

45 W **Dimmable DALI DT8/DT6** two-channel LED driver

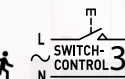
Product code: 5865

45 W 220 – 240 V 0/ 50 – 60 Hz



- DALI-2 certified LED driver, 2-channel control (DT8) for Tunable white in human centric lighting applications
- DualControl (DT6) mode available for e.g. direct/indirect light luminaires
- 0.1 % - 100 % dimming range per single channel (total range 1 % - 100 % in TW mode)*
- Amplitude dimming for the highest quality light output, complying with IEEE 1789 recommendation
- NFC technology for wireless programming
- Suitable for emergency lighting applications with central battery systems (e.g. Eaton-CEAG, Inotec), AC/DC input recognition
- Optional strain relief for independent use outside of luminaire (LC-SRB and LC-SRB-LOOP) and driving Class III luminaires

*) See pages 2-3 for details



Functional Description

- Tunable white mode: DALI Device Type 8 compatible single DALI address for controlling colour temperature by two output channels
- DualControl mode: Configurable for 2 x DALI Device Type 6 address usage
- DALI colour type: Colour temperature T_c
- Adjustable constant current output 100 mA to 900 mA (default 350 mA). In DualControl mode up to 1200 mA total current available (900 mA max. in single channel). Amplitude dimming down to 0.1 % per channel.
- Programmable via NFC or DALI
- D4i compatible Smart Data features, e.g. OEM customer and luminaire data, energy reporting, diagnostics and maintenance
- Optimal fit for BREEAM/LEED/WELL due to flicker-free light, Smart data energy monitoring and (CCT) controllability
- Built-in adjustable internal thermal protection to actively reduce the output current in case of extreme temperatures
- AC/DC input recognition functionality with DC emergency lighting mode and adjustable emergency light level
- Corridor Control for straightforward lighting control with e.g. external sensors with built-in relay
- Latest Switch-Control 3 technology for easy-to-use intensity control
- Constant Light Output (CLO), adjustable up to 100 000 h (default disabled)

Mains Characteristics

Nominal rated voltage range	220 V – 240 V, 0 / 50 – 60 Hz
AC voltage range	198 VAC – 264 VAC
	Withstands max. 320 VAC (max. 1 hour)
	Withstands min. 176 VAC (max. 1 hour)
DC voltage range	176 VDC – 280 VDC
DC starting voltage	> 190 VDC
Mains current at full load	< 0.23 A
Frequency	0 / 50 Hz – 60 Hz
Stand-by power consumption	< 0.5 W
THD at full power	< 12 %
Tested surge protection	1 kV L-N, 2 kV L-GND (IEC 61000-4-5)
Tested fast transient protection	2 kV (IEC 61000-4-4)

Insulation between circuits & driver case

Mains circuit - SELV circuit	Double/reinforced insulation
DALI circuit - SELV circuit	Double/reinforced insulation
Mains circuit - DALI circuit	Basic insulation
Mains, DALI and output - Driver case	Double/reinforced insulation
Mains input - Ground input	Double/reinforced insulation

Load Output (SELV <60 V)

Output current (I_{out})	100 mA – 900 mA
Accuracy	$\pm 5\%$ *) At maximum current
Ripple	< 1 % at ≤ 120 Hz
PstLM	< 0.15**
SVM	< 0.01**
U_{out} (max) (abnormal)	60 V

I_{LED}^*	100 mA	350 mA (default)	500 mA	900 mA
P_{Rated}^*	1.2...5 W	4.2...17.5 W	6...25 W	10.8...45 W
U_{LED}^*	12 – 50 V	12 – 50 V	12 – 50 V	12 – 50 V
PF (λ) at full load	0.66	0.90	0.94	0.97
Efficiency (η) at full load	63 %	81 %	83 %	88 %

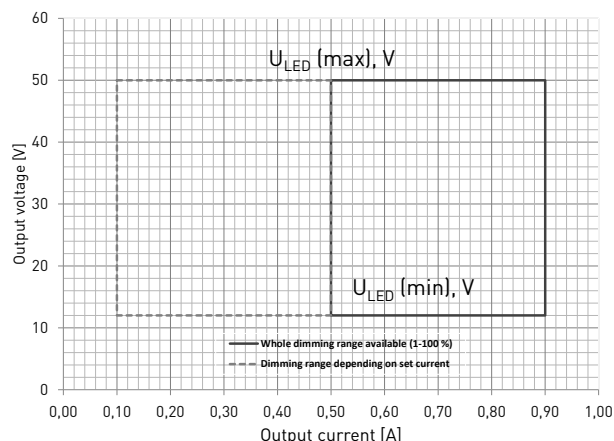
* In Tunable white mode: the chosen output current and power are divided into two channels according to the chosen CCT and module specifications.

