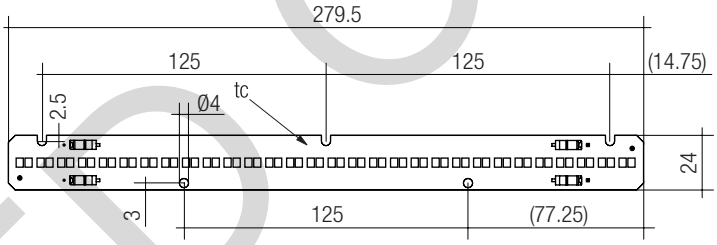
CE RoHS

Module STARK LLE premium
Modules LLE

Product description

- Linear Tunable White LED module with 2,700 and 6,500 K SMT packages
- High module efficacy up to 125 lm/W at tp = 65 °C
- High colour rendering index CRI > 80
- Low tolerances for colour temperature (MacAdam 3)
- Low light current tolerances
- Excellent thermal management[1]
- Ideal for linear and panel lights
- Linear LED modules with 700 or 1,500 lm
- Long life-time: 50,000 hours
- 5-year guarantee



LLE-24-280-1500-827-865-PRE

Technical data

Beam characteristic	120°
Ambient temperature ta[1]	-25 … +55 °C
tp rated	65 °C
tc	80 °C
Max. DC forward current for 700 lm[5]	150 mA
Max. DC forward current for 1,500lm[5]	300 mA
Max. permissible LF current ripple for 700 lm	180 mA
Max. permissible LF current ripple for 1,500 lm	360 mA
Max. permissible peak current for 700 lm	240 mA / max. 10 ms
Max. permissible peak current for 1,500 lm	480 mA / max. 10 ms
Insulation test voltage	2 kV
ESD classification	severity level 4
Risk group (EN 62471:2008)	1
Type of protection	IP00

Ordering data

Type	Article number	Colour temperature	Packaging carton	Weight per pcs.
TW LLE G1 24x280mm 700lm 827-865 PRE	**89602390**	2.700 / 6.500 K	210 pc(s).	0.031 kg
TW LLE G1 24x280mm 1500lm 827-865 PRE	**89602391**	2.700 / 6.500 K	210 pc(s).	0.031 kg

Standards, page 8

Colour temperatures and tolerances, page 11

Specific technical data

Type	Photometric code	Colour temperature	Forward current[7]	Luminous flux at tp = 25 °C[3] [4]	Luminous flux at tp = 65 °C[3] [4] [7]	Power consumption module at tp = 65 °C[2]	Min. forward voltage at tp = 65 °C	Max. forward voltage at tp = 25 °C	Efficacy of the module at tp = 25 °C	Efficacy of the module at tp = 65 °C	Colour rendering index CRI[4]
STARK-LLE-24-280-700-827-865-PRE	827/4x9 – 865/4x9	2,700 K	125 mA	680 lm	645 lm	5.7 W	43.8 V	48.2 V	117 lm/W	113 lm/W	> 80
		6,500 K	125 mA	750 lm	715 lm	5.7 W	43.8 V	48.2 V	129 lm/W	125 lm/W	> 80
STARK-LLE-24-280-1500-827-865-PRE	827/4x9 – 865/4x9	2,700 K	250 mA	1,360 lm	1,290 lm	11.6 W	43.8 V	48.2 V	116 lm/W	111 lm/W	> 80
		6,500 K	250 mA	1,500 lm	1,430 lm	11.6 W	43.8 V	48.2 V	128 lm/W	123 lm/W	> 80

[1] If the max. temperature limits are exceeded, the life of the system will be greatly reduced or the system may be damaged. The temperature of the LED module at the tc-point is to be measured in the thermally stable state with a temperature sensor or a temperature sensitive sticker according to EN 60598-1. For the precise position of the tc point see the above diagram.

[2] Tolerance range for electrical data: ±5 %.

[3] Tolerance range for optical data: ±10 %.

[4] Colour temperature and CRI according to CIE 1931.

[5] Max. DC forward current varies over the temperature of the LED module. See derating curves.

[6] If mounted with M3 screws and plastic washers.

