LL50iC-DA-100-1200

Helvar Components

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

Product code: 5875

50 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
- Ultra wide 0.1 % - 100 % dimming range per single channel in both modes (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
- Corridor Control feature for simple presence sensor applications

*) See pages 2-3 for details

DALI 2 CONSTANT LIGHT OUTPUT (CLO) · CORRIDOR CONTROL · SWITCH-CONTROL 2 · smart DATA · iC · NFC · EL · SELV · 120

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 1200 mA. In DualControl (DT6) mode up to 1500 mA total current available (1200 mA max. in single channel). Amplitude dimming down to 0.1 % per channel.
- Programmable via NFC or DALI, also multipurpose terminal on board for (LED-Iset) resistor current setting / NTC connection
- 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

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)
DC voltage range	176 VDC – 280 VDC
DC starting voltage	> 190 VDC
Mains current at full load	0.23 - 0.26 A
Frequency	0 / 50 Hz – 60 Hz
Stand-by power consumption	< 0.5 W
THD at full power	< 10 %
Leakage current to earth	< 0.7 mA
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
Output - Driver case	Basic insulation
Mains and DALI circuit - Driver case	Double/reinforced insulation
Mains input - Ground input	Double/reinforced insulation

Load Output (SELV <60 V)

Output current (I_{out})	100 mA – 1200 mA
Accuracy	± 5 %[1]
Ripple	< 1 %[2] at ⩽ 120 Hz
PstLM	< 0.2 [3]
SVM	< 0.01 [3]
U_{out} (max) (abnormal)	60 V

1) At 350 - 1200 mA range. 2) Low frequency, LED load: Cree XP-G LEDs.

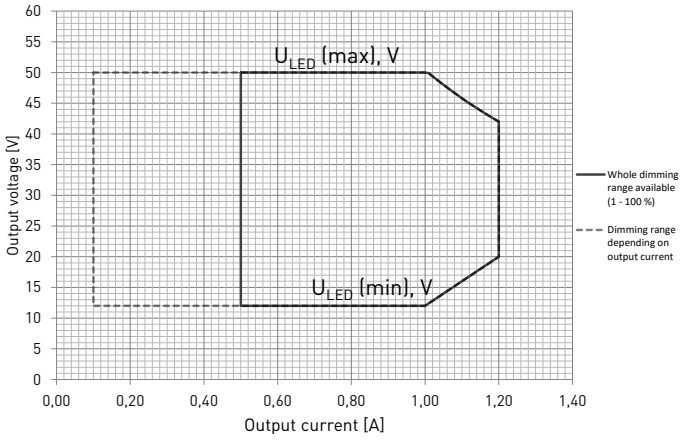
3) At full power, measured with Cree XP-G LED modules.

I_{LED*}	100 mA	350 mA (default)	1200 mA
P_{Rated*}	5 W	17.5 W	50.4 W
U_{LED*}	12 – 50 V	12 – 50 V	20 – 42 V
PF (λ) at full load	0.63	0.89	0.98
Efficiency (η) at full load	71 %	85 %	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 - 1200 mA. Total current can be up to 1500 mA. Maximum power of the two channels together can never exceed given* P_{Rated}

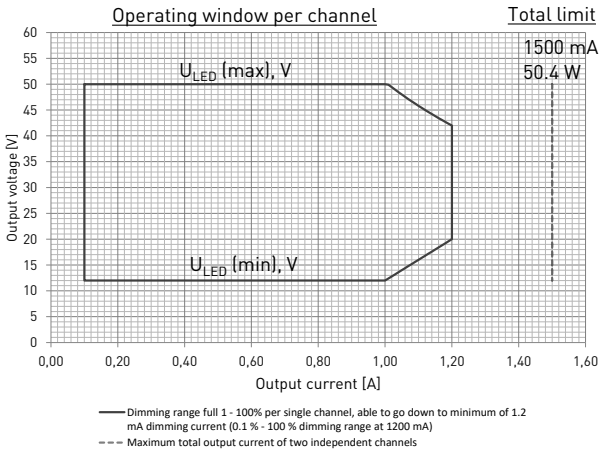
Operating window & driver performance

Tunable white mode



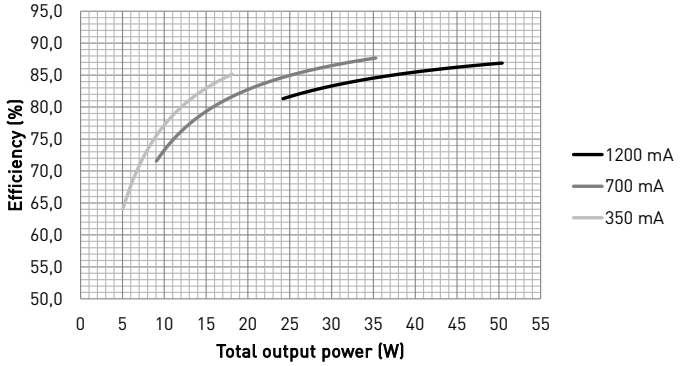
1) From 500 mA to 1200 mA, full dimming range (1 % - 100 %) and wide CCT dynamic range available in the whole area. Each single channel can dim down to 1.2 mA level.
2) From 100 mA to 500 mA, the absolute minimum dimming level is limited to 10 mA of total current. Dimming / CCT control possible all the 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 1.2 mA level.

