LED Module

SLE premium system

Technical Design-In Guide

TRIDONIC

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Introduction

1.1. Complete system solution

LEDs offer major benefits for general illumination tasks - they are versatile, highly energy-efficient and virtually maintenance-free. With SLE premium you get a complete system solution for downlights from a single source, consisting of three perfectly matched components: LED module, LED control gear and ready-made cables for connecting the module and the LED control gear.

SLE premium offers impressive benefits:

- Controllable and dimmable white light (tunable white)
- High system efficiency of up to 65 lm/W at tp=65°C.
- Excellent colour rendering (CRI > 90)
- Standardised lumen packages for precise lighting planning
- Integrated interfaces such as DALI
- High reproducible colour quality
- Configuration of individual light colours
- High lifetime 50,000 hours at L70 (t_c=65°C)
- Compliance with the mechanical and electrical standards of the luminaire industry
- Energy efficiency class A

NOTICE

Please note:

The SLE 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 utmost 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

1.2. Creative freedom

With one product you can cover a very wide range of lighting tasks that up to now would have been impossible because of the dimensions or thermal management of traditional light sources. The broad TALEXXengine SLE premium portfolio offers the right solution for any application. You can find the right functionality to meet any requirements - from the non-dimmable basic version in different white tones to fully controllable and dimmable white light (tunable white) in the colour temperature range from 2,700 K to 6,500 K. In addition, there are special light colours available, for example for presenting fresh produce, meat and bread, and specific colours from the RGB spectrum.

Introduction

1.3. Perfect white light

A uniform crystal clear colour impression is very important particularly for wide-area lighting. LEDs with their exceptional white light quality, their high luminous efficacy and their balanced distribution of light give luminaire designers a completely new tool. They provide instant light, free of ultra-violet or infra-red radiation, and constant colour.

1.4. Excellent economy

Compared with a lighting installation equipped with conventional light sources, TALEXX LEDs reduce energy consumption by up to 40 percent, and their long life significantly reduces maintenance and repair costs.

Summary of the chapters

To make it easier to find your way around the Design-in Guide we have grouped the information on the SLE premium 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 SLE premium 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 control gear 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 control gear.
All the connection options, the connections between the LED control gear 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 control gear 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

The SLE premium system is available in two different lumen packages:

Properties and functions	SLE premium KIT
Colour temperature (1)	2,700 K to 6,500 K Tunable white (controllable and dimmable colour temperatures)
Luminous flux	2,050 lm or 1,350 lm
Colour rendering / colour tolerance	CRI > 90 / MacAdam 3 SDCM
System efficiency	65 lm/W
DALI	Device Type 8 (2)
switchDIM	yes
colourSWITCH	yes

(1) Application-specific changes to the colour temperature are possible. The colour temperature can be fixed or can be varied on the basis of PI-LED® technology. PI-LED® is a trademark of Lumitech. PI-LED® technology enables the perfect light colour to be set on site for the specific application.
Further information on application-specific colours is available on request.

(2) The system supports DALI device type 8 to change the colour temperature. Supported colour types according to DALI-Device Type 8:

- xy-coordinates
- colour temperature t_c

3.1.1. Components

A uniform naming concept has been adopted for the components. The SLE premium comprises the following components:

- SLE-PRE-KIT (LMAI + SLE module with housing) and SLE-PRE-W/OH-KIT (LMAI + SLE module without housing)
- Converter
- CONNECT Cable (between LMAI and SLE Module) lengths of up to 0.5 m are approved for connecting cables. Tridonic offers cables with a length of 0.2 m.

NOTICE

SLE-PRE-KIT and/or SLE-PRE-W/OH-KIT must be operated with the LCAU 2x020/048 LED control gear!

System Overview

3.1.2. Efficiency of the modules

The high efficiency of SLE premium 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 SLE premium KIT system comply with the protection requirements of IP20. The system is therefore suitable for indoor applications.
- SLE premium KIT complies with system protection class II.
- The SLE premium KIT modules meet the requirements of protection class III.

3.2. Operating functions

SLE premium offers a wide range of settings for colour temperature and dimming level. Different controllers are available. The controllers are connected directly to the LED control gear.

3.2.1. Central control via the LED control gear

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

NOTICE

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

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.

System Overview

⚠ CAUTION!

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

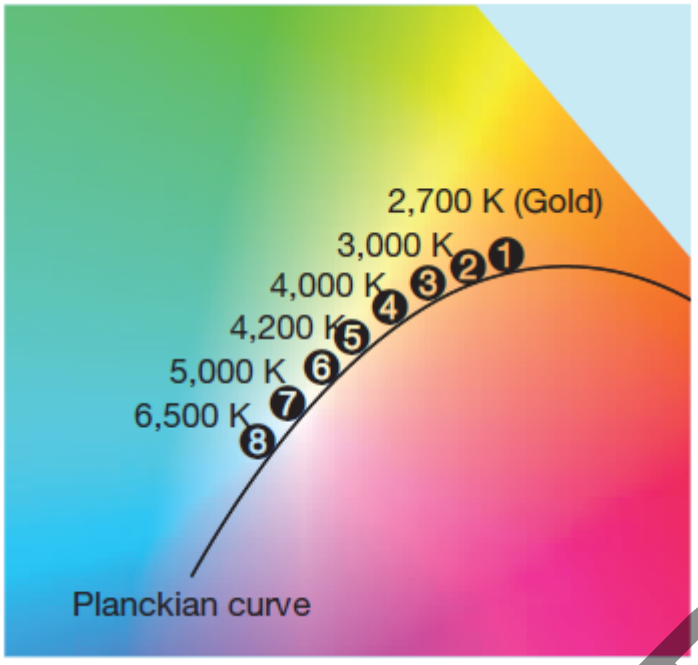
For control via a switchDIM switch different settings can be made:

- Setting for the colour temperature via colourTEMPERATURE mode or colourSWITCH mode with 8 predefined values between 2700 K and 6500 K.
- Stepless setting for the dimming level between 15% and 100%.

The colourTEMPERATURE mode and colourSWITCH mode differ in the position of the individual colour values along the Planckian curve. The colourTEMPERATURE mode is designed to meet the requirements of general and shop illumination, whereas the colourSWITCH mode is designed for food lighting.
On start-up the device first activates colour temperature setting in the colourTEMPERATURE mode. The starting values are a colour temperature of 2700 K and a dimming level of 100%.

System Overview

colourTEMPERATURE mode

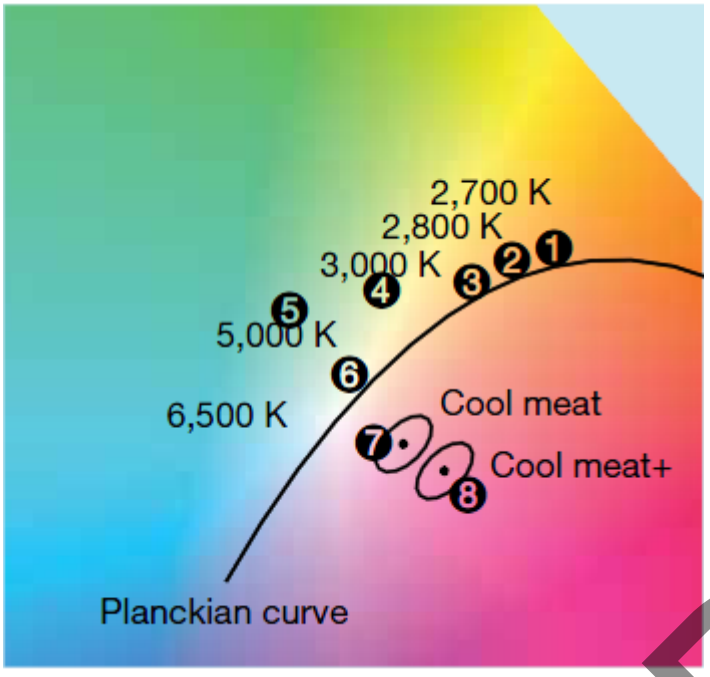


Location of the colour temperatures along the Planckian curve

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
2.700 K	3.000 K	3.500 K	4.000 K	4.500 K	5.000 K	5.700 K	6.500 K

System Overview

colourSWITCH mode



Location of the defined colour temperatures

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Gold (2,700 K) for bread and cakes	2,800 K fruit and vegetables	3,000 K	Fish x = 0.38 y = 0.38	Cheese yellow x = 0.35 y = 0.38	5,000 K	CM x = 0.3630 y = 0.3070	CM+ x = 0.3827 y = 0.2960

Setting the colour temperature

The procedure for setting the colour temperature is identical for both the colourTEMPERATURE mode and the colourSWITCH mode:

- Press the pushbutton briefly (approx. 1 s) to advance the colour temperature by one value

NOTICE

Once the maximum value has been reached, the next press takes you directly back to the minimum value.

Changing the mode

To toggle between colourTEMPERATURE mode and colourSWITCH mode you need to hold down the pushbutton. After 10 and 15 seconds the device will flash briefly. These are known as the 1st and 2nd flashing phases. Depending on the flashing phase in which the pushbutton is released (1st or 2nd), the changes are as follows:

- 1st flashing phase (after about 10 s): The device changes from colourTEMPERATURE mode to colourSWITCH mode
- 2nd flashing phase (after about 15 s): The device changes from colourSWITCH mode to colourTEMPERATURE mode

System Overview

NOTICE

If the pushbutton is released more than 5 seconds after the 2nd flashing phase this cannot be assigned to either flashing phase and will be ignored.
This can be used to avoid incorrect entries.
If the right time for releasing the pushbutton has passed all you need to do is to allow the appropriate time to elapse and start the process again.

Changing predefined colour temperatures and dimming levels

The predefined colour temperatures and dimming levels in colourTEMPERATURE mode and colourSWITCH mode can be changed via the MasterConfigurator. Any x and y values within the two limit values of 2700 K and 6500 K can be selected for the colour temperature. Either a colour value along the Planckian curve can be selected or x and y values can be entered directly. Up to 16 scenes can be individually defined. These scenes are stored in the LED control gear. 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

The dimming level is set with the other of the two pushbuttons. The procedures for the colourTEMPERATURE mode and the colourSWITCH mode are identical:

- Press the pushbutton briefly (approx. 1 s) to switch the LED control gear on or off
  -> The last values set for the colour temperature and the dimming level will be recalled when the LED control gear 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

Synchronising involves setting all the connected light modules to a uniform dimming level and a uniform dimming direction.