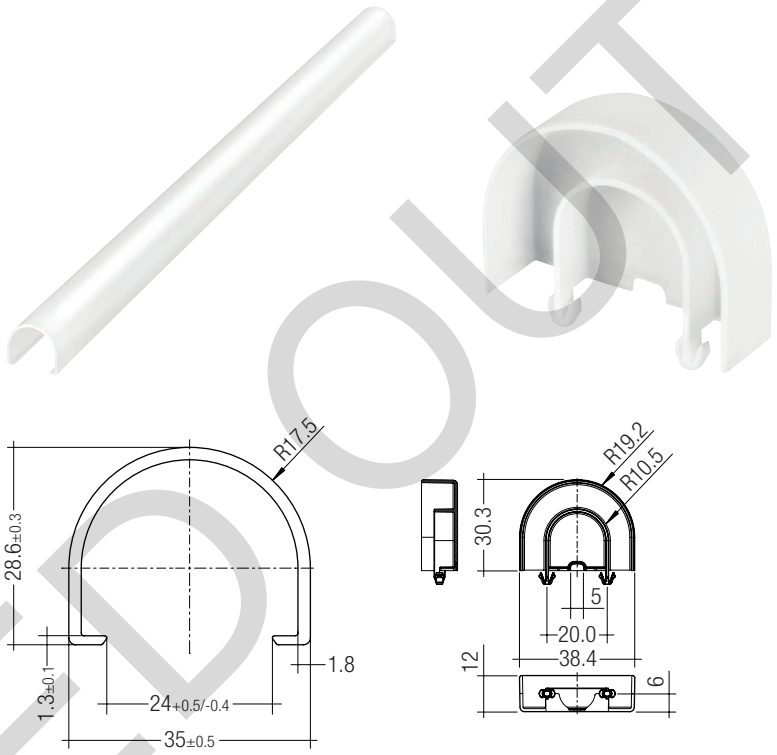
[7] The LED modules are not designed to operate both channels with the max. current of 125 mA / 250 mA! The current split has to be dimensioned to fulfil the thermal requirements and to reach a typ. luminous flux of 700 lm / 1,500 lm for the LED module. For details see page 6 „Electric supply/choice of LED control gear".

ACCES-SORIES

LINEAR COVER SY

Product description

- LINEAR COVER / ENDCAP for LLE 24
- Protection against direct touch for non-SELV applications (recommendation: use all fixing points)
- Mounting COVER: Fast snap on mounting on to LLE 24 with clips or plastic washers
- Mounting ENDCAP: Fast snap on mounting (sheet thickness 0.5 – 1.0 mm), for drilling hole 4 mm
- High transmission: transparent 94 %, semi-transparent 87 %, diffuse 76 %
- Linear cover made of PMMA
- Endcap made of Polycarbonat
- Tolerances LINEAR COVER: ± 1 mm for 597 mm length (ends finished), + 20 mm for 1,200 / 1,500 / 1,600 / 1,800 mm legth (ends raw)



Ordering data

Type	Article number	Colour	Length	Packaging carton	Weight per pc.
LINEAR COVER SY Transparent 1600mm	**28000338**	Transparent	1,600 mm	12 pc(s).	0.272 kg
LINEAR COVER SY Frosted 1800mm	**28000437**	Semi-transparent	1,800 mm	12 pc(s).	0.308 kg
LINEAR COVER SY Frosted 1600mm	**28000339**	Semi-transparent	1,600 mm	12 pc(s).	0.272 kg
LINEAR COVER SY Frosted 1500mm	**28000435**	Semi-transparent	1,500 mm	12 pc(s).	0.244 kg
LINEAR COVER SY Frosted 1200mm	**28000422**	Semi-transparent	1,200 mm	12 pc(s).	0.205 kg
LINEAR COVER SY Frosted 597mm	**28000340**	Semi-transparent	597 mm	12 pc(s).	0.102 kg
LINEAR COVER SY Diffuse 1800mm	**28000438**	Diffuse	1,800 mm	12 pc(s).	0.308 kg
LINEAR COVER SY Diffuse 1600mm	**28000341**	Diffuse	1,600 mm	12 pc(s).	0.272 kg
LINEAR COVER SY Diffuse 1500mm	**28000436**	Diffuse	1,500 mm	12 pc(s).	0.257 kg
LINEAR COVER SY Diffuse 1200mm	**28000434**	Diffuse	1,200 mm	12 pc(s).	0.205 kg
LINEAR COVER SY Diffuse 597mm	**28000342**	Diffuse	597 mm	12 pc(s).	0.102 kg

