

Engine STARK LLE PREMIUM system data sheet

STARK LLE

Product description

- Linear Tunable White system with adjustable colour temperature from 3,000 to 6,000 K at constant luminous flux
- Precalibrated set to ensure light quality and high colour consistency, consisting of LED Driver and 3 to 5 LED modules^①
- Outstanding system colour tolerance MacAdam 3 over the full operating area
- High system efficiency up to 106 lm/W at $t_p = 65\text{ °C}$
- Low-profile LED Driver with digital interface (DALI Device Type 8, DSI, switchDIM, colourTEMPERATURE)
- Linear LED modules with 700 or 1,500 lm
- Dimming range 10 – 100 % without change of colour temperature
- Long life-time of 50,000 h and 5-year system guarantee



Technical data Module STARK LLE PREMIUM, page 2

Product description Module STARK LLE PREMIUM, page 10

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Product description Driver LCAI TW Ip, page 13



Ordering data

Type	Article number	System components
STARK-LLE-3x24-280-700-830-860-PRE-KIT	89601896	1 LED Driver + 3 LED modules at 700 lm
STARK-LLE-4x24-280-700-830-860-PRE-KIT	89601897	1 LED Driver + 4 LED modules at 700 lm
STARK-LLE-5x24-280-700-830-860-PRE-KIT	89601898	1 LED Driver + 5 LED modules at 700 lm
STARK-LLE-3x24-280-1500-830-860-PRE-KIT	89601899	1 LED Driver + 3 LED modules at 1,500 lm
STARK-LLE-4x24-280-1500-830-860-PRE-KIT	89601900	1 LED Driver + 4 LED modules at 1,500 lm
STARK-LLE-5x24-280-1500-830-860-PRE-KIT	89601901	1 LED Driver + 5 LED modules at 1,500 lm

^① Mixing of components from different sets is not allowed due to the pre-calibration of the system.



Module STARK LLE PREMIUM
STARK LLE

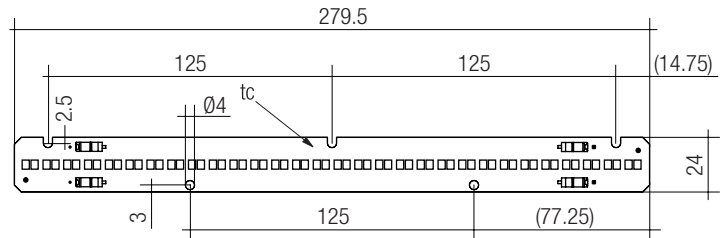
Product description

- Tunable White module with adjustable colour temperature
- High colour rendering index CRI > 80
- Low tolerances for colour temperature (MacAdam 3)
- Low light current tolerances
- Excellent thermal management[®]
- Ideal for linear and panel lights
- Long life-time: 50,000 hours
- 5-year guarantee



Technical data

Beam characteristic	120°
Ambient temperature ta [®]	-25 ... +55 °C
Typ. tp point	65 °C
Risk group (EN 62471:2008)	1