- Hold down the pushbutton (> 10 s) to synchronise all the connected devices to a uniform colour temperature and a uniform dimming level

3.2.2. Local control via the LMAI

Control via a push potentiometer or a floating pushbutton (make contact) is achieved by connecting these devices to the LMAI.

NOTICE

A mains reset is needed if a new control element is connected so that this new control element can be correctly detected.

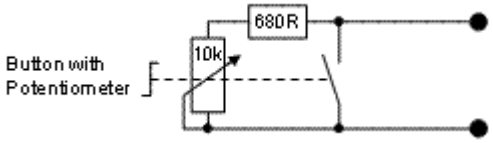
System Overview

Control via push potentiometer

NOTICE

High-resistance potentiometers may give results that are not accurate enough.
Tridonic recommends low-resistance potentiometers. The potentiometer must have the following characteristics:

- max. resistance 10 kOhm
- linear characteristic curve
- series resistance of 680 Ohm



There are two possible operating modes for control via a push potentiometer:

- Stepless setting for the colour temperature between 2,700 K and 6,500 K.
- Stepless setting for the dimming level between 15 % and 100%.

The potentiometer has two stop points:

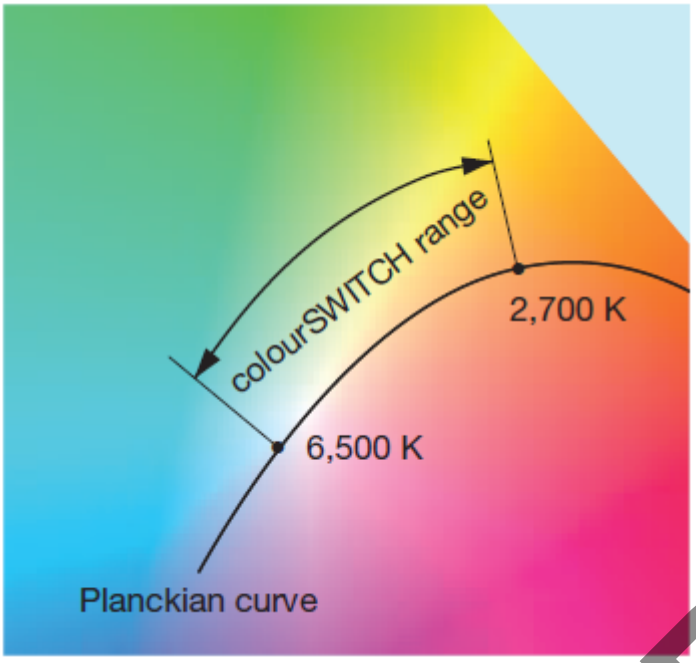
- The full-left setting corresponds to the minimum values (a colour temperature of 2700 K and a dimming level of 15%)
- the full-right setting corresponds to the maximum values (6500 K and 100%).

On start-up the device first activates light intensity setting.
The settings can be saved using two different methods:

- with a short keystroke
- with Automatic Saving (if no changes are made settings are automatically saved after 5 minutes)

System Overview

colourSWITCH range



Stepless setting for the colour temperature in the colourSWITCH range between 2700 K and 6500 K.

Setting the colour temperature

- Turn the potentiometer to the right to increase the colour temperature
- Turn the potentiometer to the left to reduce the colour temperature

Setting the dimming level

- Turn the potentiometer to the right to increase the dimming level
- Turn the potentiometer to the left to reduce the dimming level

Redefining the maximum dimming level

The factory default for the maximum dimming level is 100%. This value can be changed.

- Turn the potentiometer to the right or left to set the required dimming level
- Hold down the pushbutton (> 10 s) to store the selected dimming level as the new maximum dimming level

NOTICE

The maximum dimming level can be redefined even if it has already been changed.
Please note however that the displayed dimming level does not relate the a maximum dimming level of 100% but to the previously redefined maximum dimming level. This must be taken into consideration during the visual inspection.

System Overview

Resetting the maximum dimming level to the default value

- Turn the potentiometer to its full-right position
- Hold down the pushbutton (> 10 s) to store 100% as the maximum dimming level

Changing the operating mode

- Push down on the potentiometer to switch from setting the colour temperature to setting the dimming level or vice versa

NOTICE

When you switch between operating modes the displayed light values initially remain the same and may not correspond to the setting of the potentiometer. Briefly turning the potentiometer allows the device the detect the correct value and adjust the displayed light values.

Control via a floating pushbutton (make contact)

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

- Setting the colour temperature via colourTEMPERATURE mode or colourSWITCH mode with 8 predefined values between 2700 K and 6500 K.
- Setting the dimming level to one of 10 predefined values between 15% and 100%.

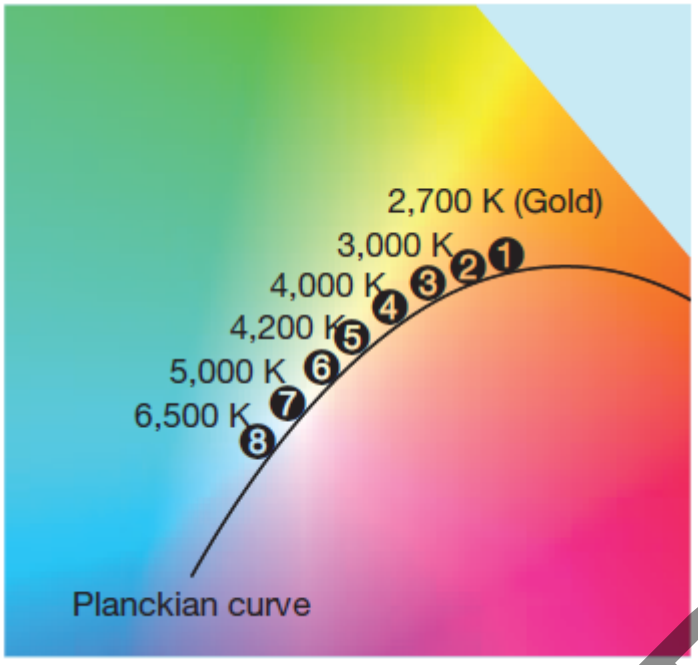
The colourTEMPERATURE mode and colourSWITCH mode differ in the position of the individual colour values along the Planckian curve. The colourTEMPERATURE mode is designed to meet the requirements of general and shop illumination, whereas the colourSWITCH mode is designed for food lighting.
On start-up the device first activates colour temperature setting.

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.

System Overview

colourTEMPERATURE mode



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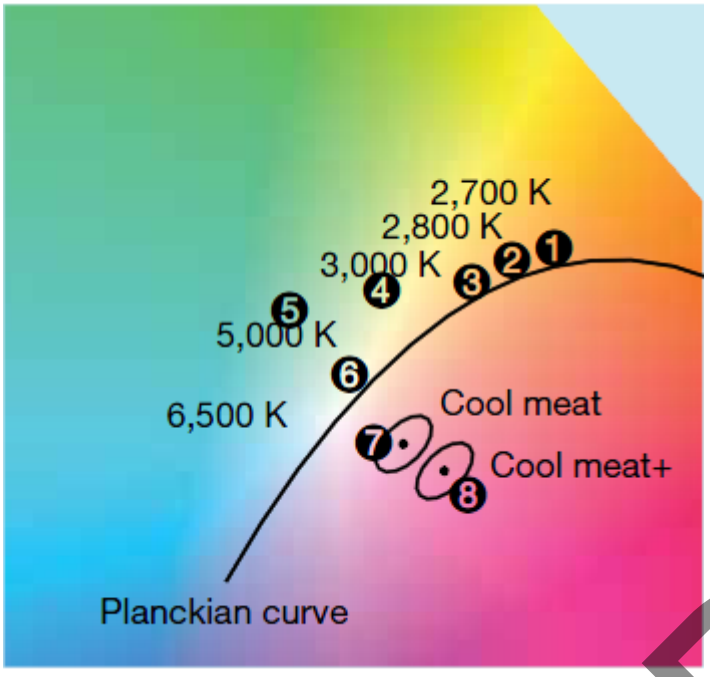
System Overview

colourSWITCH mode



Location of the defined colour temperatures

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Setting the colour temperature

The procedure for setting the colour temperature is identical for both the colourTEMPERATURE mode and the colourSWITCH mode:

- Press the pushbutton briefly to advance the colour temperature by one value

Setting the dimming level

The procedure for setting the dimming level is identical for both the colourTEMPERATURE mode and the colourSWITCH mode:

- Press the pushbutton briefly to advance the dimming level by one value

Changing the mode

To toggle between the different setting options hold down the pushbutton. After 2, 10 and 15 seconds the device will flash briefly. These are known as the 1st, 2nd and 3rd flashing phases. Depending on the flashing phase in which the pushbutton is released (1st, 2nd or 3rd), the changes are as follows:

- 1st flashing phase (after about 2 s): The device toggles between setting the colour temperature and setting the dimming level
- 2nd flashing phase (after about 10 s): The device changes from colourSWITCH mode to colourTEMPERATURE mode
- 3rd flashing phase (after about 15 s): The device changes from colourTEMPERATURE mode to colourSWITCH mode

System Overview

NOTICE

If the pushbutton is released more than 5 seconds after the 2nd flashing phase this cannot be assigned to either flashing phase and will be ignored.
This can be used to avoid incorrect entries.
If the right time for releasing the pushbutton has passed all you need to do is to allow the appropriate time to elapse and start the process again.

NOTICE

Only one setting change is possible per switching operation.
For example, to switch from colour temperature to dimming level and from colourTEMPERATURE mode to colourSWITCH mode you must activate flashing phase 1 and then flashing phase 3.
When selecting a flashing phase you must bear in mind the initial settings.
If the device is already in colourSWITCH mode then flashing phase 2 will not result in a change. The same applies to colourTEMPERATURE mode and flashing phase 2.

