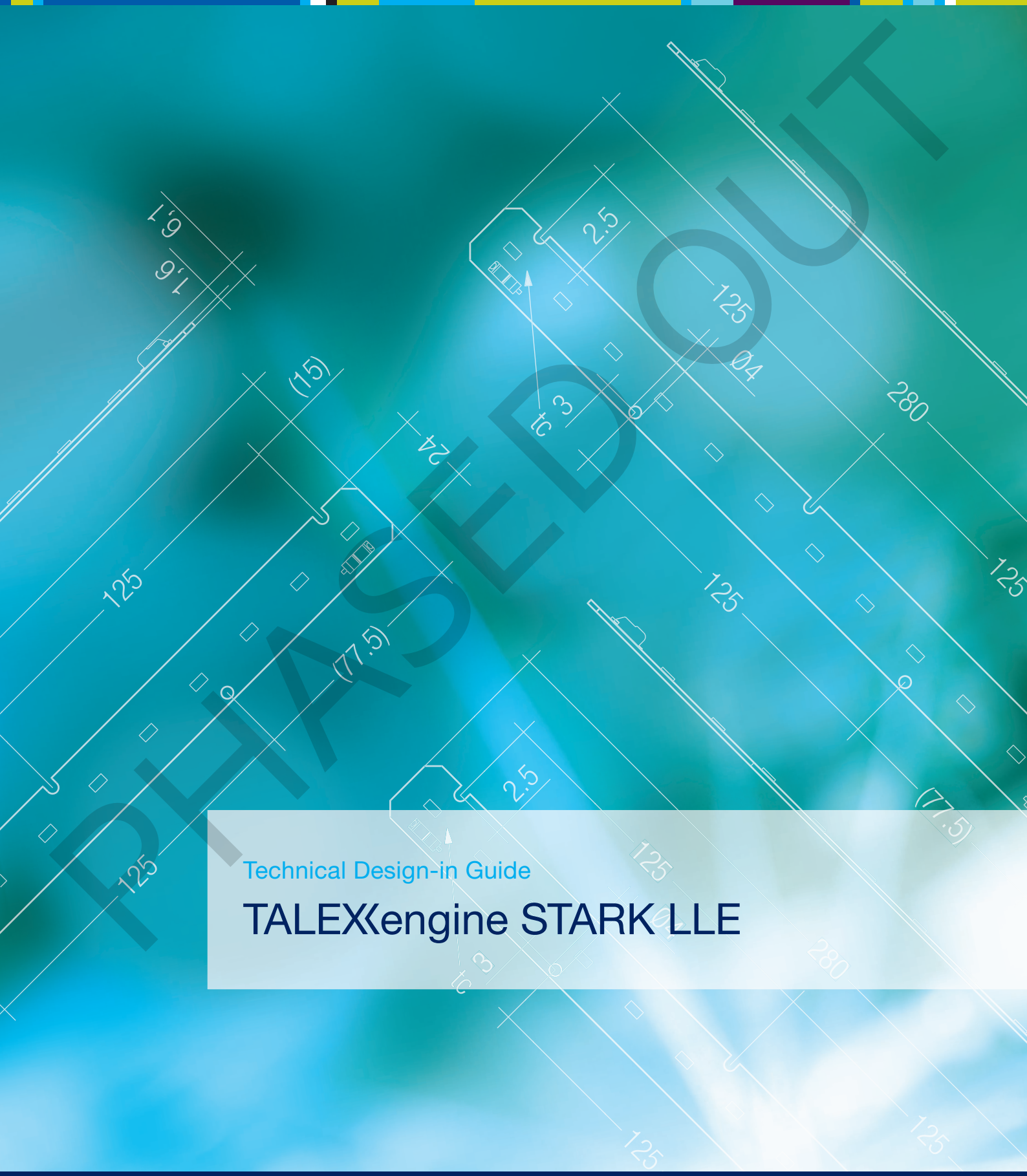
TRIDONIC

enlightening your ideas



Technical Design-in Guide

TALEXengine STARK LLE

Table of contents

Description

A new era has dawned with TALEXX-LED. Now, high-quality light and optimum efficiency are no longer mutually exclusive. The versatile system solutions from Tridonic provide the basis for outstanding lighting designs that are future-proof, economical and eco-friendly in a wide range of applications.
LEDs come into their own in offices and educational institutions, in industry as well as technical working environments.

When designing LED lighting, there are certain differences compared to designs with conventional light sources. This design guide has been written to help you understand these differences. It answers all the most important questions you may have, such as on the right mechanical design, thermal management and optical conditions.

Complete system solution

LEDs offer major advantages in terms of general lighting: They are versatile, highly energy efficient and virtually maintenance free. With TALEXXengine STARK LLE you get a complete system solution from a single source comprising perfectly harmonised components: TALEXXmodule STARK LLE and TALEXXconverter.

The TALEXXengine STARK LLE offers impressive advantages:

- LED system solution with outstanding system efficiency of up to 112 lm/W consisting of a linear LED module and LED control gear
- Small colour tolerances of up to MacAdam 3
- Luminous flux of approximately 1,250 lumen per LED module (hot lumen measurement at 65°C for technical specification under real conditions)
- High colour rendering (CRI >80)
- Colour temperatures of 3,000 K, 4,000 K and 5,000 K
- Option of combining multiple products, also with TALEXXengine STARK QLE
- Emergency lighting compatible LED control gear in dimmable and non-dimmable versions
- Long lamp life of up to 50,000 hours
- Compliance with the mechanical and electrical standards of the luminaire industry

NOTICE

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.

Creative freedom

This linear LED module is virtually predestined for combination. When lined up lengthwise, narrow strip lighting is created and, in combination with the square sister product, TALEXXengine STARK QLE, any number of customised luminaire designs can be realised. Up to six LED modules can be operated with just one LED control gear.
The LED modules can be quickly wired up thanks to the push-in terminals.
This makes it extremely easy to both integrate efficient LED technology into existing luminaire designs and also realise new design ideas - irrespective of the optics as the TALEXXengine STARK LLE is suitable for all systems, from louvre to diffuser lights.

Warm and pleasant light

With excellent colour rendering and a choice of warm and neutral white colour temperatures, the LED system solution is a high-quality replacement for T5 and T8 fluorescent lamps - the result is pleasant and feel-good lighting.

Outstanding cost effectiveness

Compared to light installations with conventional lamps, TALEXX-LED reduces energy consumption by up to 40 percent. Its long service life means significantly lower maintenance and repair costs.
Experience a new world of lighting with TALEXX-LED!

Summary of the chapters

To make it easier to find your way around the Design-in Guide, we have grouped the information on the TALEXXengine STARK LLE system 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.

System overview

The TALEXXengine STARK LLE system is available in the versions LLE Classic, LLE24 Classic and LLE24. The relevant components can be clearly assigned by their type codes.

Mechanical aspects

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

Electrical aspects

The TALEXXmodule STARK LLE can be combined with a variety of LED control gear.

Electrical safety aspects, connection options, the connection between the LED control gear and the power supply and the connections are described and shown in the relevant wiring diagrams.

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 on beam characteristics and illumination strength.

Thermal aspects

The system modules are designed for operation with a passive heat sink and, to this end, can be mounted directly on a suitable heat sink. Information on heat sinks and temperature measurement is summarised in this section.

Ordering information and sources

Information on ordering heat sinks as well as where heat sinks, reflectors and accessories can be sourced can be found at the end of this document.

System overview

System versions

The TALEXXengine STARK LLE system is available in the following versions

Properties and functions	TALEXXengine STARK LLE CLASSIC	TALEXXengine STARK LLE24 CLASSIC	TALEXXengine STARK LLE24 CLASSIC EM
Colour temperature	3,000 K and 4,000 K	3,000 K, 4,000 K and 5,000 K	3,000 K und 4,000 K
Luminous flux*	1,250 lm or 1,190 lm	1,300 lm, 1,360 lm, 1,370 lm	1,300 lm, 1,360 lm, 240 lm, 250 lm
Colour rendering / colour tolerance	CRI > 80 / MacAdam 4 SDCM	Ra > 80 / MacAdam 3 SDCM	Ra > 80 / MacAdam 3 SDCM
System efficiency**	98 lm/W	108 lm/W	107 lm/W
DALI***	Device Type 6 for LED control gear with dimming function	Device Type 6 for LED control gear with dimming function	Device Type 6 for LED control gear with dimming function
DSI***	yes	yes	yes
switchDIM***	yes	yes	yes
corridorFUNCTION***	yes	yes	yes
Emergency light function	no	no	yes

* with a forward current of 350 mA
** in combination with TALEXXconverter LCAI 080/0350 with a colour temperature of 4,000 K, hot lumen measurement at 65 °C
*** in combination with TALEXXconverter LCAI

Converters

Components

A uniform naming concept has been adopted for the components. The TALEXXengine STARK LLE system (linear LED Engine) comprises the following components:

- TALEXXmodule STARK LLE CLASSIC
- TALEXXconverter
  Suitable LED control gear with various functions are available for operation of the modules.

