a simple standard mains voltage push button is connected to the terminal marked DA/L and the neutral conductor is connected to the terminal marked DA/N.

Using the function is easy and convenient:

_ A short press (50-600 ms) switches the device on or off

_ A long press (> 600 ms) fades the connected operating device alternately up and down (between 1 and 100 %).

switchDIM is therefore a very simple form of lighting management. It also has a positive effect on material and labour costs.

The device has a switchDIM memory function. This is used, among other things, for storing the last dimming value in the event of interruptions in the power supply.
When power returns, the LED is automatically restored to its previous operating state and dimmed to the last value.

⚠ CAUTION!

Glow switches are not approved for controlling switchDIM.
Glow switches may cause the LED Driver to spontaneously switch on or off or make sudden changes in the dimming value.

⚠ CAUTION!

To ensure correct operation a sinusoidal mains voltage with a frequency of 50 Hz or 60 Hz is required at the terminal.
Special attention must be paid to achieving clear zero crossings. Serious mains faults may impair the operation of switchDIM and corridorFUNCTION.

⚠ CAUTIONS!

A maximum number of 25 operating devices per switchDIM system should not be exceeded.
If you have more devices please use DALI or DSI.

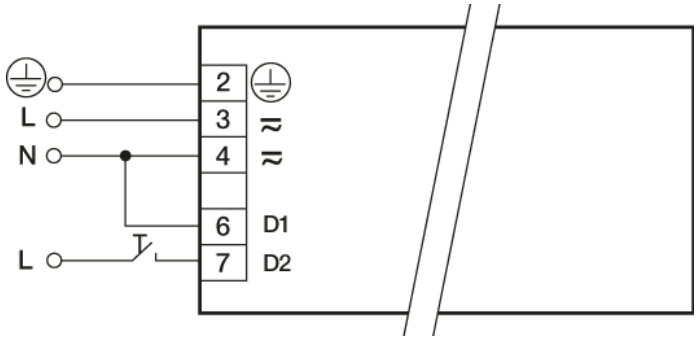
6.3.2. Installation

Wiring variants

There are two options for installing switchDIM: four-pole and five-pole wiring.

Four-pole wiring

Configuration:



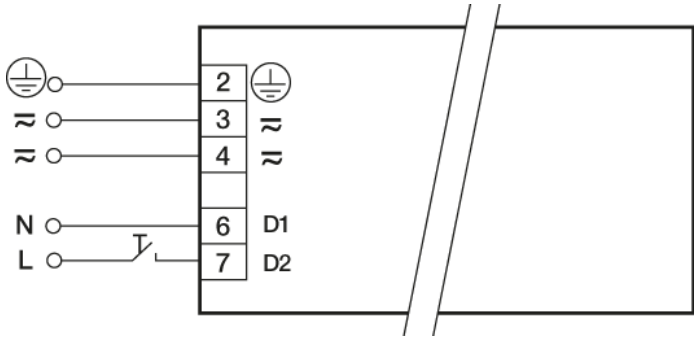
Phase (L), neutral (N), earth (PE), control line (L')

Benefits:

No need for a control line thanks to bridging terminal 6 and the N-connection of the luminaire

Five-pole wiring

Configuration:



Phase (L), neutral (N), earth (PE), control line (L), neutral (N)

Benefits:

Control can be changed at any time to a digital control signal (DSI or DALI) without having to change the luminaire or provide an additional control line

⚠ CAUTION!

For five-pole wiring the neutral conductor must be connected to DA/N.
This prevents 400 V being applied between adjacent terminals if a different phase is used for the control input.

6.3.3. Commissioning

NOTICE

If the corridorFUNCTION is activated, the LED Driver is controlled only by motion. To operate the LED Driver via DALI, DSI or switchDIM the corridorFUNCTION must be deactivated.

Using the switchDIM function

switchDIM is operated by the mains voltage push button.

Procedure:

_ Switch the device on/off by briefly actuating the push button -or-

_ Dim the device by holding down the push button

Synchronizing devices

If the devices in a system do not operate synchronously, the devices must be synchronized, i.e. put in the same status (on/off).