System Overview

3.3. Type codes

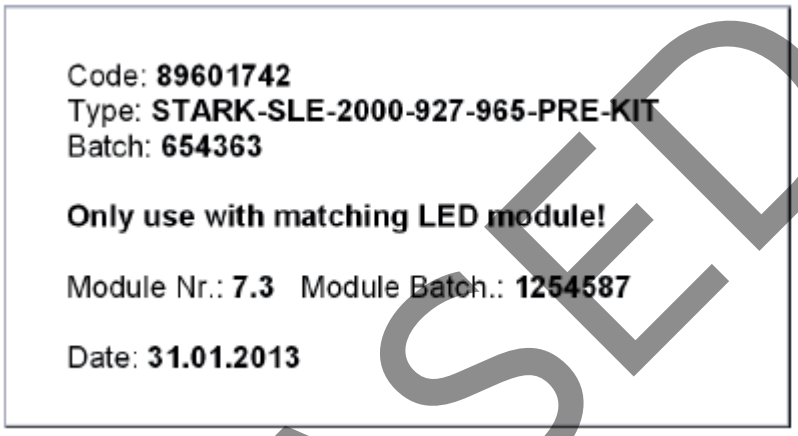
3.3.1. Type code for modules

The following type code is used to identify the modules. The table shows reference codes and their meaning for the SLE-PRE-W/OH-KIT.

SLE	-	2000	-	927 - 965	-	PRE	-	W/OH	-	KIT
Form		Luminous flux		CRI 90 Colour temperature between 2,700 and 6,500 K		Version		without housing		Bundled with LMAI

⚠ CAUTION

The SLE 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 LMAI 044/0500 with the corresponding module information.



3.3.2. Type code for LED control gear

The following type code is used to identify the LED control gear:

Type code for LED control gear for LCAU 2x020/0048 ... or example

Reference	LCAU	2x020	/	0048
Meaning	LED control gear, constant current	Power in W		Voltage in V

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

System Overview

3.4. Versions

3.4.1. Engine SLE premium

The SLE premium 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: 2,050 lm or 1,350 lm
- Colour rendering index CRI > 90
- Very small MacAdam 3 SDCM colour tolerance
- System efficiency of up to 65 lm/W with high energy savings
- Option for operating a 12 V active cooling system
- Temperature monitoring
- Plug'n Play connection between SLE premium KIT and converter

Control functions:

- DALI Device Type 8
- switchDIM
- colourSWITCH

Combinations

The SLE premium KIT version can be combined as follows:

Module	Luminous flux	LCAU 2x020/0048
STARK-SLE-2000-927-965-PRE-KIT	2,050 lm	✅
STARK-SLE-1400-927-965-PRE-KIT	1,350 lm	✅

Suitable connecting cables (LCAU - LMAI) are available in the following lengths:

- 1 m: CONNECT RJ45/RJ45 1.0m
- 2 m: CONNECT RJ45/RJ45 2.0m

Suitable connecting cable (LMAI - SLE modules):

System Overview

- 0.2 m: accessories CONNECT 10PIN PLUG/10PIN PLUG 0.2m

System Overview

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

2006/95/EG	Low-voltage directive: Directive relating to electrical equipment for use within certain voltage limits
2004/108/EG	EMC(1) directive: Directive relating to electromagnetic compatibility

(1) EMC: Electromagnetic compatibility

RoHS

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

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

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

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

System Overview

3.5.2. Standards and directives for LED control gear

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

EMI

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

EN 50172 2005	Safety lighting systems

DALI

IEC 62386-101:2009	General requirements, system
IEC 62386-102:2009	General requirements, controller
IEC 62386-207:2009	Special requirements, controller; LED modules
IEC 62386-209:2010	Special requirements, controller; colour control

Mechanical Aspects

4.1. Installation

4.1.1. Installation versions

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/technical-docs.asp

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

In-built version | Remote version

Tool for screw assembly | Connection side Base | Base plate of the module

Mechanical Aspects

4.1.2. Notes on installation

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

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

Protection measures against damage

Mechanical stress

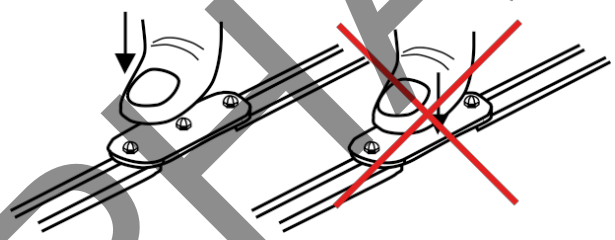
Modules contain electronic components that are sensitive to mechanical stress. Such stress should be kept to an absolute minimum. In particular the following mechanical stresses should be avoided as these may cause irreversible damage:

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

Compressive stresses

The components of the 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 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:

Mechanical Aspects

- 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)

HINWEIS

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.
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

Mechanical Aspects

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 synthet. oils	_ siloxanes _ fatty acids	_ silicone oils _ linseed oil _ fats
Harder, vulcanizer	_ sulfur compounds	_ seals _ sealants _ colours

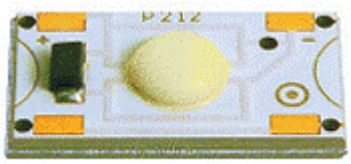
Protection measures for the glob top material

The following guidelines must be observed to avoid damage to the glob-top:

- Make sure that the chemicals used in LED applications are not solvent-based, condensation crosslinked or acetate crosslinked (acetic acid). These give rise to reagents (e.g. solvent vapors, acetic acid) that may damage LED modules or the encapsulant. This applies to chemicals that are used not in the immediate vicinity of the modules (e.g. seals) and also to chemicals that come into direct contact with the modules (e.g. insulating coatings, adhesives).
- To ascertain the chemicals used and the type of cross linking a technical data sheet containing a list of substances must be requested from the manufacturer.

Example of damaged encapsulant material, recognizable by the change of the chromaticity coordinates:

powerLED P211, original



powerLED P211, damaged by dissolver waste gas

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 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 tc 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

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.

Mechanical Aspects

Packaging and transport

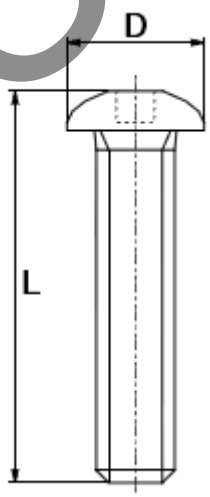
Products from Tridonic are delivered in appropriate packaging. The packaging provides special protection against mechanical damage and ESD (electrostatic discharge). If you need to transport products you should use this packaging.

4.1.3. Installing the modules

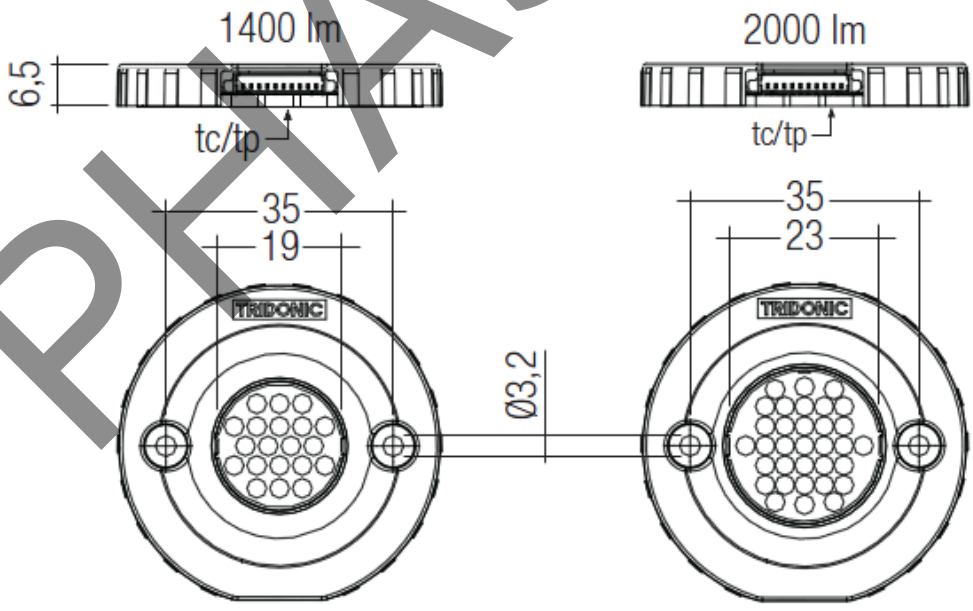
The modules are mounted on a heat sink with 2 bolts per module. In order not to damage the modules only raised head bolts should be used. The bolts should be selected on the basis of the following dimensions:

Dimensions of the fastening bolts

Bolt size	M3
Max. diameter D	5.8 mm
Min. length L	10 mm
Max. length L	Depending on the design of the luminaire and the heat sink



