

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

Product code: 5829

100 W 220 – 240 V 0/ 50 – 60 Hz

- 2-channel control (DT8) for Tunable white in human centric lighting
- Also DualControl mode (DT6) available for e.g. direct/indirect light luminaires
- DALI-2 certified LED driver, ultra wide 0.1 % - 100 % dimming range per single channel in Tunable white mode
- Amplitude dimming technology for the highest quality light output, complying with IEEE 1789 recommendations
- NFC technology for wireless programming
- Suitable for emergency lighting applications with central battery systems (e.g. Eaton-CEAG, Inotec), AC/DC input recognition
- Corridor Control feature for simple presence sensor applications

**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 800 mA. In DualControl (DT6) mode up to 1000 mA total current available (800 mA max. in single channel). Dimming down to 1 % per channel.
- NFC or DALI configuration for parameter setting (e.g. output current, colour control parameters, DC light level)
- Amplitude dimming and flicker-free light output suitable for camera recording applications
- 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 2 technology for easy-to-use intensity control
- Constant Light Output (CLO), adjustable up to 100 000 h (default disabled)

Mains Characteristics

AC voltage range	198–264 VAC
DC voltage range	Withstands max. 320 VAC (max. 1 hour)
DC starting voltage	176–280 VDC
Mains current at full load	> 186 VDC
Frequency	0.45 – 0.57 A
Stand-by power consumption	0 / 50 Hz – 60 Hz
THD at full power	< 0.3 W
Leakage current to earth	< 9 %
Tested surge protection	< 0.7 mA
Tested fast transient protection	1 kV L-N, 2 kV L-GND (IEC 61000-4-5)
	2 kV (IEC 61000-4-4)

Insulation between circuits & driver case

Mains circuit - Output	Non-isolated
DALI circuit - Output	Basic insulation
Mains circuit - DALI circuit	Basic insulation
Mains, DALI and output - Driver case	Basic insulation

Load Output (Non-isolated)

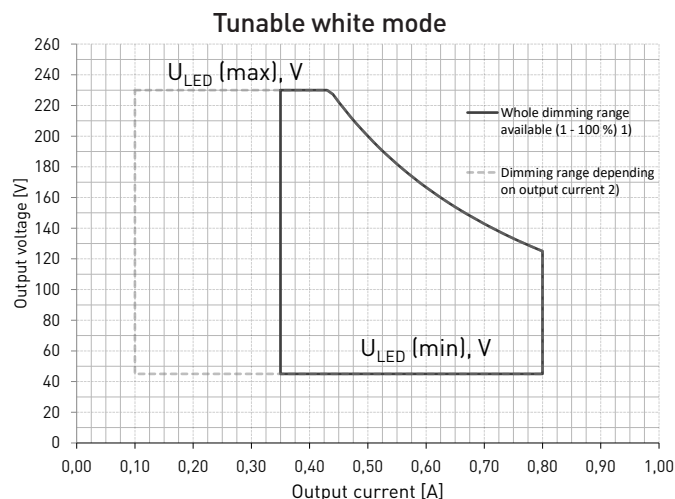
Output current (I_{out})	100 mA – 800 mA
Accuracy	$\pm 5 \%$
Ripple	< 1 % ¹⁾ at ≤ 120 Hz
PstLM	< 0.02 ²⁾
SVM	< 0.01 ²⁾
U_{out} (max) (abnormal)	1) ¹⁾ Low frequency, measured with Cree XP-G LED modules 2) ²⁾ At full power, measured with Cree XP-G LED modules
	250 V

I_{LED}^*	100 mA	350 mA (default)	800 mA
P_{Rated}^*	23 W	80.5 W	100 W
U_{LED}^*	45 – 230 V	45 – 230 V	45 – 125 V
PF (λ) at full load	0.91	0.98	0.98
Efficiency (η) at full load	82 %	92 %	91 %