Procedure:

_ Hold down the push button for 10 seconds
→ All devices will be synchronized to the same status
→ LEDs will be set to a uniform light value (approx. 50 %)

Changing the fading time

The default value for the fading time is approx. 3 seconds. For devices of the types ECO and EXCEL this can be changed to approx. 6 seconds.

Procedure:

_ Hold down the push button for 20 seconds
→ After 10 seconds: all devices will be synchronized to the same status
→ After 20 seconds: a new fading time will be set
→ LEDs will be set to a uniform light value (approx. 100 %)

Resetting the control gear to the factory defaults

Procedure:

_ Hold down the push button for 10 seconds four times in a row. Release the push button briefly between each 10 second hold

Switching the control gear to automatic mode

In automatic mode the device detects which control signal (DALI, DSI, switchDIM, etc.) is connected and automatically switches to the corresponding operating mode.

Procedure:

_ Press the push button 5 times within 3 seconds

6.4. Power-up Fading (ECO)

6.4.1. Description

The power-up fading function offers the opportunity to realize a soft start. The soft start will be applied at turning on the mains and at starts by switchDIM. The function is programmed as a DALI fade time in the range from 0.7 to 16 seconds and dims in the selected time from 0 % to the power-on level.

By factory default power-up fading is not active (0 seconds).

6.4.2. Commissioning

Procedure via the masterCONFIGURATOR

_ Open dialog box "Tridonic-specific configuration"
_ Click tab "Power-up Fading"
_ Choose value from drop-down menu "Power-up Fading"
_ Click "save"
→ Changes are saved

Further information can be found in the masterCONFIGURATOR manual (see Reference list, p. 64).

6.5. DALI (ECO)

6.5.1. Description

DALI standard

DALI (Digital Addressable Lighting Interface) is an interface protocol for digital communication between electronic lighting equipment.

The DALI standard was developed by Tridonic together with renowned manufacturers of operating and control equipment. Today, these manufacturers belong to the DALI Activity Group which promotes the use and further development of DALI.

The DALI standard is defined in IEC 62386. A test procedure standardised by the DALI Activity Group ensures compatibility between products from different manufacturers. Tridonic products have undergone this test and meet all the requirements. This is indicated by the logo of the DALI Activity Group on the device.

The agreement by the lighting industry to adopt a common protocol has opened up a virtually unlimited number of options. With the right choice of individual DALI components an extremely wide range of requirements can be met, from operating a simple light switch to lighting management systems for entire office complexes with thousands of light sources.

DALI in Action

DALI offers a lot of possibilities:

- DALI line: 64 control gear can be grouped to a line
- DALI groups: Every control gear can be attributed into 16 groups
- Addressability: All control gear are individually addressable
- Grouping: Possible without complicated rewiring
- Programmability: Individual programmability makes it possible to use functions which transcend the DALI standard
- Monitoring: Easily possible thanks to status feedback
- Wiring: Simple wiring with five pole standard cables and a cable length of max. 300 metres
- Wiring: Polarity-free control lines can be used for mains and control lines
- Wiring: Multiple wiring possibilities (star, series and mixed wiring)
- Unaffected by interruptions: All luminaires receive the same, unaffected digital signal and dimming level
- Similar light level from first to last luminaire

Technical data of a DALI line:

- DALI voltage: 9.5 V - 22.4 V DC
- Maximum DALI system current: max. 250 mA
- Data transfer rate: 1200 Baud
- Maximum line length: up to 300 m (for 1.5 mm^2)

6.5.2. Commissioning

NOTICE

If the corridorFUNCTION is activated, the LED Driver is controlled only by motion. To operate the LED Driver via DALI, DSI or switchDIM, the corridorFUNCTION must be deactivated.

Further information can be found in the DALI Handbook (see Reference list, p. 64).

eDALI

eDALI ("enhanced DALI") offers extended DALI commands. They can be used to activate specific commands of the control gear. The masterCONFIGURATOR software works with eDALI commands. These commands are Tridonic specific. They are not part of the DALI standard and are not publicly available.

6.6. Constant Light Output (ECO)

6.6.1. Description

The light output of an LED module reduces over the course of its life. The Constant Light Output function compensates for this natural decline by constantly increasing the output current of the LED Driver throughout its life. As a results, a virtually uniform light output is achieved at all times.