- The EM Power LED 2-4 W can be used for operation of a decentralised emergency light function. A TALEXXmodule is
  then operated with minimal luminious flux.

NOTICE

Information on components for emergency light functions can be found on the Tridonic homepage led.tridonic.com a nd the respective product pages.

Efficiency of the modules

The high efficiency of the TALEXXmodule STARK LLE results not only in energy savings but also in a reduction in the thermal load. This means that more compact luminaires can be designed.

Area of application

- The components of the TALEXXengine STARK LLE system are suitable for indoor applications.
- TALEXXengine STARK LLE is mostly used in protection class I luminaires.

Operating functions

DALI

DALI functionality enables the modules to be digitally controlled via the DALI signal (16-bit Manchester Code). The possible functions depend on the controller used.
The minimum and maximum dimming levels can be programmed.
The control input is protected against polarity reversal and accidental connection to mains voltage up to 264 V AC.
The control line must be installed in accordance with the relevant directives on low voltage.

DSI

The DSI interface (Digital Serial Interface) allows luminaires to be controlled via a separate line, irrespective of the power supply cabling. If the room layout is changed, only the control line needs to be rerouted, the load line can be left unchanged. Switching on and off is controlled via the digital interface.
The low-voltage cable of the digital interface is polarity-free and can therefore be connected with either polarity to the DSI connection of the LED control gear.
TALEXXconverters with integrated DSI function are able to specify a minimum dimming value, maximum brightness and an emergency lighting value for all the connected operating devices in a control circuit. Using a digital interface ensures a consistent lighting level from the first to the last luminaire.
However, in contrast to DALI, the individual luminaires cannot be addressed separately.

switchDIM

The integrated switchDIM function enables a standard switch for dimming and switching to be connected directly. Pressing briefly on the switch (< 0.6 s) switches the LED control gear on or off. The last dimming value set will be recalled when the LED control gear is switched on.
Pressing the button for an extended period (> 0.6 s) serves to dim the connected module. The dimming direction (up/down) is changed when the switch is operated again.
Hold down the switch for about 10 seconds to synchronise all the connected devices to a dimming value of 50%. This prevents the LED control gear from starting at different dimming values or operating in the opposite dimming direction (e.g. with retrofit installations).

⚠ CAUTION!

Switches with glow lamps affect the switchDIM function and should therefore not be used for this purpose.

corridorFUNCTION

TALEXXconverters one4all together with commercially available motion detectors enable the corridorFUNCTION: Presence-controlled lighting systems can be programmed without an additional controller so that the light is not switched off when no one is present and, instead, dimmed to a minimal level - and possibly only switched off completely after a preset period of time.

Type codes and versions

Type code for modules

The following type code is used to unambiguously identify the modules:

Type code for modules using STARK LLE 24 1250 830 CLA as an example

Designation	STARK	LLE	24	1250	8	30	CLA
Meaning	Product	Form	Width	Luminous flux in lm	Ra > 80	Colour temperature 3,000 K	Version

Type code for LED control gear

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

Type code for LED control gear using LCI 080/0350 ....as an example

Designation	LCI	080	/	0350
Meaning	LED LED control gear, constant current non-dimmable	Power in W		Current in mA

Type code for LED control gear using LCAI 080/0350 ...as an example

Designation	LCAI	080	/	0350
Meaning	LED LED control gear, constant current dimmable	Power in W		Current in mA

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

NOTICE

Please note the system combinations with the matching components on the following pages.
Ordering information on the components can be found at the end of this document.

Versions

TALEXXengine STARK LLE

The TALEXXengine STARK LLE system is an attractive entrylevel solution for general LED illumination. Depending on the application TALEXXconverters with and without a dimming function are available.

Characteristics

- Colour temperature 3,000 K, 4,000 K or 5,000 K
- Colour rendering index CRI > 80
- Lumen values of approximately 1,250 lm
- Low colour tolerance of up to MacAdam 3 SDCM
- System efficiency of up to 112 lm/W with high energy savings and short payback time

Control functions

- ON/OFF via network with LED control gear without dimming function
- DALI, DSI, corridorFUNCTION and switchDIM with LED control gear with dimming function

Converter matrix

Possible combinations for serial wiring

TALEXXconverter in-built with dimming function

Converter	LCAI 080/350 one4all
Art. No.	86459392
Protection class	NON SELV
STARK-LLE-1250...*	4-6
STARK-LLE-24-1250...*	4-6
STARK-LLE-1250-EM...*	4-6

* Number of modules (min. - max.)

TALEXXconverter in-built without dimming function

Converter	LCI 080/350 I010	LCCI 016/035 Q010
Art. No.	86459366	86459213
Protection class	NON SELV	SELV
STARK-LLE-1250-830-CLA*	4-6	1
STARK-LLE-1250-840-CLA*	4-6	1
STARK-LLE-1250-850-CLA*	4-6	1

* Number of modules (min. - max.)

TALEXXconverter independent with dimming function

Converter	LCAI 015/0350 A020 one4all
Art. No.	86458899
Protection class	SELV
STARK-LLE-1250-830-CLA*	1
STARK-LLE-1250-840-CLA*	1
STARK-LLE-1250-850-CLA*	1

* Number of modules (min. - max.)

TALEXXconverter independent without dimming function

Converter	LCI 015/0350 E020
Art. No.	24166312
Protection class	SELV
STARK-LLE-1250-830-CLA*	1
STARK-LLE-1250-840-CLA*	1
STARK-LLE-1250-850-CLA*	1

*Number of modules (min. - max.)

Advantages and disadvantages of serial wiring

- Advantage: Very efficient operation with a non-SELV LED control gear
- Disadvantage: Additional protection measure is required in the luminaire

Possible combinations for parallel wiring

TALEXXconverter in-built without dimming function

Converter	LCI 050/1050 R010	LCI 055/1400 R010
Art. No.	86459216	86459217
Protection class	SELV	SELV
STARK-LLE-1250-830-CLA**	3	4
STARK-LLE-1250-840-CLA**	3	4
STARK-LLE-1250-850-CLA**	3	4

** Number of modules

TALEXXconverter independent with dimming function

Converter	LCAI 030/0700 A120 one4all
Art. No.	86458900
Protection class	SELV
STARK-LLE-1250-830-CLA**	2
STARK-LLE-1250-840-CLA**	2
STARK-LLE-1250-850-CLA**	2

** Number of modules

TALEXXconverter independent without dimming function

Converter	LCI 050/1050 T020	LCI 055/1400 T020	LCI 030/0700 E020
Art. No.	86459218	86459219	24166314
Protection class	SELV	SELV	SELV
STARK-LLE-1250-830-CLA**	3	4	2
STARK-LLE-1250-840-CLA**	3	4	2
STARK-LLE-1250-850-CLA**	3	4	2

** Number of modules

Advantages and disadvantages of parallel wiring

- Advantages: SELV level protection class Several modules can be operated in parallel with just one LED control gear
- Disadvantage: Possible reduction in service life (if a module fails or a cable breaks, the current of the other modules increases), tolerance-related differences in brightness as well as larger amount of cabling.

