TRIDONIC

Module LLE 24mm 3500lm CRI90 DL PRE

Modules LLE premium

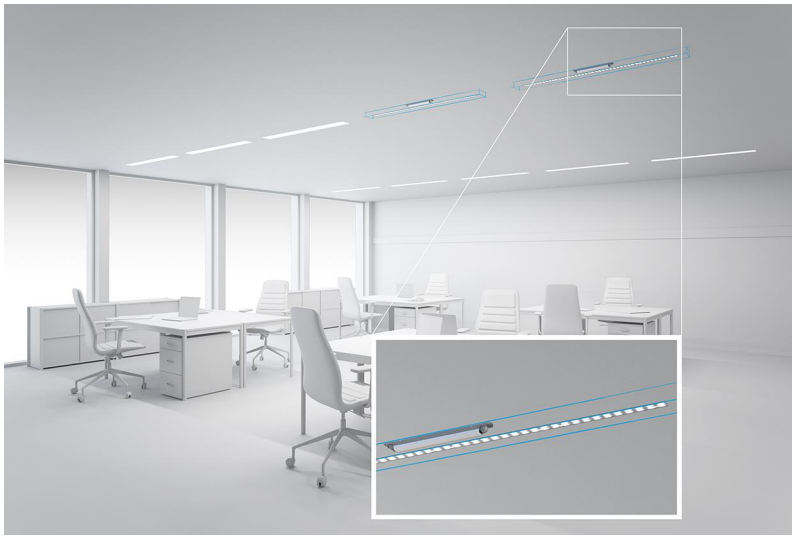
Product description
_ Ideal for linear luminaires
_ Push terminals for quick and simple wiring of LED module to LED module
_ Design for LEDiL DAISY 7x1 / 28x1 and LEDiL BRIANNA 7x1 / 14x1 / 28x1 portfolio
_ HE ... High Efficiency, NM ... Nominal Mode, HO ... High Output
_ Orders only in full carton quantities.
_ Long lifetime up to 102,000 hours
_ 5 years guarantee (conditions at https://www.tridonic.com/en/int/services/manufacturer-guarantee-conditions)

Optical properties
_ Colour temperatures 3,000 and 4,000 K
_ Efficacy up to 205 lm/W
_ High colour rendering index CRI > 90
_ High colour consistency (MacAdam 3)
_ Small luminous flux tolerances

Mechanical properties
_ Module dimension 24 x 1,120 mm
_ Simple installation of lens and module with M3 screws

System solution
_ Integrate compatible partner products into your final system solution: https://www.tridonic.com/en/int/products/accessories#partner
_ Combine Tridonic's LED modules and dimmable drivers to achieve an outstanding system efficacy (configuration possible via https://setbuilder.tridonic.com/)

Website
http://www.tridonic.com/28006228



Linear | High bay | Decorative | Downlights | Spotlights | Free-standing | Area | Floor | Wall | Street

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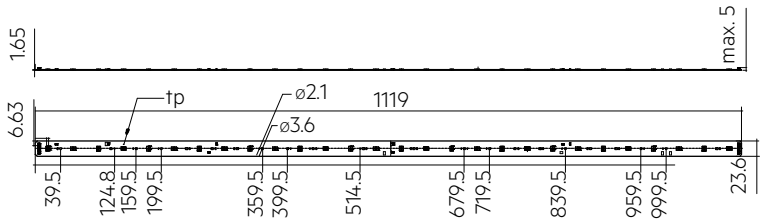


Ordering data

Type	Article number	Colour temperature	Packaging, carton	Weight per pc.
LLE 24x1120mm 3500lm 930 DL PRE	**28006228**	3,000 K	20 pc(s).	0.088 kg
LLE 24x1120mm 3500lm 940 DL PRE	**28006231**	4,000 K	20 pc(s).	0.088 kg