For configuration purposes the expected module-specific values for lifetime and residual luminous flux must be specified. The output current is then controlled automatically on the basis of these values.
The LED Driver typically starts with an output current ("Required Intensity") that corresponds to the expected residual luminous flux and calculates the increase in the value on the basis of the anticipated lifetime.

6.6.2. Commissioning

Procedure via the masterCONFIGURATOR

NOTICE

To be able to adjust the parameters "Required intensity", "LED burning hours" and "Expected LED life" the "Advanced settings" must be activated.
Further information can be found in the masterCONFIGURATOR manual (see Reference list, p. 64).

Activating the Constant Light Output function

_ Open dialog box "Tridonic-specific configuration"
_ Click tab "CLO and OTL"
_ Set drop-down menu "Constant intensity" to "enabled"
_ Click "save"
→ Changes are saved

Setting Required intensity and Expected LED life

_ Open dialog box "Tridonic-specific configuration"
_ Click tab "CLO and OTL"
_ Enter values in input fields "Required intensity" and "Expected LED life"
_ Click "save"
→ Changes are saved

Transferring existing values to a new control gear

If a control gear is replaced the existing parameter values can be transferred to the new control gear.

_ Chose a control gear that is in the same room as the new control gear
_ Open dialog box "Tridonic-specific configuration"
_ Click tab "CLO and OTL"

Constant Light Output

_ Note down the values for "Required intensity", "LED burning hours" and "Expected LED life"

_ Close dialog box "Tridonic-specific configuration"

_ Chose the new control gear

_ Open dialog box "Tridonic-specific configuration"

_ Click tab "CLO and OTL"

_ Take the noted values and enter them in the input fields "Required intensity", "LED burning hours" and "Expected LED life"

_ Click "save"
→ Changes are saved

Replacing the LED module

If a LED module is replaced the parameter "LED burning hours" must be set to "0".

_ Open dialog box "Tridonic-specific configuration"

_ Click tab "CLO and OTL"

_ Delete value from input field "LED burning hours"
→ CLO function is automatically restarted
→ Changes are saved

Further information can be found in the masterCONFIGURATOR manual (see Reference list, p. 64).

6.7. Over the Lifetime (ECO)

6.7.1. Description

If the Over the Lifetime function is enabled, visual feedback is given as soon as the LED exceeds the expected LED lamp life. If the expected LED lamp life is exceeded, the luminaire flashes for two seconds after being switched on.

6.7.2. Commissioning

Procedure via the masterCONFIGURATOR

Activating the Over the Lifetime function

_ Open dialog box "Tridonic-specific configuration"
_ Click tab "CLO und OTL"
_ Set drop-down menu "Visual feedback" to "enabled"
_ Click "save"
→ Changes are saved

Setting the Expected LED life

(Only necessary if not already done during the commissioning of the Over the Lifetime function.)

_ Open dialog box "Tridonic-specific configuration"
_ Click tab "CLO und OTL"
_ Enter value in input field "Expected LED life"
_ Click "save"
→ Changes are saved

Further information can be found in the masterCONFIGURATOR manual (see Reference list, p. 64).

6.8. DC recognition (ECO, TOP)

6.8.1. Description

In emergency light systems with central battery supply the DC recognition function uses the input voltage to detect that emergency mode is in place. The LED Driver then automatically switches to DC mode and dims the light to the defined DC level. Without DC recognition different and more complex solutions need to be applied in order to detect emergency mode.

LED Driver of the LCAI ECO series are factory preset to a DC level of 15 %. This value can be customized.
LED Driver of the LCI TOP series have a DC level of 100 %. This value is fixed and can not be changed.

Further information can be found in the masterCONFIGURATOR manual (see Reference list, p. 64).

WARNING!

If Dimming on DC is activated then emergency mode is not recognised. The device no longer automatically switches to the emergency light level.
Make sure that if Dimming on DC is activated an appropriate dimming level is selected for the emergency lighting mode.

Please also note the following:

_ Dimming on DC may only be activated by trained personnel

_ A security code must be entered before activation

_ The security code is issued only after a consent form has been signed

_ Dimming on DC must not be used in emergency lighting systems to EN 50172

NOTICE

The LED Driver is designed to operate on DC voltage and pulsing DC voltage.
In DC recognition connected sensors are ignored.