4.2. Dimensional drawings modules



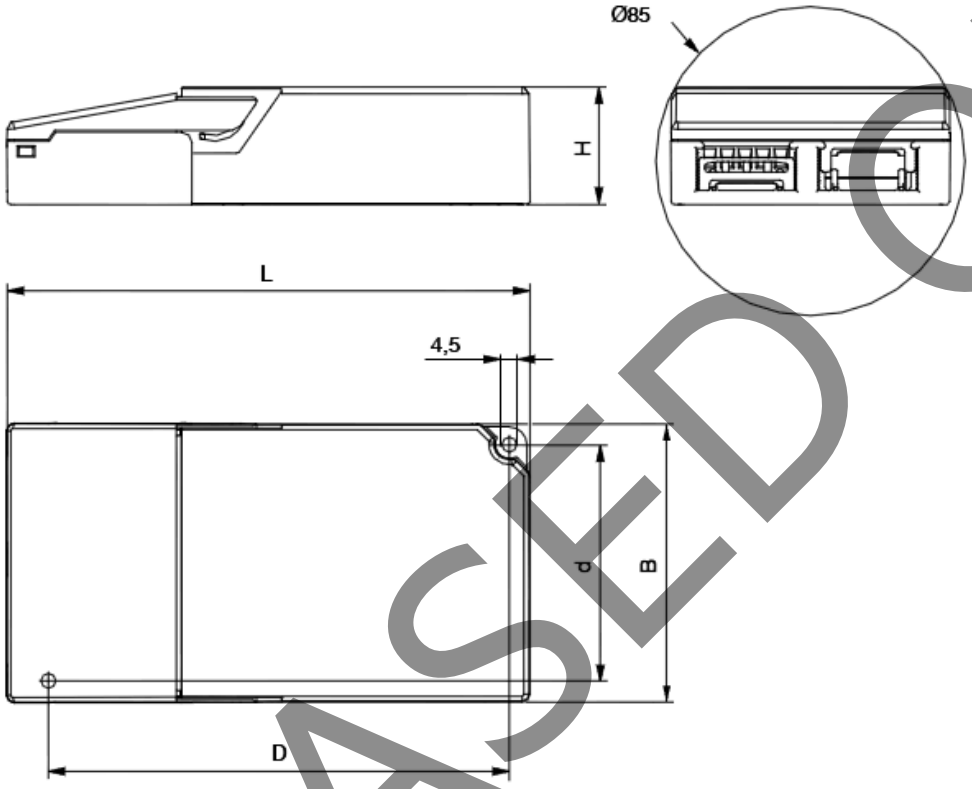
Mechanical Aspects

Dimensional drawing of the module SLE premium

NOTICE

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

4.2.1. Dimensional drawings LED control gear

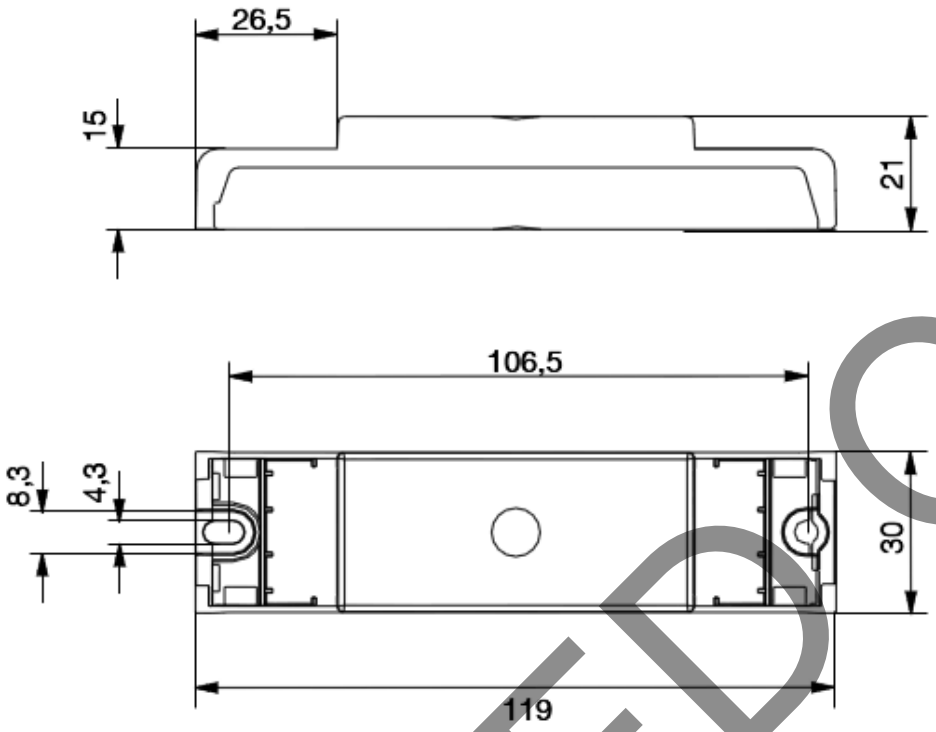


LED control gear for SLE premium

Length L	150 mm
Width W	79.5 mm
Height H	34 mm
Hole spacing D	127.6 mm
Hole spacing d	68.6 mm

Mechanical Aspects

4.2.2. Dimensional drawing LMAI



NOTICE

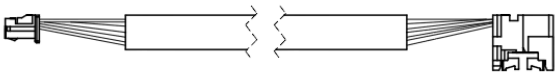
Detailed information and CAD data for the LED control gear can be downloaded from the Tridonic homepage (www.tridonic.com) and the relevant product page.

Electrical Aspects

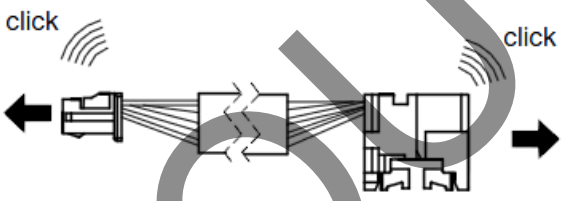
5.1. Electrical connections

5.1.1. Connection between the SLE premium and the Remote LMAI

In the case of the SLE premium KIT version, the connection between the modules and the Remote LMAI is made with a cable and connector at both ends. The cable is available in a length of 0.2 m. The possible maximum length is 0.5 m.



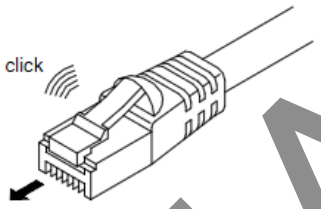
Plug connection on the module



Plug connection on the Remote LMAI

5.1.2. Connection between the Remote LMAI and the LED control gear

Special Tridonic cables for connecting the Remote LMAI to the LED control gear are available to ensure efficient and reliable operation of the SLE premium system.
The connection between the Remote LMAI and the LED control gear is made via a cable with an RJ45 connector at both ends. The cable is available in lengths of 1 m and 2 m and meets the requirements of CAT.5e UTP.



Plug connection on the Remote LMAI and the LED control gear

5.1.3. Electrical safety

All the components of the SLE premium system comply with the SELV standard. The voltages are therefore less than 50 V.
Safety extra low voltage (SELV) is defined as ac voltages up to 50 V rms and dc voltages up to 120 V. SELV is part of the low-voltage range. These voltages are not life-threatening to an adult and correspond to the maximum constant contact voltage or fault voltage. Thanks to SELV voltage, the luminaire can be replaced without risk. There is no need in this case to disconnect the luminaire from the power supply.

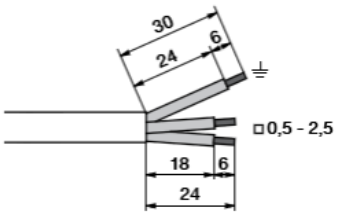
5.1.4. Screw terminals on the LED control gear

The connections between the LED control gear and the power supply and the connections of the control lines are made via screw terminals on the LED control gear.

- Screw size M3

Electrical Aspects

- Max. torque 0.5 nm
- Diameter of the cables for strain relief 6.3 to 9.7 mm
- Permissible cable cross-section for terminal: 0.5-2.5 mm²



5.2. Connections on the LED control gear

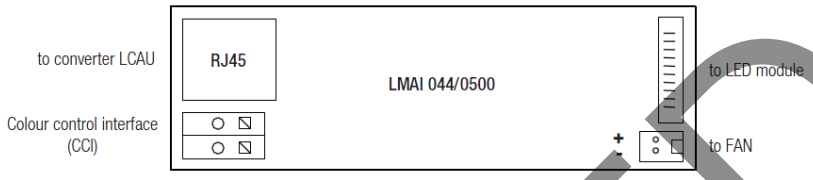
5.2.1. Connections on the LED control gear and the Remote LMAI for SLE premium

Pin / connection	Connection on the converter	Design
⏚	Function earth	Screw terminal
~	Power input 230 – 240 V AC	Screw terminal
~	Power input 230 – 240 V AC	Screw terminal
CS	Control input for colourSWITCH	Screw terminal
DA	Control input for DALI / switchDIM	Screw terminal
DA	Control input for DALI / switchDIM	Screw terminal
LAMP 1	Remote LMAI	RJ45
LAMP 2	Remote LMAI	RJ45

Electrical Aspects

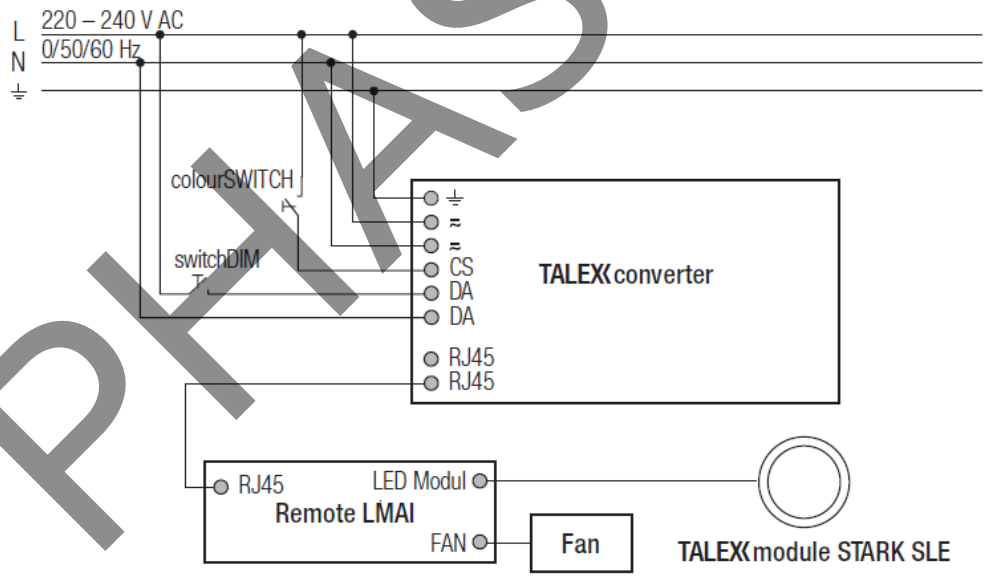
Pin / connection	Connection on the Remote LMAI	Design
RJ45	Converter	RJ45
+FAN	Feed for active cooling	plug-in terminal
-FAN	Feed for active cooling	plug-in terminal
LED Modul	SLE premium	plug-in terminal
CCI	Colour Control Interface	Spring terminal
CCI	Colour Control Interface	Spring terminal