ACCES-SORIES

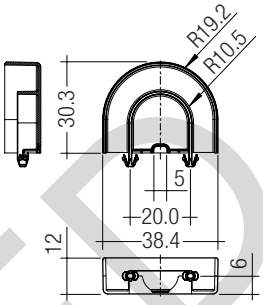
ACL ENDCAP LLE24 PUSH-FIX / SCREW-FIX

Product description

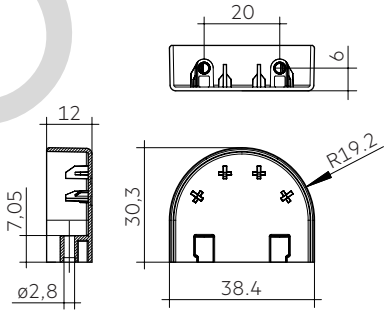
- ENDCAP for LLE 24
- PUSH-FIX: Fast snap on mounting
  (sheet thickness 0.5 – 1.0 mm), for drilling hole 4 mm
- SCREW-FIX: Screw mounting with EJOT Delta PT WN 5451 30x8,
  tightening torque 0.7 Nm
- Made of Polycarbonat

ACL ENDCAP LLE24 PUSH-FIX

ACL ENDCAP LLE24 SCREW-FIX



ACL ENDCAP LLE24 PUSH-FIX



ACL ENDCAP LLE24 SCREW-FIX

Ordering data

Type	Article number	Colour	Packaging carton	Weight per pc.
ACL ENDCAP LLE24 PUSH-FIX	**28001037**	White	480 pc(s).	0.003 kg
ACL ENDCAP LLE24 SCREW-FIX	**28002315**	White	480 pc(s).	0.003 kg

ACCES-SORIES

ACL LENS 24mm

Product description LINEAR LENS

- Linear lens for LLE 24
- Available with different beam characteristics
- Protection against direct touch for non-SELV applications (recommendation: use all fixing points)
- Fast snap on mounting on to LLE 24 with clips or plastic washers
- Linear lense made of PMMA
- Available lengths: 1,200, 1,500, 1,600 and 1,800 mm, Tolerance: + 10 mm, at 1,600 mm length ± 20 mm tolerance and raw ends
- Max. permissible temperature 80 °C
- Photometric data available on website

Product description Endcap

- ENDCAP for LINEAR LENS 24mm INTENSE, ASY and DASY
- Mounting by clipping in and screwing from below using screw EJOT Delta PT WN 5451 20x4, tightening torque 0.7 Nm
- Made of Polyamide UL94 V0