DualControl mode

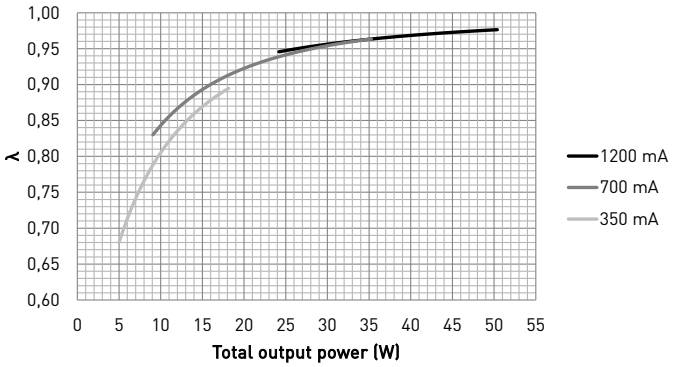


1) At least 1 - 100 % dimming range provided on whole operation window. Each channel can go down to 0.1 % dimming at 1200 mA (minimum dimming current at whole range is 1.2 mA)
2) Each of the channel can operate independently on the operating window shown. The maximum total current of both channels is 1500 mA and the total maximum power is 50.4 W.
3) In the DualControl mode, the dimming follows linear dimming curve.

Typical efficiency



Typical power factor



Operating Conditions and Characteristics

Absolute highest allowed t_c point temperature	75 °C
Tc life (50 000 h) temperature	75 °C
Ambient temperature range	–25 °C .. +40 °C[1)]
Storage temperature range	–40 °C ... +80 °C
Maximum relative humidity	No condensation

1) 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)

Metallic luminaires (built-in use)

Total output current in the two output channels	Ta	40 °C	45°C	50 °C
350 mA	**Tc at full load**	46 °C	51 °C	56 °C
	Lifetime	>100 000	>100 000	>100 000
700 mA	**Tc at full load**	49 °C	54 °C	59 °C
	Lifetime	>100 000	>100 000	>100 000
1200 mA	**Tc at full load**	52 °C	57 °C	62 °C
	Lifetime	>100 000	>100 000	>100 000

The shown t_c temperatures and lifetimes were measured in reference conditions i.e. metallic luminaire design and built-in use.

Non-metallic luminaires (built-in use)

Total output current in the two output channels	Ta	40 °C	45 °C	50 °C
350 mA	**Tc at full load**	55 °C	58 °C	63 °C
	Lifetime	>100 000	>100 000	>100 000
700 mA	**Tc at full load**	63 °C	68 °C	73 °C
	Lifetime	>100 000	>100 000	>100 000
1200 mA	**Tc at full load**	67 °C	71 °C	
	Lifetime	>100 000	90 000	Not allowed

The shown t_c temperatures and lifetimes were measured in non-metallic luminaire design and built-in use.

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

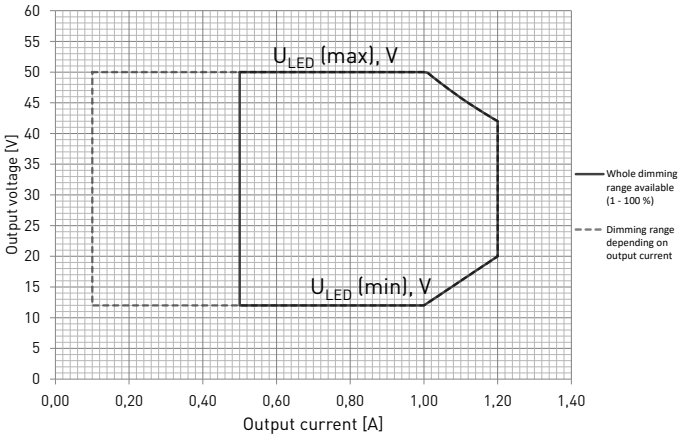
This LED driver supports two optional operating modes: Tunable white mode and DualControl mode with two separately controllable channels. The operating mode can be changed via NFC or DALI bus and Helvar Driver Configurator / NFC Production Programmer. The driver operates in Tunable white mode by default. 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} .

