LED Module

Engine QLE G2 PRE KIT

Technical Design-in Guide

TRIDONIC

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Introduction

The versatile system solutions from Tridonic provide the basis for lighting designs that are futureproof, economical and eco-friendly in a wide range of applications. LEDs are showing their strengths in retail outlets, offices, hotels and restaurants.
If you are designing a luminaire to work with LEDs there are certain differences compared to designs with conventional light sources that you need to be aware of. We have written this design guide to help you understand these differences. It answers all the most important questions you may have, such as the right mechanical design, thermal management and optical conditions.

LEDs offer major benefits for general illumination tasks - they are versatile, highly energy-efficient and virtually maintenance-free. With QLE G2 PRE KIT you get a complete system solution for linear and panel lights from a single source, consisting of perfectly matched components: LED module, LED Driver in a kit package.

QLE G2 PRE KIT offers impressive benefits:

- Linear Tunable White System with adjustable colour temperature from 2.700 to 6.500 K at constant luminous flux
- High system efficiency up to 136 lm/W at tp=45 °C
- Excellent colour rendering (CRI > 90)
- Precalibrated set to ensure light quality and high colour consistency, consisting of LED Driver and 2 to 6 LED modules
- Low-Profile LED Driver with digital interface (DALI Device Type 8, DSI, switchDIM, colourTEMPERATURE)
- Quadratic LED-modules with 1.250 lm
- Dimming range from 3 – 100 % without change of colour temperature
- Compliance with the mechanical and electrical standards of the luminaire industry
- Energy efficiency class A+

NOTICE

Please note:

QLE G2 PRE KIT components form a matched and calibrated unit. Therefore it is not allowed to separate and operate the components in different combinations!

All information in this guide has been produced with the most care.
However, the guide is subject to change without notice. Errors and omission excepted. Tridonic does not accept liability for possible damage resulting from the use of this guide.
The latest version of this guide can be found at led.tridonic.com or from your sales partner

Summary of the chapters

To make it easier to find your way around the Design-in Guide we have grouped the information on the QLE G2 PRE KIT systems into chapters.
The guide begins with a system overview in which the different versions of the system are presented. The mechanical, electronic, optical and thermal aspects of the components are then described. At the end of the Design-in Guide you will find ordering information and sources.

2.1. System overview

The QLE G2 PRE KIT system is available with different properties and functions. The relevant components can be clearly assigned by their type codes.

2.2. Mechanical aspects

Depending on the particular situation, the LED Driver can be installed in the luminaire casing (in-built) or outside the casing (remote). Dimensional drawings and installation instructions will help you take account of the requirements of the particular situation.

2.3. Electrical aspects

Special Tridonic connecting cable is available to ensure efficient and reliable connection between the modules and the LED Driver.
All the connection options, the connections between the LED Driver and the power supply and the connections of the control lines are shown in relevant wiring diagrams.

2.4. Optical aspects

The overall efficiency of the system is improved by choosing a reflector with suitable optical properties (e.g. beam angle) and dimensions.
This chapter provides information to support customer-specific reflector design.

2.5. Thermal aspects

The system modules have been designed to operate with a passive or active heat sink and can be mounted directly on such a suitable heat sink.
In the case of active cooling the fan can be connected directly to the module or LED Driver depending on the version.

2.6. Ordering information and sources

The ordering information for the components and the sources for heat sinks, reflectors and accessories can be found at the end of the document.

System Overview

3.1. Overview

Properties and functions	QLE G2 PRE KIT
Colour temperature [1]	2,700 to 6,500 K Tunable white (controllable and dimmable colour temperatures)
Luminous flux	1,250 lm
Colour rendering / colour tolerance	CRI > 90 / MacAdam 3 SDCM (at100 % Dimmlevel)
System efficiency	up to 136 lm/W at tp=45 °C
DALI	Device Type 8 [2]
switchDIM	yes
colourTEMPERATURE	yes

[1] Application-specific changes to the colour temperature are possible. The colour temperature can be varied from 2,700 to 6,500 K.
[2] The system supports DALI device type 8 to change the colour temperature.

3.1.1. Components

A uniform naming concept has been adopted for the components. The system QLE G2 PRE KIT comprises the following components:

- LCA LED Driver
- QLE G2 PRE module

NOTICE

QLE G2 PRE KIT must be operated with the calibrated LCA 50W 350-1050mA DT8 lp PRE, LCA 100W 350-1050mA 2xDT8 lp PRE LED Driver from the set!

3.1.2. Efficiency of the modules

The high efficiency of the QLE G2 PRE KIT results not only in energy savings but also to a reduction in the thermal load. This means that smaller heat sinks can be used and more compact luminaires can be designed.

3.1.3. Area of application

- All the components of the QLE G2 PRE KIT system comply with the protection requirements of IP20. The system is therefore suitable for indoor applications.
- QLE G2 PRE KIT complies with system protection class II

3.2. Operating functions

QLE G2 PRE KIT offers a wide range of settings for colour temperature and dimming level. Different controllers are available. The controllers are connected directly to the LED Driver.

NOTICE

The factory preset for colour temperature is 2,700 K, the factory preset for light intensity is 100 %.

3.2.1. Central control via the LED Driver

Control via DALI or a switchDIM switch is achieved by connecting these devices to the LED Driver.

Control via DALI

CAUTION!

The control line must be installed in accordance with the relevant directives on low voltage.

NOTICE

The control input is protected against polarity reversal and against accidental connection to mains voltage up to 264 V AC.

For DALI control the light modules are digitally controlled via the DALI signal (16-bit Manchester Code).
The predefined colour temperatures and dimming level can be changed via DALI.

Control via switchDIM

A conventional double pushbutton switch can be used for control via switchDIM. One of the pushbuttons is used to set the colour temperature, the other to set the dimming level. Which button has which function is determined during the installation.

CAUTION!

Pushbuttons with glow lamps affect the switchDIM, colourTEMPERATURE functions and should therefore not be used for this purpose.

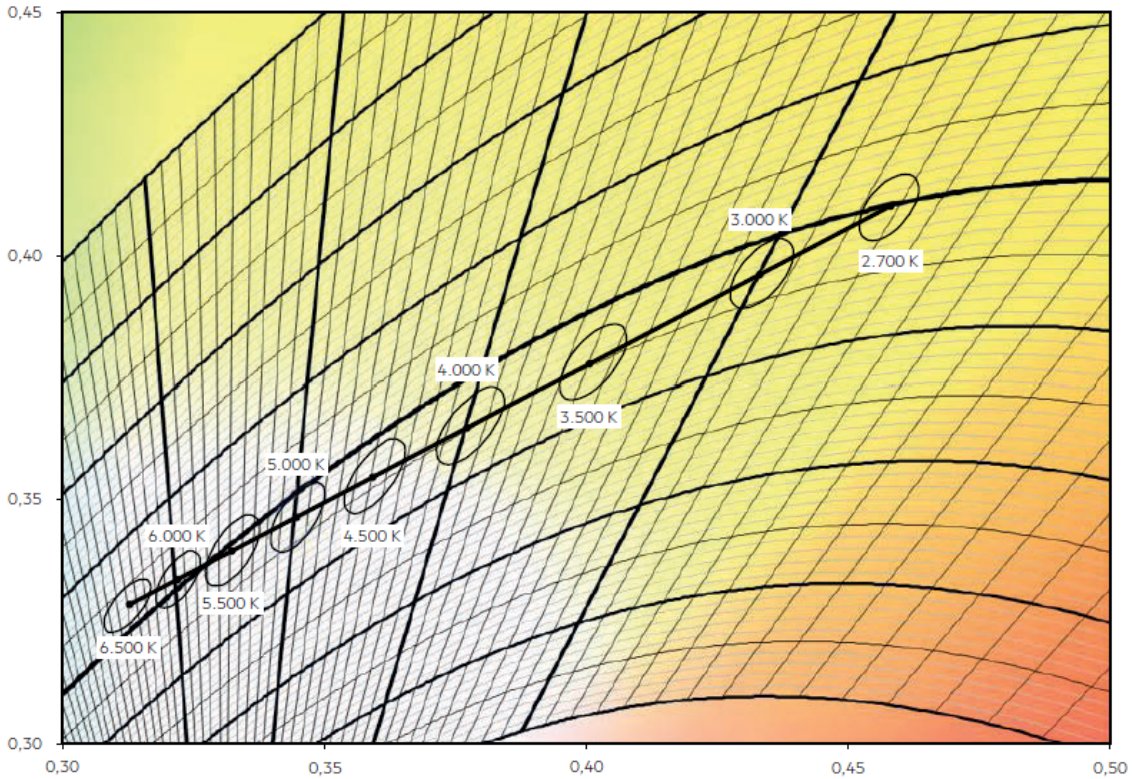
For control via a switchDIM switch different settings can be made:

- Setting for the colour temperature via colourTEMPERATURE mode with 7 predefined values between 2,700 K and 6,500 K with 500 K steps
- Stepless setting for the dimming level between 3 % and 100 %.

colorTEMPERATURE modes differ in the position of the individual colour values along the Planckian curve. colourTEMPERATURE mode is tailored to the needs of general and shopping lighting.

On start-up the device first activates colour temperature setting in the colourTEMPERATURE mode. The starting values are a colour temperature of 2,700 K and a dimming level of 100 %.

System Overview



Light colour [K]	2,700	3,000	3,500	4,000	4,500	5,000	5,500	6,000	6,500
Centre x0	0.4578	0.4335	0.4013	0.3778	0.3596	0.3448	0.3324	0.3220	0.3123
Centre y0	0.4101	0.3964	0.3783	0.3651	0.3548	0.3465	0.3395	0.3336	0.3282
MacAdam ellipse 100 – 50 % dimming level					3 SDCM				
MacAdam ellipse 50 – 10 % dimming level					4 SDCM				
MacAdam ellipse 10 – 3 % dimming level					6 SDCM				

System Overview

HINWEIS

Once the maximum value has been reached, the next press takes you directly back to the minimum value. The change from maximum to minimum value is indicated by brief flashing of the light module.

Changing predefined colour temperatures and dimming levels

The predefined colour temperatures and dimming levels in colourTEMPERATURE mode can be changed via the masterCONFIGURATOR. Any fixed values within the two limit values of 2,700 K and 6,500 K can be selected for the colour temperature.
Adjustments could be in the minimum range step of 100 K. Either a colour value along the Planckian curve can be selected. Up to 16 scenes can be individually defined. These scenes are stored in the LED Driver. They can then be recalled via DALI and switchDIM.

A DALI environment is needed for the configuration (power supply, DALI USB). For more information on the procedure see the masterCONFIGURATOR handbook.

Setting the dimming level

- Select that of the two pushbuttons that is used to set the dimming level
- Press the pushbutton briefly (< 1 s) to switch the LED Driver on or off
  -> The last values set for the colour temperature and the dimming level will be recalled when the LED Driver is switched on again
- Hold down the pushbutton (> 1 s) to change the dimming level

NOTICE

The dimming direction (fade direction) changes automatically with each dimming operation.

Synchronising the dimming level

- Select that of the two pushbuttons that is used to set the dimming level
- Hold down the pushbutton (> 7 s) to synchronise all the connected devices to a uniform dimming level of 50 %

Synchronising the colour temperature

- Select that of the two pushbuttons that is used to set the colour temperature
- Hold down the pushbutton (> 7 s) to synchronise all the connected devices to a uniform colour temperature of 2,700 K

Control via a floating pushbutton

For control via a floating pushbutton (make contact) different settings can be made:

- Setting the colour temperature via colourTEMPERATURE mode with 7 predefined values between 2,700 K and 6,500 K in 500 K steps
- Setting the dimming level between 3 % and 100 %.