ACL LINEAR LENS 24mm 60°

ACL LINEAR LENS 24mm 90°

ACL LINEAR LENS 24mm INTENSE

ACL LINEAR LENS 24mm BATWING

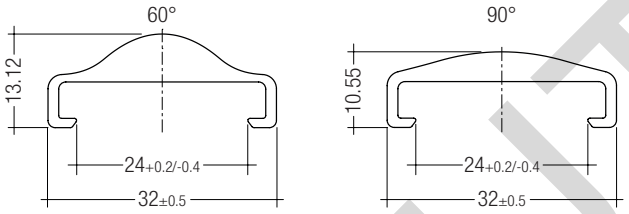
ACL LINEAR LENS 24mm ASY

ACL LINEAR LENS 24mm DASY

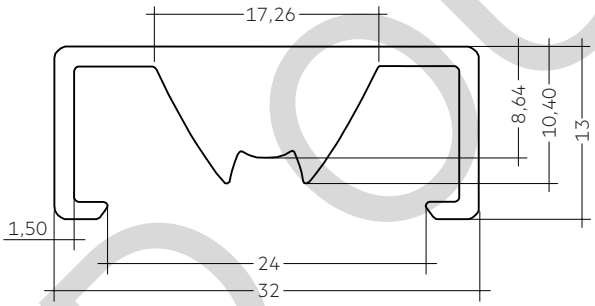
ACL Endcap LENS 24mm PSF

ACCES-SORIES

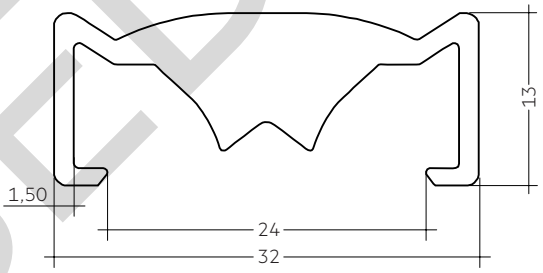
ACL LENS 24mm



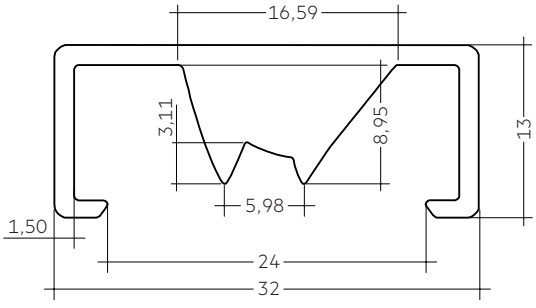
ACL LINEAR LENS 24mm 60° and 90°



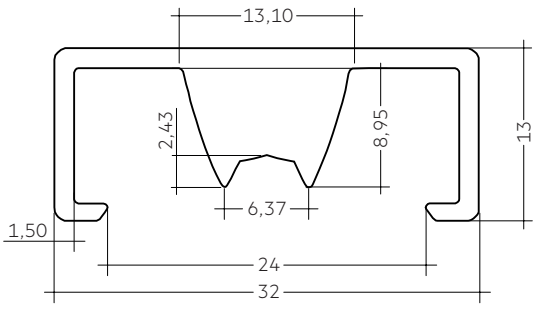
ACL LINEAR LENS 24mm INTENSE



ACL LINEAR LENS 24mm BATWING



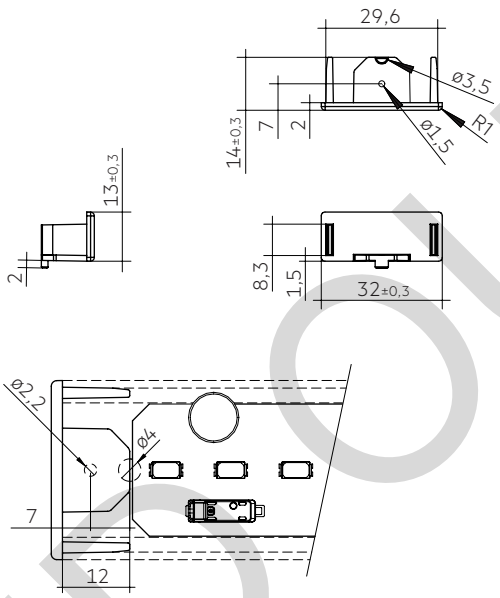
ACL LINEAR LENS 24mm ASY



ACL LINEAR LENS 24mm DASY

ACCES-SORIES

ACL LENS 24mm



ACL Endcap LENS 24mm PSF

Ordering data

Type	Article number	Beam characteristic	Efficiency	Packaging carton / bag	Weight per pc.
ACL LINEAR LENS 24x1200mm 60°	**28001428**	60°	97 %	21 pc(s).	0.196 kg
ACL LINEAR LENS 24x1200mm 90°	**28001429**	90°	97 %	21 pc(s).	0.165 kg
ACL LINEAR LENS 24x1600mm 60°	**28000953**	60°	97 %	21 pc(s).	0.261 kg
ACL LINEAR LENS 24x1600mm 90°	**28000955**	90°	97 %	21 pc(s).	0.221 kg
ACL LINEAR LENS 24x1200mm INTENSE	**28002024**	40°	95 %	18 pc(s).	0.261 kg
ACL LINEAR LENS 24x1500mm INTENSE	**28002025**	40°	95 %	18 pc(s).	0.326 kg
ACL LINEAR LENS 24x1800mm INTENSE	**28002026**	40°	95 %	18 pc(s).	0.392 kg
ACL LINEAR LENS 24x1200mm BATWING	**28002027**	batwing	95 %	18 pc(s).	0.275 kg
ACL LINEAR LENS 24x1500mm BATWING	**28002028**	batwing	95 %	18 pc(s).	0.344 kg
ACL LINEAR LENS 24x1800mm BATWING	**28002029**	batwing	95 %	18 pc(s).	0.412 kg
ACL LINEAR LENS 24x1200mm ASY	**28002030**	asymmetric	95 %	18 pc(s).	0.250 kg
ACL LINEAR LENS 24x1500mm ASY	**28002031**	asymmetric	95 %	18 pc(s).	0.312 kg
ACL LINEAR LENS 24x1800mm ASY	**28002032**	asymmetric	95 %	18 pc(s).	0.375 kg
ACL LINEAR LENS 24x1200mm DASY	**28002033**	double asymmetric	92 %	18 pc(s).	0.249 kg
ACL LINEAR LENS 24x1500mm DASY	**28002034**	double asymmetric	92 %	18 pc(s).	0.311 kg