Wiring of converter LMAI 044/0500

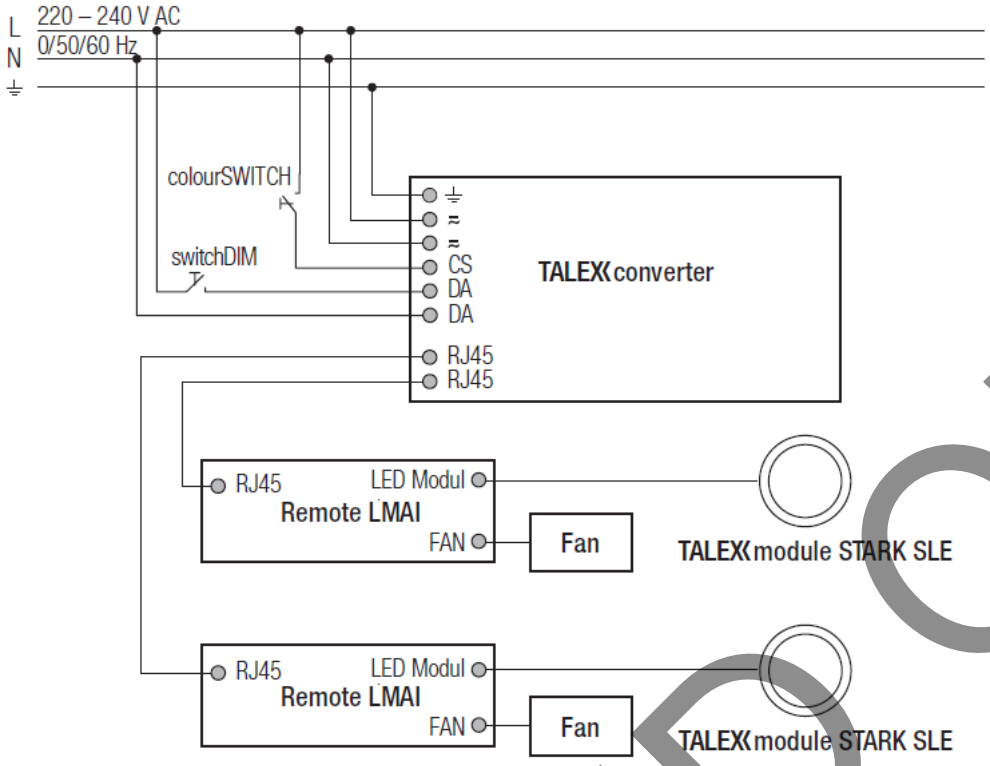


5.3. Wiring diagrams

5.3.1. Wiring diagram for switchDIM and colourSWITCH für SLE premium

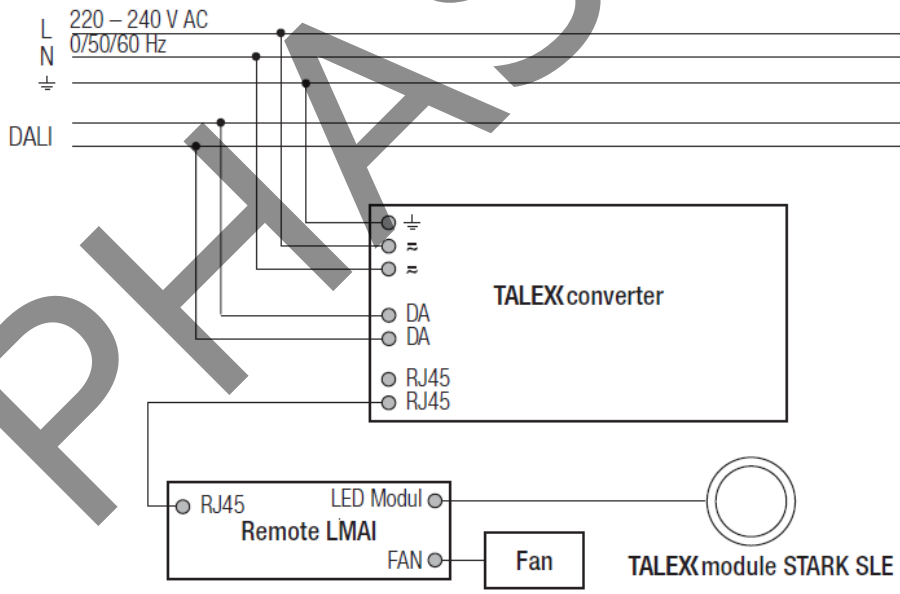


Electrical Aspects

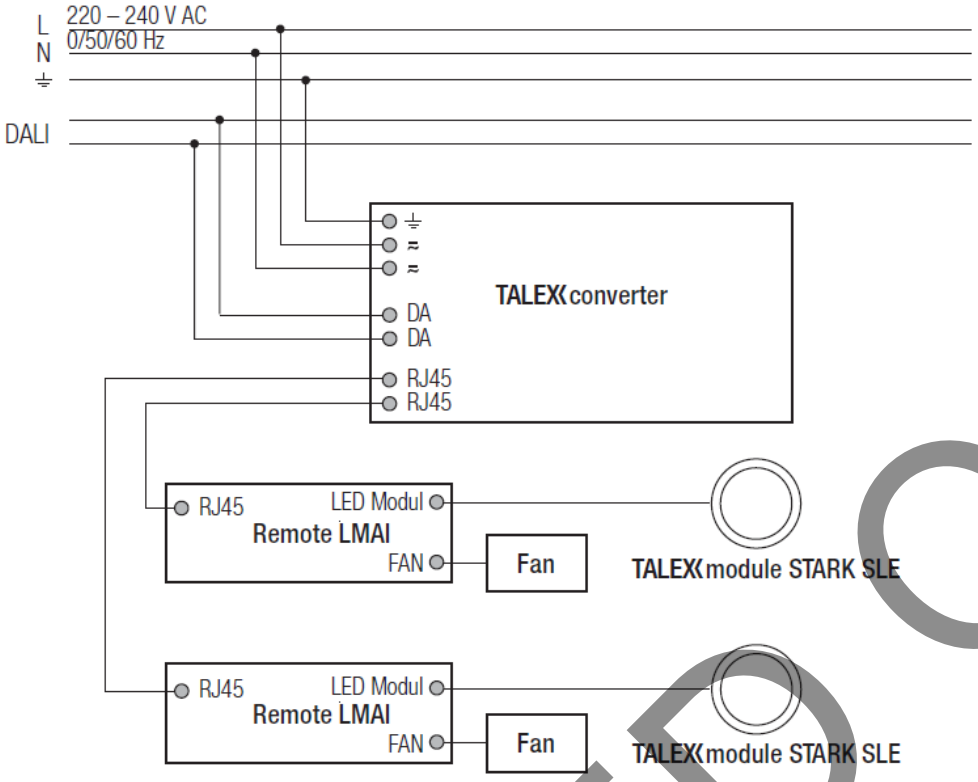


The wiring diagram shows the connection between an LED control gear and up to two SLE premium KIT modules and the connection between the LED control gear and the power supply.
The integrated switchDIM and colourSWITCH functions are operated via appropriate momentary-action switches.

5.3.2. Wiring diagram for DALI for engine SLE premium



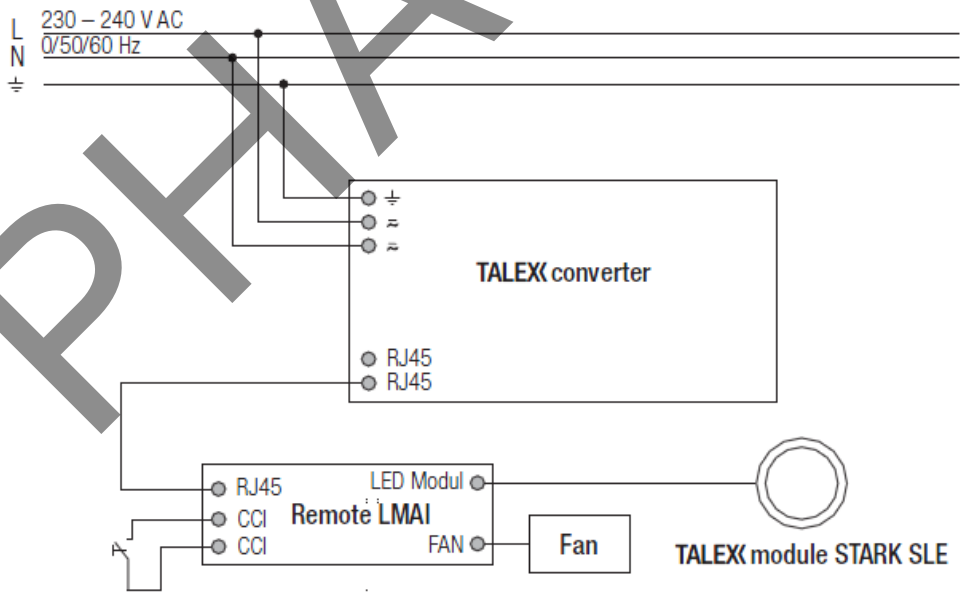
Electrical Aspects



The wiring diagram shows the connection between an LED control gear and up to two SLE premium KIT modules and the connection between the LED control gear and the power supply and also between the LED control gear and the digital DALI signal.
The LED control gear of the engine SLE premium system support DALI Device Type 8.