Technical data

Beam characteristic	120°
Ambient temperature ta	-40 … +65 °C
tp rated	65 °C
tc	80 °C
Irated for 3,500 lm	500 mA
Imax for 3,500 lm	1,400 mA
Max. permissible LF current ripple for 3,500 lm	1,760 mA
Max. permissible peak current for 3,500 lm	2,400 mA / max. 10 ms
Max. working voltage for insulation ①	380 V
Insulation test voltage	1.76 kV
Colour tolerance	3 SDCM
ESD classification	Severity level 2
Risk group (IEC 62471)	RG1
Classification acc. to IEC 62031	Built-in
Type of protection	IP00
Lumen maintenance L70B50	102,000 h
Guarantee (conditions at www.tridonic.com)	5 Year(s)

Approval marks

RoHS

Standards

IEC 62031, IEC 62471, IEC 61000-4-2, IEC 62778, IEC 61547, UL 8750

Specific technical data

Type	Article number	Photometric code	Useful luminous flux at tp = 25 °C[2]	Expected luminous flux at tp rated[3]	Typ. forward current	Min. forward voltage at tp rated	Max. forward voltage at tp = 25 °C	Power consumption Pon at tp = 25 °C[4]	Efficacy of the module at tp = 25 °C	Expected efficacy of the module at tp rated	Colour rendering index CRI
LLE 24x1120mm 3500lm – Operating mode NM at 500 mA											
LLE 24x1120mm 3500lm 930 DL PRE	**28006228**	930/359	3,680 lm	3,427 lm	500 mA	35.6 V	39.7 V	18.8 W	196 lm/W	186 lm/W	>90
LLE 24x1120mm 3500lm 940 DL PRE	**28006231**	940/359	3,850 lm	3,693 lm	500 mA	35.6 V	39.7 V	18.8 W	205 lm/W	200 lm/W	>90
LLE 24x1120mm 3500lm – Operating mode HO at 800 mA											
LLE 24x1120mm 3500lm 930 DL PRE	**28006228**	930/359	–	5,479 lm	800 mA	36.3 V	40.5 V	–	–	182 lm/W	>90
LLE 24x1120mm 3500lm 940 DL PRE	**28006231**	940/359	–	5,905 lm	800 mA	36.3 V	40.5 V	–	–	196 lm/W	>90
LLE 24x1120mm 3500lm – Operating mode HO at 1,200 mA											
LLE 24x1120mm 3500lm 930 DL PRE	**28006228**	930/359	–	8,041 lm	1,200 mA	37.1 V	41.4 V	–	–	174 lm/W	>90
LLE 24x1120mm 3500lm 940 DL PRE	**28006231**	940/359	–	8,666 lm	1,200 mA	37.1 V	41.4 V	–	–	188 lm/W	>90

① If mounted with M3 screws in combination with a lens like LEDiL DAISY.
② Tolerance of useful light flux - 0 % / + 15 %. Measurement uncertainty ± 10 %.
③ Tolerance of expected light flux - 0 % / + 15 %. Measurement uncertainty ± 10 %. Based on calculation.
④ Tolerance of power consumption Pon ± 10 %. Measurement uncertainty ± 3 %.

1. Standards

IEC 62031
IEC 62471
IEC 61000-4-2
IEC 62778
IEC 61547
UL 8750

1.1 Photometric code

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

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 lifetime (max.6000h)	Luminous flux after 25% of the lifetime (max.6000h)	
					Code	Luminous flux
7	70 – 79				7	≥ 70 %
8	80 – 89				8	≥ 80 %
9	≥90				9	≥ 90 %

1.2 Energy classification

Type	Colour temperature	Forward current	Energy classification	Energy consumption
LLE 24x1120mm 3500lm 930 DL PRE	3,000 K	500 mA	C	19 kWh / 1,000 h
LLE 24x1120mm 3500lm 940 DL PRE	4,000 K	500 mA	B	19 kWh / 1,000 h

Energy label and further information at www.tridonic.com in the certificates tab of the corresponding product page and at the EPREL data base https://eprel.ec.europa.eu/

2. Thermal details

2.1 tc point, ambient temperature and lifetime

The temperature at tp reference point is crucial for the light output and lifetime of a LED product.

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

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.