ACL LINEAR LENS 24x1800mm DASY	**28002035**	double asymmetric	92 %	18 pc(s).	0.373 kg
ACL Endcap LENS 24mm PSF	**28002669**	–	–	720 / 36 pc(s).	0.003 kg

ACCES-SORIES

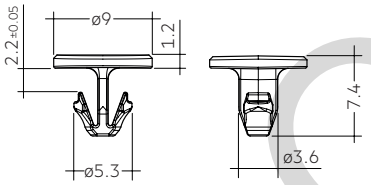
CLIP 4.3mm

Product description

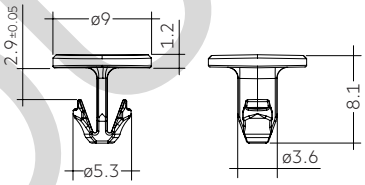
- Clip for fixation of LED modules with 4.3 mm holes
- Fast snap on mounting (sheet thickness 0.5 – 1.0 mm for PUSH-FIX and 1 – 2 mm for PUSH-FIX Long)
- For drilling hole 4 mm
- Clip made of Polycarbonat

ACL CLIP 4.3mm PUSH-FIX

ACL CLIP 4.3mm PUSH-FIX Long



ACL CLIP 4.3mm PUSH-FIX



ACL CLIP 4.3mm PUSH-FIX Long

Ordering data

Type	Article number	Colour	Packaging bag[1]	Weight per pc.
ACL CLIP 4.3mm PUSH-FIX	**28001036**	White	500 pc(s).	0.001 kg
ACL CLIP 4.3mm PUSH-FIX Long	**28002314**	Transparent	500 pc(s).	0.001 kg

[1] Minimum sales quantity 500 pcs.

Standards
EN 62031
EN 62471
EN 61347-1
EN 61547
EN 61000-4-6

Photometric code

Key for photometric code, e. g. 930 / 359

1st digit		2nd + 3rd digit	4th digit	5th digit	6th digit	
Code	CRI	Colour temperature in Kelvin x 100	MacAdam initial	MacAdam after 25% of the life-time (max.6000h)	Luminous flux after 25% of the life-time (max.6000h)	
					Code	Luminous flux
7	70 – 79				7	≥ 70 %
8	80 – 89				8	≥ 80 %
9	≥90				9	≥ 90 %

Thermal design and heat sink
The rated life of LED products depends to a large extent on the temperature. If the permissible temperature limits are exceeded, the life of the STARK LLE will be greatly reduced or the STARK LLE may be destroyed.

Therefore the STARK LLE needs to be mounted onto a heat sink.

Tridonic's excellent thermal design for the LED products provides the lowest thermal resistance and therefore allowing new compact designs without sacrificing quality, safety and life-time.

tc point, ambient temperature and life-time
The temperature at tp reference point is crucial for the light output and life-time of a LED product.