System Overview

NOTICE

Once the maximum value has been reached, the next press takes you directly back to the minimum value. The change from maximum to minimum value is indicated by brief flashing of the light module.

Colour temperature set

Adjusting the colour temperature

- short press on the switch to increase the colour temperature

Dimmlevel set

- short press on the switchDIM switch increases or decreases the dimming level depending on its orientation

3.3. Type codes

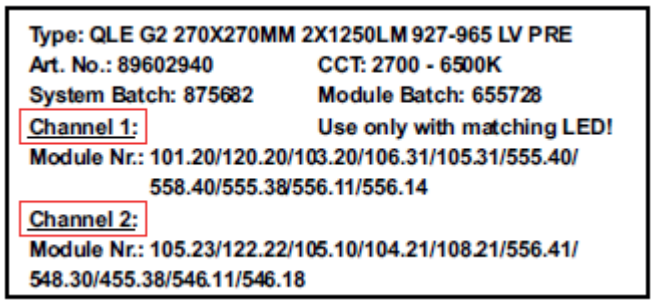
3.3.1. Type code for modules

The following type code is used to identify the modules. The table shows reference codes and their meaning for the Q LE G2 PRE KIT .

Reference	QLE	G2	270x270mm	3x1250	927-965	LV	PRE
Meaning	Form	Generation	Module width x length in in mm	3 LED modules with 1,250 lm each	CRI 90 Colour temperature between 2,700 and 6,500 K	Low Voltage	Version

⚠ CAUTION!

The QLE G2 PRE KIT components form a matched and calibrated unit. Therefore it is not allowed to separate and operate the components in different combinations!
There is a label on the LCA 50W 350-1050mA DT8 lp PRE or LCA 100W 350-1050mA 2xDT8 lp PRE with the corresponding module information.



3.3.2. Type code for LED Driver

The following type code is used to identify the LED Driver:

Type code for LED Driver LCA 50W 350-1050mA DT8 lp PRE as an example

Reference	LCA	50W	350-1050mA	DT8	lp	PRE
Meaning	LED Driver, constant current	Power	Current range	DALI Device Type 8	Case form 'low profile'	Version PRE

The precise type designation for the LED Driver is given on the type plate on the LED Driver.

3.4. Versions

3.4.1. QLE G2 PRE KIT

The QLE G2 PRE KIT system is packed with completely new functions such as tunable white. The colour temperature can be changed smoothly between 2,700 K and 6,500 K to meet the specific needs of the relevant application.

Characteristics:

- A colour temperature between 2,700 K and 6,500 K that can be set along the Planckian curve
- Different functions packed in a system for individual lighting solutions
- Constant colour temperature over the entire dimming range
- Constant luminous flux
- Lumen values: 1,250 lm
- Colour rendering index CRI > 90
- Very small MacAdam 3 SDCM colour tolerance at 100 % dim level
- System efficiency of up to 136 lm/W with high energy savings
- Temperature monitoring

Control functions:

- DALI Device Type 8
- switchDIM
- colourTEMPERATURE

3.5. Standards and directives

3.5.1. Standards and directives for modules

The following standards and directives were taken into consideration in designing and manufacturing the modules:

CE

Standard	Description
2006/95/EG	Low-voltage directive: Directive relating to electrical equipment for use within certain voltage limits
2004/108/EG	EMC directive: Directive relating to electromagnetic compatibility

RoHS

Standard	Description
2002/95/EC	RoHS(1) directive: Directive on the restriction of the use of certain hazardous substances in electrical and electronic equipment

(1) RoHS: Restriction of (the use of certain) hazardous substances

Safety

Standard	Description
DIN IEC 62031:2008	Safety requirements for LED modules
EN 60598-1:2008 und A11:2009	General requirements and tests for luminaires
EN 60598-2-2:1996 und A1:1997	Luminaires - Part 2. Special requirements; Main section 2: Recessed luminaires
EN 62471:2008	Photo-biological safety of lamps and lamp systems

Safety and performance

Standard	Description
EN 61347-1:2009	General and safety requirements
EN 61347-2-13:2007	Special requirements for dc and ac powered electronic operating equipment for LED modules
EN 62384:2007 IEC 62384 A1:2009	Operational requirements

Energy labelling

Standard	Description
EU Regulation No: 874/2012	"Energy labelling of electrical lamps and luminaires"

3.5.2. Standards and directives for LED Drivers

The following standards and directives were taken into consideration in designing and manufacturing the LED Driver:

EMI

Standard	Description
EN 55015 2008	Limit values measurement methods for radio interference properties of electrical lighting equipment and similar electrical devices
EN 61000-3-2:2005 A1: 2008 und A2:2009	Limit values for harmonic currents (equipment input current < 16 A per conductor)
EN 61000-3-3:2005	Limit values for voltage fluctuations and flicker in low-voltage systems for equipment with an input current < 16 A per conductor that are not subject to any special connection conditions
EN 61547:2001	EMC(1) requirements

(1) EMC: Electromagnetic compatibility

Safety

Standard	Description
EN 50172 2005	Safety lighting systems

DALI

Standard	Description
IEC 62386-101:2009	General requirements, system
IEC 62386-102:2009	General requirements, controller
IEC 62386-207:2009	Special requirements, controller; LED modules

4.1. Installation

4.1.1. Installation details

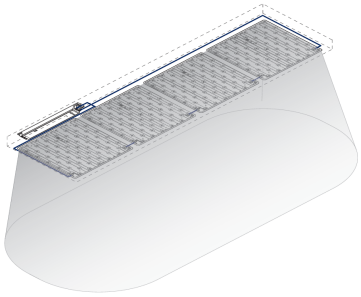
NOTICE

EOS/ESD safety guidelines
The device/module contains components that are sensitive to electrostatic discharge and may only be installed in the factory and on site if appropriate EOS/ESD protection measures have been taken. No special measures need be taken for devices/modules with enclosed casings (contact with the pc board not possible), just normal installation practice.

Please note the requirements set out in the document EOS/ESD guidelines (Guideline_EOS_ESD.pdf) at:

- www.tridonic.com/com/en/download/technical/Guideline_EOS_ESD_en.pdf
- www.tridonic.com/com/en/technical-docs.asp

Installation example with serial wiring

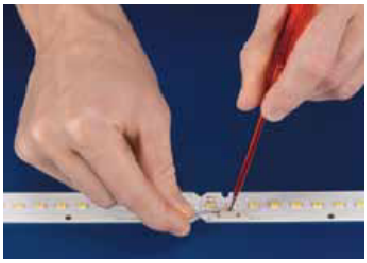


Installation version IN-BUILT serial wiring with LCA 50W 350-1050mA DT8 lp PRE

Mechanical Aspects

Installation details

Depending on the particular situation, the LED Driver can be installed in the luminaire casing (in-built) or outside the casing (remote).



Terminals with push button for quick and easy wiring.

Perfectly uniform light, even if several LED modules are used together.

Beveled edges for discreet wiring and easy installation.

4.1.2. Notes on installation

Depending on the installation situation for the LED Driver and the modules, the following requirements must be met:

- Adequate distance from insulating materials
- Adequate strain relief for closed covering on the LED Driver
- Adequate cooling of the modules (the maximum temperature at the t_p point must not be exceeded)
- Unrestricted exit of light from the modules

Protection measures against damage

Mechanical stress

QLE G2 PRE modules contain electronic components that are sensitive to mechanical stress. Such stress should be kept to an absolute minimum. In particular the following mechanical stresses should be avoided as these may cause irreversible damage:

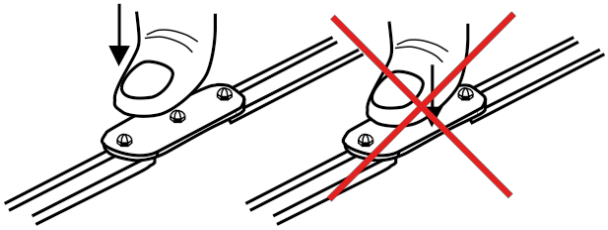
- Pressure

- Drilling,
- Milling,
- Breaking,
- Sawing,
- and similar mechanical processing.

Compressive stresses

The components of the QLE G2 PRE modules (circuit boards, glob-top, lenses, electronic components etc.) are sensitive to compressive stresses. The components must not be exposed to compressive stresses.

- If glass or Plexiglas shields are used make sure that pressure is not exerted on the glob-top.
- Only touch the QLE G2 PRE modules at the edges



correct (left) and incorrect (right)

Chemical compatibility

LED modules can be damaged by other materials, if these materials have certain chemical properties. The cause for these damages are different gaseous compounds, which penetrate into the encapsulant of the LED and thereby attack the encapsulant, the colour conversion phosphor or the LED chips and can affect the electrical contacts or the substrate.

Application areas for chemical substances

The following are known areas in which chemical substances are used:

- use of protective coating in applications with high relative humidity (outdoor applications),
- encapsulation of LED modules,
- cementing of LED modules,
- sealing of luminaires.

The following materials must be checked for their safety:

- All components and auxiliaries used in the assembly of the luminaire:
  - Solvents of adhesives and coatings
  - Other so-called VOC ("volatile organic compounds")
- All other additional substances present in the atmosphere:
  - Outgassing of adhesives, sealants and coatings
  - Cleaning agents and processing aids (e.g. cutting oils and drilling coolants)

Mechanical Aspects

NOTICE

Contact your LED manufacturer for questions about the materials used and possible interactions and risks.

Putting together a "safe list" is not possible due to the complexity of the topic. The following table lists possible contaminants for LED modules, the classes of compounds and examples of possible sources.

Mechanical Aspects

The list shows the most commonly used materials but does not claim to be complete.

Class of compounds	Chemical names	Occurs in
Acids	_ hydrochloric acid _ sulfuric acid _ nitric acid _ phosphoric acid	_ cleaner _ cutting oils
Organic acids	_ acetic acid	_ RTV silicones _ cutting oils _ degreaser _ adhesives
Alkalis	_ ammonia _ amines _ sodium hydroxide	_ detergents _ cleaner
Organic solvents	_ ethers (e.g. glycol) _ ketones (e.g. Methylethylketon) _ aldehydes (e.g. formaldehyde) _ aromatic hydrocarbons (e.g. xylene and toluene)	_ cleaner _ benzine _ petroleum _ paints and varnishes
VOC (volatile organic compounds)	_ acetate _ acrylates _ aldehydes _ serve	_ super glue _ all-purpose glue _ screw locking varnish _ coatings _ paints and varnishes
Mineral oils	_ hydrocarbons	_ machine oil _ lubricants
Vegetable oils and synthetic oils	_ siloxanes _ fatty acids	_ silicone oils _ linseed oil _ fats
Harder, vulcanizer	_ sulfur compounds	_ seals _ sealants _ colours

Mechanical Aspects

Protection measures in regards to sealing

The points above also apply to chemicals used for sealing luminaire casings. If however the LED module is not installed in the luminaire until after the sealing compound has been completely cured (see relevant material information) the above points can be ignored. If the LED modules have already been installed in the luminaire, possible damage to the encapsulant can be reduced to a minimum by ensuring adequate spacing (>10 cm) and ventilation (open casing and air circulation, extraction / fan) during the curing process.