6.9. Dimming on DC (ECO)

6.9.1. Description

If Dimming on DC is activated the requirements of the DC recognition function are ignored. Even if DC is detected the control gear continues to behave as in AC mode:

_ The present dimming level is retained
_ An emergency light level defined for the DC recognition function (DC level) is ignored
_ Control signals via DALI and DSI continue to be executed

6.9.2. Commissioning

⚠ WARNING!

If Dimming on DC is activated then emergency mode is not recognised. The device no longer automatically switches to the emergency light level.
Make sure that if Dimming on DC is activated an appropriate dimming level is selected for the emergency lighting mode.

Please also note the following:

_ Dimming on DC may only be activated by trained personnel
_ A security code must be entered before activation
_ The security code is issued only after a consent form has been signed
_ Dimming on DC must not be used in emergency lighting systems to EN 50172

Procedure with masterCONFIGURATOR

Further information can be found in the masterCONFIGURATOR manual (see Reference list, p. 64).

6.10. Intelligent Temperature Guard (ECO, TOP, TEC)

⚠ WARNING!

The T_c temperature is the maximum permitted in terms of safety.
Operating the control gear above the permitted T_c temperature is not compliant with relevant standards.
The Intelligent Temperature Guard function does not replace the proper thermal design of the luminaire and does not enable the lighting to operate for lengthy periods of time in impermissible ambient temperatures.

6.10.1. Description

The Intelligent Temperature Guard function (ITG) provides protection against temporary thermal overloads. It slowly reduces the output if the maximum T_c temperature is exceeded. This way instant failure of the control gear can be prevented. Thermal overload protection is triggered as soon as the T_c temperature is exceeded by around 5 to 10 °C. The precise trigger temperature depends on the device. The value is selected so that the protection function is not performed until there is a significant impact on rated life.

The following table shows the exact behaviour and parameters of the Intelligent Temperature Guard function for different types of devices.

	TOP - IFX based solution 10W, 20W, 35W C, SR and lp and non SELV drivers	TOP - ASIC based solution 55W C and SR, 65W lp and 100W C and SR	TEC - 20W series	TEC - all others: 10/35/60/65W	LCAI (Star Trek) und auch LCA PRE (Hyperion)
Start of power reduction	≈ 10 °C above rated T_c (1)	≈ 10 °C above rated T_c (1)	≈ 10 °C above rated T_c (1)	≈ 10 °C above rated T_c (1)	≈ 10 °C above T_c (1)
Power reduction rate	Reduction of max current by ≈ 3 % / 10 sec	Reduction of max current by ≈ 1 % / 2 min	No fixed rate, reduction of max current is continously increased for as long as the temperature rises	No fixed rate, reduction of max current is continously increased for as long as the temperature rises	Reduction of max level by 1 DALI step / 2 min

Intelligent Temperature Guard

Power reduction methode	Pulse wave modulation (300 Hz)	Analogue dimming (AM)	Pulse wave modulation (8 Hz) [2]	Analogue dimming (AM)	**LCAI** Analogue dimming (100-35 %) Pulse wave modulation (< 35 %) **LCA PRE** Analogue dimming (100-1 %)
Power reduction process and control	Reduction of max current continues until min power level is reached.	Reduction of max current continues until min power level is reached.	Power reduction is dependent on temperature: _ Power reduction continues if temperature still rises _ Power reduction stops if temperature does not rise anymore or if min power level is reached.	Power reduction is dependent on temperature: _ Power reduction continues if temperature still rises _ Power reduction stops if temperature does not rise anymore or if min power level is reached.	Power reduction is dependent on temperature: _ Power reduction continues if temperature still rises _ Power reduction stops if temperature does not rise anymore or if max power reduction is reached (min power level = 0 %)
Min power level	50 % of max power	50 % of max power	0 % of max power	≈ 70 % of max power (T_c + 20 °C)	≈ 50 % dimming level
Shut off behaviour	Device will shut off if temperature still rises although min power level has been reached.	Device will shut off if temperature still rises although min power level has been reached.	Device will shut off if temperature still rises although min power level has been reached.	Device will shut off if temperature still rises although min power level has been reached.	No shut off behavior: Device will not shut off if temperature still rises. AC mode: Device switches to 15 % dimming level DC mode: Device switches to 50 % dimming level