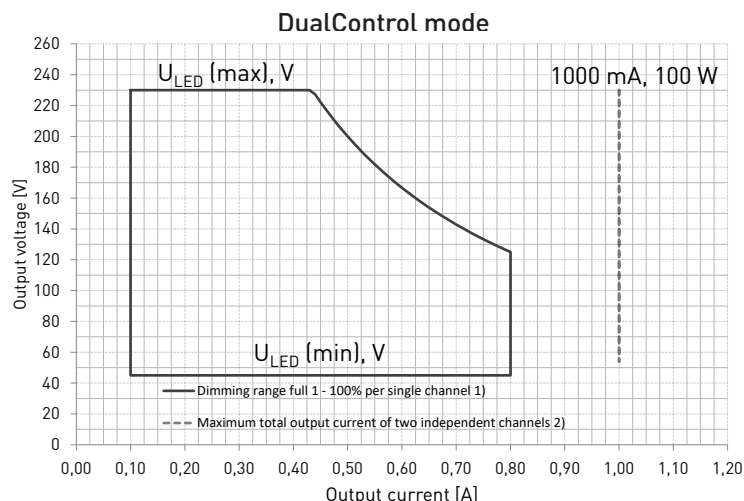
* In Tunable white mode: the chosen output current and power are divided into two channels according to the chosen CCT and module specifications.

In DualControl mode: the output current of both channels can be separately adjusted within 100 - 800 mA. Total current can be up to 1000 mA. Maximum power of the two channels together can never exceed given P_{Rated}

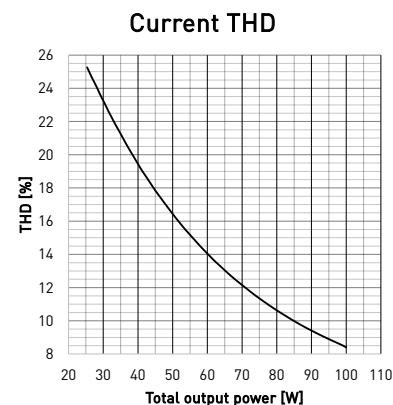
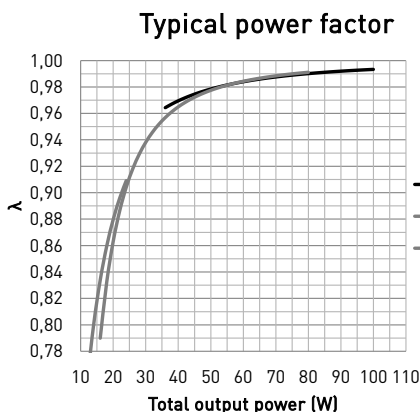
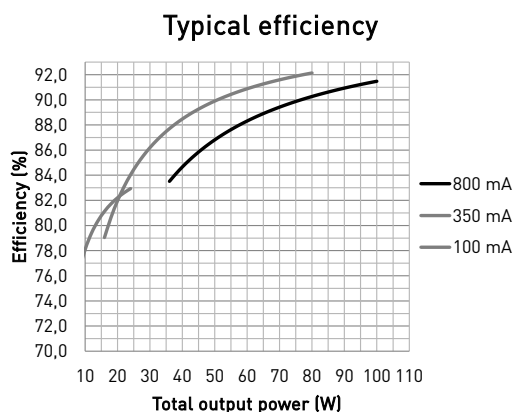
Operating window & driver performance



1) From 350 mA to 800 mA, full dimming range (1 % - 100 %) and wide CCT dynamic range available in the whole area. Each single channel can dim down to 0.50 mA level.
2) From 100 mA to 350 mA, the absolute minimum dimming level is limited to 3.5 mA of total current. Dimming / CCT control possible all the way down to that current (dimming range 3.5% - 100 % at 100 mA), but the dynamic range may be limited. Each single channel can dim down to 0.50 mA level.



1) Full 1 - 100 % dimming range provided on whole operation window. Each single channel can go down to 1 % dimming at 100 - 800 mA.
2) Each of the channel can operate independently on the operating window shown. The maximum total current of both channels is 1000 mA and the total maximum power is 100 W.