Protection measures in regards to cementing

To avoid damaging the LED modules you must not use any tools or exert any pressure on the electronic components or the encapsulant.

- If glass or Plexiglas shields are used make sure that pressure is not exerted on the encapsulant.
- Only touch the LED modules at the edges

Instructions for cementing QLE G2 PRE modules

Preparation

Clean and durable bonding of two materials requires special attention. The following cleaning agents are recommended:

- Isopropanol / Water 50/50
- Acetone
- Heptane

Important aspects

- Carrier material The carrier material must have adequate thermal conductivity (e.g. aluminium). The size of the cooling surface depends on the power of the LEDs, among other things. For information on the cooling surface required, see the appropriate product data sheet.
- Adhesive material The carrier material itself plays an important role in selecting the adhesive material. The crucial factors are the coefficient of expansion and compatibility with the base material of the module board (plastic or aluminium). This must be checked in the application in terms of long-term stability, surface contamination and mechanical properties.
- Surface quality The carrier material must be uncoated (thermal transport, adhesion) and level at the connection points.
- Installation temperature To achieve optimum adhesion we recommend you carry out this work at room temperature.
- Duration, optimum adhesive strengths Maximum adhesion is achieved within 48 hours at room temperature; the process is accelerated by heat. In actual practice this means that at the maximum t_c temperature (approx. 75-85 °C, product-specific) maximum adhesion is reached after about 12 hours. During the curing period make sure that there is no tensile load on the adhesive connection of the module.

Additional information

QLE G2 PRE modules must not be stuck and restuck time and again without replacing the adhesive tape. Damaged adhesive tapes must be completely removed and replaced by new tapes.

Packaging and transport

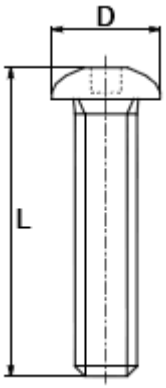
QLE G2 PRE Kits from Tridonic are delivered in appropriate packaging. The packaging provides special protection against mechanical damage and ESD (electrostatic discharge). If you need to transport QLE G2 PRE products you should use this packaging.

4.1.3. Installation of the modules on the heat sink

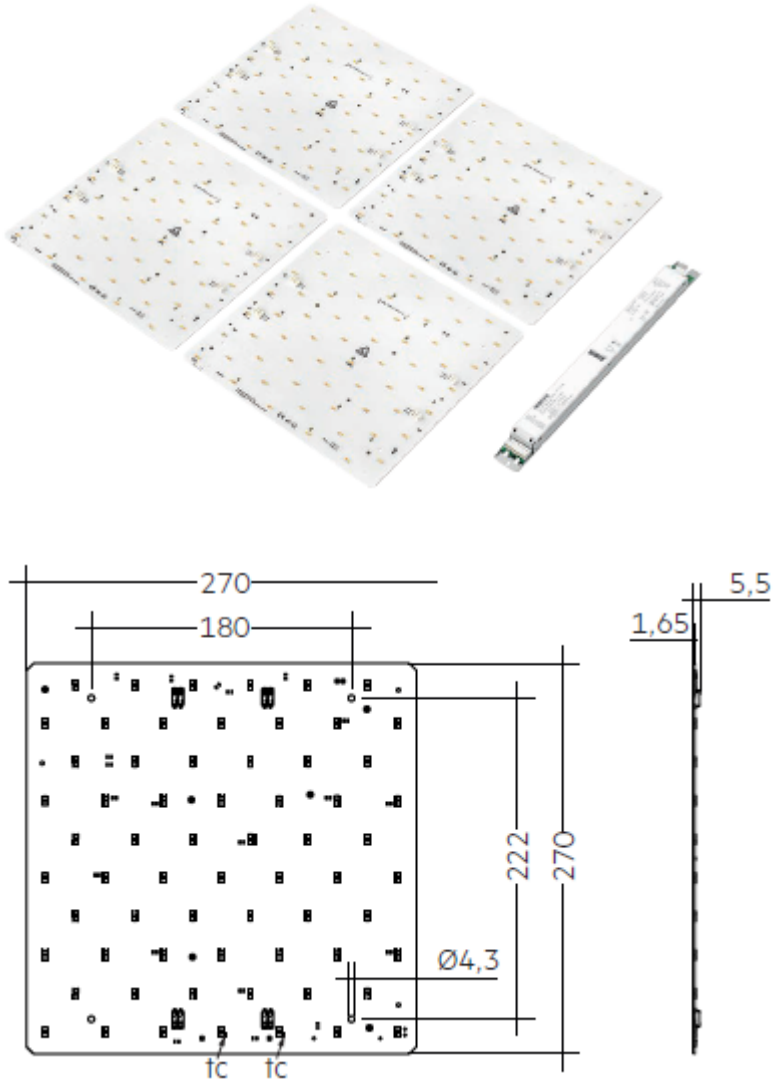
The LED modules are mounted onto a heat sink with 4 screws per module. For optimal thermical connection it is recommended to use all fastening holes (e.g. 5 screws for the LLE24). In order not to damage the modules only rounded head screws and an additional plastic flat washer should be used.
Suitable screws should be selected on the basis of the following dimensions:

Dimensions of the fastening screws

Parameters	Value
Bolt size	M4
Max. diameter D	7 mm
Min. length L	5 mm
Max. length L	Depending on the design of the luminaire



4.2. Dimensional drawings modules

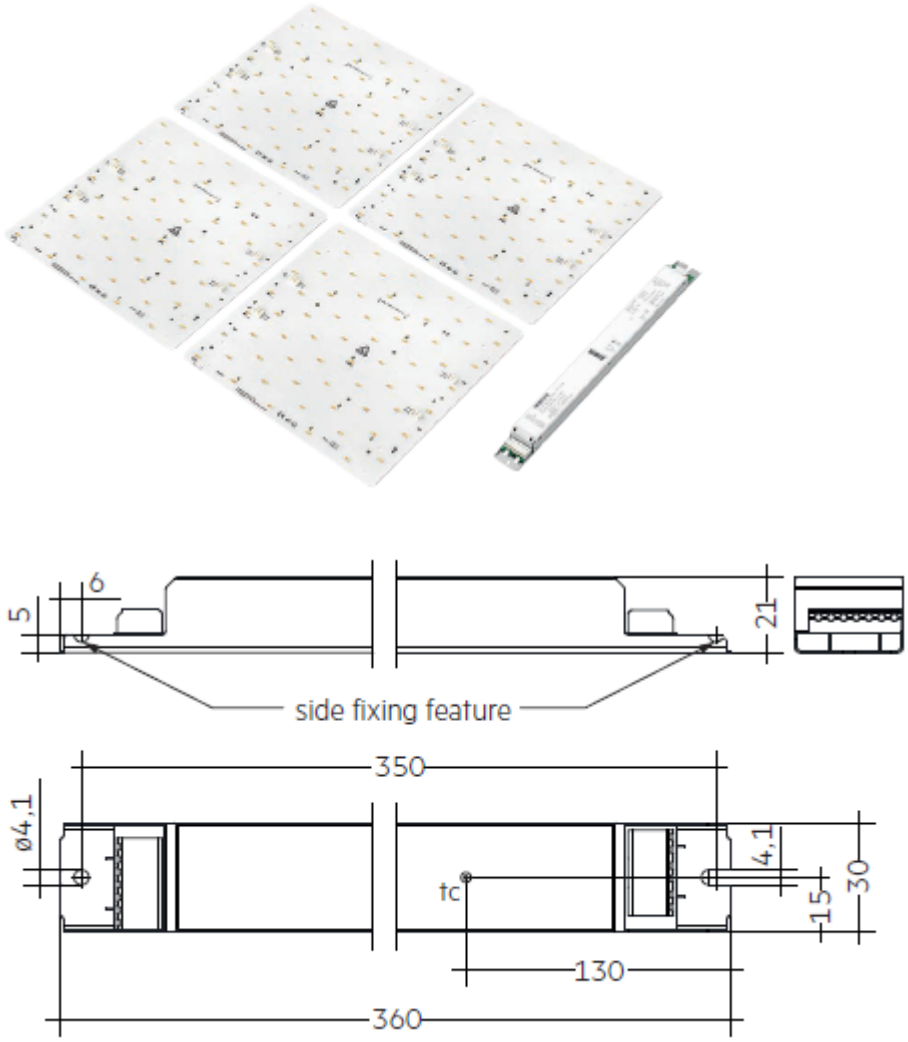


Dimensional drawing of the QLE G2 PRE module

NOTICE

CAD data for the modules can be downloaded from the Tridonic homepage (www.tridonic.com) and the relevant product page.

4.3. Dimensional drawings LED Driver



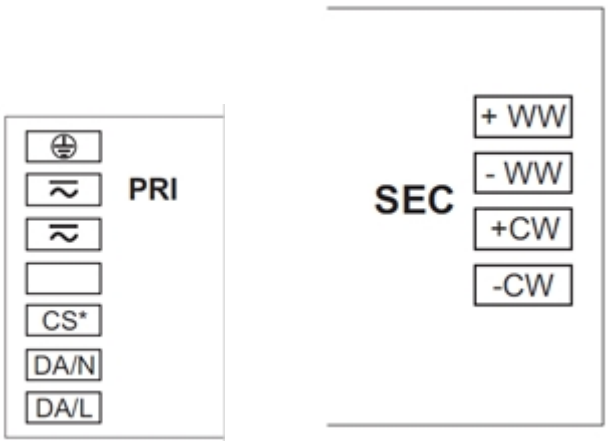
Dimensional drawing of the LED Driver for QLE G2 PRE

NOTICE

Detailed information and CAD data for the LED Driver can be downloaded from the Tridonic homepage (www.tridonic.com) and the relevant product page.

Electrical Aspects

5.1. Connections on the LED Driver



5.1.1. Connections on the LED control gear for QLE G2 PRE Module

Pin/Connection	Connection on the LED Driver	Design
⏚	Protective earth or functional earth	Spring terminal
~	Power input	Spring terminal
~	Power input	Spring terminal
DA*	Control input DALI / DSI / switchDIM / corridor FUNCTION	Spring terminal
DA*	Control input DALI / DSI / switchDIM / corridor FUNCTION	Spring terminal
CS	colourTEMPERATURE	Spring terminal
WW+	QLE G2 PRE Module - warmwhite PLUS	Spring terminal
WW-	QLE G2 PRE Module - warmwhite MINUS	Spring terminal
CW+	QLE G2 PRE Module - coldwhite PLUS	Spring terminal
CW-	QLE G2 PRE Module - coldwhite MINUS	Spring terminal

* only with LED Driver with the corresponding functionality

5.2. Electrical safety

5.2.1. Basic classification of protection classes

Depending on the design of the luminaire, the requirements of different electrical protection classes are satisfied:

Luminaires in protection class III (also SELV which stands for Safety Extra Low Voltage) have such low internal voltages that a shock current would be inconsequential. AC voltages with an effective value of up to 50 V AC and direct currents up to 120 V DC are referred to as low voltage (also extra-low voltage and weak current).

Protection class II (non-SELV) applies for luminaires with double insulation, with no protective earth, between the mains circuit and the output voltage or metal casing. Even if the luminaires have electrically conductive surfaces, thanks to their insulation they are protected against contact with other live parts.