Intelligent Temperature Guard

Automatic restart behavior	Device will automatically restart if restart temperature is reached.	Device will automatically restart if restart temperature is reached.	Device will automatically restart if restart temperature is reached.	Device will automatically restart if restart temperature is reached.	No automatic restart behavior (because there is no shut off behavior) Device stays at 15 % dimming level
Restart temperature	< 80 °C	< 80 °C	< T_c + 10 °C	< T_c + 10 °C	No restart temperature

(1) Rated T_c is device specific.
(2) Flicker will be visible because of pulse wave modulation frequency.

NOTICE

The standard setting for the dimming curve is logarithmic:
If alternative dimming curves are used the power reduction can be implemented differently.

6.11. Intelligent Temperature Management (ECO, TOP)

NOTICE

Not every LED Driver includes the Intelligent Temperature Management function. Whether an LED Driver includes the function depends on the exact type of device and can be looked up in the data sheet.

6.11.1. Description

The Intelligent Temperature Management (ITM) function is intended to protect the LED against thermal damage. The device offers the possibility to connect a Silicium based temperature sensor (KTY81-210, KTY82-210) to monitor the LED temperature.
If the temperature exceeds certain temperature limits, the LED output current will be gradually reduced or completely switched off. As a result, the LED will dim down and the temperature can fall. If the temperature falls below the given temperature limit, the device will automatically return to nominal operation.

The use of a NTC or PTC resistor is not possible. The device can be operated without a sensor (default setting). The function can be adjusted via masterCONFIGURATOR. Further information can be found in the masterCONFIGURATOR manual (see Reference list, p. 64).

Intelligent Temperature Management

⚠ CAUTION!

The ITM function will only work properly if

_ one of the specified temperature sensors is used (KTY81-210 or KTY82-210) and

_ if the used temperature sensor is working properly and without any defect.

If one of these requirements is not fulfilled the ITM function will show one the following wrong behaviours:

ITM in connection with a non-specified sensor

The ITM function reacts to the resistance value of the sensor (KTY81 or KTY82). When using a sensor with values that differ from the specified resistance value the ITM function will not work properly (wrong dimming behaviour).

ITM function with sensor in open circuit

_ At power up:
  _ Sensor will not be recognised
  _ ITM function will not be activated

_ If open circuit occurs during operation:
  _ Device will turn off
  _ After power on reset: Same behaviour as "at power up" (Sensor will not be recognised, ITM function will not be activated)
  _ If open circuit was intermittent: ITM function will remain active for a time limit of 20 ms, if time limit is exceeded the device will turn off

ITM function with sensor in short circuit

_ At power up:
  _ Sensor will not be recognised
  _ ITM function will not be activated

_ If short circuit occurs during operation:
  _ If ITM function is active:
    _ Device detects short circuit and sets error flag
    _ After power on reset: Device recognises error flag and will start with last active dimm level (instead of 100 % dimm level)
  _ If ITM is not active:
    _ Device shows no reaction

Intelligent Temperature Management

Temperature limits

The following temperature values (T1-T4) are factory preset.
For device type LCI TOP these values are fixed and cannot be changed. For device type LCAI ECO the switch-off temperature (T4) can be adjusted via masterCONFIGURATOR. The other three values are automatically calculated on the basis of the value for the switch-off temperature.

Switch-off temperature (T4)

_ Factory preset: 90 °C

_ Calculating the value: Value is preset or can be customised by user (only LCAI ECO).

_ Description: Temperature at which the LED Driver is completely switched off in order to protect the LEDs from thermal damage.
→ LED driver remains switched off until the temperature has been reduced and reaches the "Temperature for restart" (T1) .

Parameter "Start power reduction at" (T3)

_ Factory preset: 76.5 °C

_ Calculating the value: T3 = T4 - 15 %

_ Description: Temperature at which the LED output current is gradually reduced.
→ LED output current is gradually reduced until the temperature has been reduced by 10 % or until the LED output current has been reduced by 50 %.