Standards, page 5

Colour temperatures and tolerances, page 7

Product description, page 5

Specific technical data

Type	Photo-metric code	Typ. forward current [®]	Typ. luminous flux at tp = 25 °C [®]	Typ. luminous flux at tp = 65 °C [®]	Typ. power consumption at tp = 65 °C [®]	Efficacy of the module at tp = 25 °C	Efficacy of the module at tp = 65 °C	Efficacy of the system at tp = 65 °C	Colour rendering index CRI [®]	Energy classification
Operating with LCAI 38 W 125 mA TW Ip										
STARK-LLE-3x24-280-700-830-860-PRE	830/349 – 860/349	125 mA	2,100 lm	2,000 lm	20 W	105 lm/W	100 lm/W	90 lm/W	> 80	A+
STARK-LLE-4x24-280-700-830-860-PRE	830/349 – 860/349	125 mA	2,800 lm	2,650 lm	26 W	108 lm/W	102 lm/W	92 lm/W	> 80	A+
STARK-LLE-5x24-280-700-830-860-PRE	830/349 – 860/349	125 mA	3,500 lm	3,350 lm	32 W	109 lm/W	105 lm/W	95 lm/W	> 80	A+
Operating with LCAI 75 W 250 mA TW Ip										
STARK-LLE-3x24-280-1500-830-860-PRE	830/349 – 860/349	250 mA	4,500 lm	4,300 lm	40 W	113 lm/W	108 lm/W	101 lm/W	> 80	A+
STARK-LLE-4x24-280-1500-830-860-PRE	830/349 – 860/349	250 mA	6,000 lm	5,700 lm	52 W	115 lm/W	110 lm/W	103 lm/W	> 80	A+
STARK-LLE-5x24-280-1500-830-860-PRE	830/349 – 860/349	250 mA	7,500 lm	7,150 lm	63 W	119 lm/W	114 lm/W	106 lm/W	> 80	A+

[®] Tolerance range for optical data over the CCT range: ±5 %.

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

[®] 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.

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

IP20    

Driver LCAI TW Ip

Product description

- LED Driver for LLE PREMIUM modules
- Output power: 38 W or 75 W
- Power input on standby < 0.3 W

Properties

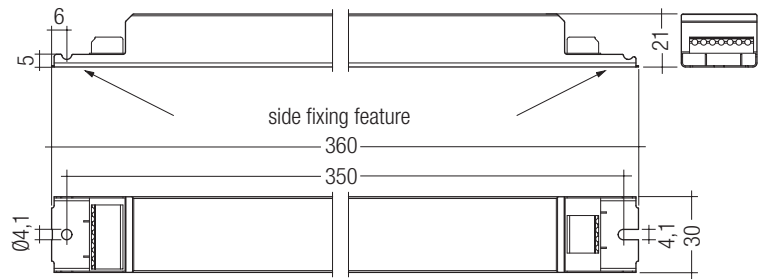
- Low-profile LED Driver with digital interface (DALI Device Type 8, DSI, switchDIM, colourTEMPERATURE)
- switchDIM and colourTEMPERATURE with memory function^{①②}
- Powerless switching via digital interface (no need for switching via mains)
- Intelligent Temperature Guard (protection against thermal damage)
- Short-circuit shutdown feature with one restart (after 0.5 s)
- Overload protection with one restart (after 0.5 s)

Technical data

Rated supply voltage	220 – 240 V
Input voltage range, AC	198 – 264 V
Input voltage range, DC	176 – 280 V
Rated current (at 230 V 50 Hz) for 38 W	0.18 A
Rated current (at 230 V 50 Hz) for 75 W	0.35 A
Mains frequency	0 / 50 / 60 Hz
Efficiency for 38 W	90 %
Efficiency for 75 W	93 %
λ (at 230 V 50 Hz, full load)	0.96
Control input ^{① ②}	DSI, DALI, switchDIM, colourTEMPERATURE
Stand-by power	< 0.3 W
Max. output voltage (no-load voltage)	270 V
Dimming range	10 – 100 %
PWM frequency	200 – 500 Hz
Set up time (at 230 V 50 Hz)	< 0.5 s
Switchover time AC/DC and DC/AC	< 1 s
Leakage current (PE)	150 μ A
t_a operating (at life-time 50,000 h) for 38 W	-25 ... +60 °C
t_a operating (at life-time 50,000 h) for 75 W	-25 ... +55 °C
Max. casing temperature t_c (at life-time 50,000 h) for 38 W	70 °C
Max. casing temperature t_c (at life-time 50,000 h) for 75 W	75 °C

^① In DC operation the last set colour is used.