2.2 Storage and humidity

Storage temperature	-40 … +80 °C

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

2.3 Heat sink values

LLE 24x1120mm 3500lm DL PRE

ta	tp	Forward current	$R_{th, hs-a}$	Cooling area
25 °C	65 °C	500 mA	4.76 K/W	140 cm²
25 °C	65 °C	1,400 mA	0.85 K/W	785 cm²
35 °C	65 °C	500 mA	3.53 K/W	189 cm²
35 °C	65 °C	1,400 mA	0.59 K/W	1,125 cm²
40 °C	65 °C	500 mA	2.91 K/W	229 cm²
40 °C	65 °C	1,400 mA	0.46 K/W	1,437 cm²
45 °C	65 °C	500 mA	2.29 K/W	291 cm²
45 °C	65 °C	1,400 mA	0.34 K/W	1,987 cm²
50 °C	65 °C	500 mA	1.67 K/W	398 cm²
50 °C	65 °C	1,400 mA	0.21 K/W	3,221 cm²
55 °C	65 °C	500 mA	1.06 K/W	631 cm²
55 °C	65 °C	1,400 mA	0.08 K/W	8,499 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.

3. Installation / wiring

3.1 Electrical supply/choice of LED driver

LLE modules 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 LLE modules guarantees the necessary protection for safe and reliable operation.

If a LED driver other than Tridonic is used, it must provide the following protection:
- Short-circuit protection
- Overload protection
- Overtemperature protection

LLE modules 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 LLE.

With parallel wiring tolerance-related differences in output are possible (thermal stress of the module) and can cause differences in brightness.

If a wire breaks or a complete module fails then the current passing through the other module increases. This may reduce its life considerably.

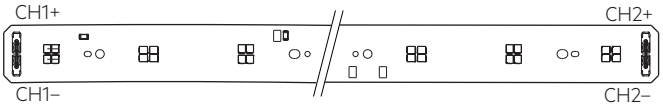
The max. permissible output current of the LED driver for parallel wiring is 3 A.

Serial wiring is recommended for optimum homogeneity.

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

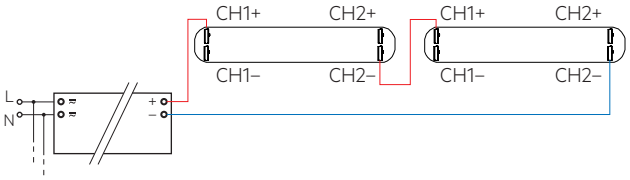
LLE are basic insulated up to 380 V SELV (if mounted with M3 screws in combination with a lens like LEDiL DAISY) against ground and can be mounted directly on earthed metal parts of the luminaire. If the max. output voltage of the LED driver (also against earth) is above 60 V SELV, an additional insulation between LED module and heat sink is required (for example by insulated thermal pads) or by a suitable luminaire construction.

3.2 Wiring

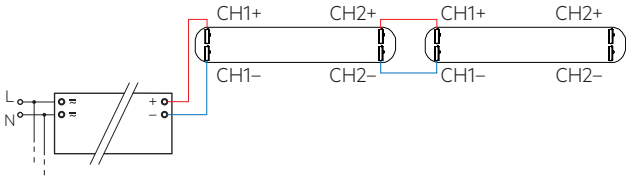


Wiring examples

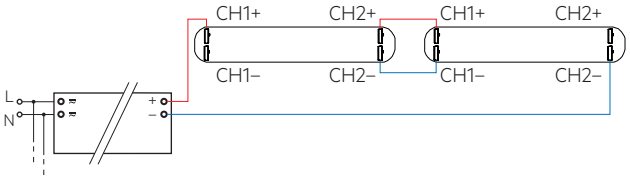
Serial wiring:



Parallel wiring:



Parallel wiring - improved homogeneity:

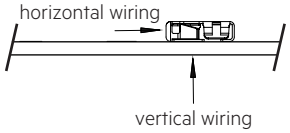


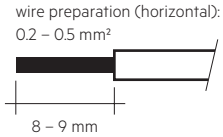
Type	Max. number with parallel wiring*
LLE 24x1120mm 3500lm 930 DL PRE	3
LLE 24x1120mm 3500lm 940 DL PRE	2

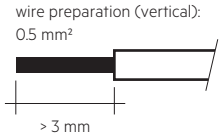
* with direkt chaining (without additional terminals).