Standards and directives

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* directive: Directive relating to electromagnetic compatibility

RoHS

2002/95/EC	RoHS*-Directive: Directive on the restriction of the use of certain hazardous substances in electrical and electronic equipment

* 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"

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* requirements

* 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

Mechanical aspects

Installation

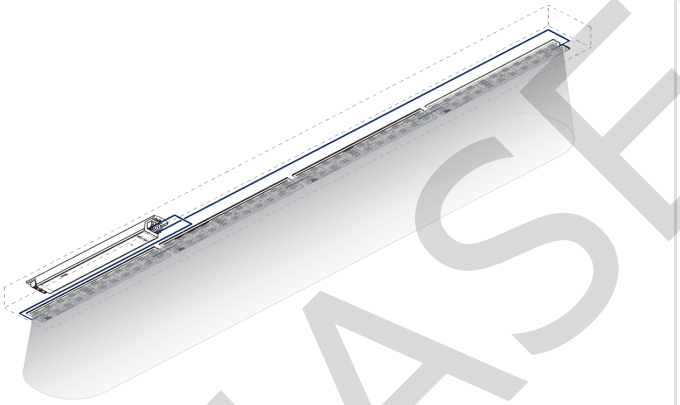
Installation details

NOTICE

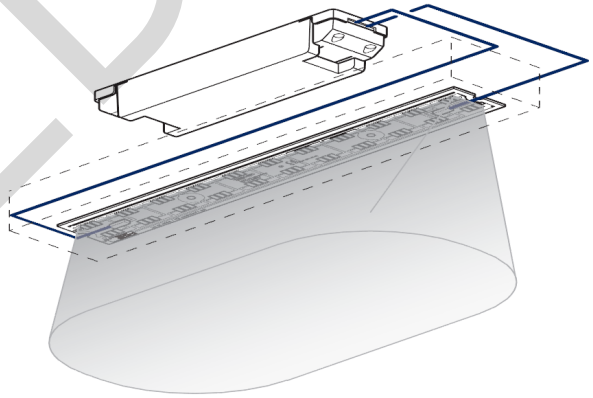
EOS/ESD safety guidelines
The device/module contains components that are sensitive to electrostatic discharge and may only be installed in the factory and on site if appropriate EOS/ESD protection measures have been taken. No special measures need be taken for devices/modules with enclosed casings (contact 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/technical-docs.asp

Installation example with TALEXXconverter and serial wiring

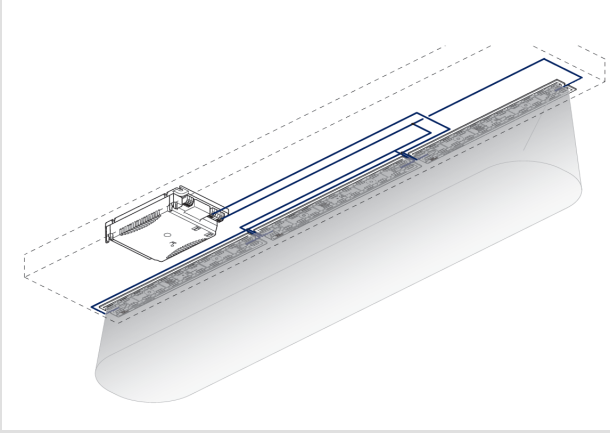
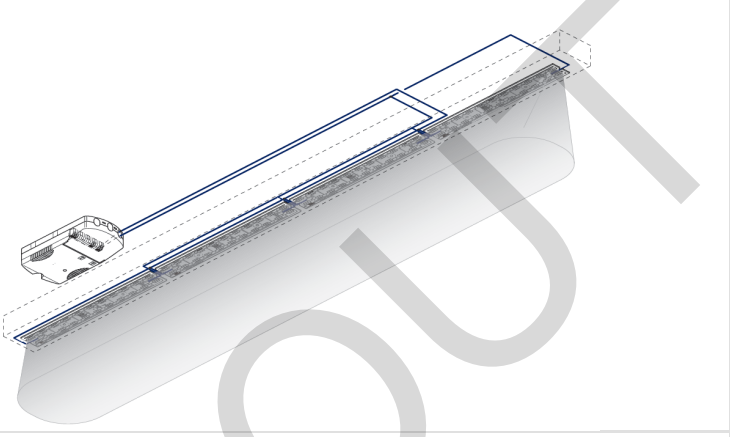


Installation version IN-BUILT serial wiring with TALEXXconverter LCAI 80 W 350 mA one4all



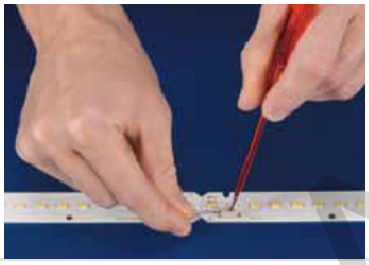
Surface-mounting version REMOTE with serial wiring with TALEXXconverter LCI 15 W 350 mA

Installation example with TALEXXconverter and parallel wiring

	
Installation version IN-BUILT parallel wiring with TALEXXconverter LCI 50 W 1050 mA	Surface-mounting version REMOTE with parallel wiring with TALEXXconverter LCI 55 W 1400 mA

Installation details

Depending on the particular situation, the LED control gear 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

Notes on installation

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

- Sufficient distance to active conducting materials
- Sufficient strain relief when the LED control gear cover is closed
- Sufficient cooling of the modules
  (the max. temperature at the tc point must not be exceeded)
- Unrestricted exit of light from the modules
- The module's push-in terminals allow easy wiring. They can be released via the trigger

NOTICE

Detailed information on the thermal connection and the position of the t_c point is given at "Thermal aspects".

Protection measures against damage

Mechanical stress

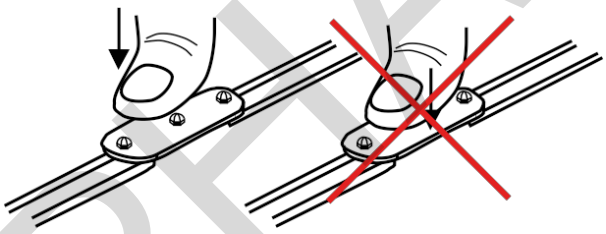
TALEXX modules contain electronic components that are sensitive to mechanical stress. Such stress should be kept to an absolute minimum. In particular the following mechanical stresses should be avoided as these may cause irreversible damage:

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

Compressive stresses

The components of the TALEXX 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 TALEXX modules at the edges



correct (left) and incorrect (right)

Bending stress

Bending the circuit board of a TALEXX module by more than 3 % along its length may damage the product and is therefore not permitted. 3 % corresponds for example to 6 mm for a 200 mm long module.

Max. bending stress for LED strip modules

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 color 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)

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

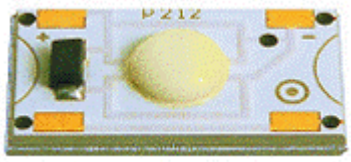
Protection measures for the glob top material

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

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 TALEXX 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 TALEXX 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 TALEXX module.

Additional information

TALEXX 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

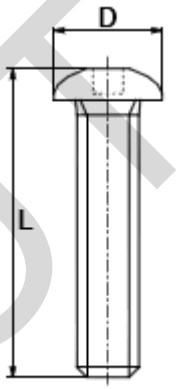
TALEXX products from Tridonic are delivered in appropriate packaging. The packaging provides special protection against mechanical damage and ESD (electrostatic discharge). If you need to transport TALEXX products you should use this packaging.