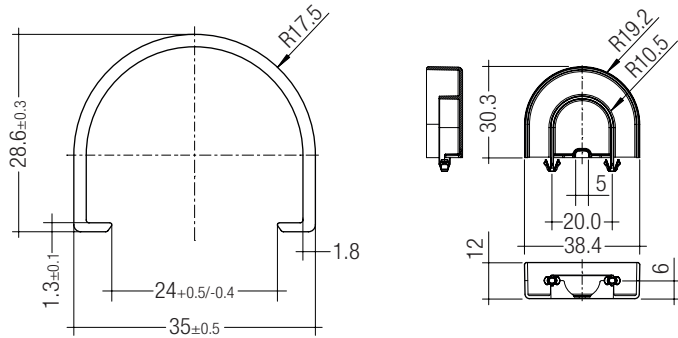
^② No colourTEMPERATURE mode at DC operation.



Product description, page 8

Product description

- LINEAR COVER / ENDCAP for LLE 24
- Protection against direct touch for non-SELV applications
- 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 length (ends raw)

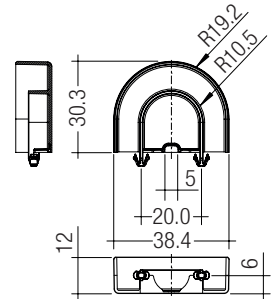


Ordering data

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

Product description

- ENDCAP for LLE 24
- Fast snap on mounting (sheet thickness 0.5 – 1.0 mm), for drilling hole 4 mm
- Made of Polycarbonat



Ordering data

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

Product description

- Linear lens for LLE 24
- Available with different beam characteristics
- Protection against direct touch for non-SELV applications
- 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 \pm 20 mm tolerances and
ends raw
- Photometric data available on website