Operating Conditions and Characteristics

Absolute highest allowed t_c point temperature	88 °C
Tc life (50 000 h) temperature	88 °C
Ambient temperature range	-25 °C .. +50 °C* in Tunable white mode -25 °C .. +45 °C* in DualControl mode
Storage temperature range	-40 °C .. +80 °C
Maximum relative humidity	No condensation

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

Lifetime tables (90 % survival rate)

TUNABLE WHITE MODE

Output current in the two output channels	Ta	40 °C	50 °C
200 mA (100/100 mA)	Tc at full load	60 °C	70 °C
	Lifetime	> 100 000 h	70 000 h
500 mA (250/250 mA)	Tc at full load	69 °C	78 °C
	Lifetime	> 100 000 h	70 000 h
700 mA (350/350 mA)	Tc at full load	73 °C	82 °C
	Lifetime	> 100 000 h	60 000 h
800 mA (400/400 mA)	Tc at full load	74 °C	83 °C
	Lifetime	> 100 000 h	50 000 h
800 mA (700/100 mA)	Tc at full load	76 °C	86 °C
	Lifetime	100 000 h	50 000 h

DUALCONTROL MODE

Output current in the two output channels	Ta	40 °C	45 °C
200 mA (100/100 mA)	Tc at full load	60 °C	65 °C
	Lifetime	> 100 000 h	100 000 h
500 mA (250/250 mA)	Tc at full load	69 °C	74 °C
	Lifetime	> 100 000 h	90 000 h
800 mA (400/400 mA)	Tc at full load	74 °C	79 °C
	Lifetime	> 100 000 h	70 000 h
1000 mA (500/500 mA)	Tc at full load	79 °C	83 °C
	Lifetime	100 000 h	70 000 h
1000 mA (200/800 mA)	Tc at full load	84 °C	88 °C
	Lifetime	90 000 h	50 000 h

The shown Tc temperatures for each Ta environment in the table above are for guidance only, as the real relation between Ta and Tc depends always on the luminaire design. In built-in use, refer to the used output current and Tc for lifetime estimation. Never exceed the Tc maximum 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 via NFC or DALI bus and Helvar Driver Configurator / NFC Production Programmer. The driver operates in Tunable white mode by default. See detailed operating windows and conditions in both control modes in page 2.

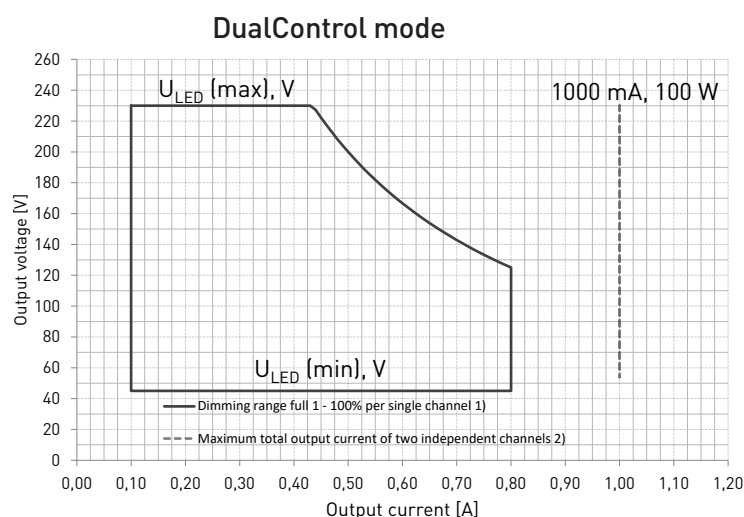
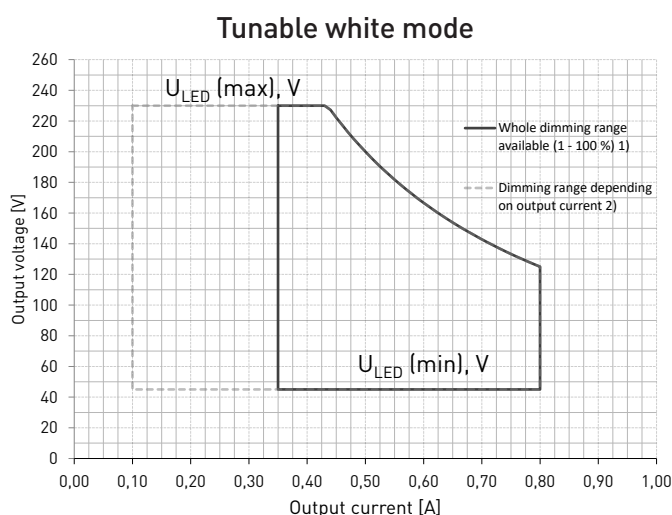
In **Tunable white (DT8) mode**, the driver reacts to DALI DT8 commands of light level and Correlated Colour Temperature (CCT) among others. User-adjusted output currents are set for both output channels, and then the output current and power are divided into two channels according to the chosen CCT 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 - 800 mA and the total current can be up to 1000 mA. However, the integrator has the responsibility to ensure that the loads are chosen in such a way that the maximum power of 100 W is never exceeded!