In DualControl mode: the output current of both channels can be separately adjusted within 100 - 900 mA. Total current can be up to 1200 mA.

Maximum power of the two channels together can never exceed given P_{Rated}

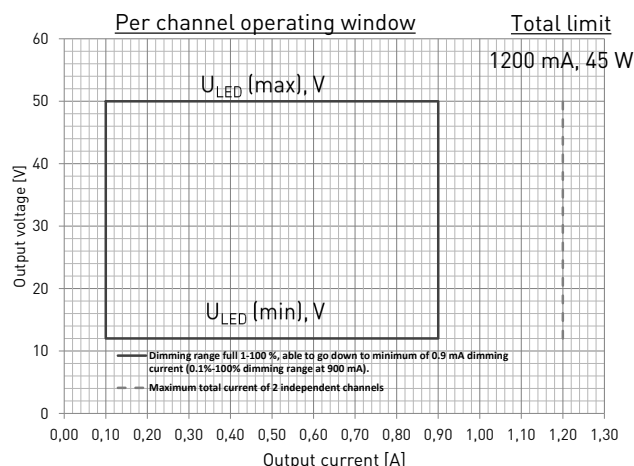
Operating window & driver performance

Tunable white mode



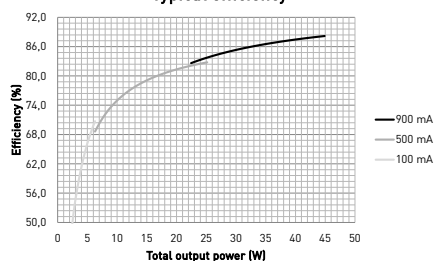
- 1) From 500 mA to 900 mA, full dimming range (1 % - 100 %) and wide CCT dynamic range available in the whole area. Each single channel can dim down to 0.9 mA level.
- 2) From 100 mA to 500 mA, the absolute minimum dimming level is limited to 10 mA of total current. Dimming / CCT control possible all the way down to that current (dimming range 10 % - 100 % at 100 mA), but the dynamic range may be limited. Each single channel can dim down to 0.9 mA level.

DualControl mode

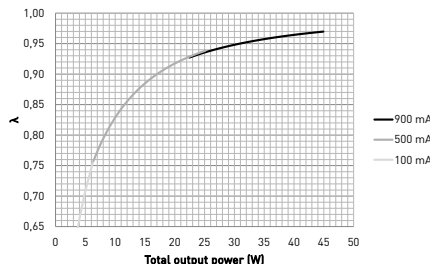


- 1) At least 1 - 100 % dimming range provided on whole operation window. Each channel can go down to 0.1 % dimming at 900 mA (minimum dimming current at whole range is 0.9 mA)
- 2) Each of the channel can operate independently on the operating window shown. The maximum total current of both channels is 1.2 A and the total maximum power is 45 W.
- 3) In the DualControl mode, the dimming follows linear dimming curve.

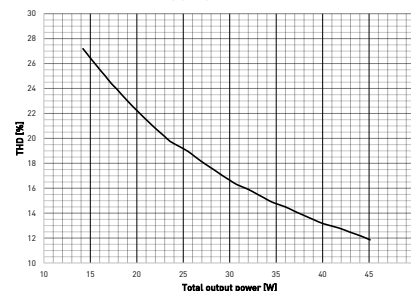
Typical efficiency



Typical power factor



Current THD



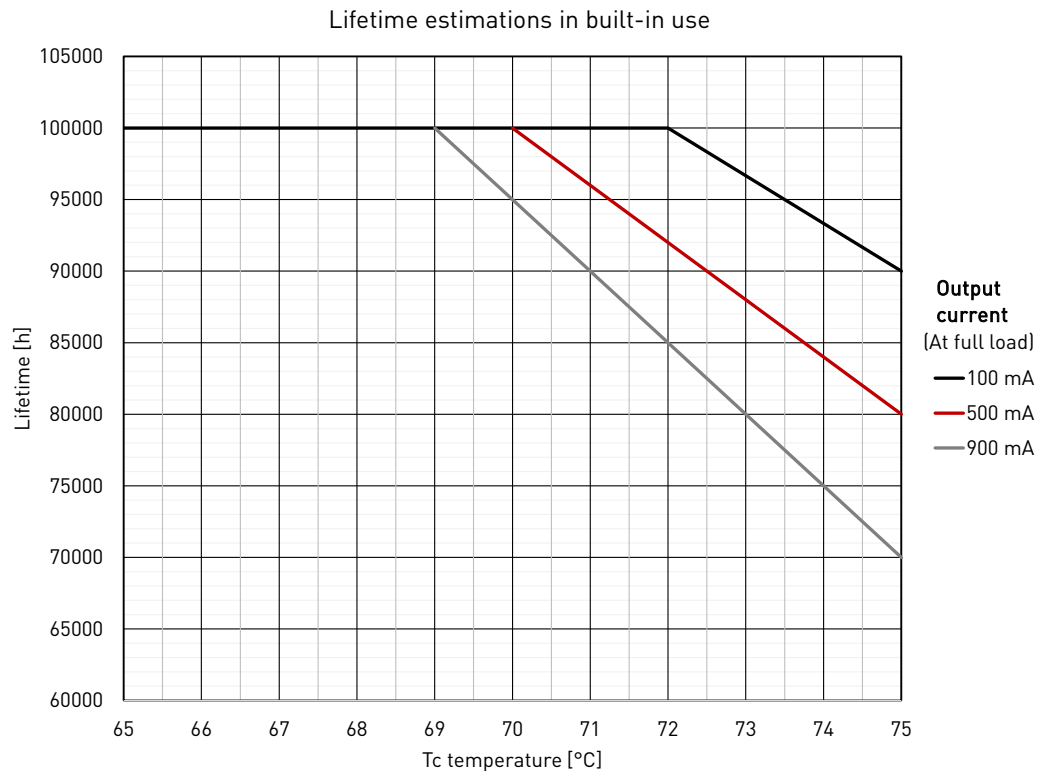
Operating Conditions and Characteristics