ACL LINEAR LENS 24mm 60°



ACL LINEAR LENS 24mm 90°



ACL LINEAR LENS 24mm INTENSE



ACL LINEAR LENS 24mm BATWING

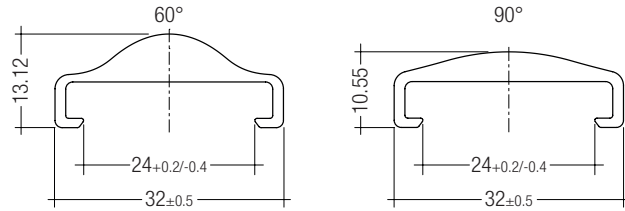


ACL LINEAR LENS 24mm ASY

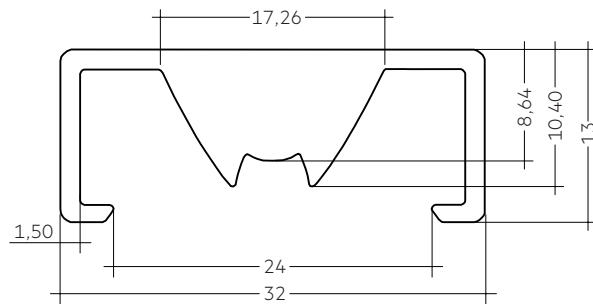


ACL LINEAR LENS 24mm DASy

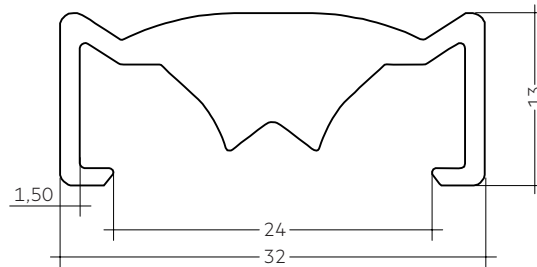
ACL LENS 24mm



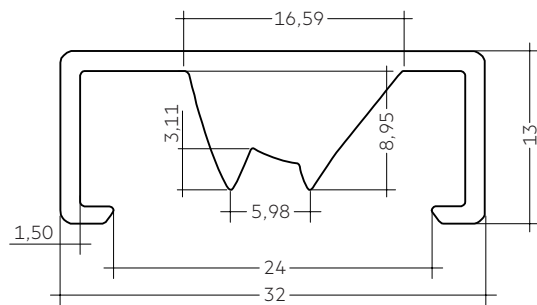
ACL LINEAR LENS 24mm 60° and 90°



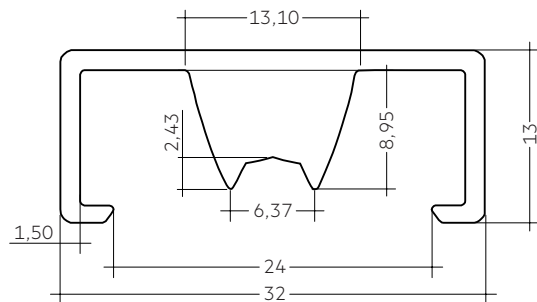
ACL LINEAR LENS 24mm INTENSE



ACL LINEAR LENS 24mm BATWING



ACL LINEAR LENS 24mm ASY



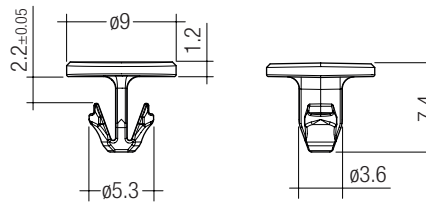
ACL LINEAR LENS 24mm DASY

Ordering data

Type	Article number	Beam characteristic	Efficiency	Packaging carton	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 DASYS	28002033	double asymmetric	92 %	18 pc(s).	0.249 kg
ACL LINEAR LENS 24x1500mm DASYS	28002034	double asymmetric	92 %	18 pc(s).	0.311 kg
ACL LINEAR LENS 24x1800mm DASYS	28002035	double asymmetric	92 %	18 pc(s).	0.373 kg

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 drilling hole 4 mm
- Clip made of Polycarbonat



Ordering data

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

[®] Minimum sales quantity 500 pcs.

Module STARK LLE PREMIUM

Product description

Standards

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

Photometric code

Key for photometric code, e. g. 830 / 349

1 st digit	2 nd + 3 rd digit	4 th digit	5 th digit	6 th digit
Code CRI	Colour temperature in Kelvin x 100	McAdam initial	McAdam after 25% of the life-time (max.6000h)	Luminous flux after 25% of the life-time (max.6000h)
7 70 – 79				Code Luminous flux
8 80 – 89				7 \geq 70 %
9 \geq 90				8 \geq 80 %
				9 \geq 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 STARK LLE 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 the 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: 0.5Nm.

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 cm ²
35°C	65°C	125 mA	7.3 K/W	90 cm ²
45°C	65°C	125 mA	4.8 K/W	135 cm ²

STARK LLE PREMIUM 1,500 lm

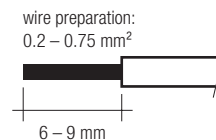
ta	tp	Forward current	R _{th, hs-a}	Cooling area
25°C	65°C	250 mA	5.1 K/W	131 cm ²
35°C	65°C	250 mA	3.8 K/W	176 cm ²
45°C	65°C	250 mA	2.5 K/W	268 cm ²

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.

Thermal behaviour

storage temperature	-30 ... +80 °C
operating temperature	-25 ... +55 °C
tp (at typ. current)	65 °C
tc max. (at typ. current)	70 °C
max. humidity	0...80%