Protection class I (non-SELV) applies for luminaires with basic insulation and protective earth. All the electrically conductive casing components are connected via a protective conductor system which is at earth potential.

5.2.2. Basic insulation of QLE G2 PRE modules

The QLE G2 PRE module features basic insulation against earth, i.e., a clearance/creepage distance greater or the same as 3 mm and can be directly assembled on an earthed metal part of the luminaire, also in operation with LCA 50W 350-1050mA DT8 lp PRE und LCA 100W 350-1050mA 2xDT8 lp PRE .

5.2.3. Design measures for satisfying protection class requirements

Not all the components of the QLE G2 PRE KIT system comply with the SELV standard. The voltages can thus be greater than 120 V DC.

5.2.4. Protection class II luminaires

When using a QLE module with NON-SELV level, the following measures are essential in order to achieve protection class II:

- Reinforced insulation between QLE G2 PRE module and the luminaire casing, e.g., by means of plastic casing or an additional insulating foil between the luminaire casing and the module.
- Reinforced insulation between the LED Driver and luminaire casing, e.g., by means of plastic casing
- Use of double-insulated lines
- Protect all electrical contacts against mechanical contact, this can typically be achieved with optics which cannot be removed

5.2.5. Protection class I luminaires

When using a QLE control gear with NON-SELV level, the following measures are essential in order to achieve protection class I:

- Use of metal casing for the luminaire
- Assembly of the QLE G2 PRE module directly on the casing
- Grounding of the LED Driver, QLE G2 PRE module and the luminaire itself
- Protect all electrical contacts against mechanical contact, this can typically be achieved with optics which cannot be removed

Electrical Aspects

DANGER!

The following measures must be followed in order to avoid life threatening situations:

- Electrical work on a luminaire with protection class I or II (non-SELV) must only be carried out by an electrically skilled person.
- The luminaire must be disconnected from the mains before starting work on it.
- Check the luminaire for damage, if there are any signs of damage, the luminaire must be replaced.

5.3. Electrical safety and connection

5.3.1. Electrostatic safety and EMC protection

The LED modules are tested up to a voltage of 8 KV static discharging. Depending on the ambient conditions, appropriate precautionary measures must be taken in order to avoid higher voltages, for example during production or installation.

For good EMC conduct, the lines should be run separately from the mains connections and lines. The maximum secondary line length on the terminals is 2 metres.

5.3.2. Electrical supply and selection of the LED Driver

⚠ CAUTION!

QLE G2 PRE module are not protected against overvoltages, overcurrents, overloads and short-circuit currents!
Safe and reliable operation of the LED modules can only be guaranteed in conjunction with a LED Driver which complies with the relevant standards.

QLE G2 PRE module must be supplied by a constant current LED Driver. Operation with a constant voltage LED Driver leads to irreversible damage to the modules! Wrong polarity can damage the QLE G2 PRE module. If a wire breaks or a complete module fails in the case of parallel wiring, the current passing through the other modules increases. This may reduce the service life considerably.

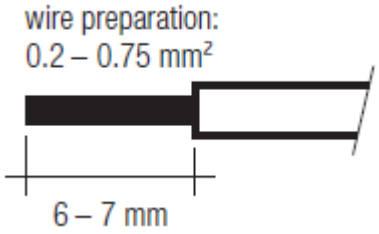
5.4. Electrical connections

5.4.1. Q LE G2 PRE module connections

The LED Driver is connected to the power supply and the connections of the control lines and the LED module via push-in and spring terminals:

Line cross-section and stripped length of the insulation on the LED module:

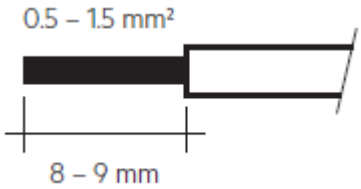
- Permissible line cross-section: 0.2 - 0.75 mm²
- Stripped length of the insulation 6 - 7 mm
- Push-in terminal for solid conductors



5.4.2. Push-in terminal for solid conductors

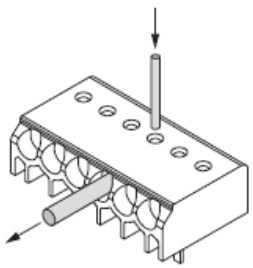
Line cross-section on the LED Driver:

- Permissible line cross-section: 0.5 - 1.5 mm²
- Stripped length of the insulation 8 - 9 mm
- Spring terminal for stranded wire



Loose wiring

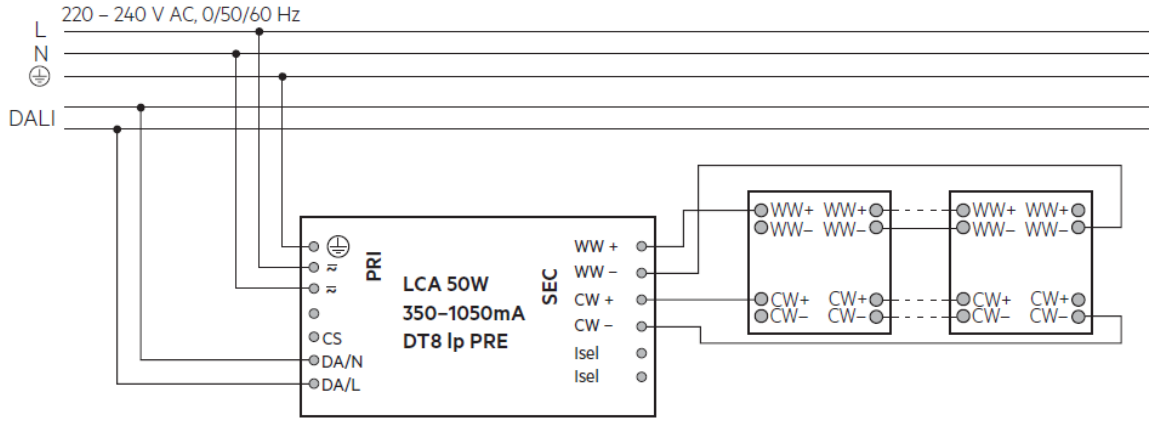
- Loosen wire through twisting and pulling or using a Ø 1 mm release tool.



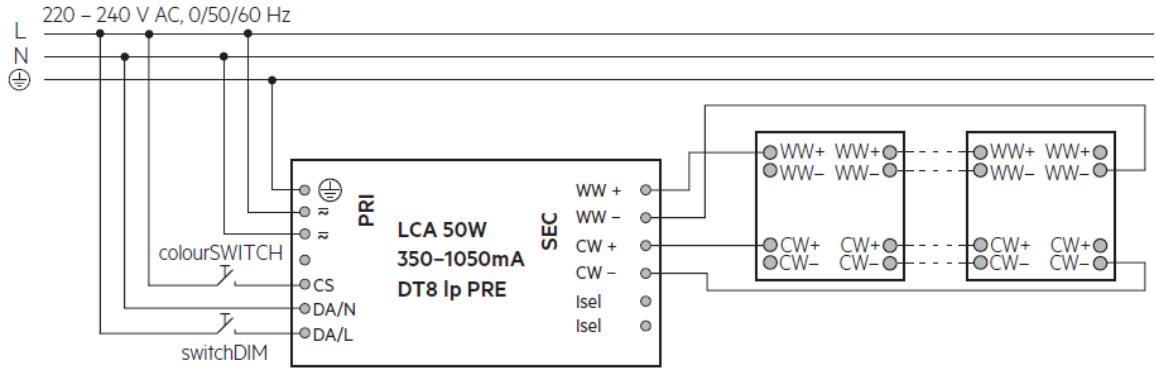
5.5. Wiring diagrams

5.5.1. Wiring diagrams for LCA 50W 350-1050mA DT8 lp PRE

Wiring diagram DALI for QLE PRE (with 2 to 4 modules)

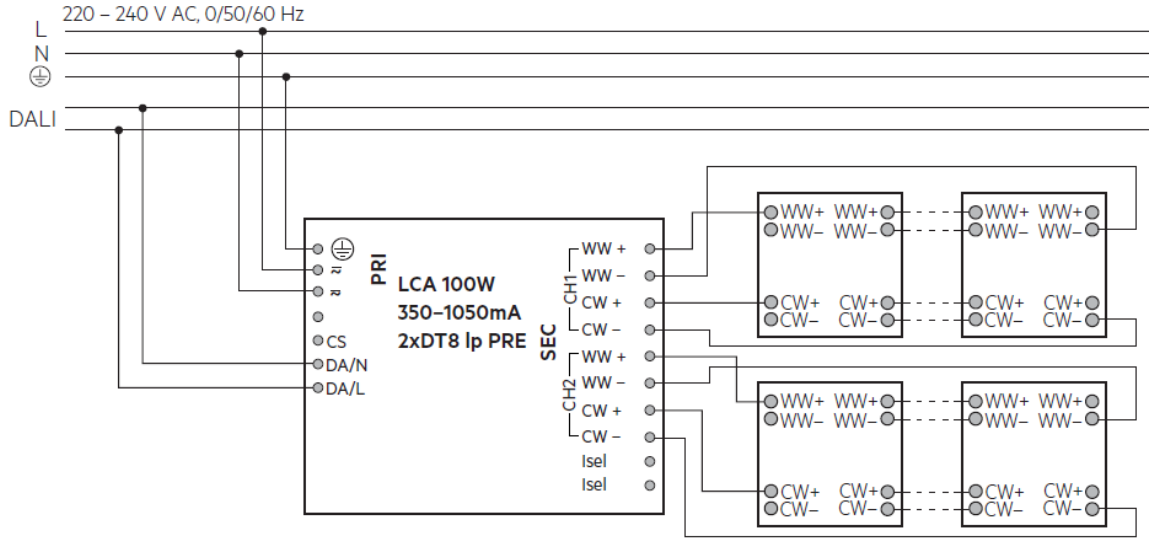


Wiring diagram switchDIM and colourSWITCH for QLE PRE (with 2 to 4 modules)

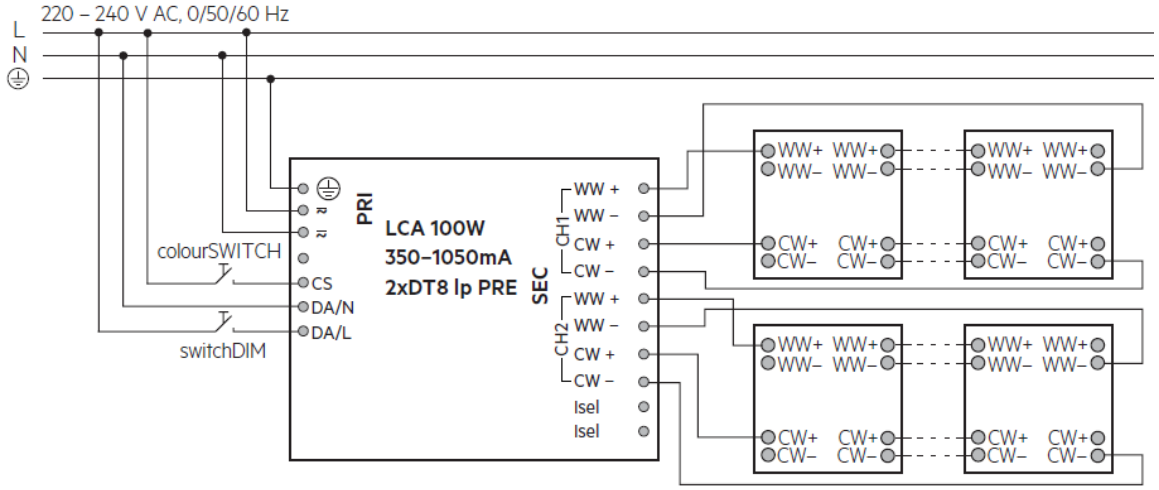


5.5.2. Wiring diagrams for LCA 100W 350-1050mA 2xDT8 lp PRE

Wiring diagram DALI for QLE PRE (with 5 to 6 modules)