Absolute highest allowed t_c point temperature	75 °C
Ambient temperature range*	-25 °C ... +45 °C*
in independent use	-25 °C ... +40 °C
Storage temperature range	-40 °C ... +80 °C
Maximum relative humidity	No condensation

*) For other than independent use, higher t_a of the control gear possible as long as highest allowed t_c point temperature is not exceeded

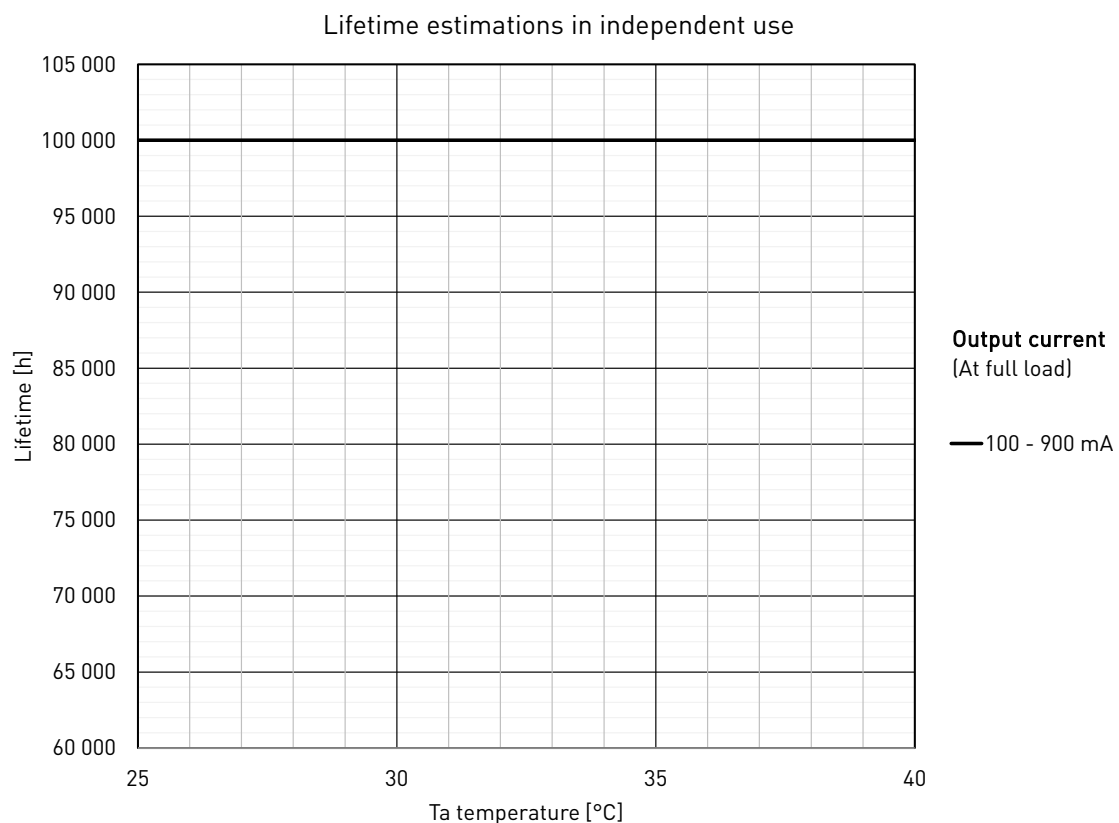
Lifetimes

Lifetime graphs (90 % survival rate)



The shown t_c temperatures and lifetimes were measured in non-metallic luminaire design and built-in use. Please refer to the used output current and t_c for the most accurate lifetime estimation.