Parameter "Stop power reduction at" (T2)

_ Factory preset: 67.5 °C

_ Calculating the value: T2 = T4 - 25 %

_ Description: Temperature at which the reduction of the LED output current is stopped and the LED output current is gradually increased again.
→ LED output current is gradually increased until the temperature reaches the "Start power reduction at" (T3) parameter .

Parameter "Temperature for restart":

_ Factory preset: 45 °C

_ Calculating the value: T1 = T4 - 50 %

_ Description: Temperature at which the LED output current is switched back on after a thermal shut down: The LED output current assumes the value before the Intelligent Temperature Management was activated.

NOTICE

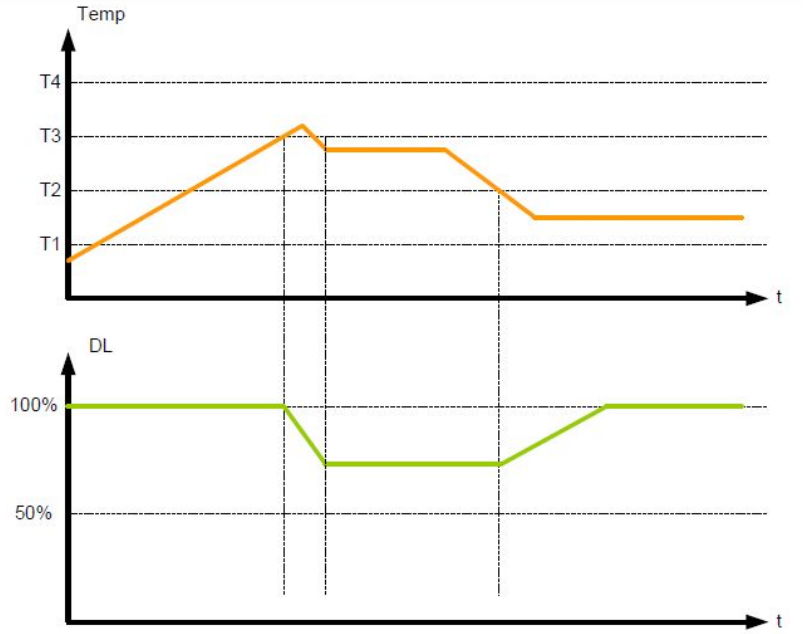
The standard setting for the dimming curve is logarithmic:
If alternative dimming curves are used the power reduction can be implemented differently.

Intelligent Temperature Management

Working principle

The following case examples illustrate the operation of the Intelligent Temperature Management function.

Case 1: Exceeding T3 temporarily



_ LED temperature exceeds T3
→ LED output current is reduced: Dimming level is gradually reduced (1 DSI step per 2 minutes)

_ LED temperature is reduced and reaches a value of 10 % below T3
→ Reduction of LED output current is stopped

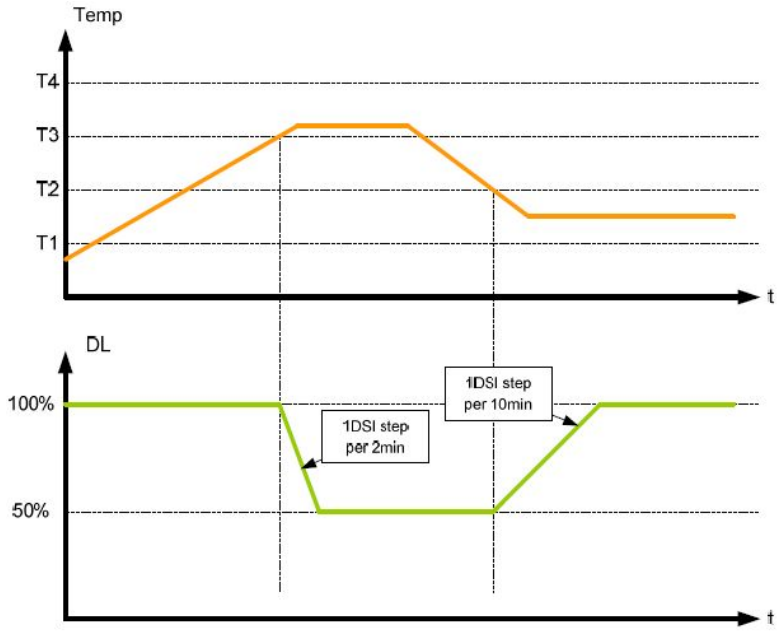
_ LED temperatur keeps getting lower and reaches T2
→ LED output current is increased: Dimming level gradually increases (1 DSI step per 10 minutes)