For STARK LLE a tp temperature of 65 °C has to be complied in order to achieve an optimum between heat sink requirements, light output and life-time.

Compliance with the maximum permissible reference temperature at the tc point must be checked under operating conditions in a thermally stable state. The maximum value must be determined under worst-case conditions for the relevant application.

The tc and tp temperature of LED modules from Tridonic are measured at the same reference point.

Mounting instruction

None of the components of the STARK LLE (substrate, LED, electronic components etc.) may be exposed to tensile or compressive stresses.

Max. torque for fixing: 0.5 Nm.

The LED modules are mounted onto a heat sink with min. 5 screws per module. In order not to damage the modules and reduce possible leakage current only rounded head screws and an additional plastic flat washer should be used.

Chemical substance may harm the LED module. Chemical reactions could lead to colour shift, reduced luminous flux or a total failure of the module caused by corrosion of electrical connections.

Materials which are used in LED applications (e.g. sealings, adhesives) must not produce dissolver gas. They must not be condensation curing based, acetate curing based or contain sulfur, chlorine or phthalate.
Avoid corrosive atmosphere during usage and storage.

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: http://www.tridonic.com/esd-protection

Heat sink values

STARK LLE premium 700 lm

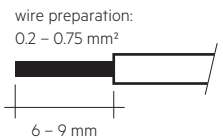
ta	tp	Forward current	$R_{th, hs-a}$	Cooling area
25 °C	65 °C	125 mA	9.8 K/W	68 cm²
35 °C	65 °C	125 mA	7.3 K/W	90 cm²
45 °C	65 °C	125 mA	4.8 K/W	135 cm²

STARK LLE premium 1,500 lm

ta	tp	Forward current	$R_{th, hs-a}$	Cooling area
25 °C	65 °C	250 mA	5.1 K/W	131 cm²
35 °C	65 °C	250 mA	3.8 K/W	176 cm²
45 °C	65 °C	250 mA	2.5 K/W	268 cm²

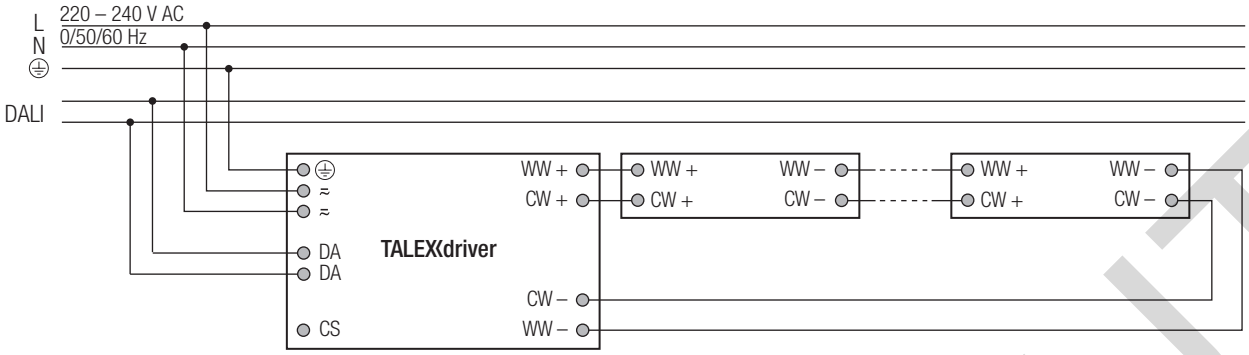
Notes
The actual cooling surface can differ because of the material, the structural shape, outside influences and the installation situation. Depending on the heat sink a heat conducting paste or heat conducting film might be necessary to keep the specified tp temperature. LED modules have to be insulated against the heat sink with a insulating thermal interface material.

Wiring type and cross section
The wiring can be stranded or solid wires with a cross section of 0.2 to 0.75 mm². For the push-wire connection you have to strip the insulation (6–9 mm).