Installation of the modules on the heat sink

The LED modules are mounted onto a heat sink with 2 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:

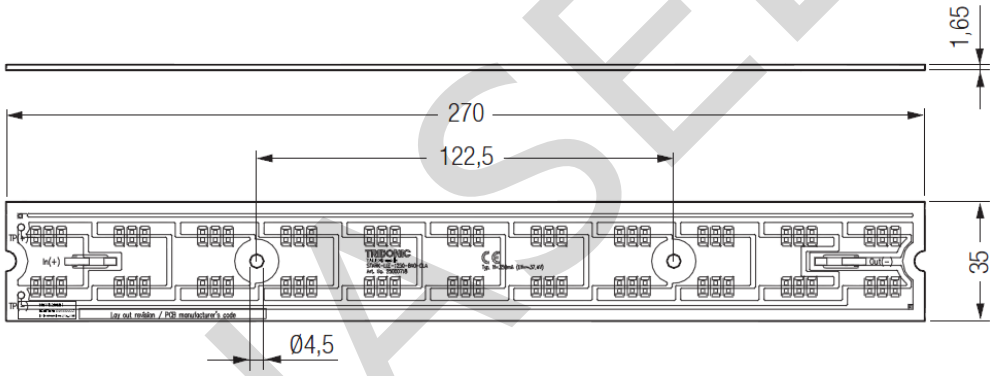
Dimensions of the fastening screws

Screw size	M3
Max. diameter D	7 mm
Min. length L	5 mm
Max. length L	depending on the design of the luminaire

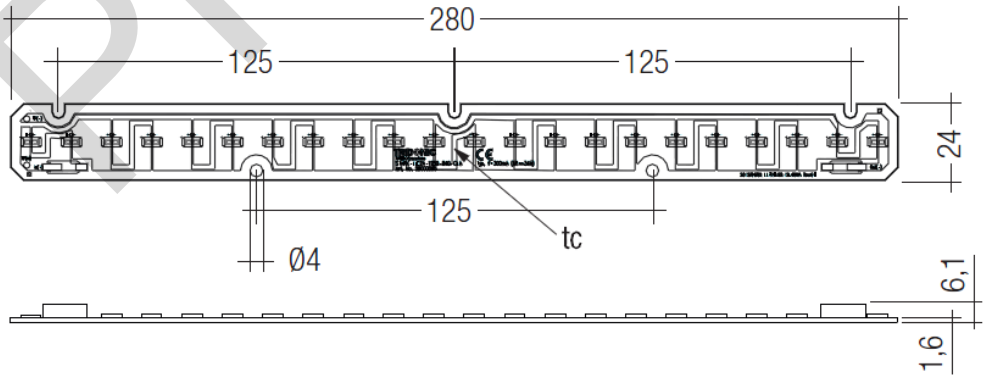


Dimensional drawings

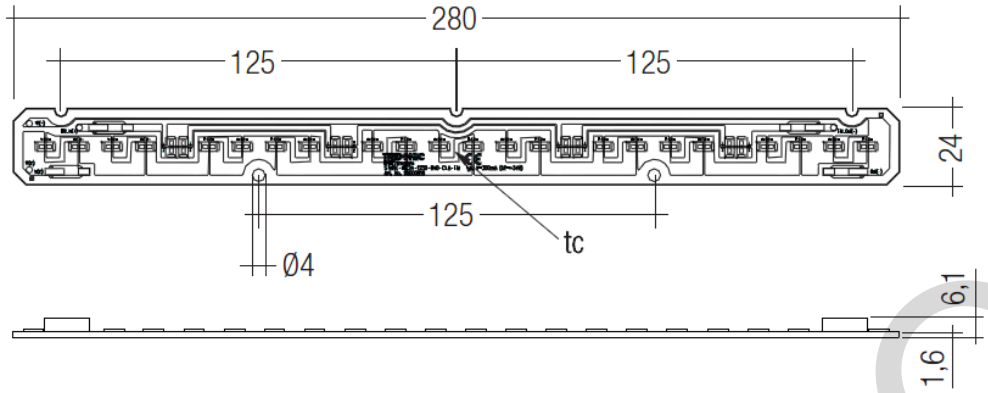
Dimensional drawings of the TALEXXmodule STARK LLE CLASSIC



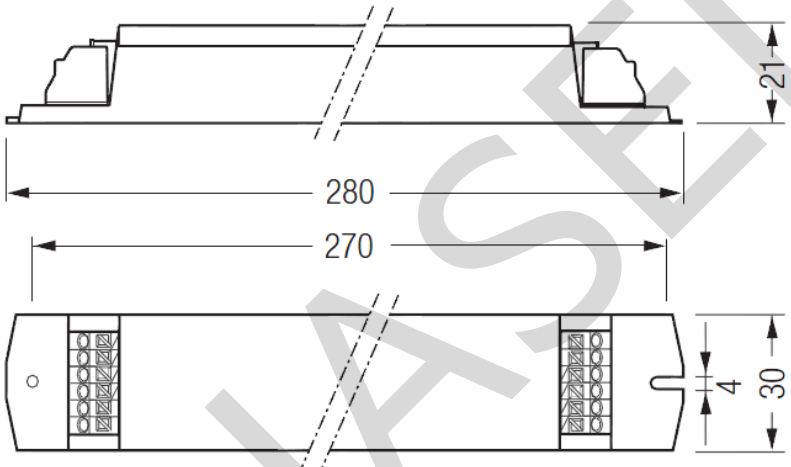
Dimensional drawings of the TALEXXmodule STARK LLE24 CLASSIC



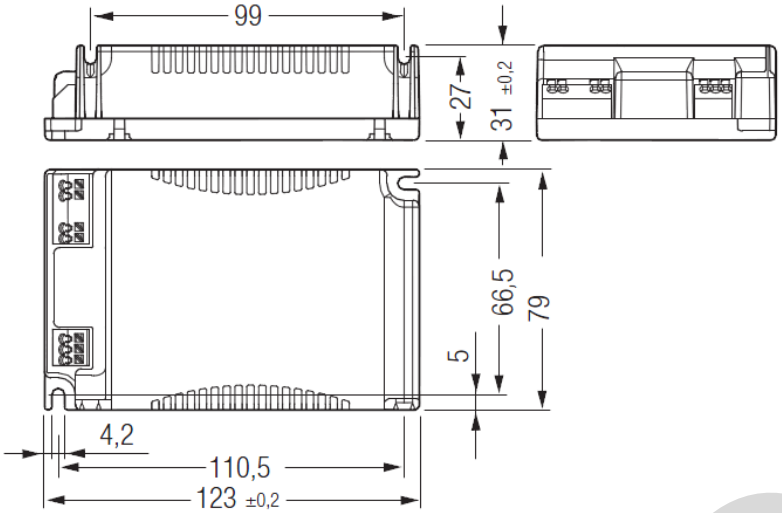
Dimensional drawings of the TALEXXmodule STARK LLE24 CLASSIC EM



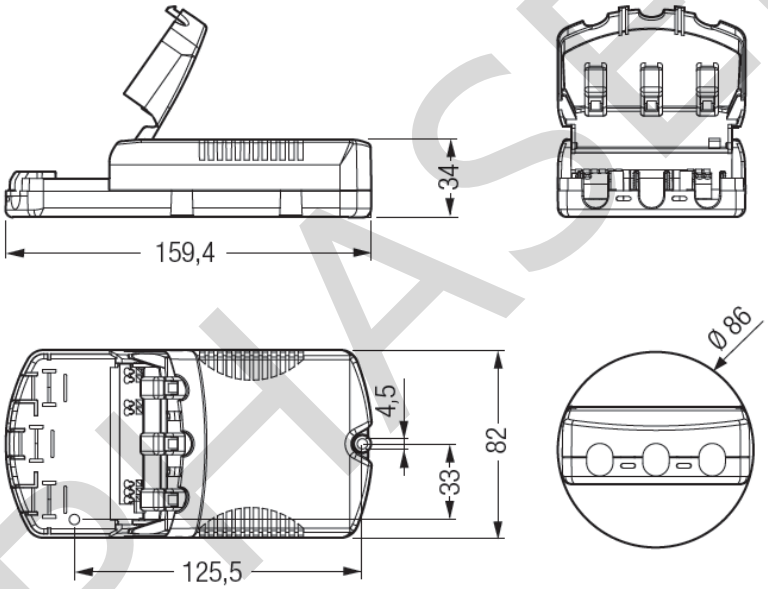
Dimensional drawing of the TALEXXconverter LCAI 080/0350 I010 one4all IN-BUILT



Dimensional drawing of the TALEXXconverter LCI 055/1400 R010 IN-BUILT



Dimensional drawing of the TALEXXconverter LCI 050/1050 T020 REMOTE



Dimensions of further TALEXXconverters

Type	L x W x H
LCAI 015/0350 A020 one4all	167 x 42 x 31 mm
LCAI 016/0350 Q010 one4all	103 x 67 x 31 mm
LCAI 030/0700 A120 one4all	207 x 42 x 31 mm
LCI 015/0350 E020	165 x 43 x 30 mm
LCI 080/0350 I010	280 x 30 x 21 mm
LCI 030/0700 E020	141 x 43 x 30 mm
LCI 050/1050 R010	123 x 79 x 31 mm
LCI 055/1400 T020	160 x 82 x 34 mm
LCCI 016/0350 Q010	103 x 67 x 31 mm
EM powerLED 2W	127 x 30 x 21 mm
EM powerLED 2W	127 x 30 x 21 mm

NOTICE

CAD data on these and other LED control gear can be downloaded from the Tridonic homepage www.tridonic.com and the relevant product page.