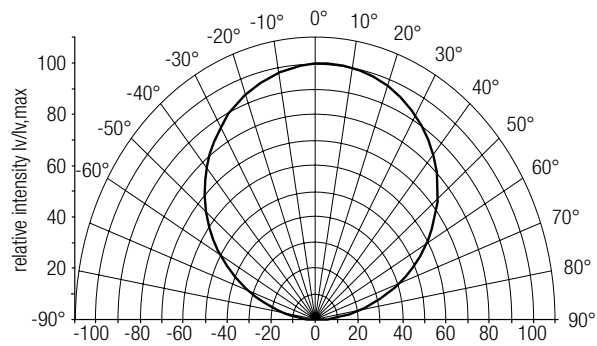
Ambient

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

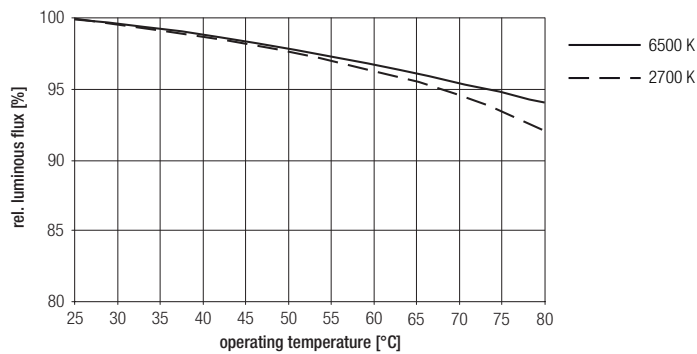
Optical characteristics STARK LLE

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

Light distribution



Relative light flux vs. operating temperature



The diagrams are based on statistic values.

For further information see Design-in Guide, 3D data and photometric data on www.tridonic.com or on request.

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

Selection of the LED Driver

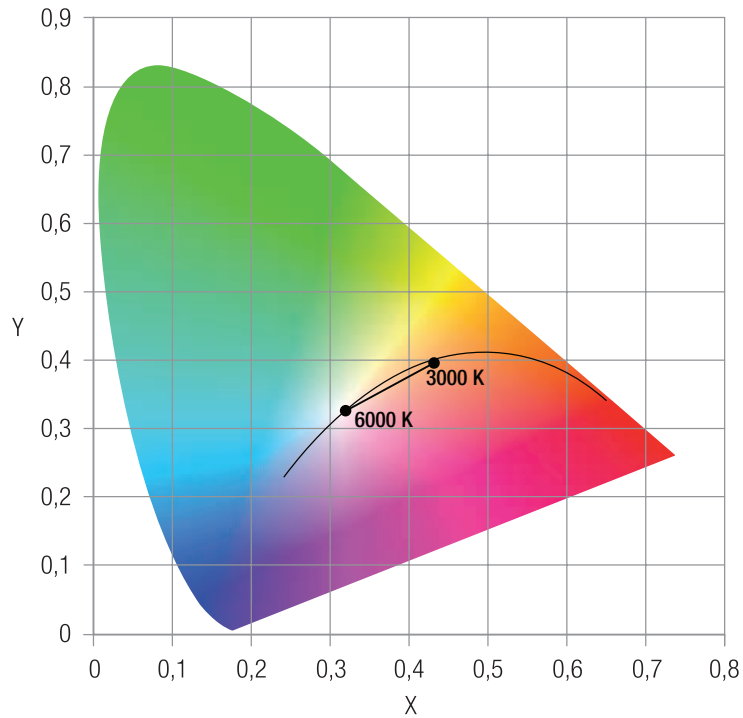
The STARK LLE PREMIUM can only be operated with the LCAI TW Ip.



Only components out of a single set shall be connected. Mixing the sets will invalidate the system calibration and will decrease the system performance considerably.

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 $t_a = 25\text{ }^\circ\text{C}$.
The measurement tolerance of the colour coordinates are ± 0.01 .