Never exceed the t_c maximum of the driver stated in the datasheet!



The shown t_a temperatures and lifetimes were measured in independent use. Please refer to the used output current and t_a for the most accurate lifetime estimation.

Never exceed the t_c or t_a maximum for built-in usage of the driver stated in the datasheet!

Selection of the operating mode

This LED driver supports two optional operating modes: Tunable white mode and DualControl mode with two separately controllable channels. The operating mode can be changed either via NFC and Helvar Driver Configurator or then via Freedom protocol. The driver operates in Tunable white mode by default. See detailed operating windows and conditions in both control modes in page 2.

In **Tunable white (DT8) mode**, the driver reacts to DALI DT8 commands of light level and Correlated Colour Temperature (CCT) among others. User-adjusted output currents are set for both output channels, and then the output current and power are divided into two channels according to the chosen CCT and module specifications. Total maximum power of the two channels can never exceed given P_{Rated} .

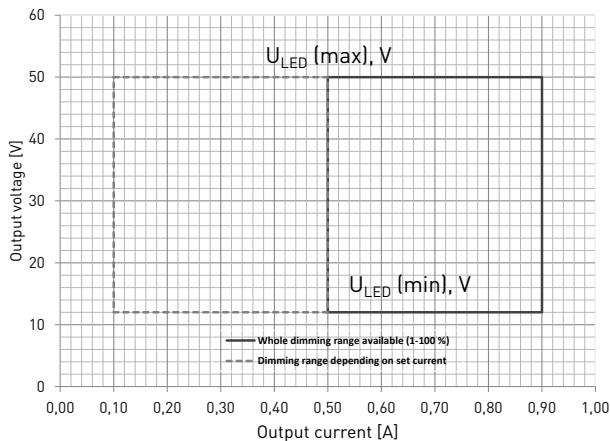
In **DualControl (DT6) mode**, the output current of both channels can be separately adjusted within 100 - 900 mA and the total current can be up to 1200 mA. However, the integrator has the responsibility to ensure that the loads are chosen in such a way that the maximum power of 45 W is never exceeded!

In the DualControl mode, the dimming follows linear dimming curve.

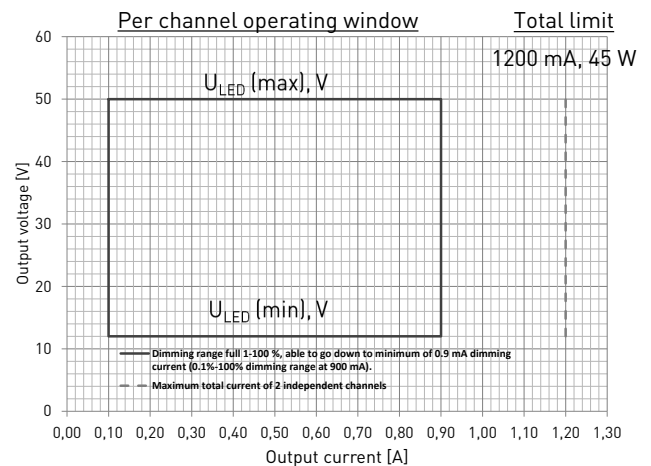
Examples:

- 1) 1st channel 900 mA 30 V, 2nd channel 300 mA and 25 V. Total current 1200 mA and total power 34.5 W. This is a suitable installation.
- 2) 1st channel 900 mA 45 V, 2nd channel 300 mA and 40 V. Total power is **52.5 W**. This is **NOT** a suitable installation.

Tunable white mode



DualControl mode

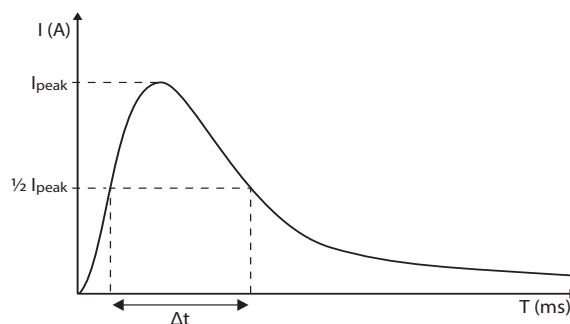


Quantity of drivers per miniature circuit breaker 16 A Type C

Based on inrush current I_{peak}	Typ. peak inrush current I_{peak}	1/2 value time, Δt	Calculated energy, $I_{peak}^2 \Delta t$
61 pcs.	30 A	138 μs	0.089 A ² s