3.3 Wiring type and cross section

For horizontal wiring use stranded wire of 0.5 mm² or solid wire from 0.2 to 0.5 mm² (stripping length 8 - 9 mm) and for vertical wiring solid wire with 0.5 mm² (stripping length > 3 mm).
Only one wire per terminal allowed.

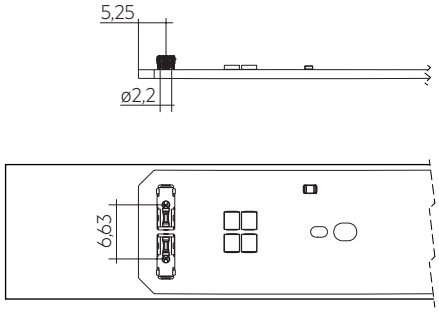






Removing the wires through twist and pull.

Cut-out for vertical wiring:



3.4 Mounting instruction

None of the components of the 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 M3 rounded head screws.

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.

3.5 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

4. Lifetime

4.1 Lifetime, lumen maintenance and failure rate

The light output of an LED module decreases over the lifetime, this is characterized with the L value.
L70 means that the LED module will give 70 % of its initial luminous flux.
This value is always related to the number of operation hours and therefore defines the lifetime of an LED module.

As the L value is a statistical value and the lumen maintenance may vary over the delivered LED modules.
The B value defines the amount of modules which are below the specific L value, e.g. L70B10 means 10 % of the LED modules are below 70 % of the initial luminous flux, respectively 90 % will be above 70 % of the initial value.
In addition the percentage of failed modules (fatal failure) is characterized by the C value.

4.2 Lumen maintenance for LLE 24mm DL PRE

LLE 24x1120mm DL PRE

Forward current	tp temperature	L90 / B10	L90 / B50	L80 / B10	L80 / B50	L70 / B10	L70 / B50
500 mA	55 °C	52k h	52k h	> 102k h	> 102k h	> 102k h	> 102k h
	80 °C	52k h	52k h	> 102k h	> 102k h	> 102k h	> 102k h
1400 mA	55 °C	52k h	52k h	> 102k h	> 102k h	> 102k h	> 102k h
	80 °C	52k h	52k h	> 102k h	> 102k h	> 102k h	> 102k h

L00C03 >102k h. At tp rated and I rated, based on 10 switching cycles per day.

4.3 Switching capability

100,000 cycles

Tridonic test according to IEC 62717 Cl 10.3.3
30 s on / 30 s off at Imax

5. Electrical values

5.1 Declaration of electrical parameters

Irated ... Nominal operating current the module is designed for.

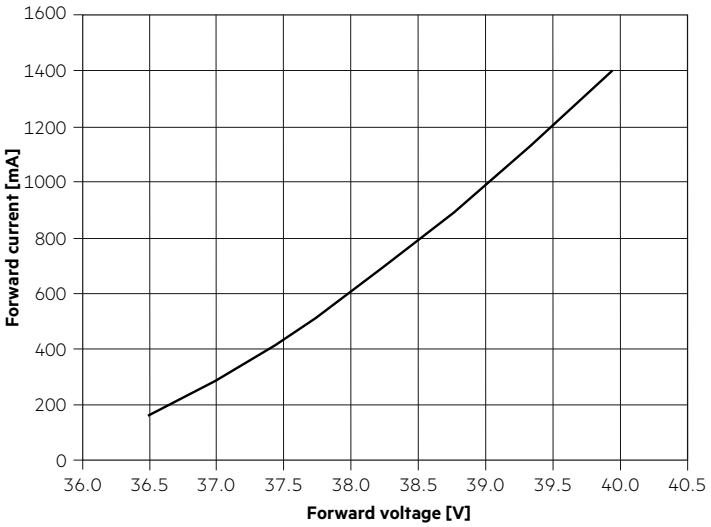
Imax ... Max. permissible continuous operating current incl. The tolerances of the LED driver.

Max. permissible LF current ripple ... Max. output current of the LED driver incl. Tolerances and LF current ripple must not exceed this value.