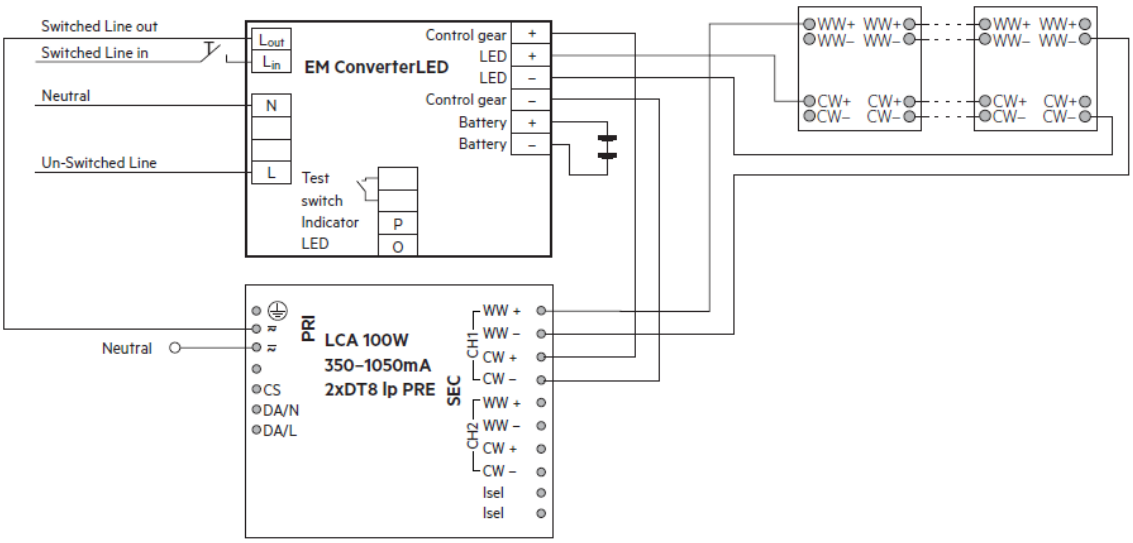


Wiring diagram switchDIM and colourSWITCH for QLE PRE (with 5 to 6 modules)



Electrical Aspects

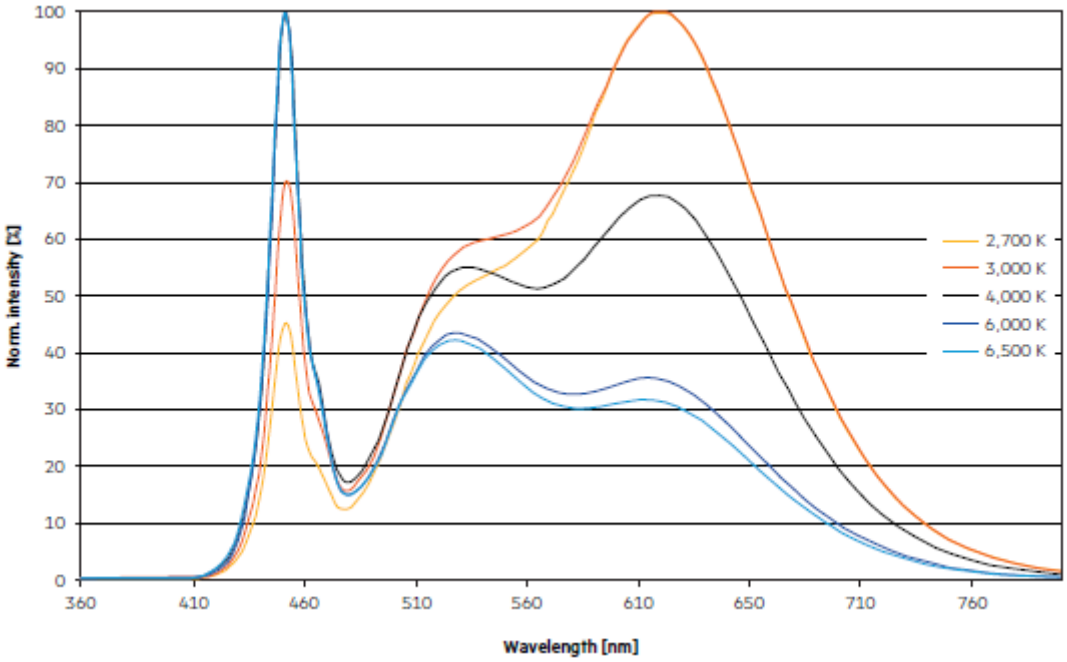
Wiring diagram emergency



Optical Aspects

6.1. Colour spectrum

The used technology enables LEDs to be produced in special light colours or colour temperatures. This means that lighting systems can be created that are not only energy-efficient but also have excellent colour rendering.



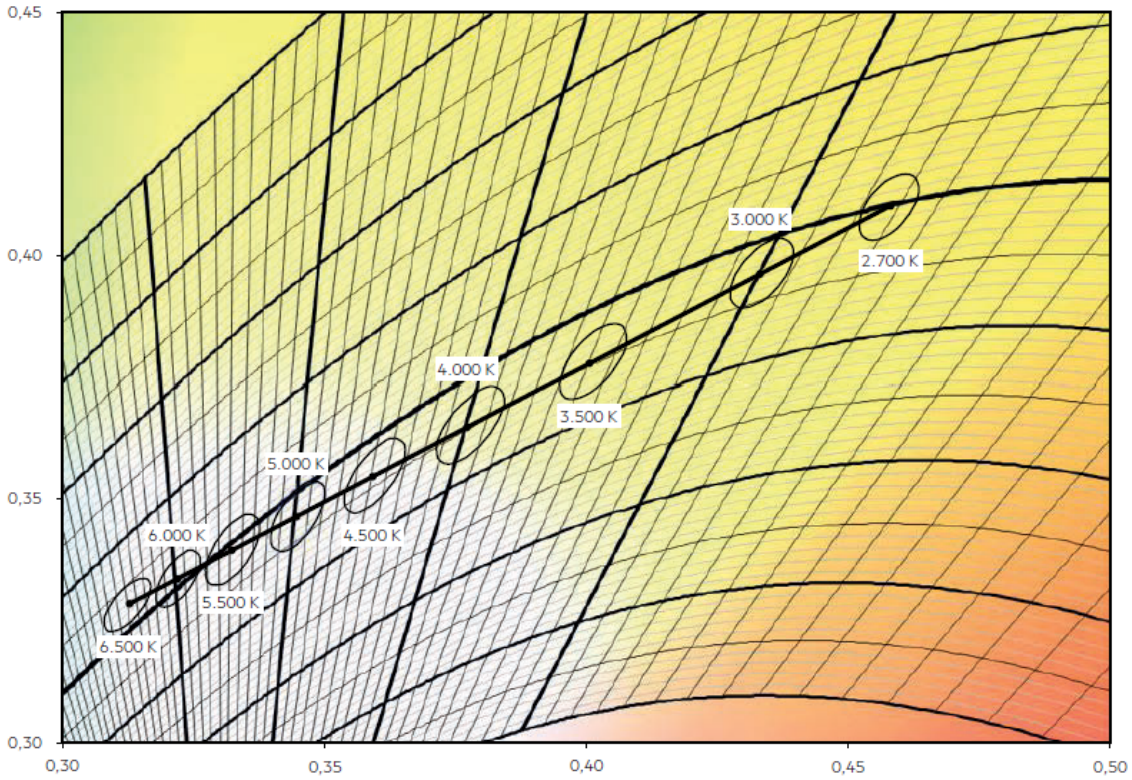
Colour spectrum at different colour temperatures

The diagram shows the normalised intensity in percent over the wave length in nm at different colour temperatures.

6.2. Coordinates and tolerances

6.2.1. Light colours

QLE G2 PRE KIT covers all the light colours below.



	2,700 K	3,000 K	3,500 K	4,000 K	4,500 K	5,000 K	5,500 K	6,000 K	6,500 K
Centre x0	0.4578	0.4335	0.4013	0.3778	0.3596	0.3448	0.3324	0.3220	0.3123
Centre y0	0.4101	0.3964	0.3783	0.3651	0.3548	0.3465	0.3395	0.3336	0.3282
MacAdam ellipse 100 – 50 % dimming level					3 SDCM				
MacAdam ellipse 50 – 10 % dimming level					4 SDCM				
MacAdam ellipse 10 – 3 % dimming level					6 SDCM				

6.3. CRI, Ra and Ri - different colour rendering values

The CRI (colour rendering index) and Ra (arithmetic average) value are different names for the same thing. They are defined as the “effect of an illuminant on the colour appearance of objects by conscious or unconscious comparison with their colour appearance under a reference illuminant”.

Optical Aspects

CRI and Ra are determined by a test procedure. In this procedure eight colour samples (R1-R8) are illuminated both by the light in question and by a reference light source and the appearance of the samples under the different lights is compared.

If there is no perceivable difference the light in question will be rated with a maximum value of 100. Differences in appearance result in a deduction from the maximum value. The resulting number is the Ri value and describes the colour rendering for one specific colour sample. The average of all eight Ri values is the CRI or Ra value and describes the general colour rendering of the tested light source.

The eight colour samples consist of different pastel colours and can be found in the table below as TCS (test colour samples) 01-08.

There are six more colour samples: R9 to R14 or TCS09 to 14. They consist of different saturated colours and are not used for the calculation of the Ri, Ra and CRI value. However, these colours, especially R9, do have a special importance in the illumination of meat, fish, vegetables and fruit in retail areas.

Name	Appr. Munsell	Appearance under daylight	Swatch
TCS01	7,5 R 6/4	Light greyish red	
TCS02	5 Y 6/4	Dark greyish yellow	
TCS03	5 GY 6/8	Strong yellow green	
TCS04	2,5 G 6/6	Moderate yellowish green	
TCS05	10 BG 6/4	Light bluish green	
TCS06	5 PB 6/8	Light blue	
TCS07	2,5 P 6/8	Light violet	
TCS08	10 P 6/8	Light reddish purple	
TCS09	4,5 R 4/13	Strong red	
TCS10	5 Y 8/10	Strong yellow	
TCS11	4,5 G 5/8	Strong green	
TCS12	3 PB 3/11	Strong blue	
TCS13	5 YR 8/4	Light yellowish pink	
TCS14	5 GY 4/4	Moderate olive green (leaf)	

In the production of modules chips with different wavelengths and chip performances are used.

Because of this, different phosphor mixtures are needed to achieve the required target coordinates and single Ri values can differ between orders. This is not problematic. What is decisive for the overall impression of the LED module is its CRI value. But if specific single Ri values are required for an application, it must be made clear that these values may change for the reasons stated above. It is also not possible to specify tolerances.