CONVERSION TABLE FOR OTHER TYPES OF MINIATURE CIRCUIT BREAKER

MCB type	Relative quantity of LED drivers
B 10 A	37 %
B 16 A	60 %
B 20 A	75 %
C 10 A	62 %
C 16 A	100 % (see table above)
C 20 A	125 %

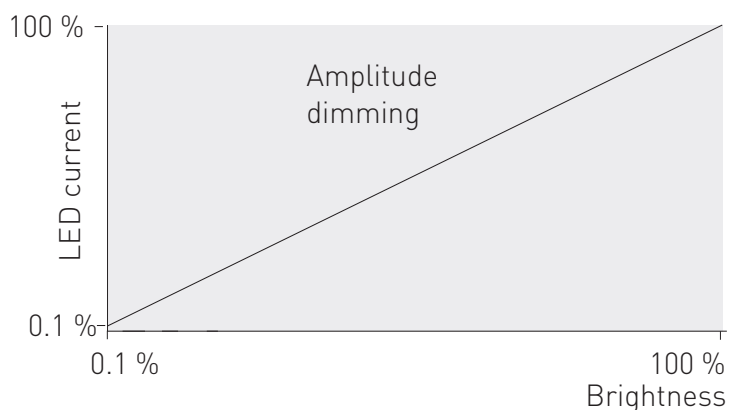


CONTINUOUS CURRENT

Total continuous current of the drivers and installation environment must always be considered and taken into calculations when installing drivers behind miniature circuit breaker. Example calculation of total drivers amount limited by continuous current: $n(I_{cont}) = (16 A / I_{nom, Ta}) \times 0.76$. This calculation is an example according to recommended precautions due to multiple adjacent circuit breakers (> 9 MCBs) and installation environment (T_a 30 degrees); variables may vary according to the use case. Both inrush current and continuous current calculations are based on ABB S200 series circuit breakers. More specific information in ABB series S200 circuit breaker documentation.

NOTE! Type C MCB's are strongly recommended to use with LED lighting. Please see more details in "MCB information" document in each driver product page in "downloads & links" section.

Amplitude dimming technology



Dimming range per single channel	Dimming range in tunable white use	Dimming technology
0.1 % – 100 %	2 % - 100 %	Amplitude (DC)

LC45iC-DA-100-900 LED driver implements amplitude dimming technology across whole dimming range. Amplitude dimming offers the best available technology for dimming the light output in an accurate and flicker-free way to ensure high quality lighting in even the most demanding situations such as camera recording applications. Amplitude dimming technology complies with IEEE 1789-2015 recommendations of current modulation to mitigate health risks to viewers.

Dynamic range in colour temperature control

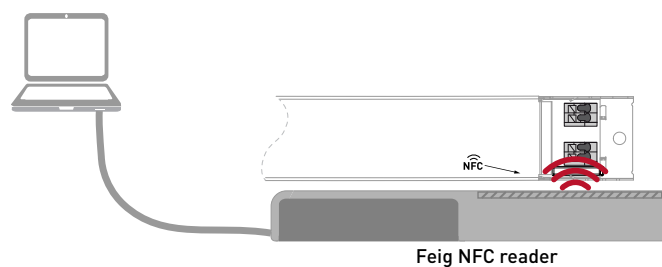
LC45iC-DA-100-900 LED driver is ready to be used out of the box.

Highest precision and color consistency in controlling combinations of different luminaire types is achieved by setting colour temperatures and lumen outputs before use with Helvar Driver Donfigurator. The configured colour temperatures of the channels should match the ones of the LED modules used. The factory default settings of cool and warm channels are 6500 K and 2700 K accordingly, and the maximum theoretical dynamic range is 16 K - 1 000 000 K (configurable in Helvar Driver Configurator tool).

After setting up the colour temperatures, the lumen output values of full dimming level (100 %) should be configured for both channels. By default, the lumen output values are preset to match Helvar Components iC LED modules.

Wireless configuration

LC45iC-DA-100-900 LED driver is equipped with NFC wireless technology for effortless configuration of the driver via Helvar Driver Configurator Support. Helvar Driver Configurator enables easy-to-use automatic configuration of the driver parameters via NFC, without mains or DALI connection to the driver. The most popular MD-SIG qualified NFC readers are supported giving flexibility for the operator. For further information about the usage with Helvar Driver Configurator, please see the user guide at www.helvar.com

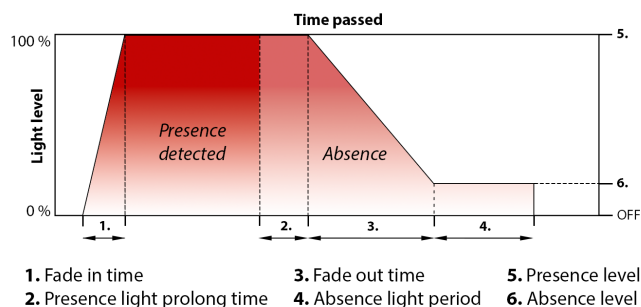


Corridor Control

Corridor Control is a feature which enables simple and cost-efficient lighting control with relay-based PIR/multisensors. Corridor Control offers straightforward install-and-forget lighting control solution, ensuring increased energy efficiency, lighting comfort and added feeling of safety in various environments. Large base of available different 3rd party PIR sensors with relay can be used in implementing a Corridor Control installation on site.