_ Increasing the LED output current stops if

  _ T3 is reached -or-

  _ dimming level reaches 100 % (here: this variant)

Case 2: Exceeding T3 for longer time



_ LED temperature exceeds T3
→ LED output current is reduced: Dimming level is gradually reduced (1 DSI step per 2 minutes)

_ In case LED temperature is not reduced:
→ LED output current is reduced until the minimum value of 50 % is reached: Dimming level is reduced accordingly

_ In case LED temperature is reduced below T2 after the minimum value has been reached:
→ LED output current is increased: Dimming level is gradually increased (1 DSI step per 10 minutes)

_ Increasing the LED output current stops if

  _ T3 is reached -or-

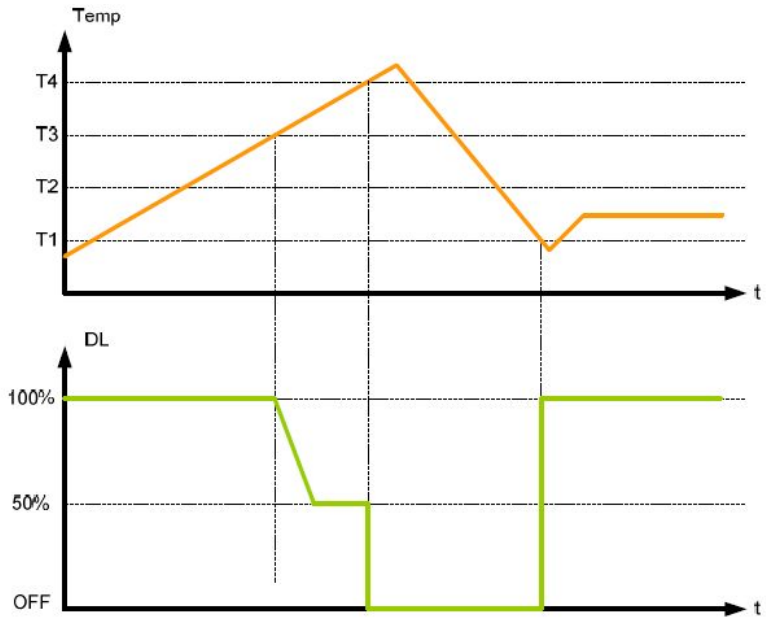
  _ dimming level reaches 100 % (here: this variant)

Case 3: Exceeding both T3 and T4

NOTICE

If the temperature rises quickly from T3 to T4, only a small number of DSI steps are carried out before the LED Driver switches off . This could cause the misleading impression that the device didn't dim at all. For the change to be clearly visible, dimming must last for about 20 minutes or 10 DSI steps.

Intelligent Temperature Management



_ LED temperature exceeds T3
→ LED output current is reduced: Dimming level is gradually reduced (1 DSI step per 2 minutes)