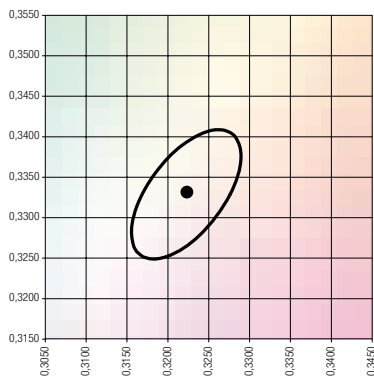
6,000 K

	x0	y0
Centre	0.3220	0.3330

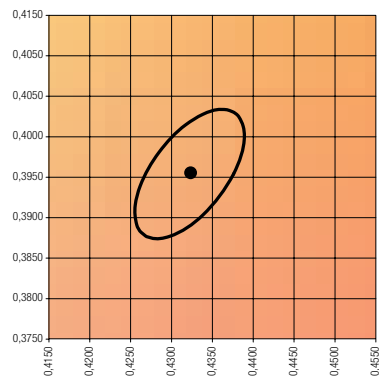
3,000 K

	x0	y0
Centre	0.4325	0.3955

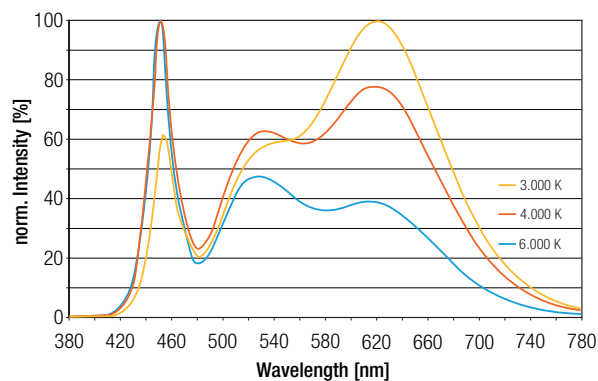
MacAdam ellipse: 3SDCM



MacAdam ellipse: 3SDCM



Colour spectrum at different colour temperatures



Driver LCAI TW Ip
Product description

Standards

- EN 61347-1
- EN 61347-2-13
- EN 62384
- EN 61000-3-2
- EN 61547
- EN 55015
- EN 62493
- EN 62386-101
- EN 62386-102
- EN 62386-209 (DALI DEVICE Type 8)

Control input (DA/D1, DA/D2)

Digital DALI/DSI signal or switchDIM can be wired on the same terminals (DA/D1 and DA/D2).

Digital signal DALI/DSI

The control input is non-polar and protected against accidental connection with a mains voltage up to 264 V. The control signal is not SELV. Control cable has to be installed in accordance to the requirements of low voltage installations. Different functions depending on each module.

Colour types

Supported colour types according to DALI Device Type 8:

- colour temperature (colourTEMPERATURE)

Thermal protection of the unit

The unit also has an ITG (Intelligent Temperature Guard). This protects the LCAI TW Ip from thermal overload by reducing the output power or switching off in case of operation above the thermal limits of the luminaire or ballast. Depending on the luminaire design, the ITG operates at about 12 °C (±5 °C) above t_c temperature.

Control via switchDIM and colourTEMPERATURE

A conventional double pushbutton can be used to control the system via switchDIM and colourTEMPERATURE. One of the pushbuttons is used to set the colour temperature, the other to set the dimming level.

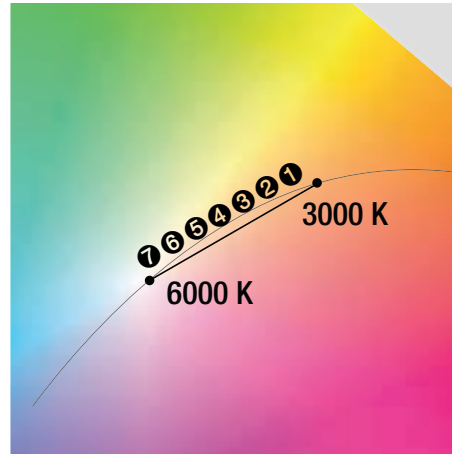


Pushbuttons with glow lamps affect the switchDIM and colourTEMPERATURE and should therefore not be used for this purpose.