By installing an external mains voltage sensor and connecting it to the DALI terminal, the driver adapts to preset default mode to increase the light level when presence is detected, while decreasing the light level when no one is nearby anymore. **Preset colour temperature (programmable with Helvar Driver Configurator) does not change in Corridor Control mode.**

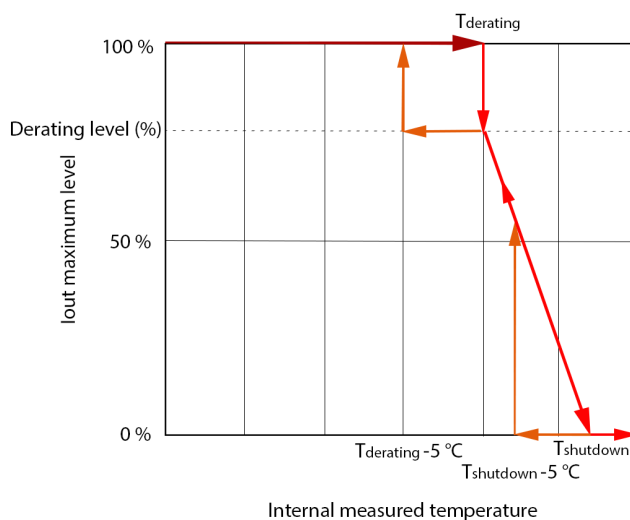
Corridor Control feature can be activated by connecting mains voltage in the DALI terminal for 55 seconds without interruption. Configuring the Corridor Control parameters is possible via Helvar Driver Configurator.



Internal thermal protection

This LED driver has built-in active internal thermal protection. This feature protects the LED driver by limiting the maximum output current based on set limit temperatures. If the temperature exceeds a predefined derating temperature, the output current is reduced within one minute fade time to the derating level. If the temperature increases beyond set derating temperature, the LED driver will reduce output current gradually within the slope set by shutdown and derating temperatures. The shutdown temperature sets the temperature where the output will eventually be shut OFF. If the current increases rapidly to shutdown temperature, the output is set to OFF without fade time. The LED driver returns automatically once the temperature decreases below the threshold. The default behavior is shown in the graph on the right.

The exact triggering points vary depending of the LED driver model. By factory default, the derating point is adjusted high enough so that the feature should never be triggered below the point of T_c max temperature being exceeded and will thus not affect normal operation of the LED driver. **Note that the internal measured temperature does not equal T_c temperature of the driver!**



Internal thermal protection feature is enabled by default, and it can be either disabled or manually adjusted to trigger earlier if desired. Configuring the internal thermal protection is done via Helvar Driver Configurator.

D4i-compatible Smart Data Features (DALI 251-253)

LC45iC-DA-100-900 LED driver has integrated Smart Data features, which monitor, gather and provide key data about the LED driver usage and internal parameters through DALI. This useful data provided by LED driver enables various applications and integrations into data management and IoT services, establishing the Helvar LED drivers as key components in the latest generation of smart luminaires.

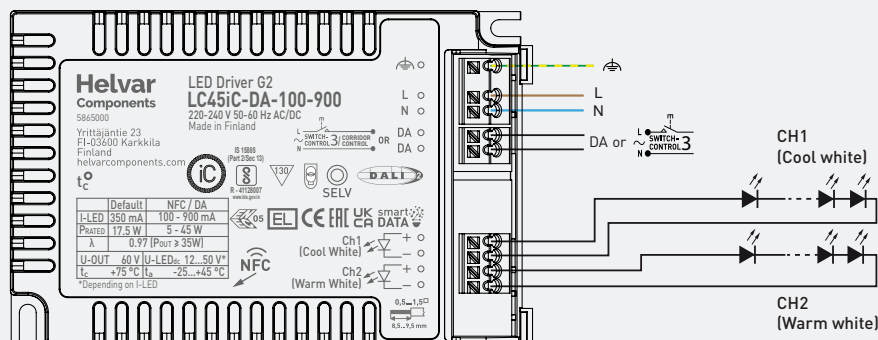
The DALI parts 251-253 include:

- OEM Customer data (DALI part 251)
- Energy reporting (DALI part 252)
- Diagnostics and maintenance (DALI part 253)