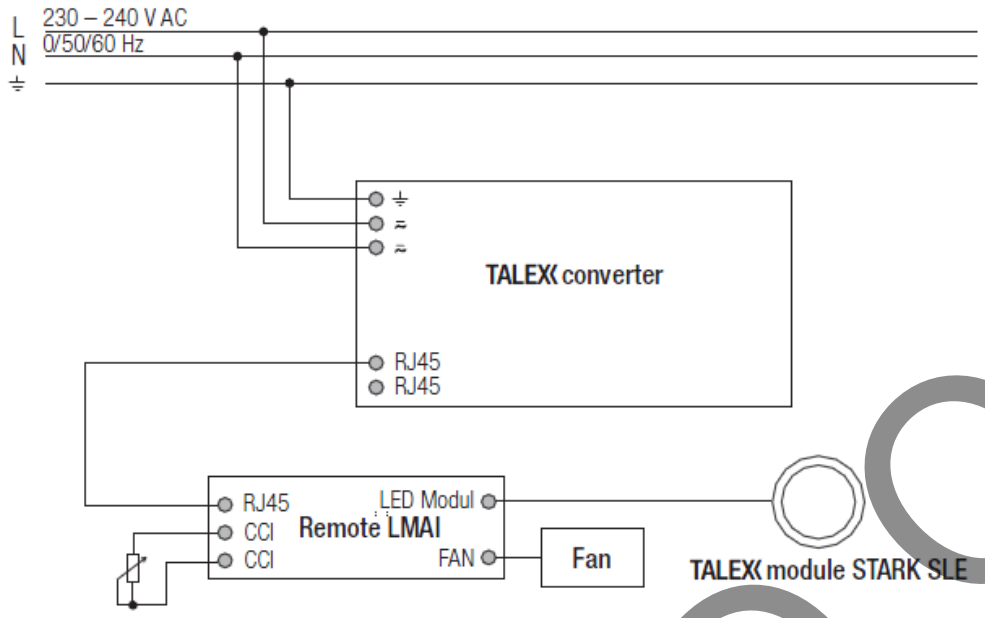
5.3.3. Wiring diagram for engine SLE premium to control by CCI (Colour Control Interface)

Operating with single momentary-action switch



Electrical Aspects

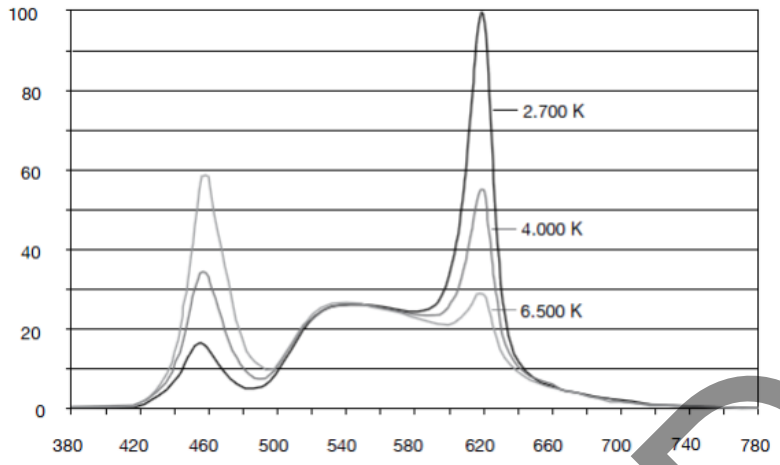
Operating with continously variable potentiometer



Optical Aspects

6.1. Colour spectrum

The PI-LED® technology used in the LED products 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.



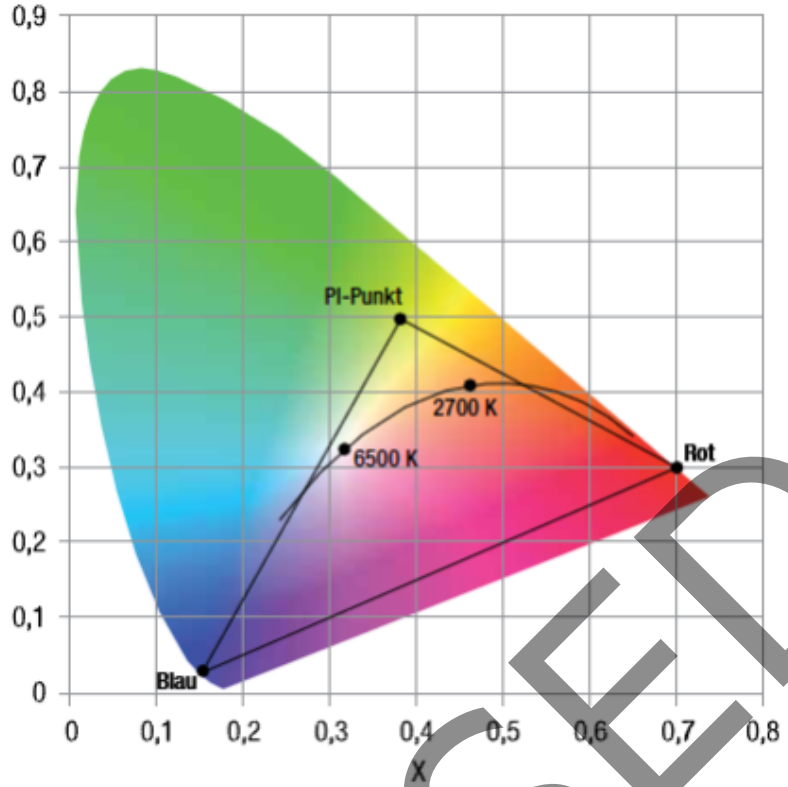
Colour spectrum at different colour temperatures

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

Optical Aspects

6.1.1. Coordinates and tolerances (to CIE 1931)

As before, the production process for 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.



Location of the measuring points along the Planckian curve:

Ambient temperature of the measurement	t_a = 25 °C
Measurement tolerances of the colour coordinates	±0,01

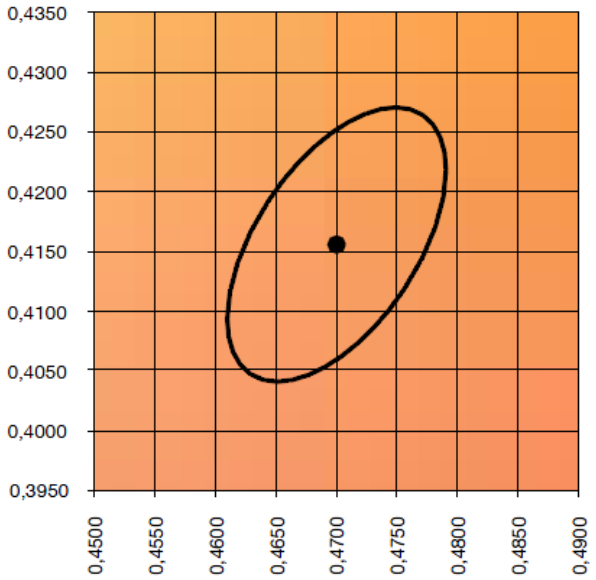
6.2. Coordinates and tolerances

6.2.1. Light colours

SLE premium covers all the light colours below.

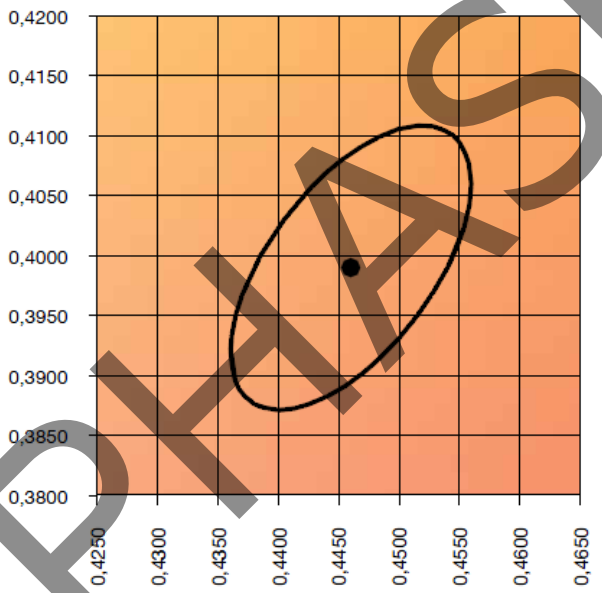
Optical Aspects

MacAdam Ellipse: 2,700 K (Gold)



	x0	y0
Centre	0.4700	0.4160

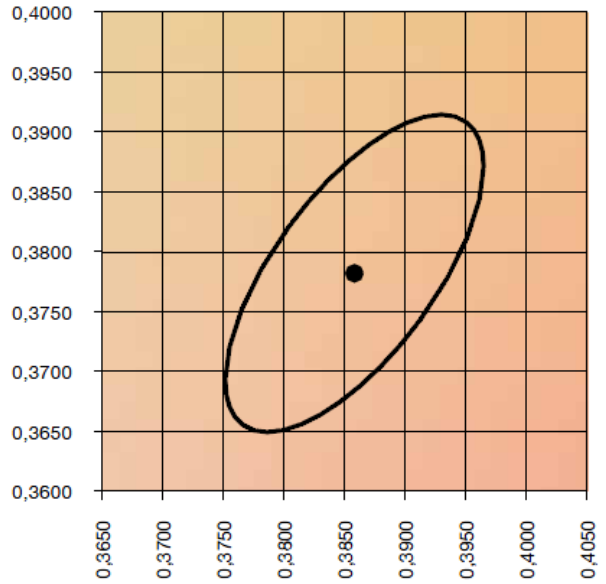
MacAdam Ellipse: 3,000 K



	x0	y0
Centre	0.4460	0.3990

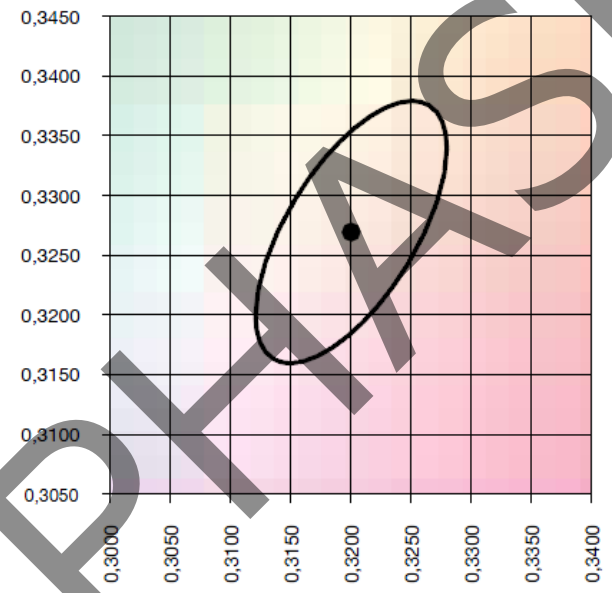
Optical Aspects

MacAdam Ellipse: 4,000 K



	x0	y0
Centre	0.3860	0.3780

MacAdam Ellipse: 6,500 K



	x0	y0
Centre	0.3200	0.3270

Optical Aspects

6.2.2. 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.