Electrical aspects

Electrical safety

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.

Basic insulation of TALEXXmodule STARK LLE

The TALEXXmodul STARK LLE 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 the TALEXXconverter LCAI 80W 350mA.

Design measures for satisfying protection class requirements

Not all the components of the TALEXX STARK LLE system comply with the SELV standard. The voltages can thus be greater than 120 V DC.

Luminaire with SELV level

When using the LED module STARK LLE CLASSIC in combination with a TALEXXconverter in protection class SELV, the SELV level for the luminaire is achieved.
Thanks to SELV voltage, the luminaire can be replaced by an expert without risk.

Protection class II luminaires

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

- Reinforced insulation between TALEXXmodule STARK LLE 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 control gear 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

Protection class I luminaires

When using a TALEXXconverter 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 TALEXXmodule STARK LLE directly on the casing
- Grounding of the LED control gear, TALEXXmodule STARK LLE and the luminaire itself
- Protect all electrical contacts against mechanical contact, this can typically be achieved with optics which cannot be removed

⚠ DANGER!

The following measures must be followed in order to avoid lifethreatening 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.

Electrical safety and connection

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.

Electrical supply and selection of the LED control gear

⚠ CAUTION!

TALEXXmodules STARK LLE 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 control gear which complies with the relevant standards.
When using a TALEXXconverter, the following protection is offered:

- Short-circuit recognition
- Overload recognition
- Overtemperature switch-off

TALEXXmodules STARK LLE must be supplied by a constant current LED control gear. Operation with a constant voltage LED control gear leads to irreversible damage to the modules! Wrong polarity can damage the TALEXXmodules STARK LLE. 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.

Electrical connections

TALEXXmodule STARK LLE CLASSIC connections

The LED control gear 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: 0.4 - 0.75 mm²
- Stripped length of the insulation 6 - 7 mm
- Push-in terminal for solid conductors

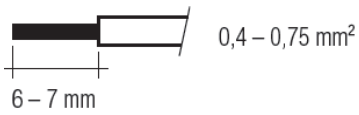
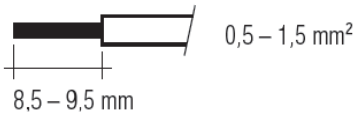
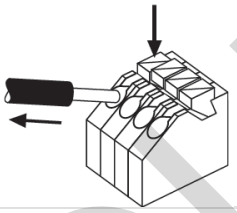
Push-in terminal for solid conductors

Line cross-section on the LED control gear with spring terminal:

- Permissible line cross-section: 0.5 - 1.5 mm²
- Stripped length of the insulation 8.5 - 9.5 mm
- Spring terminal for stranded wire with end splice or solid conductor

Spring terminal for stranded wire with end splice or solid conductor

Permissible line cross-sections and stripped insulation lengths of LED control gear with screw terminals can be found in the respective LED control gear data sheets.

		
LED module wire preparation	Converter wire preparation	Spring terminal on the LED control gear

Connections on the LED control gear

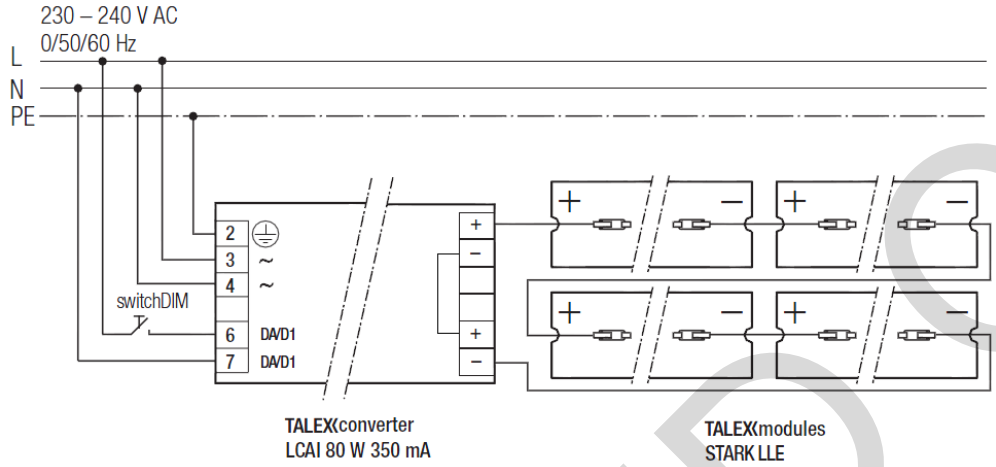
Connections on the LED control gear for TALEXXmodules STARK LLE CLASSIC

Pin/Connection	Connection on the TALEXXconverter	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
+LED	TALEXXmodule STARK LLE CLASSIC	Spring terminal
-LED	TALEXXmodule STARK LLE CLASSIC	Spring terminal

* only with LED control gear with the corresponding functionality

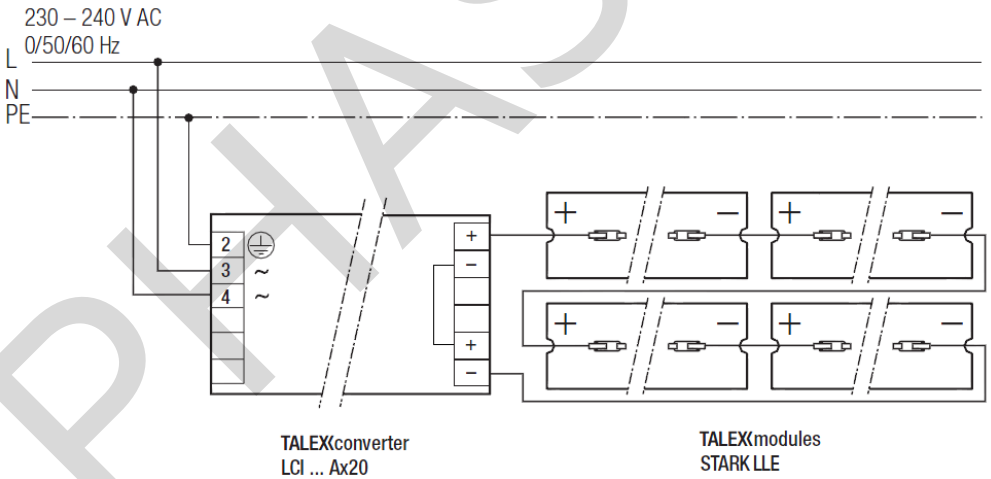
Wiring diagrams

Wiring diagram for TALEXXengine STARK LLE CLASSIC with serial wiring and switchDIM



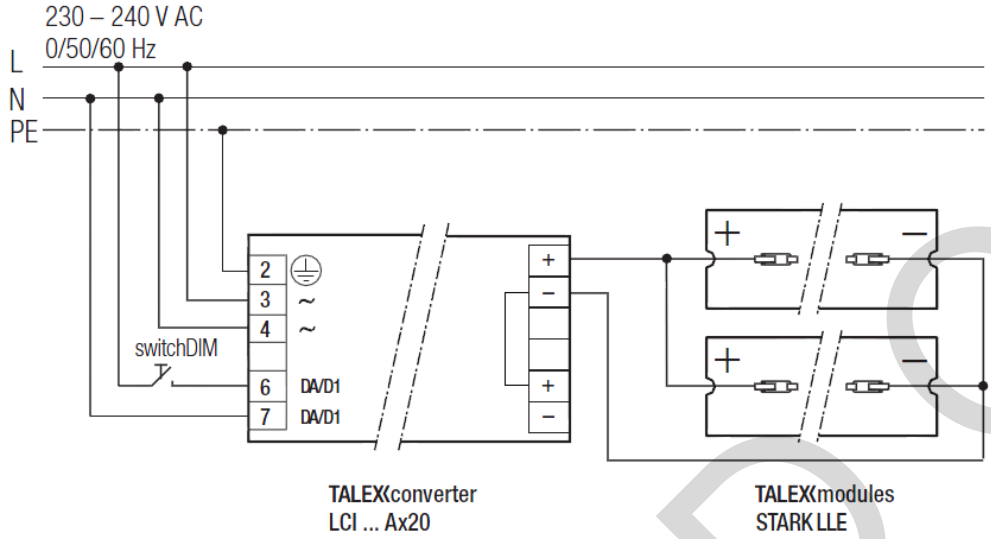
The wiring diagram shows serial wiring on a LED control gear with dimming function and 4 modules of type TALEXXmodule STARK LLE CLASSIC as well as connection of the LED control gear to the power supply and direct connection of a commercially available push to make switch.