For control via a double pushbutton different settings can be made:

- Setting the colour temperature via colourTEMPERATURE mode with 7 predefined values between 3,000 and 6,000 K.
- Stepless setting of the dimming level between 10 and 100 %.
- These values can be changed via masterCONFIGURATOR.

colourTEMPERATURE mode



Location of the predefined colour temperatures

1	3.000 K
2	3.500 K
3	4.000 K
4	4.500 K
5	5.000 K
6	5.500 K
7	6.000 K

Setting the colour temperature

The procedure for setting the colour temperature mode (colourTEMPERATURE):

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



When reaching the maximum value the LED module will flash shortly. Another press on the pushbutton will switch the colour temperature immediately to the minimum value.

- Alternatively the colour temperature could be changed via DALI device type 8 control system.

Light level in DC operation

The LED Driver is designed for operation on DC voltage and pulsed DC voltage.

Light output level in DC operation: programmable 10 – 100 % (EOFx = 0.13).
Programming by DALI.

In DC operation dimming mode can be activated.

The voltage-dependent input current of Driver incl. LED module is depending on the used load.

For further information please refer to the brochure entitled "Technical Design-In-Guide LLE PREMIUM".

Dimming

Dimming range 10 % to 100 %

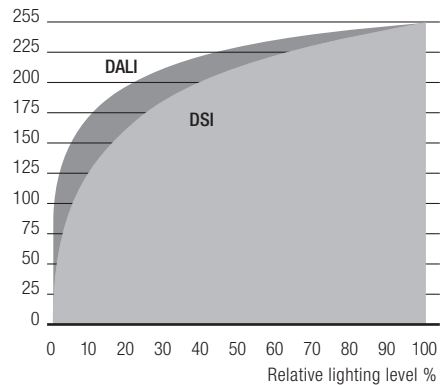
Digital control with:

- DSI signal: 8 bit Manchester Code
Speed 10 % to 100 % in 1.4 s
 - DALI signal: 16 bit Manchester Code
Speed 10 % to 100 % in 0.1 s
- Programmable parameter:
Minimum dimming level
Maximum dimming level
Default minimum = 10 %
Programmable range $10 \% \leq \text{MIN} \leq 100 \%$
Default maximum = 100 %
Programmable range $100 \% \geq \text{MAX} \geq 10 \%$

Dimming curve is adapted to the eye sensitiveness.

Dimming characteristics

Digital dimming value



Dimming characteristics as seen by the human eye

Maximum loading of automatic circuit breakers

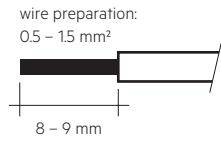
Automatic circuit breaker type	C10	C13	C16	C20	B10	B13	B16	B20	Inrush current	
Installation Ø	1.5 mm ²	1.5 mm ²	1.5 mm ²	2.5 mm ²	1.5 mm ²	1.5 mm ²	1.5 mm ²	2.5 mm ²	I_{max}	time
LCAI 38 W 125 mA TW Ip	22	30	40	58	11	15	20	29	23 A	290 µs
LCAI 75 W 250 mA TW Ip	14	20	28	38	7	10	14	19	26 A	350 µs

Harmonic distortion in the mains supply (at 230 V / 50 Hz and full load) in %

Type	THD	3	5	7	9	11
LCAI 38 W 125 mA TW Ip	< 12	9	5	4	1	2
LCAI 75 W 250 mA TW Ip	< 9	6	5	4	3	2

Wiring type and cross section

Solid wire with a cross section of 0.5 – 1.5 mm². Strip 8 – 9 mm of insulation from the cables to ensure perfect operation of terminals.



Wiring instructions

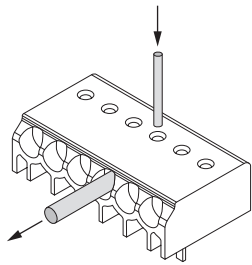
The secondary leads should be separated from the mains connections and wiring for good EMC performance.