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

Examples:

- 1) 1st channel 800 mA 90 V, 2nd channel 200 mA and 60 V. Total current 1000 mA and total power 84 W. This is a suitable installation.
- 2) 1st channel 800 mA 110 V, 2nd channel 200 mA and 100 V. Total current 1000 mA, total power 108 W. This is NOT a suitable installation.



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
36 pcs.	34 A	190 μs

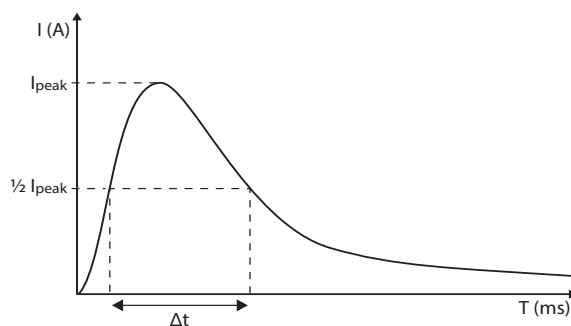
CONVERSION TABLE FOR OTHER TYPES OF MINIATURE CIRCUIT BREAKER

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 %

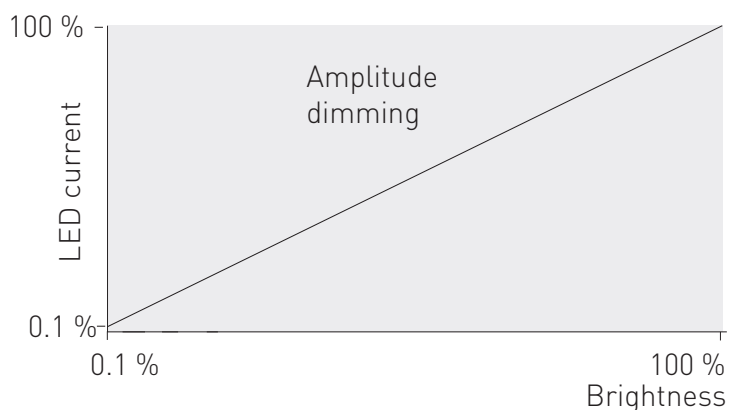
CONTINUOUS CURRENT

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: $n(I_{cont}) = [16 A (I_{nom, Ta}) / \text{"nominal mains current with full load"}] \times 0.76$. 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 %	1 % - 100 %	Amplitude (DC)

LL100iC-DA-100-800 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

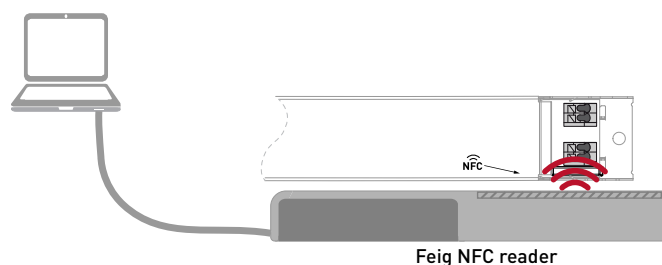
LL100iC-DA-100-800 LED driver is ready to be used out of the box.

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 configurator. 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 iC LED modules.