Wiring diagram for TALEXXengine STARK LLE CLASSIC with serial wiring



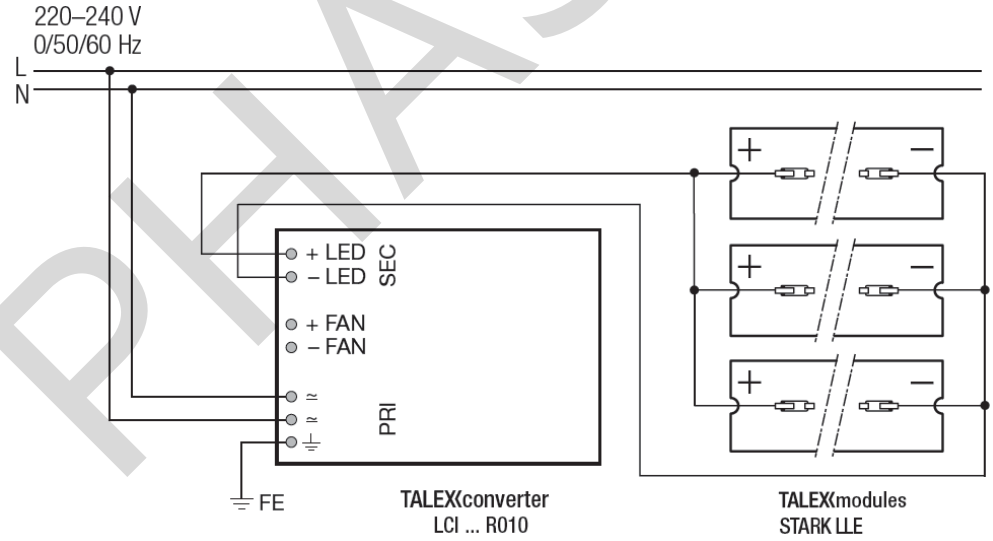
The wiring diagram shows serial wiring on a LED control gear with 4 modules of type TALEXXmodule STARK LLE CLASSIC as well as connection of the LED control gear to the power supply.

Wiring diagram for TALEXXengine STARK LLE CLASSIC with parallel wiring and switchDIM



The wiring diagram shows parallel wiring between a LED control gear with dimming function and 2 modules of type TALEXXmodule STARK LLE CLASSIC as well as connection of the LED control gear to the power supply and direction connection of a commercially available push to make switch.
With parallel wiring tolerance-related differences in brightness are possible. If one module fails, the remaining modules may be overloaded.

Wiring diagram for TALEXXengine STARK LLE CLASSIC with parallel wiring

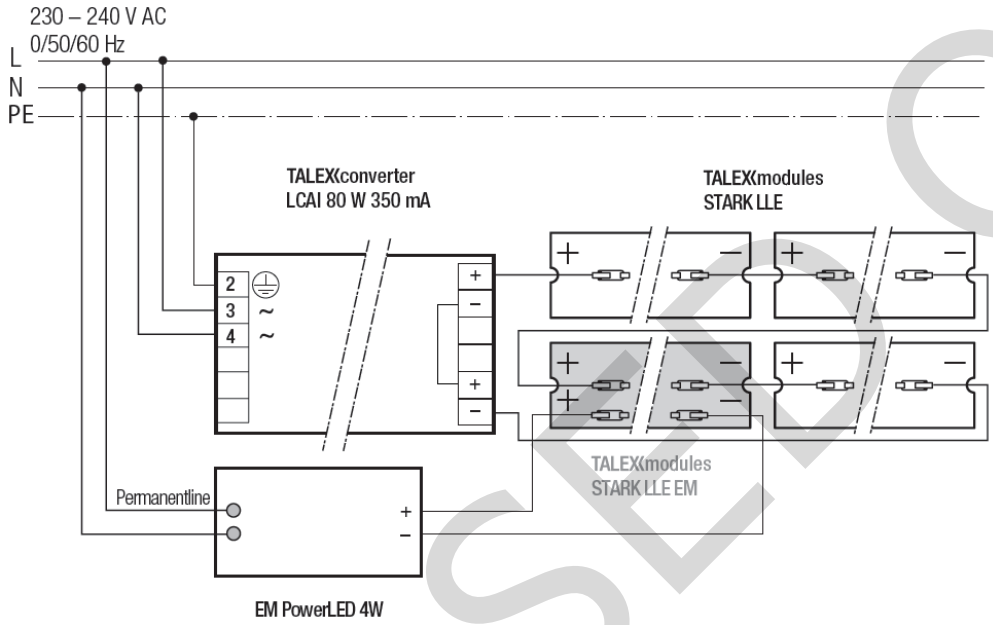


The wiring diagram shows parallel wiring between a LED control gear and 3 modules of type TALEXXmodule STARK LLE CLASSIC as well as connection of the LED control gear to the power supply.

NOTICE

With parallel wiring tolerance-related differences in brightness are possible. If one module fails, the remaining modules may be overloaded.

Wiring diagram for TALEXXengine STARK LLE CLASSIC and STARK LLE CLASSIC EM



The wiring diagram shows connection between a LED control gear and 4 modules with serial wiring, of which 3 modules are of type TALEXXmodule STARK LLE CLASSIC and 1 of type TALEXXmodule STARK LLE EM CLASSIC with emergency light function. The emergency light module is additionally operated by an emergency light supply device.

Furthermore, connection of the LED control gear to the power supply / charger of the emergency light supply device is shown.

Optical aspects

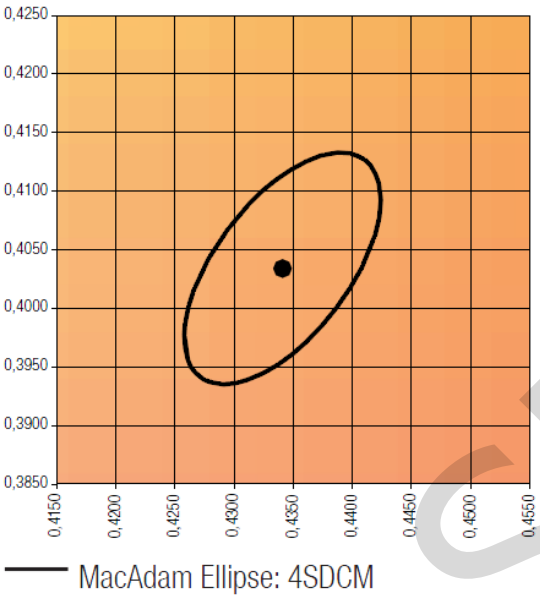
Colour spectrum

Light colours

The TALEXXengine STARK LLE CLASSIC is available in the colours 3,000 K, 4,000 K and 5,000 K.