Special LED modules are optimised to illuminate a particular product group (for example, MEAT+ is designed for the illumination of beef). In this case, specifying the CRI or single Ri values does not make sense. For special LED modules the subjective human perception is the most important factor. The colour coordinates for GOLD, GOLD+, Fresh Meat and MEAT+ are the result of appropriate tests. Single Ri values or the CRI value are not assessed.

6.4. SDCM

The human eye can not only recognise different colours along the black body curve, but also deviations above or below this line. If an LED has a colour temperature of 2,700 K , but is not directly located on the black body curve, it can be perceived as different from another LED with the same colour temperature. To prevent such differences and to assign an LED unambiguously, the chromaticity coordinate must be specified using the x, y coordinates in the colour space chromaticity diagram .

An even more accurate approach is to specify the standard deviation from the target colour, based on levels of MacAdam ellipses. The unit for this is called "SDCM" (abbreviation for "Standard Deviation of colour Matching"). When looking directly into a light source, these differences are perceived more strongly than in a "normal" situation where light is mainly perceived because of its reflections from illuminated surfaces.

Colour differences within one level of the MacAdam ellipses are not visible even when looking directly into the light source. Deviations of two to three levels (<= 3 SDCM) are considered barely perceptible. A value of 3 SDCM is good for LED light sources. For most applications a value of 5 SDCM is still sufficient .

6.5. Binning

Chips and packages from the same production can still show small variations in colour temperature and forward voltage . If the chips are used without pre-selection, these differences can be noticeable and interfere with the appearance.

Binning means that the chips and packages are classified according to their colour temperature and forward voltage. This leads to groups of chips or packages that fall into a very narrow window of tolerance. If LED modules are equipped with such chips and packages differences in appearance can be prevented.

6.6. Secondary Optics

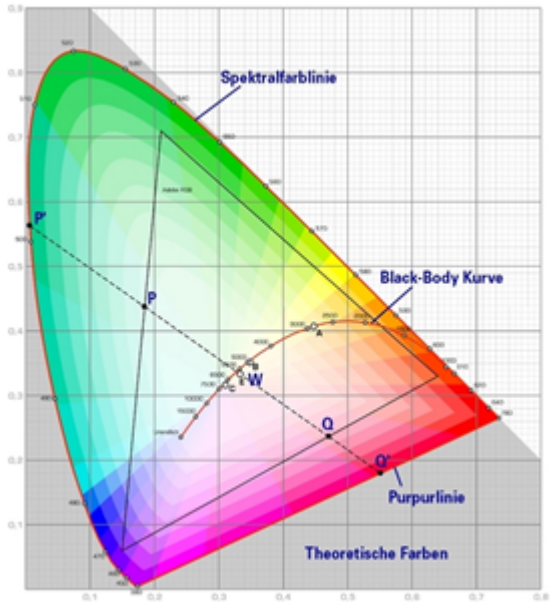
The term Secondary Optics refers to additional optical elements that shape the light output in different forms. Secondary Optics include e.g. reflectors, lenses or covers.

6.7. Coordinates and tolerances (to CIE 1931)

As before, the production process for TALEXX LEDs does without binning. As a result, white LEDs can be produced with normal distribution in the range of a MacAdam-Ellipse 3. Thanks to the proximity to the Planckian curve there are no annoying colour discrepancies.
Every module is automatically tested at the final inspection stage to ensure that all the supplied products fall within the agreed specification.

Optical Aspects

6.7.1. Chromaticity coordinate



LEDs exhibit variations in terms of their exact shade of colour. This means that different “white” LEDs will all shine in a colour that is within the white colour spectrum. But the colours won’t be exactly the same.

These colour differences between LEDs are problematic in areas where the lighting must produce a specified and uniform colour and deviations from that can impair the visual appearance of an installation. Using the chromaticity coordinate helps to avoid such problems by defining the exact shade of colour of an LED.

Technically speaking, the chromaticity coordinate is defined by its three coordinates (x, y, z) within the so called CIE 1931 colour space chromaticity diagram.
The CIE 1931 colour space chromaticity diagram represents all the colours that are discernible for humans. Since the three coordinates sum up to 1, two coordinates are sufficient to define a colour and so one one coordinate is sometimes left out.

6.7.2. Colour temperature and Black Body Curve

The Black Body Curve within the colour space chromaticity diagram represents the colours that show when a so-called "black body" is slowly heated.

A "black body" is an "idealised" body which absorbs all light and has no reflected radiation.
If a "black body radiator" is slowly heated, it passes through a colour scale from dark red, red, orange, yellow, white to light blue. The definition for the colour temperature of a light source is the temperature where the “black body radiator” shows the same colour.

The colour temperature is measured in Kelvin (K). The most common luminaires have colour temperatures below 3,300 Kelvin (warm white), between 3,300 and 5,300 Kelvin (neutral white) or above 5,300 Kelvin (daylight white).

Optical Aspects

6.7.3. Eye safety

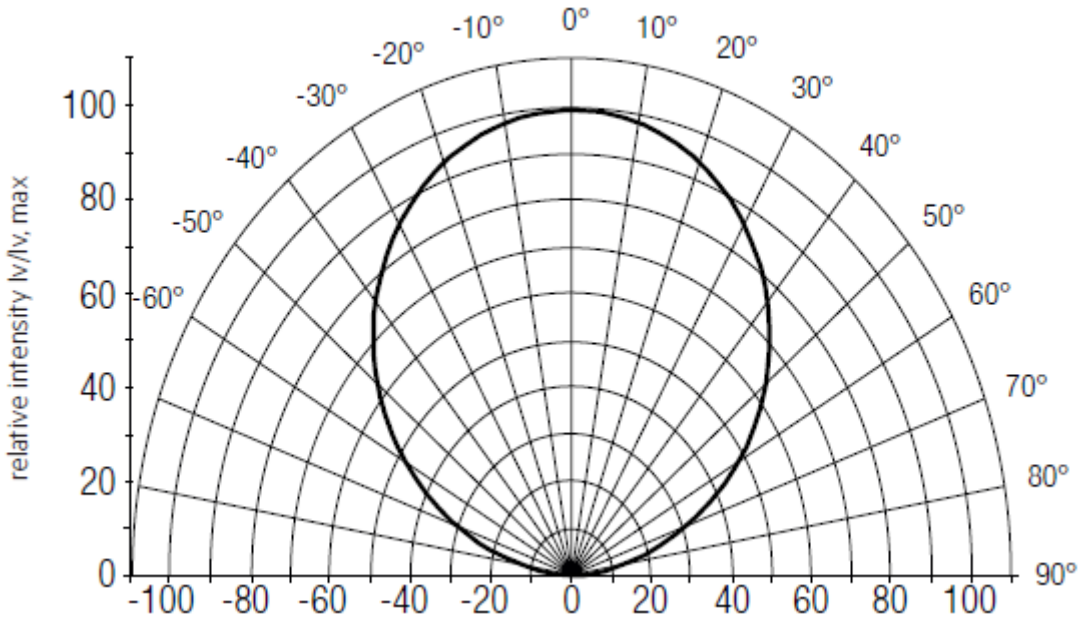
Risk group	Evaluation
Actinic UV E_S (200 - 400 nm)	Risk group 0[(1)]
Near UV E_{UVA} (315 - 400 nm)	Risk group 0[(1)]
Blue light L_B (300 - 700 nm)	Risk group 0[(1)]
Retina, thermal L_R (380 - 1,400 nm)	Risk group 0[(1)]
IR radiation, eye E_{IR} (780 - 3,000 nm)	Risk group 0[(1)]

[(1)] The evaluation of eye safety is based on EN 62471:2008 (photo-biological safety of lamps and lamp systems):

- Risk-free (risk group 0): The LEDs do not pose any photo-biological risk.
- Low risk (risk group 1): The LEDs pose a small risk because of normal limitations.
- Medium risk (risk group 2): The LEDs pose a small risk because of reactions to bright light sources or thermal discomfort.
- High risk (risk group 3): The LEDs pose a risk even with just momentary or temporary exposure.

6.8. Beam characteristics of the QLE G2 PRE module

Maximum relative light intensity Iv/v



Thermal Aspects

7.1. Passive cooling

Heat transfer from a heat source to the surrounding cooling medium (e.g. air) depends primarily on the difference in temperature, the effective surface area and the flow rate of the cooling medium. The function of a heat sink is to increase the surface area over which the heat can be dissipated. This lowers the thermal resistance.
A passive heat sink works mainly by convection. The surrounding air is heated, which makes it rise, and is replaced by cooler air.
Heat pipes can be used as an alternative to cooing with fans. If space is particularly tight, the heat is first conveyed away. The actual heat sink is located at the other end of the heat pipe.

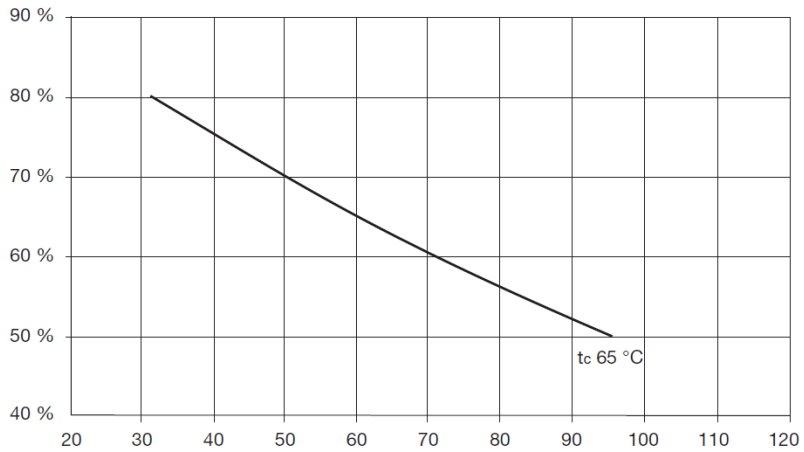
Benefits of passive cooling

- Energy savings
- Silent
- No mechanical wear
- No maintenance

7.2. Module cooling

7.2.1. Effect of cooling on the life of the modules

The modules of the Engine STARK QLE system are self-cooling and a heat sink is not required. The life of the module depends to a large extent on the operating temperature. The more that the operating temperature can be reduced, the longer the expected life of the module. If the permitted operating temperature is exceeded, however, the life of the module will be significantly reduced.



Fall in luminous flux over the course of the service life:

The diagram shows the change in luminous flux in percent over an operating time of 1,000 h at different t_c operating temperatures.

Luminous flux	Operating time at t_c = 65 °C
80 %	30,000 h
70 %	50,000 h

Thermal Aspects

50 %	90,000 h

NOTICE

Please check the information on the operating temperature and the requirements for cooling in the module data sheets.

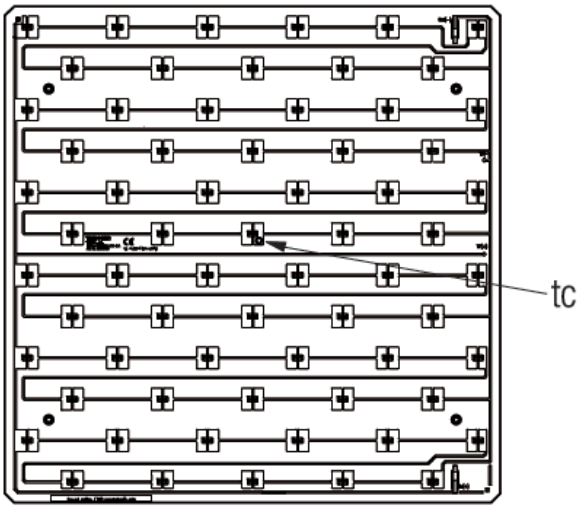
7.2.2. Temperature measurement on the module

There is a t_c point on top of the module for checking the temperature of the latter:
The temperature at the t_c point can be measured with a simple temperature probe.