Wireless configuration

LL100iC-DA-100-800 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

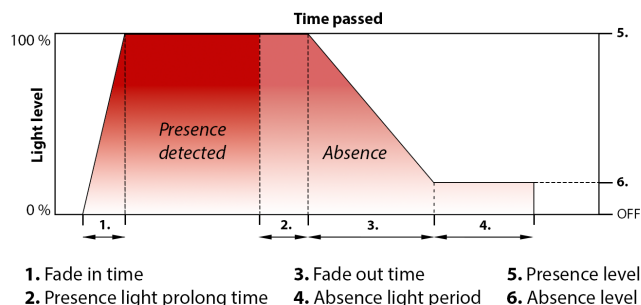


Corridor Control

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.

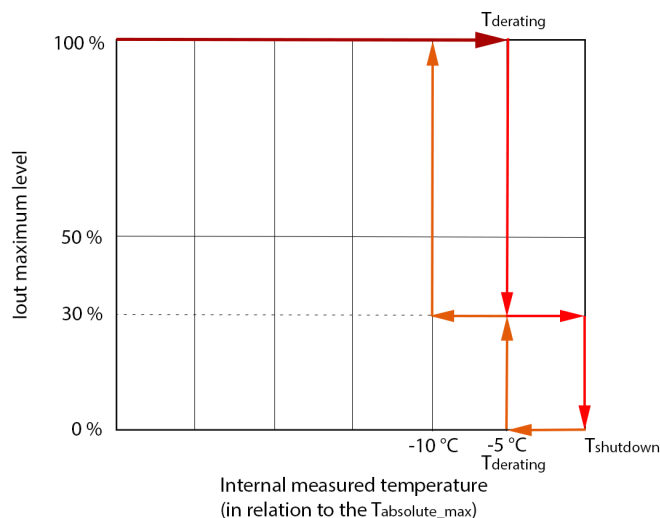


Internal thermal protection

This LED driver has built-in active internal thermal protection. This feature protects the LED driver by limiting the maximum output current within one minute fade time when the temperature rises enough above the specified operating environment of the driver. If the temperature exceeds a certain predefined critical point, the output will be switched off and 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)

LL100iC-DA-100-800 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.

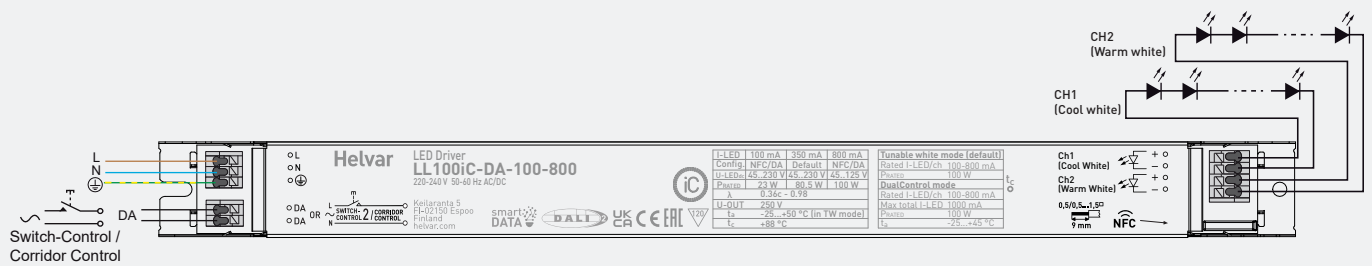
The DALI parts 251-253 include:

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

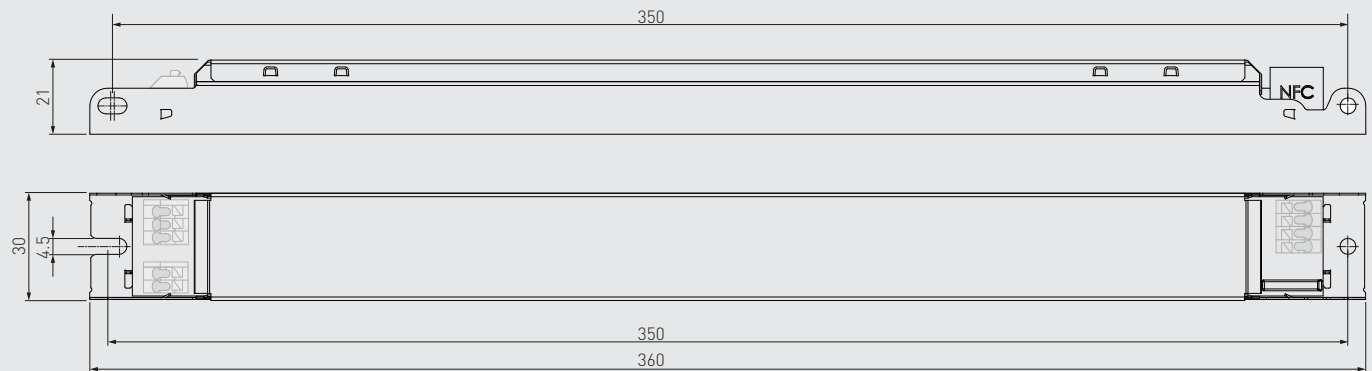
Connections and Mechanical Data

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	302 g
IP rating	IP20

Connections



Dimensions (mm)



LL100iC-DA-100-800 LED driver is suited for built-in usage in luminaires. 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.

Current setting

LL100iC-DA-100-800 LED driver features a constant current output programmable via NFC or DALI bus. When using the NFC current set, the following things shall be considered:

- After the driver has been disconnected from mains, it is recommended to wait 30 s before starting to program via NFC.
- The driver shall not be connected to the mains if active NFC field is nearby.

LED driver earthing

- LL100iC-DA-100-800 LED driver is a protective Class I device and designed for Class I luminaires.
- If used inside **Class I** luminaires, this LED driver must always have the protective earth cable connected for safety reasons.
- The driver is designed to be used inside Class I luminaires. For usage inside **Class II** luminaires, the safety of the luminaire shall be ensured through double/reinforced insulation of live parts and through supplementary insulation of conductive parts of the casing, or any conductive parts connected to the casing, as the casing is only basic insulated from the live parts. The earth connector of the driver shall be left unconnected and there shall be no protective earth terminals in the luminaire terminal block to fulfill the requirements of IEC/EN 60598-1 for Class II luminaires. The EMC performance of the driver change when left unearthed, so it is always the responsibility of the integrator to take measures and necessary actions, for example by luminaire design to ensure the assembled luminaire complies with latest EMC standard.

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.

Helvar Driver Configurator -support

LL100iC-DA-100-800 LED driver is supported by Helvar Driver Configurator software. With the LL100iC-DA-100-800 the output current of the driver can be programmed using the HDC software, as well as OEM customer data and parameters for features such as operating mode selection, CLO, Tunable white, Corridor Control and Internal Thermal Protection. Programming the driver with Helvar Driver Configurator can be done via DALI bus or then wirelessly via NFC using Helvar NFC Production Programmer.

Functionality in abnormal conditions

No load

When open load is detected, the driver will go to standby mode and remain in automatic recovery status. In automatic recovery mode, the driver will check every four seconds if the load has been reconnected. Once that happens, it returns to normal operation.

Short circuit

When short circuit 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.

Overload

When overload/voltage is detected, driver will act similarly to no load situation, it will go to standby mode and remain in automatic recovery status. In automatic recovery mode, the driver will check every four seconds if the load has been reconnected. Once that happens, it returns to normal operation.

Underload

When underload/voltage is detected, driver will act similarly to short circuit 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 decrease and limit the maximum output current level. It will be decreased down to 30 % level within one minute fade time, after which in case the temperature still rises, the output of the driver will be eventually shut down. The output will be returned after the temperature drops below a certain threshold. 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 2 & Corridor Control

Use of Switch-Control functionality

- Preset colour temperature (programmable with Helvar Driver Configurator) does not change while using Switch-Control 2 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.
- 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.helvar.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 61347-1, 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 (pending) and CE/UKCA marked	

Suitable for emergency luminaires complying with the standard EN 60598-2-22.

Label symbols



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



DALI-2 certified control gear.



Driver equipped with NFC wireless technology for effortless configuration.



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



Driver is capable of monitoring and measuring key data about driver usage and providing access to that data via DALI, complying with DALI parts 251-253. This includes data sets such as OEM customer data, energy reporting and diagnostics.