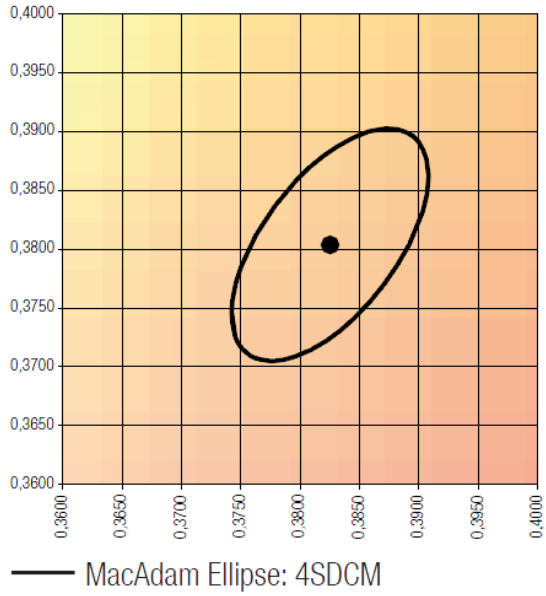
TALEXXengine STARK LLE CLASSIC

MacAdam Ellipse: 4SDCM 3.000 K



	x0	y0
Centre	0.4344	0.4032

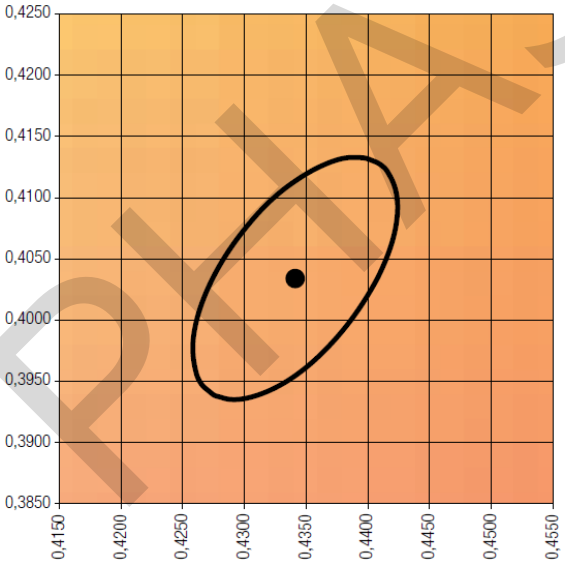
MacAdam Ellipse: 4SDCM 4.000 K



	x0	y0
Centre	0.3828	0.3803

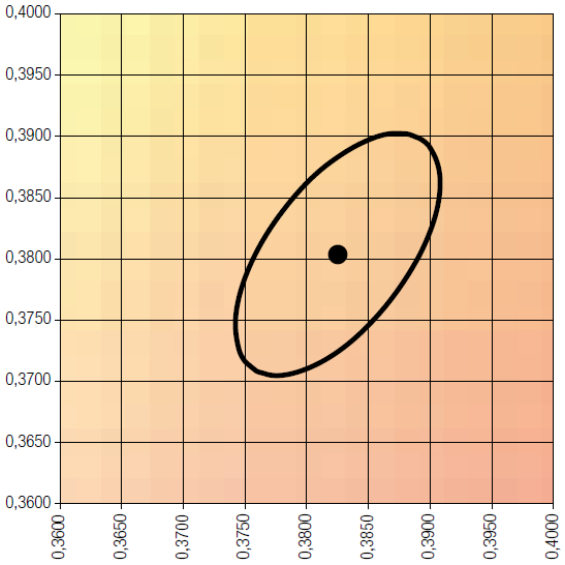
TALEXXengine STARK LLE24

MacAdam Ellipse: 3SDCM 3.000 K



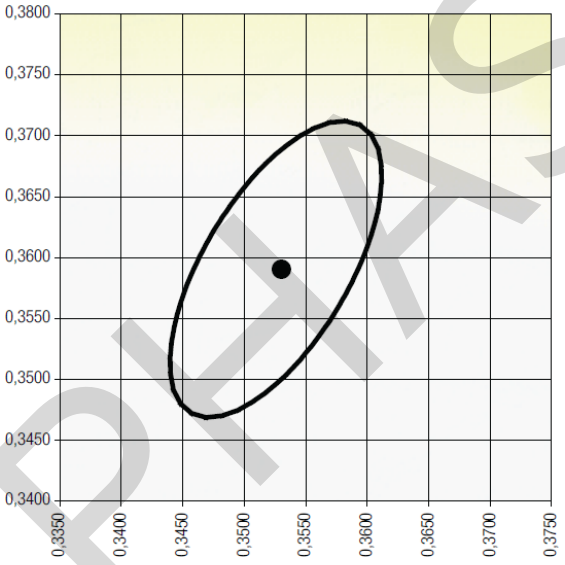
	x0	y0
Centre	0.4344	0.4032

MacAdam Ellipse: 3SDCM 4.000 K



	x0	y0
Centre	0.3828	0.3803

MacAdam Ellipse: 3SDCM 5.000 K



	x0	y0
Centre	0.3422	0.3558

Eye safety

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

* 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.

Beam characteristics

Reflector and diffusers

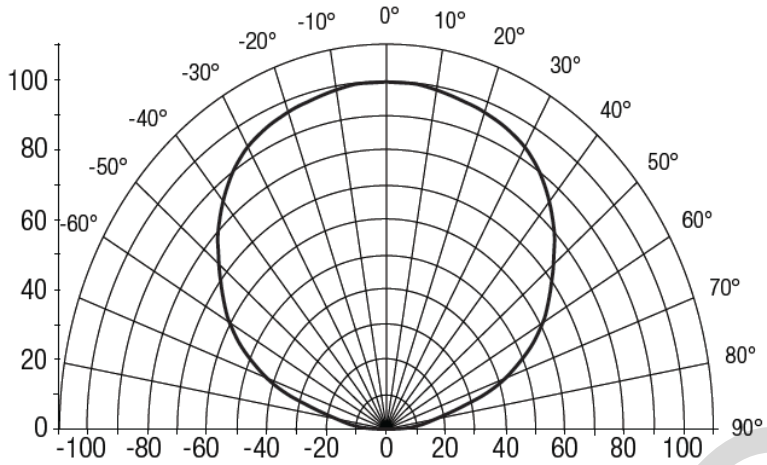
With STARK LLE CLASSIC modules, the luminaire can be produced with either a diffuser or reflectors. There must be a minimum distance of 3 mm between the active parts and the conductive optical parts, e.g., reflector to the LED module.

⚠ CAUTION!

When using reflectors in combination with a non-SELV LED control gear, protection against contact must be ensured.
This is typically achieved with optics which cannot be removed over the module.

Beam characteristics of the TALEXXmodule STARK LLE

Maximum relative light intensity Iv/v



Average illuminance in relation to the lumen values of TALEXXmodule STARK LLE CLASSIC

Installation height	Diameter of the beam	1,190 lm 3,000 K	1,250 lm 4,000 K	1,300 lm 5,000 K
0.25 m	0.79 m	1,828 lux	1,920 lux	2,000 lux
0.5 m	1.59 m	457 lux	480 lux	500 lux
0.75 m	2.38 m	203 lux	213 lux	220 lux
1.0 m	3.17 m	114 lux	120 lux	125 lux

All the values refer to Beam angle = 116° LOR = 100%, Forward current 350 mA

Average illuminance in relation to the lumen values of TALEXXmodule STARK LLE CLASSIC

Installation height	Diameter of the beam	1.190 lm 4.000 K
0.25 m	0.75 m	1,961 lux
0.5 m	1.49 m	490 lux
0.75 m	2.24 m	218 lux
1.0 m	2.99 m	123 lux

All the values refer to Forward current 300 mA

NOTICE

To aid customised design and for optical simulation, Tridonic is happy to provide the modules' CAD data on request. Sources of reflectors can be found at the end of this document.

Thermal aspects

Cooling the modules

Effect of cooling on the life of the modules

The modules of the TALEXXengine STARK LLE system have been designed for operation with a passive 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.

Operating time for TALEXXengine STARK LLE and TALEXXengine STARK LLE24

The table shows the operating time for different luminous flux at t_c = 65 °C, 350 mA.

Luminous flux	Operating time STARK LLE
80 %	32,000 h
70 %	50,000 h
50 %	92,000 h

Luminous flux	Operating time STARK LLE24
80 %	30,000 h
70 %	60,000 h
50 %	100,000 h

NOTICE

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

Requirements for the heat sink

The modules must not be operated without a heat sink. The heat sinks must be dimensioned to provide adequate cooling capacity.
The necessary R_{th} value is decisive when selecting a suitable heat sink. This value depends on the thermal power loss of the module and the ambient temperature at which the module is to be operated. The R_{th} value of the heat sink must always be smaller than the required Rth value.

Ambient temperature (t_a)	$R_{th, hs-a}$ LLE	Cooling surface LLE	$R_{th, hs-a}$ LLE24	Cooling surface LLE24
25 °C	3.4 K/W	100 cm^2	5.1 K/W	131 cm^2
35 °C	3.0 K/W	120 cm^2	3.8 K/W	176 cm^2
45 °C	2.3 K/W	250 cm^2	2.5 K/W	268 cm^2
55 °C	1.5 K/W	680 cm^2	n.a.	n.a.