Connections and Mechanical Data

Wire size	0.5 mm ² – 1.5 mm ²
Wire type	Solid core and fine-stranded
Wire insulation	According to EN 60598
Maximum driver to LED wire length	1.5 m
Weight	193 g
IP rating	IP20

Connections

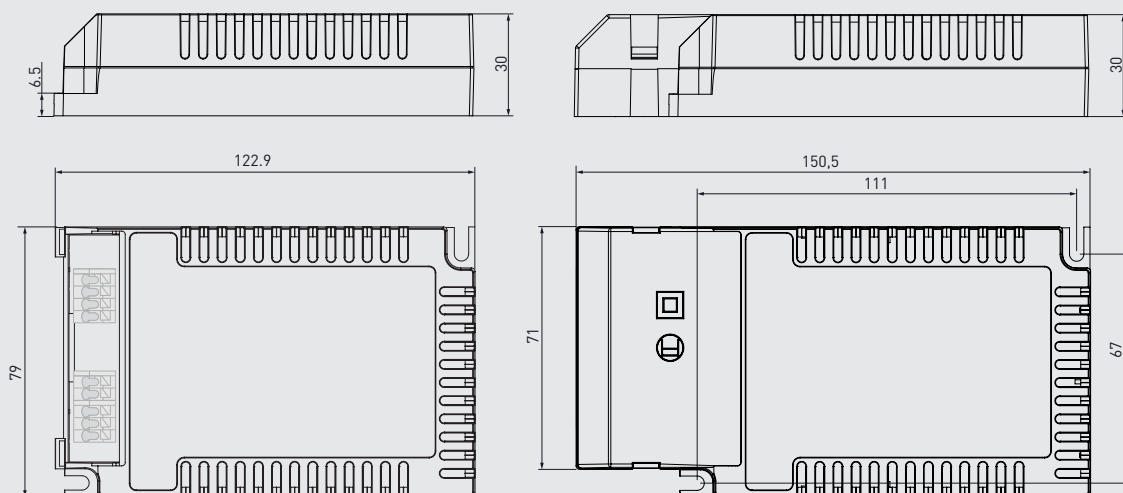


Note:

- Please connect Line (L) and Neutral (N) into the respective terminals and not the other way around for the DC Emergency lighting mode to operate optimally.
- Earth connection to FE terminal is optional and not needed for the functionality of the driver. See page 4 for details.
- Not suitable for load side switching operation

Dimensions (mm)

With strain relief (LC1x70-SR)



LC45iC-DA-100-900 LED driver is suited for built-in usage in luminaires. With LC1x70-SR/LC-SRB/LC-SRB-LOOP strain relief, independent use is possible too. In order to have safe and reliable LED driver operation, the LED luminaires will need to comply with the relevant standards and regulations (e.g. IEC/EN 60598-1). The LED luminaire shall be designed to adequately protect the LED driver from dust, moisture and pollution. The luminaire manufacturer is responsible for the correct choice and installation of the LED drivers according to the application and product datasheets. Operating conditions of the LED drivers may never exceed the specifications as per the product datasheet.

Installation & operation

Maximum ambient and t_c temperature:

- For built-in components inside luminaires, the t_a ambient temperature range is a guideline given for the optimum operating environment. However, integrator must always ensure proper thermal management (i.e. mounting base of the driver, air flow etc.) so that the t_c point temperature does not exceed the t_c maximum limit in any circumstance.
- Reliable operation and lifetime is only guaranteed if the maximum t_c point temperature is not exceeded under the conditions of use.

LED driver earthing

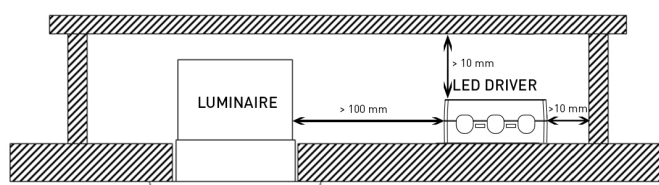
- LC45iC-DA-100-900 is a Class II LED driver suitable for built-in use in Class I and II luminaires. When used inside **Class I and Class II** luminaires, the earth cable is recommended to be connected to improve the EMC performance of the driver, but it is not mandatory. It is the responsibility of the integrator to ensure that the assembled luminaire EMC performance complies with the latest standards.
- If used in **independent** installation with Class I/II/III luminaires, the earth cable connection is also optional for the same reasons. Please follow the installation instructions provided in the strain relief datasheets.

Miniature Circuit Breakers (MCB)

- Type-C MCB's with trip characteristics in according to EN 60898 are recommended.
- Please see more details in "MCB information" document in each driver product page in "downloads & links" section.