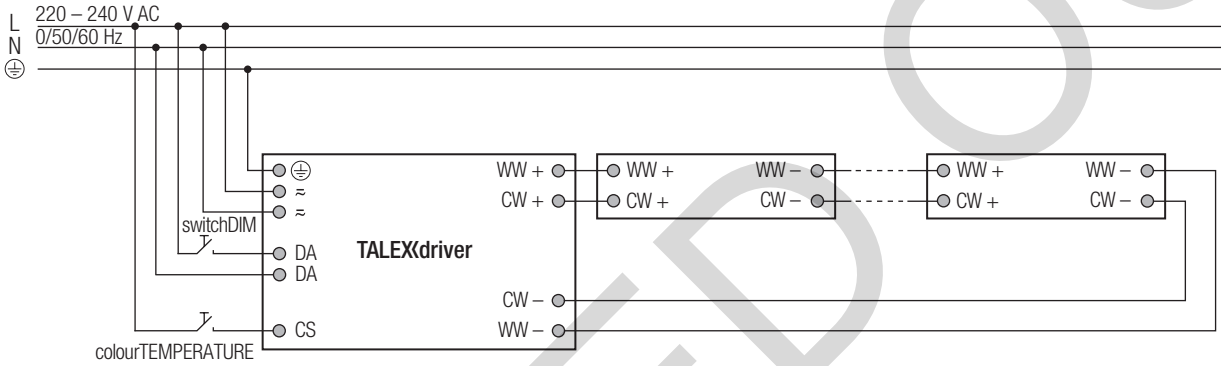


To remove the wires use a suitable tool (e.g. Microcon release pin) or through twist and pull.

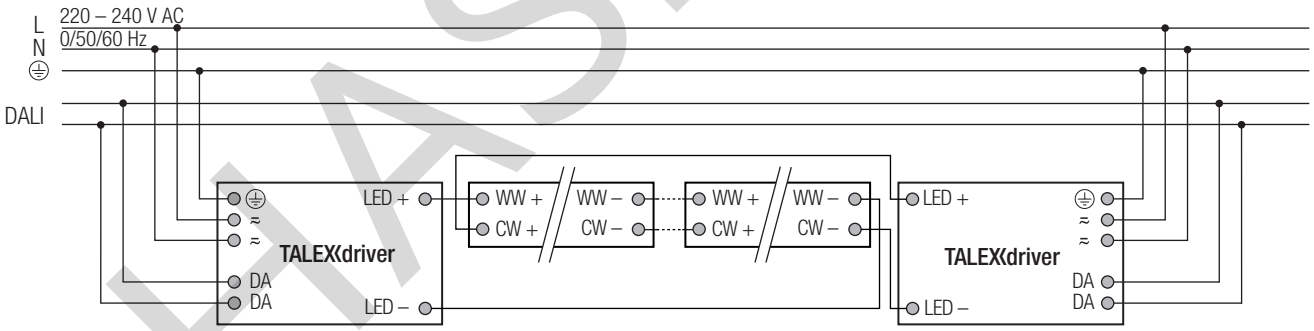
Wiring diagram for DALI for the STARK LLE premium (with DALI DT8 LED Driver)



Wiring diagram for switchDIM and colourTEMPERATURE for the STARK LLE premium (with DALI DT8 LED Driver)



Wiring diagram DALI for the LLE premium (with DALI DT6 LED Driver)



Storage and humidity

storage temperature	-30 … +80 °C

Operation only in non condensing environment.
Humidity during processing of the module should be between 30 to 70 %.

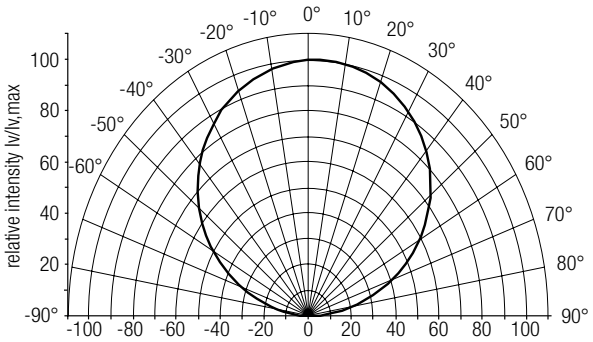
Ambient

STARK LLE is designed for inbuilt applications. It has no IP protection.

Optical characteristics STARK LLE

The optical design of the STARK LLE product line ensures optimum homogeneity for the light distribution.