All the values refer to a maximum surface temperature t_c = 65°C and 350 mA.

The actual cooling surface can deviate depending on the material, design, external influences and the installation situation.

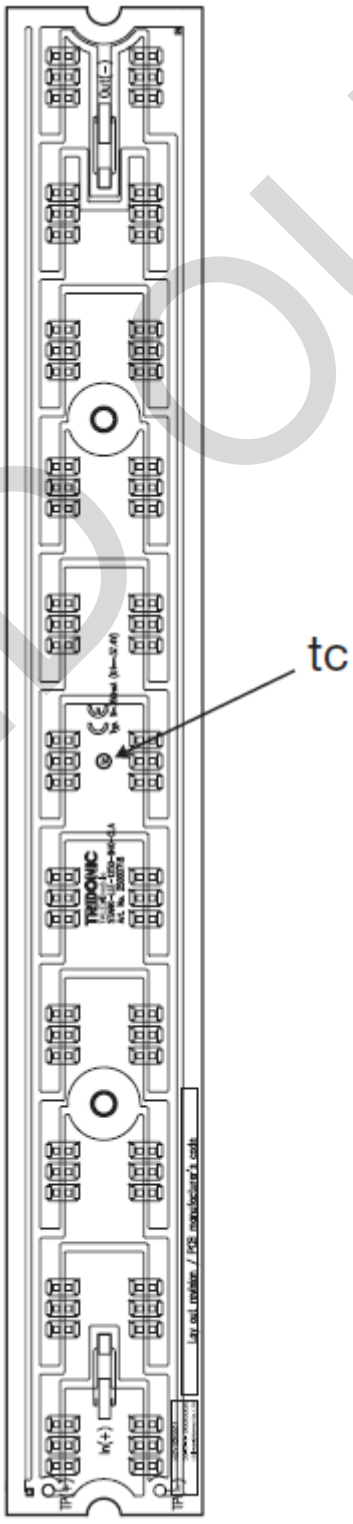
A thermal connection between TALEXXmodule STARK LLE and the heat sink using heat-conducting paste or heat-conducting adhesive foil is essential.

Temperature measurement on the module

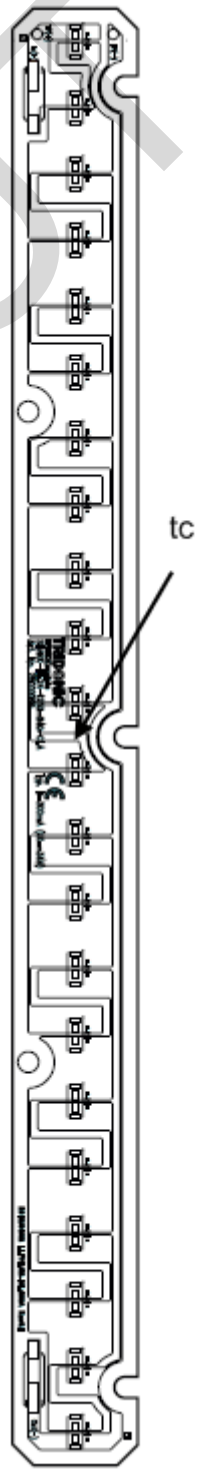
There is a t_c point on top of the module for checking the temperature of the latter:
The temperature at the t_c point can be measured with a simple temperature probe. Since the underside of the modules is made from anodised aluminium, any measurements taken with an infra-red camera would lead to inaccurate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

In practice, thermocouples (e.g. B&B Thermotechnik, K-type thermocouple) have proved successful. Such thermocouples can be attached directly to the t_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 LLE



t_c point LLE24

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 pastes for thermal connection to a temperature probe are given at the end of this documents.

Ordering information and sources

Article numbers

TALEXXengine STARK LLE CLASSIC

Product name	Description	Article number
STARK LLE-1250-830-CLA	Module TALEXXmodule STARK LLE CLASSIC, colour temperature 3,000 K	25000717
STARK LLE-1250-840-CLA	Module TALEXXmodule STARK LLE CLASSIC, colour temperature 4,000 K	25000718
STARK-LLE24-1250-830-CLA	Module TALEXXmodule STARK LLE24, colour temperature 3,000 K	28000094
STARK-LLE24-1250-840-CLA	Module TALEXXmodule STARK LLE24, colour temperature 4,000 K	28000095
STARK-LLE24-1250-850-CLA	Module TALEXXmodule STARK LLE24, colour temperature 5,000 K	25000820
STARK-LLE24-1250-830-CLA-EM	Module TALEXXmodule STARK LLE24 EM, colour temperature 3,000 K	25000816
STARK-LLE24-1250-840-CLA-EM	Module TALEXXmodule STARK LLE24 EM, colour temperature 4,000 K	25000818
LCI 080/0350 I010	TALEXXconverter, IN-BUILT, constant current, without dimming function	86459366
LCI 015/0350 E020	TALEXXconverter, REMOTE, constant current, without dimming function	24166312
LCI 030/0700 E020	TALEXXconverter, REMOTE, constant current, without dimming function	24166314
LCI 050/1050 R010	TALEXXconverter, IN-BUILT, constant current, without dimming function	86459216
LCI 055/1400 R010	TALEXXconverter, IN-BUILT, constant current, without dimming function	86459217
LCI 050/1050 T020	TALEXXconverter, REMOTE, constant current, without dimming function	86459218
LCI 055/1400 T020	TALEXXconverter, REMOTE, constant current, without dimming function	86459219

LCI 055/1400 R010	TALEXXconverter, IN-BUILT, constant current, without dimming function	86459217
LCI 055/1400 T020	TALEXXconverter, IN-BUILT, constant current, without dimming function	86459219
LCCI 016/0350 Q010	TALEXXconverter, IN-BUILT, adjustable output current	86459213

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 TALEXXengine STARK LLE.

Product name	Artikelnummer
DALI M-Sensor	86458265
DALI SC	24034263
DALI MC	86458507
DALI Touchpanel	24035465
x-touchBOX	24138954
x-touchPANEL	24138990
DALI PS	24033444
DALI USB	24138923

NOTICE

Go to led.tridonic.com for further emergency lighting products.

Product application and partners

Product application matrix

Whether you are looking for wide-area lighting or focused accent lighting, our wide range of T 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.

TALEXXengine application

TALEXXengine	Spotlight	Downlight	Linear lumi-naries	Surface lumi-naires	Recessed floor and wall luminaires	Floor lumi-naires	Street lumi-naires	Decorative lumi-naires
TALEXXengine STARK DLE		✅						
TALEXXengine STARK DLE TWIST	✅	✅						
TALEXXengine STARK SLE	✅	✅			✅	✅		✅
TALEXXengine STARK LLE			✅	✅	✅	✅		
TALEXXengine STARK QLE				✅	✅			
TALEXXengine RLE					✅		✅	
TALEXXengine INDI			✅			✅		

TALEXXmodule application

TALEXXengine	Spotlight	Downlight	Linear luminaries	Surface luminaires	Recessed floor and wall luminaires	Floor luminaires	Street luminaires	Decorative luminaires
TALEXXmodule SPOT	✅	✅			✅	✅	✅	✅
TALEXXmodule RECTANGULAR	✅	✅			✅	✅	✅	
TALEXXmodule FULMEN	✅	✅						
TALEXXmodule STRIP								✅
TALEXXmodule EOS								✅
TALEXXmodule XED DECO		✅	✅	✅	✅			✅

TALEXXconverter application

TALEXXengine	Spotlight	Downlight	Linear luminaries	Surface luminaires	Recessed floor and wall luminaires	Floor luminaires	Street luminaires	Decorative luminaires
TALEXXconverter REMOTE dimmbar (LCA)		✅	✅	✅				✅
TALEXXconverter IN-BUILT dimmbar (LCA)	✅		✅	✅	✅	✅	✅	✅
TALEXXconverter REMOTE (LCI)		✅	✅	✅				✅
TALEXXconverter REMOTE (LCI)	✅		✅	✅	✅	✅	✅	✅

You will find further information on the technical data and the entire TALEXX product portfolio at led.tridonic.com

Partners

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

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

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
Chiyoda-ku

Tokyo 100-0004
Japan

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

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

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

Tridonic sales organisation

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

Additional information

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

Further information and ordering data:

- TALEXX 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