Installation site

- The general preferred installation position of LED drivers for independent use is to have the top cover facing upwards.
- Minimum recommended distances below:



Helvar Driver Configurator -support

LC45iC-DA-100-900 LED driver is supported by Helvar Driver configurator software. The LC45iC-DA-100-900 driver supports output current setting with software, the output current of the driver can be programmed using Helvar Driver Configurator, as well as OEM customer data and parameters for functions such as CLO and Tunable White behavior. Programming the driver with Helvar Driver Configurator can be done either wirelessly via NFC or then via DALI bus.

Functionality in abnormal situations

No load

When open load is detected, driver will go to standby power consumption and remains in automatic recovery mode. In automatic recovery mode, the driver waits till load is returned and once that happens, it returns to normal operation.

Short circuit

When short circuit is detected, driver goes to automatic recovery mode and follows the same logic as described in the no load condition.

Overload

When overload is detected, driver will go to standby mode. It will return to normal operation through DALI light level OFF -> ON command or through mains reset.

Underload

When underload/voltage is detected, driver will act similarly to overload situation, it will go to standby power consumption status. It will return to normal operation through DALI light level OFF -> ON command or through mains reset.

Internal overtemperature

When the driver exceeds the T_c max operating temperature, soon above that point the driver will start decreasing the maximum output current. Details about the operation in page 4 "Internal Thermal Protection". Parameters of this feature can be adjusted via Helvar Driver Configurator, or then the feature disabled if so desired.

AC to DC emergency lighting mode

When AC supply is switched to DC, driver will recognise this and switch to emergency lighting mode. The light level will be adjusted to 15 % of the nominal AC operation output current by default. The DC light level cannot be adjusted or turned off by manual control or by active features, unless "DC dimming" is specifically enabled through Helvar Driver Configurator. When the AC is switched back on, the driver returns to normal operation.

Note: The internal temperature protection feature can never force the light level off or below the set emergency level in DC emergency mode.

Switch-Control 3 & Corridor Control

Use of Switch-Control functionality

- Preset colour temperature (programmable with Helvar Driver Configurator) does not change while using Switch-Control 3 technology.
- Maximum numbers of LED drivers to be connected to one switch is 60. Wire length is not restricted by the driver technology.
- Power on to last level mode is enabled by default, ensuring that the driver returns to the last memorized light level before mains interruption in cases of e.g. power outages. Driver also remembers the dimming direction before power cycle and continues in the opposite dimming direction after powering on.
- Ensure that all components connected to Switch-Control circuitry are mains rated.
- If needed, the synchronisation of light levels in the Switch-Control circuit can be carried out by either of the two options:
 - Press and hold the Switch-Control switch until all lights are ON. Then switch all lights OFF with a short press.
 - Press and hold the Switch-Control switch for 10 seconds without interruption.

Use of Corridor Control

- Preset colour temperature (programmable with Helvar Driver Configurator) does not change in Corridor Control mode.
- Activate Corridor Control feature by connecting mains voltage to the DALI terminal for 55 seconds without interruption.
- Disable Corridor Control feature by giving exactly 5 short mains voltage signal pulses (less the 350 ms) to the DALI terminal within 3 seconds.
- Ensure that all components connected to Corridor Control circuitry are mains rated.
- Default settings are described in the User Guide.

See more details in Switch-Control and Corridor Control User Guides at www.helvarcomponents.com.

Conformity & standards

General and safety requirements	EN 61347-1
Particular safety requirements for DC or AC supplied electronic control gear for LED modules	EN 61347-2-13
Additional safety requirements for AC or DC supplied electronic controlgear for emergency lighting	EN 61347-2-13, Annex J
Thermal protection class	EN 61347, C5e
Mains current harmonics	EN 61000-3-2
Limits for voltage fluctuations and flicker	EN 61000-3-3
Radio frequency interference	EN 55015
Immunity standard	EN 61547
Performance requirements	EN 62384
Digital addressing lighting interface:	
General requirements for DALI system	EN 62386-101
Requirements for DALI control gear	EN 62386-102
Requirements for control gear of LED modules	EN 62386-207
Particular requirements for control gear - Colour control (Dali Device Type 8)	EN 62386-209
Recommended Practices for Modulating Current in High-Brightness LEDs for Mitigating Health Risks to Viewers	IEEE 1789-2015
Compliant with relevant EU directives	
RoHS/REACH compliant	
ENEC and CE / UKCA marked	

Label symbols



Safety isolating control gear with short circuit protection (SELV control gear).



Thermally controlled control gear, incorporating means of protection against overheating to prevent the case temperature under any conditions of use from exceeding 120 °C.



Driver equipped with NFC wireless technology for effortless configuration.



Helvar Intelligent Colour drivers providing DALI colour control (tunable white) functionality.



AC/DC supplied electronic control gear for emergency lighting purposes intended for connection to a centralized emergency power supply.