Light distribution



Lumen maintenance for STARK LLE premium

tp temperature	L90 / B10	L90 / B50	L80 / B10	L80 / B50	L70 / B10	L70 / B50
55 °C	50,000 h	50,000 h	50,000 h	50,000 h	50,000 h	50,000 h
60 °C	32,000 h	50,000 h	50,000 h	50,000 h	50,000 h	50,000 h
65 °C	25,000 h	50,000 h	50,000 h	50,000 h	50,000 h	50,000 h
70 °C	18,000 h	40,000 h	32,000 h	50,000 h	50,000 h	50,000 h

Electrical supply/choice of LED Driver

The LLE premium module is a 2-channel LED module with two different LED packages.
The LED packages have a colour temperature of 2,700 and 6,500 K.
They can be driven independently of each other.
This makes it possible to generate colour temperatures in the intermediate range.
The LED packages can be driven by a DALI DT8 2-channel driver or 2 units of a DALI DT6 Driver.
The data listed in the “specific technical table” (see page 1) apply per channel.

STARK LLE from Tridonic are not protected against overvoltages, overcurrents, overloads or short-circuit currents. Safe and reliable operation can only be guaranteed in conjunction with a LED Driver which complies with the relevant standards. The use of LED Driver from Tridonic in combination with STARK LLE guarantees the necessary protection for safe and reliable operation.

If a LED Driver other than from Tridonic is used, it must provide the following protection:

- Short-circuit protection
- Overload protection
- Overtemperature protection

STARK LLE must be supplied by a constant current LED Driver. Operation with a constant voltage LED Driver will lead to an irreversible damage of the module.

Wrong polarity can damage the STARK LLE.

With parallel wiring tolerance-related differences in output are possible (thermal stress of the module) and can cause differences in brightness. If one module fails, the remaining modules may be overloaded.

Selection of the LED Driver

STARK LLE can be operated either from SELV LED Drivers or from LED Drivers with LV output voltage.

STARK LLE are basic isolated up to 250 V against ground and can be mounted directly on earthed metal parts of the luminaire. If the max. output voltage of the LED Driver (also against earth) is above 250 V, an additional isolation between LED module and heat sink is required (for example by isolated thermal pads) or by a suitable luminaire construction.
At voltages > 60 V an additional protection against direct touch (test finger) to the light emitting side of the module has to be guaranteed. This is typically achieved by means of a non removable light distributor over the module.

Additional information

Additional technical information at www.tridonic.com → Technical Data

Guarantee conditions at www.tridonic.com → Services

Life-time declarations are informative and represent no warranty claim.

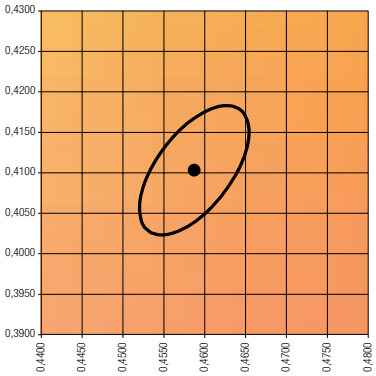
Coordinates and tolerances according to CIE 1931

The specified colour coordinates are central measured by a current impulse with typical values of module and a duration of 100 ms.
The ambient temperature of the measurement is ta = 25 °C.
The measurement tolerance of the colour coordinates are ± 0.01.

2,700 K

	x0	y0
Centre	0.4585	0.4104

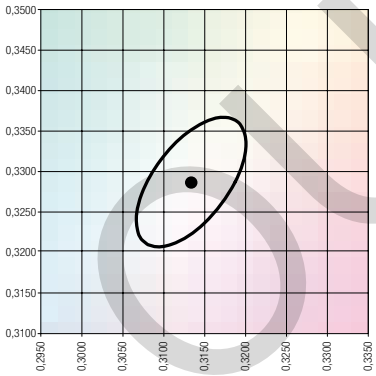
MacAdam ellipse: 3SDCM



6,500 K

	x0	y0
Centre	0.3135	0.3284

MacAdam ellipse: 3SDCM



Colour spectrum at different colour temperatures