The maximum lead length on secondary side is 1.5 m. For a good EMC performance keep the LED wiring as short as possible.

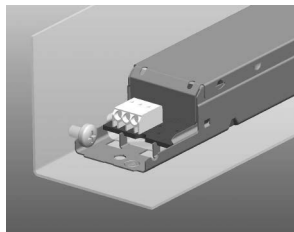
Furthermore, the wiring of the individual channels has to be separated and the use of twisted pairs is not recommended.

Release of the wiring

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

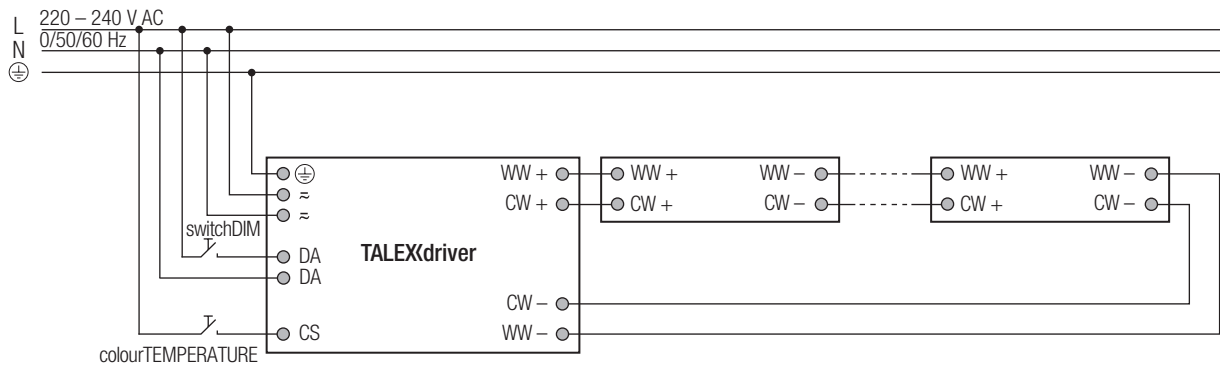


Side fixing feature

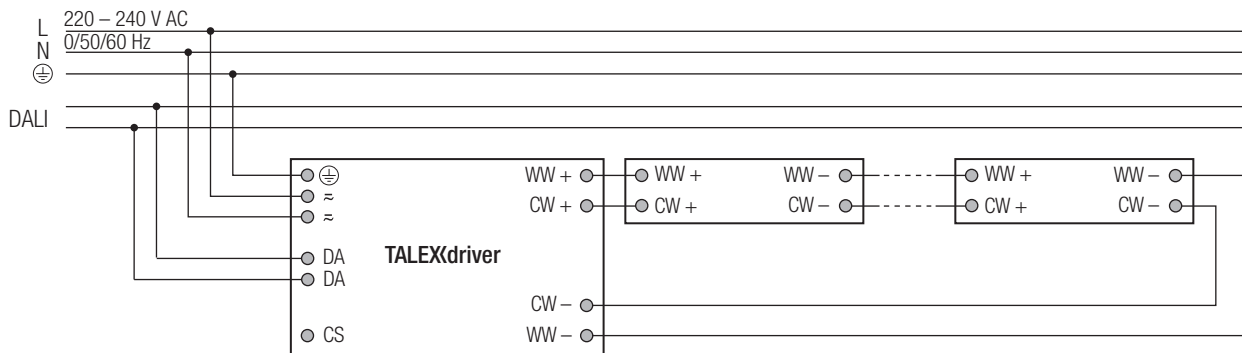


Screw M4, screw head diameter 8–10 mm

Wiring diagram for switchDIM and colourTEMPERATURE for the Engine STARK LLE PREMIUM



Wiring diagram for DALI for the Engine STARK LLE PREMIUM



Miscellaneous

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.