Max. permissible peak current ... The max. output peak current of the LED driver must not exceed this value.

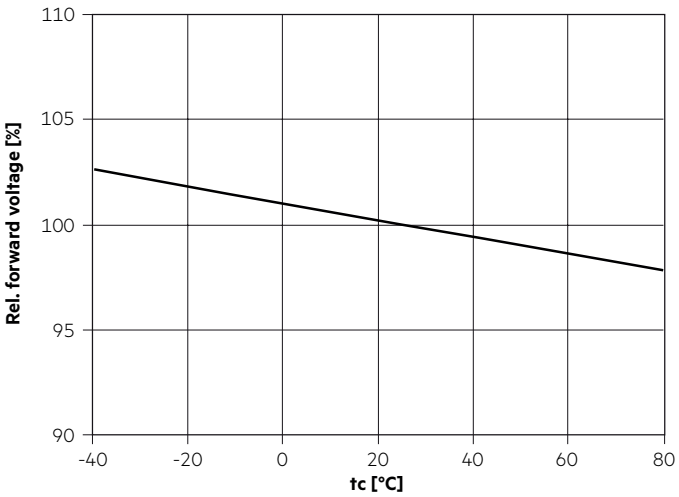
5.2 Typ. forward voltage vs. forward current

LLE 24x112mm 3500lm 9xx DL PRE



The diagrams are based on statistic values.
The real values can be different.

5.3 Forward voltage vs. tc temperature



The diagrams are based on statistic values.
The real values can be different.

6. Photometric characteristics

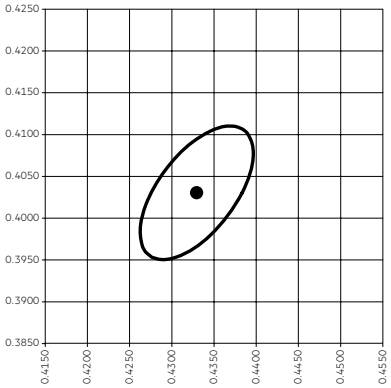
6.1 Coordinates and tolerances according to CIE 1931

The specified colour coordinates are measured integral after a settling time of 100 ms. The current impuls depends on the module type.
The ambient temperature of the measurement is ta = 25 °C.
The measurement tolerance of the colour coordinates are ± 0.01.

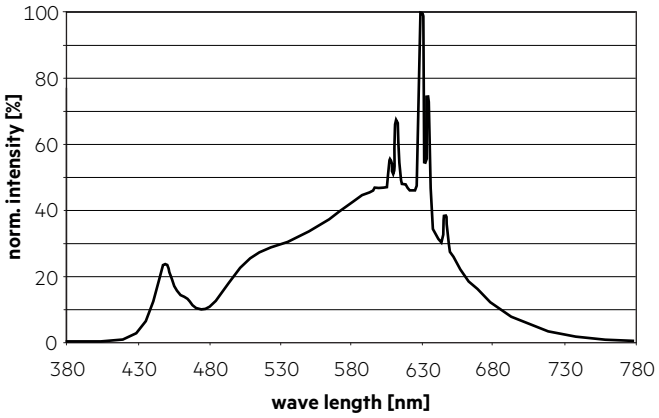
Module type	Current impulse
LLE 24x1120mm 3500lm xxx DL PRE	440 mA