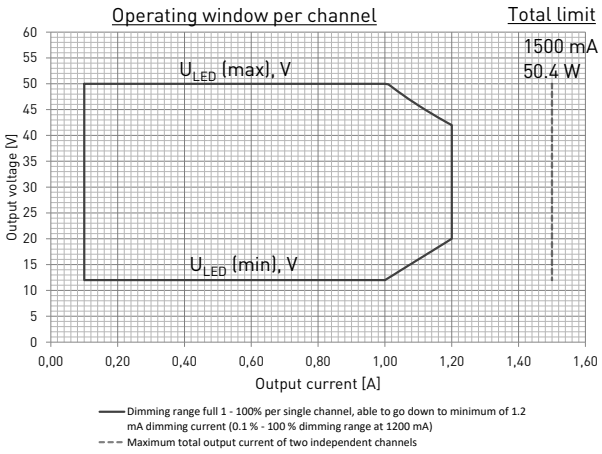
In **DualControl (DT6) mode**, the output current of both channels can be separately adjusted within 100 - 1200 mA and the total current can be up to 1500 mA. However, the integrator has the resposibility to ensure that the loads are chosen in such a way that the maximum power of 50,4 W is never exceeded!
In the DualControl mode, the dimming follows linear dimming curve.

Examples:
1) 1st channel 1200 mA 30 V, 2nd channel 300 mA and 20 V. Total current 1500 mA and total power 42W. This is a suitable installation.
2) 1st channel 1200 mA 40V, 2nd channel 300 mA and 50 V. Total power is 63 W. This is NOT a suitable installation.

Tunable white mode



DualControl mode

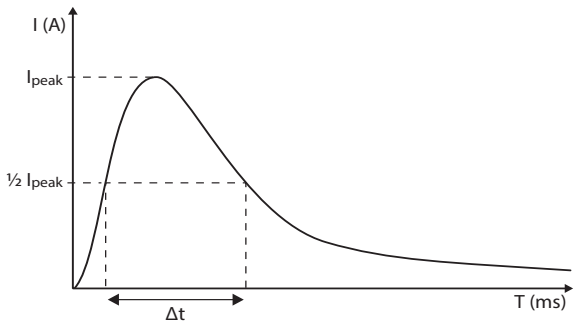


Quantity of drivers per miniature circuit breaker 16 A Type C

Based on inrush current I_{peak}	Typ. peak inrush current I_{peak}	1/2 value time, Δt	Calculated energy, $I_{peak}{}^2\Delta t$
62 pcs.	28 A	**148 µs**	**0.0737 A^2s**

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 %

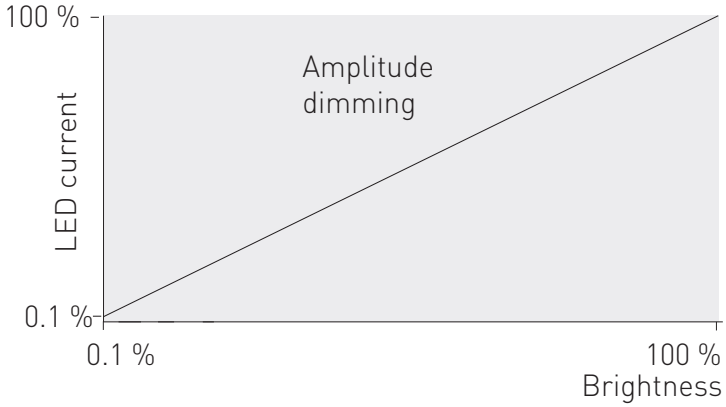


CONTINOUS CURRENT

Total continous 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 continous current: $n(I_{cont}) = (16\ A\ (I_{nom,Ta}) /$ "nominal mains current with full load") x 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 continous 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 up to	Dimming range in tunable white use	Dimming technology
0.1 % – 100 %	1 % - 100 %	Amplitude (DC)

LL50iC-DA-100-1200 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

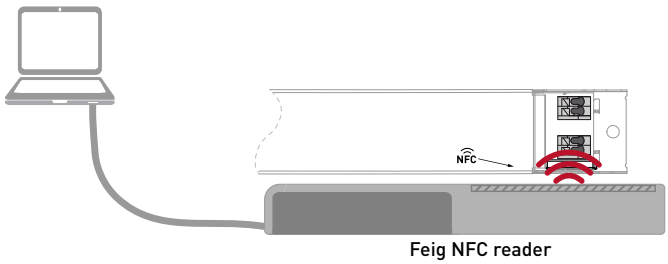
LL50iC-DA-100-1200 LED driver is ready to be used out of the box.