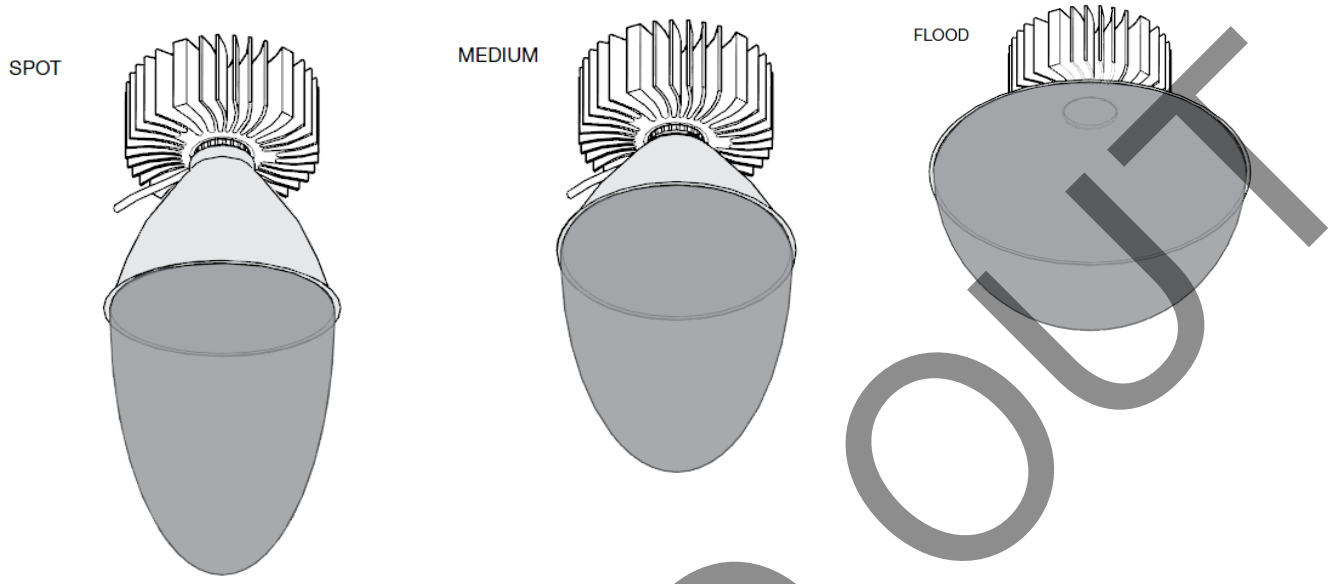
6.3. Reflector design and beam characteristics

6.3.1. Reflector design

The mechanical and optical properties of the modules of the engine SLE premium system offer the best conditions for using reflectors. The overall efficiency of the system can be optimized by choosing a reflector that directs the light appropriately.
The optical properties (e.g. beam angle) and the dimensions of the reflector play a crucial role.
The overall height of the luminaire can be reduced by selecting a low-profile reflector, depending on the beam angle required. This may improve the thermal output of the luminaire by increasing the height available for the heat sink.
To achieve uniform illumination a reflector with an integrated diffuser is recommended for LED modules with multicolour LEDs. This ensures that the colours are properly mixed. Some reflectors have the option of faceting for the reflector wall. Depending on the position of the homogenising element, different efficiencies and different colour mixing results can be achieved.

Optical Aspects

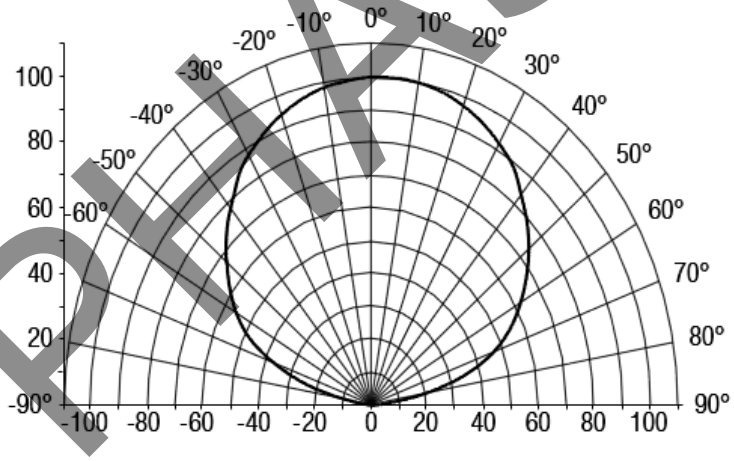
Examples of reflectors with different beam angles



NOTICE

Tridonic can supply the CAD data for the modules on request to help create customised designs and to carry out optical simulations.

6.3.2. Beam characteristics, module SLE premium

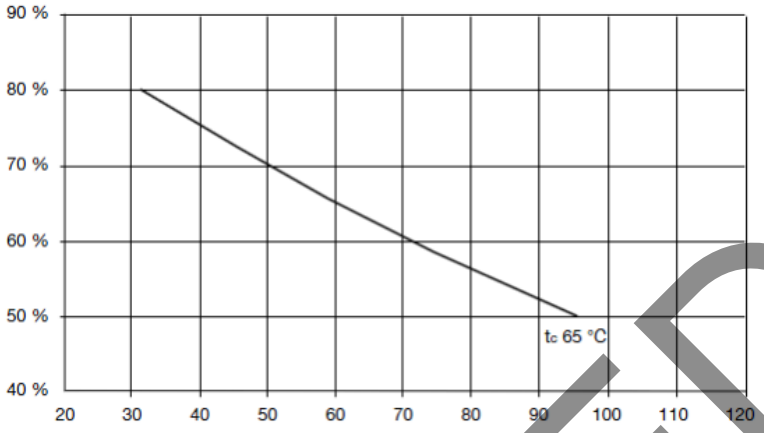


Thermal Aspects

7.1. Module cooling

7.1.1. Effect of cooling on the life of the modules

The modules of the engine SLE premium system have been designed to operate with a passive or active heat sink and can be mounted directly on such a suitable heat sink.
The life of the module depends to a large extent on the operating temperature. The more that the operating temperature can be reduced by cooling, 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.



Lifetime characteristic

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 %	32,000 h
70 %	50,000 h
50 %	91,000 h

NOTICE

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

7.1.2. 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.

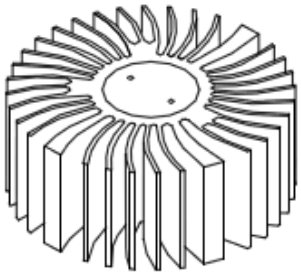
Thermal Aspects

NOTICE

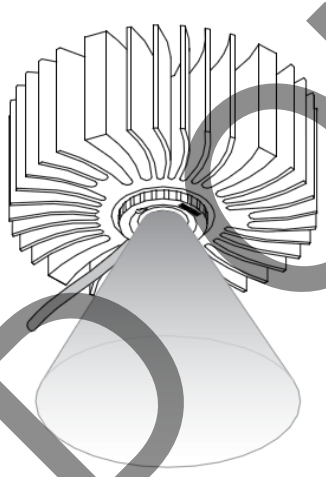
Please check the information on heat sinks in the module data sheets.

7.2. Passive and active cooling

7.2.1. Passive cooling



Passive cooling module



Example of passive cooling for the module

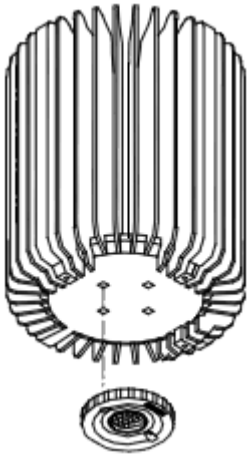
Heat transfer from a heat source to the surrounding cooling medium (e.g. air) depends primarily on the difference in temperature, the effective surface area and the flow rate of the cooling medium. The function of a heat sink is to increase the surface area over which the heat can be dissipated. This 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

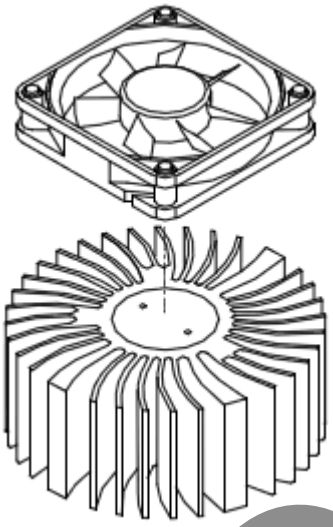
- Energy savings
- Silent
- No mechanical wear
- No maintenance

Thermal Aspects

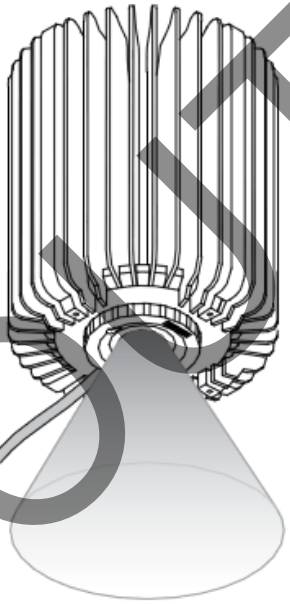
7.2.2. Active cooling



Round active cooling module round



Square active cooling module



Example of active cooling for the module

An active heat sink consists of the heat sink itself and an electrically powered fan. The fan dissipates heat from the heat sink by blowing a sufficient quantity of air along the surface of the heat sink. To reduce the power draw and noise, the fan speed can be controlled from the active cooling system on the basis of temperature. The fan speed is not controlled from the engine STARK system. A diaphragm can be used as an alternative to fans to produce active air movements.
Active heat sinks with fan cooling achieve around six times the performance of passive heat sinks for the same amount of material used. Active heat sinks can therefore be made very compact.