3,000 K

	x0	y0
Centre	0.4338	0.4030

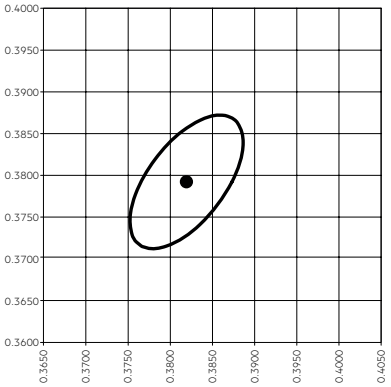


MacAdam Ellipse: 3SDCM

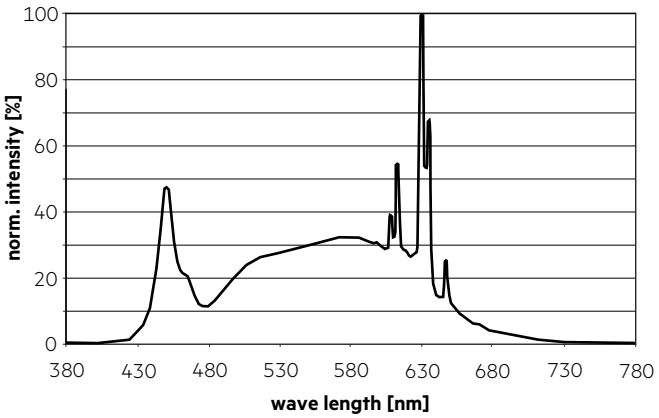


4,000 K

	x0	y0
Center	0.3818	0.3797

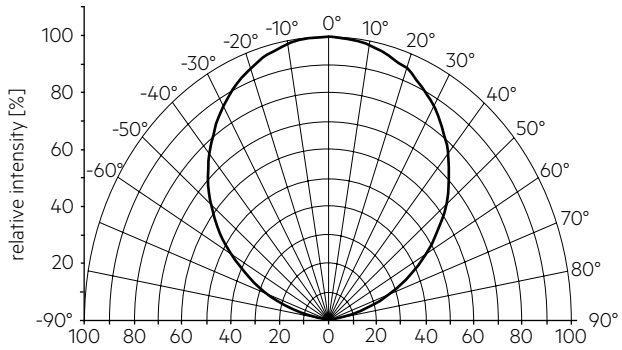


MacAdam Ellipse: 3SDCM



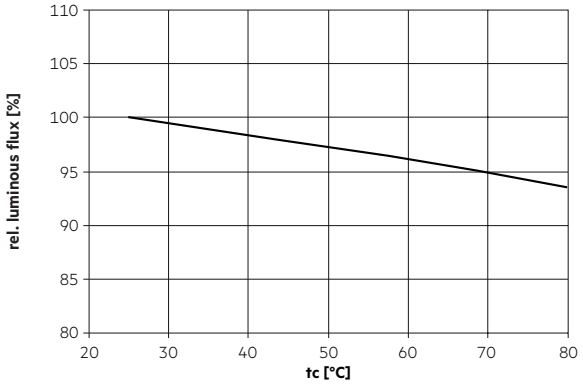
6.2 Light distribution

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



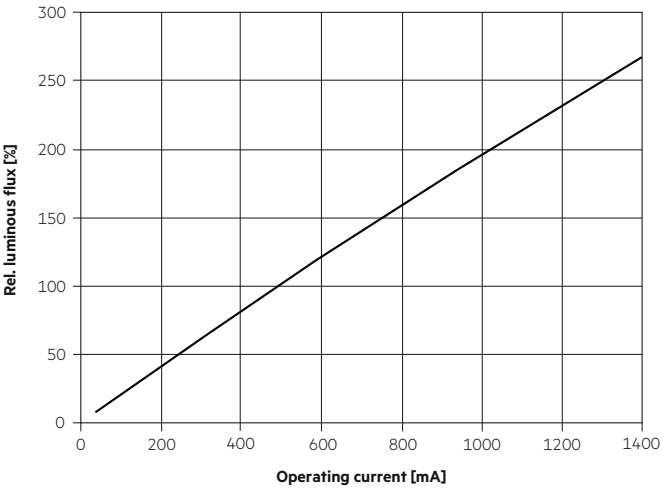
The colour temperature is measured integral over the complete module. The single LED light points can have deviations in the colour coordinates within MacAdam 5.
To ensure an ideal mixture of colours and a homogeneous light distribution a suitable optic (e. g. PMMA diffuser) and a sufficient spacing between module and optic (typ. 4 cm) should be used.

6.3 Relative luminous flux vs. tc temperature



6.4 Relative luminous flux vs. operating current

LLE 24x1120mm DL PRE



The diagrams are based on statistic values.
The real values can be different.

7. Miscellaneous

7.1 Additional information

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

Guarantee conditions at www.tridonic.com → Services

Lifetime declarations are informative and represent no warranty claim.