In practice, thermocouples (e.g. B&B Thermotechnik, K-type thermocouple) have proved successful. Such thermocouples can be attached directly to the t_c point with heat-resistant adhesive tape or a suitable adhesive. The measured values are recorded by an electronic thermometer (e.g., "FLUKE 51", VOLTCRAFT K202 data logger).

The maximum possible temperature must be determined under worst-case conditions (ambient temperature, installation of the luminaire) for the relevant application. Before the measurement is taken, the luminaire should be operated for at least 4 hours in a draught-free room.

The measurement must be taken in a steady thermal state and in a draughtfree room.



t_c point of the module

7.2.3. Temperature management of the LED control gear

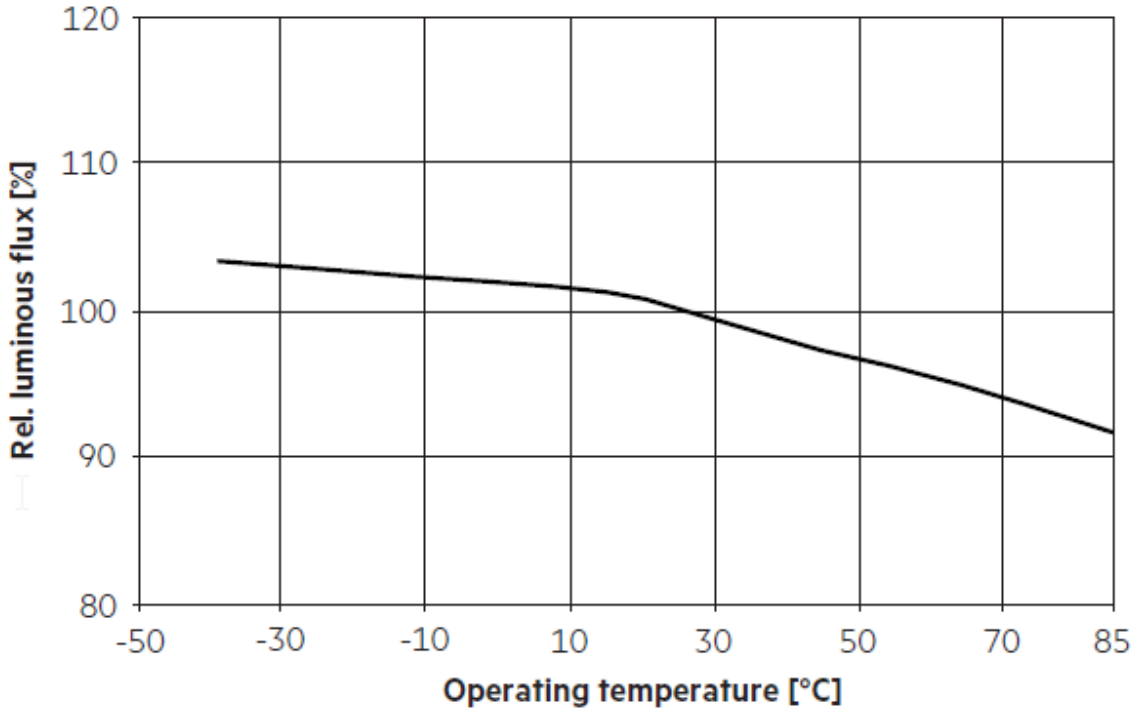
Although the LED control gear have an integrated temperature management system, the requirements relating to cooling of the LED control gear must also be taken into account. Unintentional automatic dimming at overtemperature, for example, indicates inadequate cooling of the LED control gear.
The LED control gear temperature can be measured with a simple temperature probe at the t_c point. The t_c point of the LED control gear is indicated by a sticker on the casing.

NOTICE

Measurement conditions, sensors and handling are described in detail in standard EN 60598-1 “General requirements and tests for luminaires”.
Sources for suitable heat-conducting foil and paste for the thermal connection of a temperature probe can be found at "partners".

Thermal Aspects

Relative luminous flux vs. operating temperature



Lifetime characteristic

The table shows the change in luminous flux in percent over an operating time

Forward current	tp temperature	L90 / F10	L90 / F50	L80 / F10	L80 / F50	L70 / F10	L70 / F50
825 mA	45 °C	>50,000 h	>50,000 h	>50,000 h	>50,000 h	>50,000 h	>50,000 h
	55 °C	30,000 h	>50,000 h	>50,000 h	>50,000 h	>50,000 h	>50,000 h
	65 °C	16,000 h	37,000 h	31,000 h	>50,000 h	46,000 h	>50,000 h
	75 °C	8,500 h	20,000 h	17,000 h	39,000 h	27,000 h	>50,000 h

NOTICE

Please check the information on the operating temperature and the requirements for cooling in the module data sheets.

7.2.4. Requirements for the heat sink

Although the operating temperature of the modules is continually monitored during operation and the power is automatically reduced in the event of excess temperature, the modules should not be operated without a heat sink.
The heat sinks must be dimensioned to provide adequate cooling capacity.
The R_{th} value is important for selecting an appropriate heat sink. This value depends on the light output of the module and on the ambient temperature in which the module is to be operated. The R_{th} value of the heat sink must be smaller than the required R_{th} value.

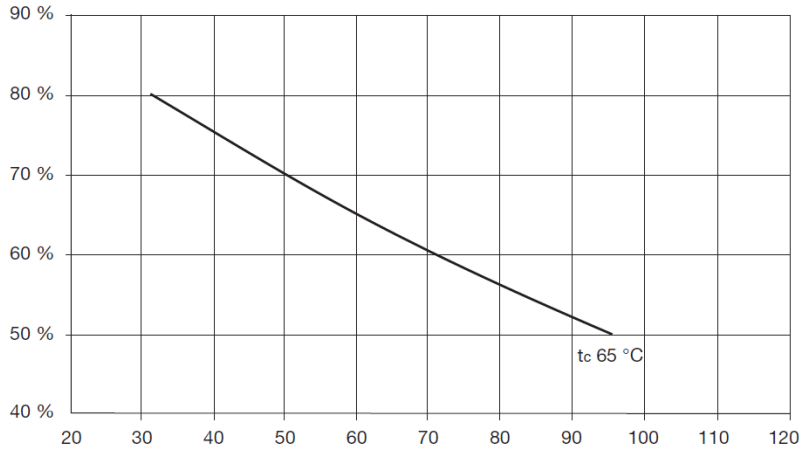
Thermal Aspects

NOTICE

Please check the information on heat sinks in the module data sheets.

7.2.5. Effect of cooling on the life of the modules

The modules of the TALEXXengine QLE G2 PRE system are self-cooling and a heat sink is not required. The life of the module depends to a large extent on the operating temperature. The more that the operating temperature can be reduced, the longer the expected life of the module. If the permitted operating temperature is exceeded, however, the life of the module will be significantly reduced.



The diagram shows the change in luminous flux in percent over an operating time of 1,000 h at different t_c operating temperatures.

Luminous flux	Operating time at t_c = 65 °C
80 %	30,000 h
70 %	50,000 h
50 %	90,000 h

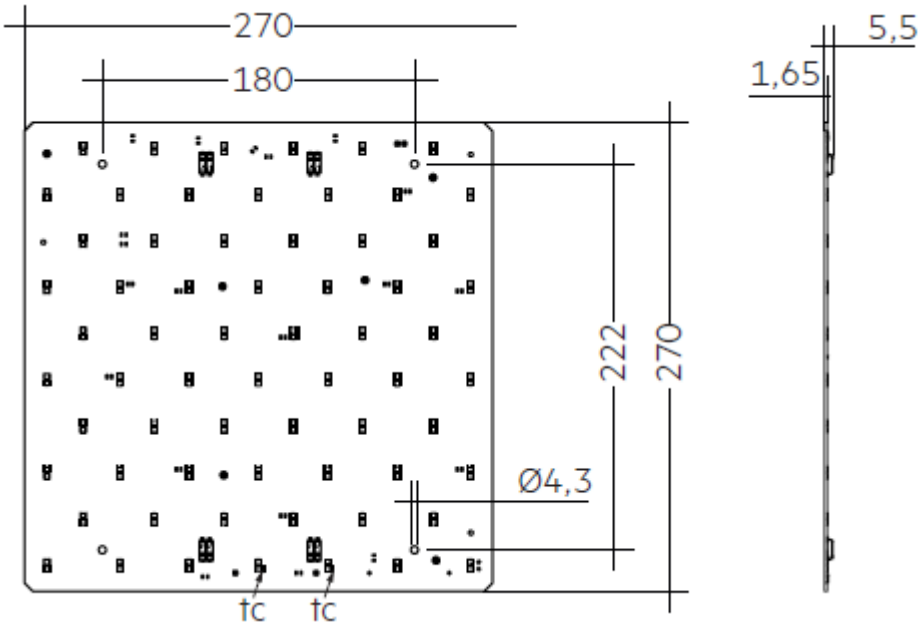
NOTICE

Please check the information on the operating temperature and the requirements for cooling in the module data sheets.

Thermal Aspects

7.2.6. Temperature measurement on the module

$t_c$point QLE



There is a t_p point on top of the module for checking the temperature of the latter:
The temperature at the t_p point can be measured with a simple temperature probe. Since the underside of the modules is made from anodised aluminium, any measurements taken with an infra-red camera would lead to inaccurate results.

In practice, thermocouples (e.g. B&B Thermotechnik, K-type thermocouple) have proved successful. Such thermocouples can be attached directly to the t_p point with heat-resistant adhesive tape or a suitable adhesive. The measured values are recorded by an electronic thermometer (e.g., "FLUKE 51", VOLTCRAFT K202 data logger).
The maximum possible temperature must be determined under worst-case conditions (ambient temperature, installation of the luminaire) for the relevant application. Before the measurement is taken, the luminaire should be operated for at least 4 hours in a draught-free room.

The measurement must be taken in a steady thermal state and in a draughtfree room.

7.2.7. Temperature management of the LED Driver

Although the LED Driver have an integrated temperature management system, the requirements relating to cooling of the LED Driver must also be taken into account. Unintentional automatic dimming at overtemperature, for example, indicates inadequate cooling of the LED Driver.
The LED Driver temperature can be measured with a simple temperature probe at the t_c point. The t_c point of the LED Driver is indicated by a sticker on the casing.

Thermal Aspects

NOTICE

Measurement conditions, sensors and handling are described in detail in standard EN 60598-1 "General requirements and tests for luminaires".
Sources for suitable heat-conducting foil and pastes for thermal connection to a temperature probe are given at the end of this documents.

8.1. DSI

8.1.1. 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
- reverse polarity protected connection: can be connected with any polarity

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

8.1.2. 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).

8.2. switchDIM

8.2.1. 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.

8.2.2. 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.

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

Synchronising devices

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

Procedure:

- Hold down the push button for 10 seconds
  -> All devices will be synchronised to the same status
  -> LEDs will will be set to a uniform light value (approx. 50 %)
  -> The fading time will be set to it default value (approx. 3 seconds)

Changing the fading time

The default value for the fading time is approx. 3 seconds. It can be changed to approx. 6 seconds.