Benefits of active cooling

- Space savings
- Effective cooling
- Professional design

7.3. Fan connection and temperature measurement

7.3.1. Connection of the fan to the SLE premium module

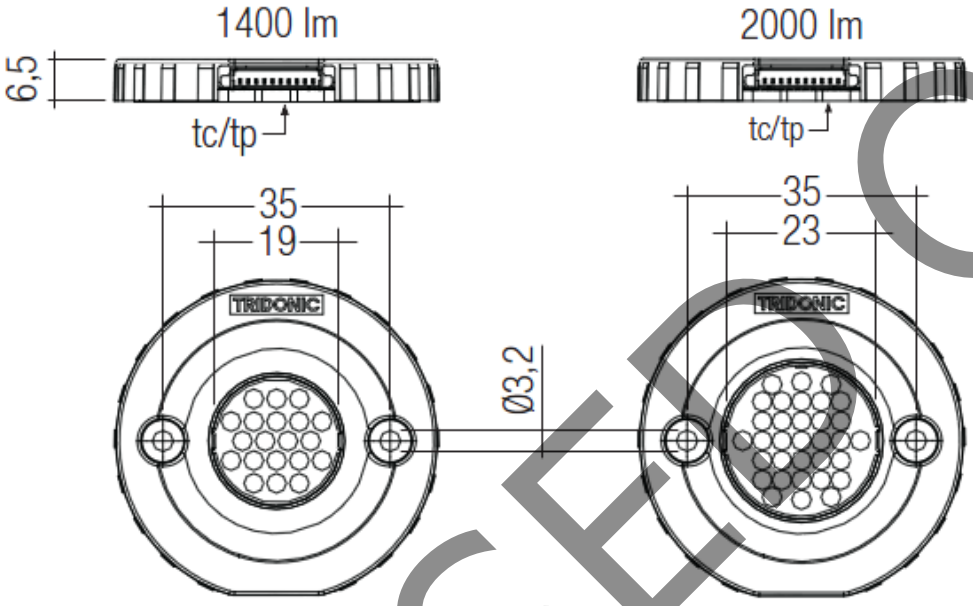
For active cooling for the SLE premium version one fan per module can be connected directly to the remote LMAI.

Thermal Aspects

12 V fan connection on the remote LMAI

Pin 1	+
Pin 2	-

7.3.2. Temperature measurement on the module



There is a t_c point underneath the modules for checking the temperature of the modules:
The temperature at the t_c point can be measured with a simple temperature probe. Since the underside of the modules is made from anodized aluminium, any measurements made by an infra-red camera would lead to inaccurate results.
In actual practice, thermocouples (e.g. B & B Thermotechnik thermocouple, K-type) have been successfully used for taking measurements. 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 of the luminaire, 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.

7.3.3. Temperature management of the LED control gear

Although the LED control gear has 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 temperature at the t_c point on the LED control gear can be measured with a simple temperature probe. The t_c point on the LED control gear is indicated by a sticker on the casing.

Ordering information and sources

NOTICE

Measurement conditions, sensors and handling are described in detail in standard EN 60598-1 “General requirements and tests for luminaires”.

8.1. Article numbers

8.1.1. Engine SLE premium with 2.050 lm

Product name	Description	Article number
SLE 2000-927-965-PRE-KIT	LMAI + SLE2000 with housing	89601742
SLE 2000-927-965-PRE-W/OH-KIT	LMAI + SLE2000 without housing	89601743
LCAU 2x020/0048 L010 one4all	LED control gear, In-built	28000907
LCAU 2x020/0048 L020 one4all	LED control gear, Remote	28000887
CONNECT RJ45/RJ45 1.0m	Connection cable (LCAU - LMAI), length 1 m	24166480
CONNECT RJ45/RJ45 2.0m	Connection cable (LCAU - LMAI), length 2 m	24166481
CONNECT 10PIN PLUG/10PIN PLUG 0.2m	Connection cable (LMAI - SLE module), length 0.2 m	24166482

8.1.2. Engine SLE premium with 1.350 lm

Product name	Description	Article number
SLE 1400-927-965-PRE-KIT	LMAI + SLE1400 with housing	89601740
SLE 1400-927-965-PRE-W/OH-KIT	LMAI + SLE1400 without housing	89601741
LCAU 2x020/0048 L010 one4all	LED control gear, In-built	28000907
LCAU 2x020/0048 L020 one4all	LED control gear, Remote	28000887
CONNECT RJ45/RJ45 1.0m	Connection cable (LCAU - LMAI), length 1 m	24166480
CONNECT RJ45/RJ45 2.0m	Connection cable (LCAU - LMAI), length 2 m	24166481
CONNECT 10PIN PLUG/10PIN PLUG 0.2m	Connection cable (LMAI - SLE module), length 0.2 m	24166482

Ordering information and sources

8.1.3. 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 SLE premium.

Product name	Article number
DALI MSensor 02	28000896
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.

8.1.4. Product application matrix

Whether you are looking for wide-area lighting or focused accent lighting, our wide range of TALEXX 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 control gear, amplifiers and sequencers round off the components for a perfect system solution: They guarantee ideal operation and maximum efficiency.

Luminaire application engine

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

Ordering information and sources

Luminaire application module

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

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

Ordering information and sources

8.2. Partners

8.2.1. Heat sinks

Heat sinks with **active and passive cooling** to match the module can be obtained from the following manufacturers:

BRYTEC AG Brytec GmbH
Vierthalerstrasse 5
AT-5020 Salzburg
T +43 662 87 66 93
F +43 662 87 66 97
info@brytec.at

Cooliance GmbH
Im Ferning 54
76275 Ettlingen
Germany
Tel: +49 7243 33 29 734
Fax. +49 7243 33 29 735
info@cooliance.eu

MechaTronix
4 to 6F, No.308 Ba-De 1st Rd.,
Sinsin district, Kaohsiung City 80050,
Taiwan
Tel: +886-7-2382185
Fax: +886-7-2382187
sales@mechatronix-asia.com
www.mechatronix-asia.com

Nuventix
Vertrieb Österreich
EBV Distributor
Schonbrunner Straße 297-307
1120 Wien
T +43 1 89152-0
F +43 1 89152-30
www.ebv.com

SUNON European Headquarters
Sales area manager
Direct line: 0033 1 46 15 44 98
Fax: 0033 1 46 15 45 10
Mobile: 0033 6 24 07 50 49
andreas.rudel@sunoneurope.com

Heat sinks with **active cooling** can be obtained from the following manufacturers:

Francois JAEGLE
NUVENTIX EMEA Sales and Support Director
+33 624 73 4646
PARIS
fjaegle@nuventix.com

Ordering information and sources

Heat sinks with **passive cooling** can be obtained from the following manufacturers:

AVC
Asia Vital Components Europa GmbH
Willicher Damm 127
D-41066 Mönchengladbach
T +49 2161 5662792
F +49 2161 5662799
sales@avc-europa.de

FrigoDynamics GmbH
Bahnhofstr. 16
D-85570 Markt-Schwaben
Germany
+49-8121-973730
+49-8121-973731
www.frigodynamics.com

8.2.2. Heat-conducting foil and paste

Heat-conducting **foil** (e.g. Transtherm® T2022-4, or Transtherm® Phase Change) for thermal connection between the module and a heat sink is available from the following partner:

BALKHAUSEN Division of Brady GmbH
Rudolf-Diesel-Straße 17
28857 Syke
Postfach 1253, 28846, Syke
T +49 4242 692 0
F +49 4242 692 30
angebot@balkhausen.de

Kunze Folien GmbH
Raiffeisenallee 12a
D-82041 Oberhaching
Tel: +49 89 66 66 82-0
Fax: +49 89 66 66 82-10
info@heatmanagement.com

3M Electro&Communications Business
4C, 3M House, 28 Great Jackson St
Manchester, M15 4PA
Office: +44 161 237 6182
Fax: +44 161 237 1105
www.3m.co.uk/electronics

Heat-conducting **paste** (e.g. Silicone Fluid Component) for thermal connection between the module and a heat sink is available from the following partner:

Shin-Etsu Chemical Co. Ltd.
6-1, Ohtemachi 2-chome

Ordering information and sources

Chiyoda-ku
Tokyo 100-0004
Japan

8.2.3. LED housing

LED housing is available from the following partner:

A.A.G. STUCCHI s.r.l. u.s.
Via IV Novembre, 30/32
23854 Olginate LC
Italy
Tel: +39.0341.653.204
Mob: +39.335.611.44.85
www.aagstucchi.it

8.2.4. Reflector solutions and reflector design

Reflector solutions and support for reflector design are available from the following partners:

ALMECO S.p.A.
Via della Liberazione 15
Tel: +39 02 988963.1
Fax: +39 02 988963.99
info.it@almecogroup.com

Alux-Luxar GmbH & Co. KG
Schneiderstrasse 76
40764 Langenfeld
Germany
T +49 2173 279 0
sales@alux-luxar.de

Jordan Reflektoren GmbH & Co. KG
Schwelmerstrasse 161-171
42389 Wuppertal
Germany
T +49 202 60720
info@jordan-reflektoren.de

KHATOD
OPTOELECTRONIC
Via Monfalcone, 41
20092 Cinisello Balsamo (Milan)
ITALY
Tel: +39 02 660.136.95
Fax: +39 02 660.135.00
Christian Todaro
Mobile: +39 342 8593226

Ordering information and sources

Skype: todaro_khatod
c.todaro@khatod.com
www.Khatod.com

LEDIL OY
Tehdaskatu 13
24100 Salo, Finland
F +35 8 2 7338001

8.2.5. Tridonic sales organisation

The complete list of the global Tridonic sales organisation can be found on the Tridonic homepage at address list.

8.2.6. Additional information

Go to www.tridonic.com to find your personal contact at Tridonic.

Further information and ordering data:

- LED catalogue at www.tridonic.com menue Services > Literature > Catalogue
- Data sheets at www.tridonic.com menue Technical data > Data sheets
- Certificates at www.tridonic.com menue Technical data > Certificates