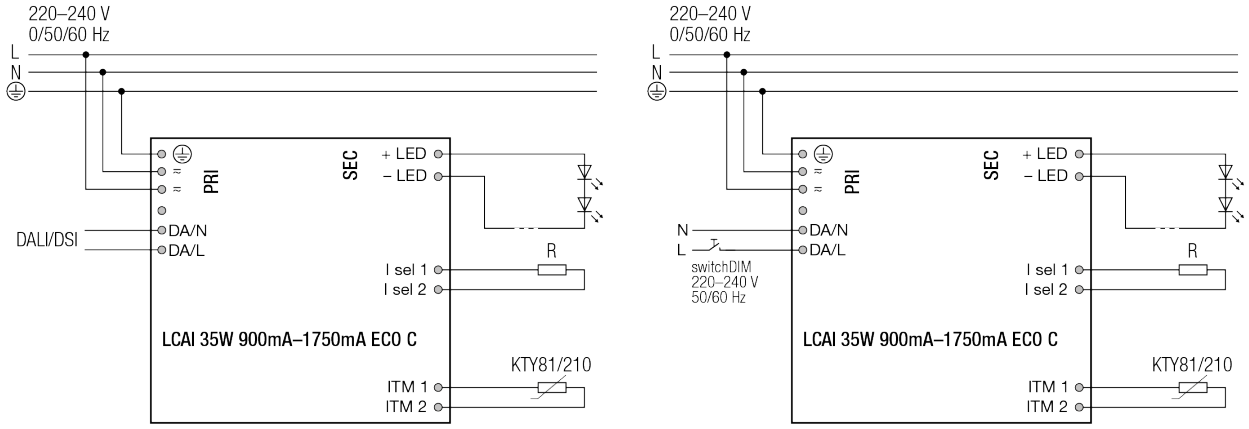
_ In case LED temperature keeps getting higher and exceeds T4:
→ LED output current is completely switched off

_ In case LED temperature is reduced and reaches T1:
→ LED output current is switched on again. The LED output current assumes the value before the Intelligent Temperature Management was activated.

6.11.2. Installation

NOTICE

To operate Intelligent Temperature Management a sensor of type KTY81/210 or KTY82/210 must be connected to the LED Driver.



Procedure

_ Switch off the LED Driver

_ Connect the sensor to terminal ITM1 and ITM2 on the secondary side

_ Switch on the LED Driver
→ Sensor is automatically recognised by the LED Driver
→ Intelligent Temperature Management function is automatically activated

6.11.3. Commissioning

Procedure via the masterCONFIGURATOR

Setting the switch-off temperature

_ Open dialog box "Tridonic-specific configuration"

_ Click tab "ITM"

_ Enter value in input field "Switch-off temperature"

_ Click "save"
→ Changes are saved

Temporarily disabling the ITM function

_ Open dialog box "Tridonic-specific configuration"

_ Click tab "ITM"

_ Click checkbox "disable temporarily"

_ Click "save"
→ Changes are saved

Reactivating the ITM function

_ Switch the LED Driver off and on
→ Sensor is automatically recognised by the LED Driver
→ ITM function is automatically activated

Permanently disabling the ITM function

_ Switch off the LED Driver

_ Disconnect sensor from the LED Driver

Further information can be found in the masterCONFIGURATOR manual (see Reference list, p. 64).

7. Reference list

7.1. Additional information

_ Web page ECO series (Compact dimming): http://www.tridonic.com/com/en/products/ECO-series.asp

_ Web page TOP series (Compact fixed output): http://www.tridonic.com/com/en/products/TOP-series.asp

_ Data sheets: Go to above web page link and click "Products" > "Downloads" > "Data sheet"

_ DALI manual: http://www.tridonic.com/com/en/download/technical/DALI-manual_en.pdf

_ Documentation masterCONFIGURATOR: http://www.tridonic.com/com/en/download/Manual_masterConfigurator_en.pdf

_ Leaflet ready2mains: http://www.tridonic.com/com/en/download/brochures/Leaflet_ready2mains_EN_web.pdf

_ Web page corridorFUNCTION: http://www.corridorfunction.com/corridorFUNCTION/index.html

7.2. Downloads

_ Tridonic software: http://www.tridonic.com/com/en/software.asp

_ Download masterCONFIGURATOR: http://www.tridonic.com/com/de/software-masterconfigurator.asp

7.3. Technical data

_ Data sheets: http://www.tridonic.com/com/en/data-sheets.asp

_ Company certificates: http://www.tridonic.com/com/en/company-certificates.asp

_ Environmental declarations: http://www.tridonic.com/com/en/environmental-declarations.asp

_ LED/lamp matrix: http://www.tridonic.com/com/en/lamp-matrix.asp

_ Operating instructions: http://www.tridonic.com/com/en/operating-instructions.asp

_ Other technical documents: http://www.tridonic.com/com/en/technical-docs.asp

_ Tender text: http://www.tridonic.com/com/en/tender.asp

_ Declarations of conformity: Available documents are found on each product page of our website in the "Certificates" tab for the specific product, www.tridonic.com/com/en/products.asp