Procedure:

- Hold down the push button for 20 seconds
  -> After 10 seconds: all devices will be synchronised to the same status
  -> After 20 seconds: a fading time of approx. 6 seconds will be set
  -> LEDs will be set to a uniform light value (approx. 100 %)

Switching the LED Driver 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

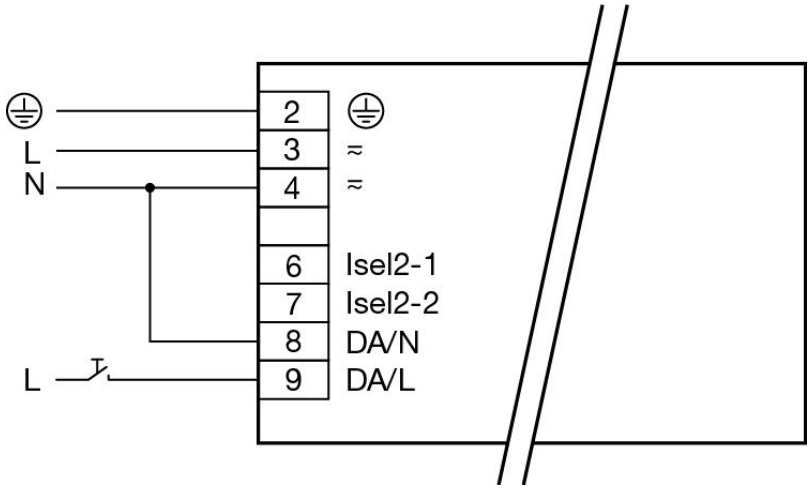
8.2.3. Installation

Wiring variants

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

Four-pole wiring

Configuration:



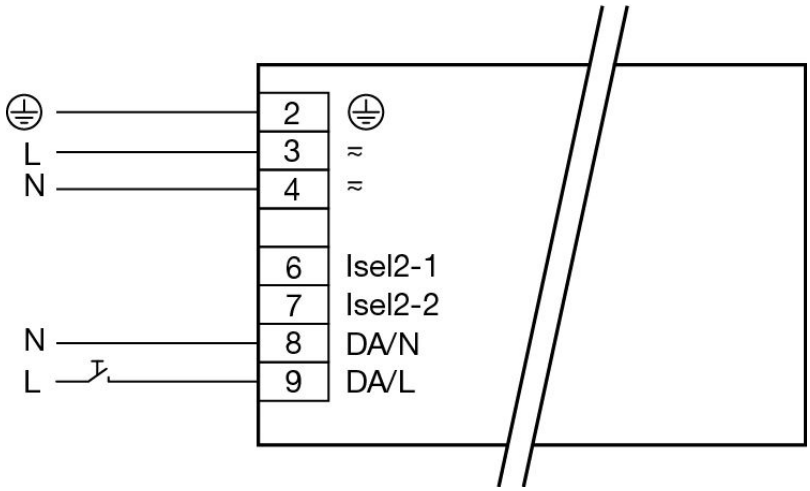
Phase (L), neutral (N), earth (PE), control line (L')

Benefits:

No need for a control line thanks to bridging terminal 8 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

switchDIM

⚠ 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.

8.3. Power-up Fading

8.3.1. Description

The power-up fading function offers the opportunity to realise 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).

8.3.2. 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).

8.4. DALI

8.4.1. Description

DALI standard

NOTICE

LCA PRE devices support the new DALI standard V2 (according to EN 62386-102).

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 LED Driver can be grouped to a line
- DALI groups: Every LED Driver can be attributed into 16 groups
- Addressability: All LED Driver 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 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)

8.4.2. 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).

eD

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

8.5. Constant Light Output

8.5.1. 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.

If the OTL 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 2 seconds after being switched on.

8.5.2. 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

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

Constant Light Output

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 LED Driver

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

- 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"
- 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 an 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).

8.6. DC recognition

8.6.1. 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 LCA PRE series are factory preset to a DC level of 15 %. This value can be customised. Further information can be found in the masterCONFIGURATOR manual (see Reference list, p. 64).
- LED Driver of the LC EXC series have different DC levels. Further information can be found in the data sheet of the corresponding LED Driver (see Reference list, p. 64).

NOTICE

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

8.6.2. Commissioning

The function is integrated in the device as standard. No additional commissioning is necessary for activation.

8.7. Dimming on DC

8.7.1. 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).

8.7.2. Description

If Dimming on DC is activated the requirements of the DC recognition function are ignored. Even if DC is detected the LED Driver 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 und DSI continue to be executed

8.8. Intelligent Temperature Guard

WARNING!

The maximum t_c temperature is the maximum permitted in terms of life time. Operating the LED Drivers above the permitted t_c temperature is not allowed.
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.

8.8.1. Description

The Intelligent Temperature Guard function provides protection against temporary thermal overloads. Thermal overload protection is triggered if the t_c temperature is exceeded. This way, instant failure of the LED Driver can be prevented.

8.8.2. Behaviour

The following table shows the exact behaviour and parameters of the Intelligent Temperature Guard function.

Parameters	Description
Starting point of power reduction	When maximum t_c temperature is exceeded. (1) **NOTICE** The temperature at which the power reduction starts is device-specific and depends on the load and the installation situation. Depending on the installation situation and the load of the device, the temperatures at different measuring points of the device may differ. As a result, it may happen that the actual measured temperature is not identical to the temperature at the t_c point. In any case, the starting point of the power reduction is higher than the predetermined maximum t_c temperature. For the functioning of the protective function these deviations are not decisive. The starting point of the power reduction is selected by the device in a way that the protective function starts when the rated life time would otherwise be significantly affected.
Type of power reduction	Power reduction takes place in gradual steps.

Intelligent Temperature Guard

Power reduction process and control	Power reduction is dependent on temperature: _ Power reduction continues if temperature still rises _ Power reduction stops if temperature does not rise anymore or if maximum power reduction is reached (minimum power level = 50 %) _ If temperature falls below a certain level, power is increased again until 100 % is reached _ If temperature still rises even if maximum power reduction is reached: _ Drivers go to 15 % dim level
Min power level	ca. 50 % dim level
Shut off behaviour	No shut off behaviour: Device will not shut off if temperature still rises. _ AC mode: Device switches to 15 % dimming level _ DC mode: Intelligent Temperature Guard is not relevant because driver goes to EOFx level anyway
Automatic restart behaviour	No automatic restart behaviour (because there is no shut off behaviour)
Restart temperature	No restart temperature

(1) Rated T_c is device specific.

NOTICE

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

Ordering information and sources

9.1. Article numbers

9.1.1. QLE G2 PRE KIT > 90 (calibrated kit)

Type	Colour-temperature (K)	Typ. luminous flux[1)] (lm)	CRI	Typ. power draw[1)] (W)	System efficacy (lm/W)	Order No.
QLE G2 270x270mm 2x1250lm 927-965 LV PRE (LCA 50W PRE LED-Driver + 2 LED-Module a 1250lm)	2,700-6,500 Tunable White	2,500	> 90	19.8	126	89602940
QLE G2 270x270mm 3x1250lm 927-965 LV PRE (LCA 50W PRE ED-Driver + 3 LED-Module a 1250lm)	2,700-6,500 Tunable White	3,750	> 90	28.4	132	89602941
QLE G2 270x270mm 4x1250lm 927-965 LV PRE (LCA 50W PRE ED-Driver + 4 LED-Module a 1250lm)	2,700-6,500 Tunable White	5,000	> 90	36.9	135	89602942
QLE G2 270x270mm 5x1250lm 927-965 LV PRE (LCA 100W PRE ED-Driver + 5 LED-Module a 1250lm)	2,700-6,500 Tunable White	6,250	> 90	46.5	134	89602943
QLE G2 270x270mm 6x1250lm 927-965 LV PRE (LCA 100W PRE ED-Driver + 6 LED-Module a 1250lm)	2,700-6,500 Tunable White	7,500	> 90	55.1	136	89602944

All of the above QLE PRE kits meet MacAdam (SDCM 3 @ 100% Dimmlevel) and have a uniform size of 270 x 270 mm.

[1)] Tolerance range for optical data: ±5 % and tolerance range for electrical data: ±5 %.

9.1.2. Suitable controllers

Tridonic offers a comprehensive range of DALI-compatible products. All the devices specified here support DALI Device Type 6 and therefore guarantee effective use of LLE PRE KIT.

Product name	Article No.
DALI MSensor 02	28000896

Ordering information and sources

DALI SC	24034263
DALI MC	86458507
DALI TOUCHPANEL 02	28000022
DALI x/e-touchPANEL 02	28000005
DALI PS	24033444
DALI USB	24138923

NOTICE

Go to www.tridonic.com to see the current range of products and the latest software updates.

9.2. Product application matrix

Whether you are looking for wide-area lighting or focused accent lighting, our wide range of PRE products will help you create an individual atmosphere and highlight specific areas exactly as you want. Our product portfolio includes individual light points, round, rectangular and strip versions. Specially matched operating equipment such as LED Driver, amplifiers and sequencers round off the components for a perfect system solution: They guarantee ideal operation and maximum efficiency.

9.2.1. Luminaire application PRE KIT

PRE KIT	Downlight	Spotlight	Linear / rectangular	Decorative	Surface	Outdoor (street)
PRE KIT DLE	✅					
PRE KIT SLE	✅	✅		✅	✅	
PRE KIT LLE			✅		✅	
PRE KIT FULMEN		✅				
PRE KIT LINE			✅	✅		

Ordering information and sources

9.2.2. Luminaire application PRE module

PRE module	Downlight	Spotlight	Linear / rectangular	Decorative	Surface	Outdoor (street)
PRE module SPOT	✅	✅		✅	✅	
PRE module RECTANGULAR						✅
PRE module EOS	✅	✅	✅	✅	✅	✅
PRE module STRIP			✅	✅		
PRE module TAPE			✅	✅		

For more information and technical data on the entire PRE product portfolio go to led.tridonic.com or see our PRE catalogue.

Reference list

10.1. Related documents

- Data sheet Module QLE G2 PRE: https://www.tridonic.com/com/en/download/data_sheets/Module_QLE_G2_PRE_en.pdf
- 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
- corridorFUNCTION: http://www.corridorfunction.com/corridorFUNCTION/index.html

10.2. Downloads

- Tridonic software: http://www.tridonic.com/com/en/software.asp
- Download masterCONFIGURATOR: http://www.tridonic.com/com/de/software-masterconfigurator.asp
- Download Android-App Emergency ADDRESSING Decoder: https://play.google.com/store/apps/details?id=net.gmx.royder.knight.EZ_easyADRESSING

10.3. Additional information

- Declarations of conformity: http://www.tridonic.com/com/en/news-declarations-of-conformity.asp
- Company certificates: http://www.tridonic.com/com/en/company-certificates.asp
- Guarantee conditions: http://www.tridonic.com/com/en/guarantee.asp
- Data sheets: http://www.tridonic.com/com/en/data-sheets.asp
- Environmental declarations: http://www.tridonic.com/com/en/environmental-declarations.asp
- Tender text: http://www.tridonic.com/com/en/tender.asp
- Other technical documents: http://www.tridonic.com/com/en/technical-docs.asp