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

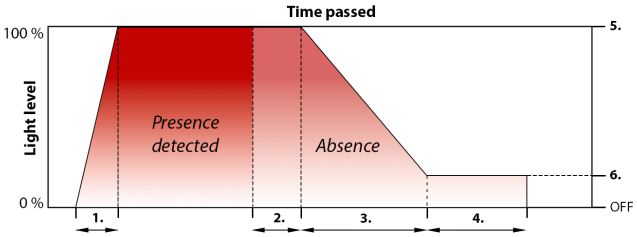
LL50iC-DA-100-1200LED driver is equipped with NFC wireless technology for effortless configuration of the driver via Helvar Driver Configurator Support. Helvar Driver Configurator enables easy-to-use automatic configuration of the driver parameters via NFC, without mains or DALI connection to the driver. 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.helvarcomponents.com



Feig NFC reader

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.



1. Fade in time
2. Presence light prolong time
3. Fade out time
4. Absence light period
5. Presence level
6. Absence level

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.

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

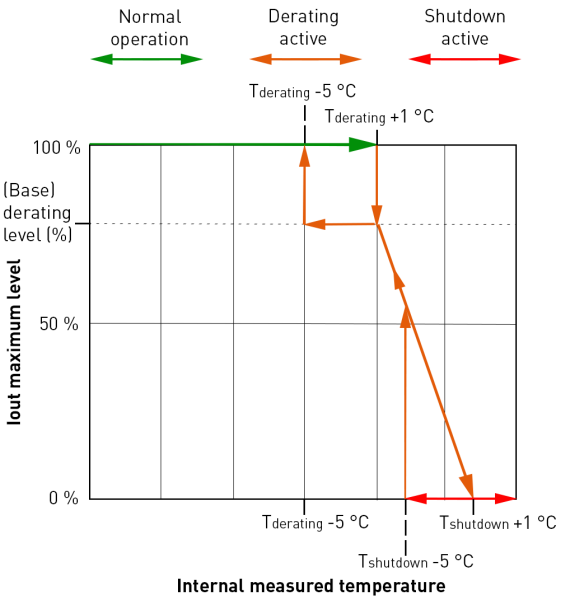
LL50iC-DA-100-1200 LED driver has integrated Smart Data features, which monitor, gather and provide key data about the LED driver usage and internal parameters through DALI. This useful data provided by LED driver enables various applications and integrations into data management and IoT services, establishing the Helvar Components 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)

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 **threshold temperatures** and **base derating level**. The internal temperature of the LED driver is measured **once per every 5 seconds** with the resolution of one Celsius degree.

If the temperature exceeds a predefined derating temperature threshold with one degree, the maximum output current is reduced within **fixed one minute fade** time to the base derating level. If the temperature still increases beyond this point, the LED driver will reduce maximum output current gradually within the slope set by shutdown and derating temperatures, always with a new one minute fade time if a new limit is activated. The shutdown temperature sets the other threshold temperature which if exceeded will shut the output completely OFF. If the temperature exceeds the shutdown temperature threshold, the output is **always switched to OFF without any fade time**. The LED driver returns the output from shutdown when the temperature drops and reaches **shutdown limit - 5 degrees**. Identically, the driver stops the current limitation and returns back to 100 % capacity when the temperature drops to **derating limit - 5 degrees or lower**. These will happen again with fixed one minute fade time. The default behavior is shown in the graph on the right.



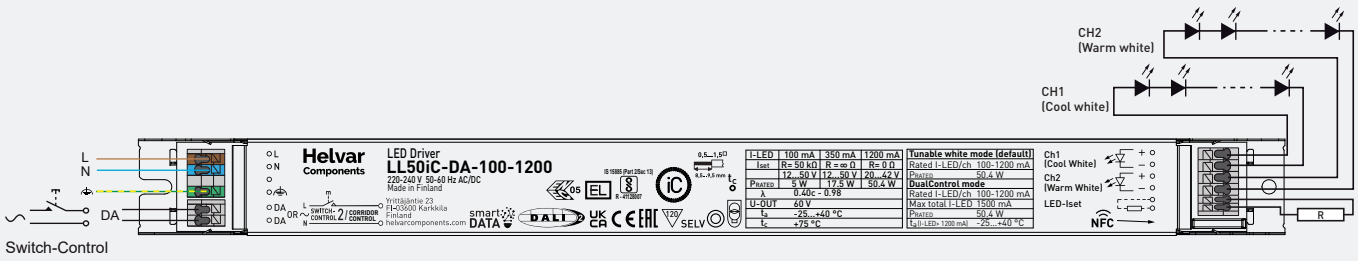
The exact triggering points vary depending of the LED driver model. By factory default, the derating temperature threshold is adjusted high enough so that the feature should never be triggered below the point of Tc max temperature being exceeded and will thus not affect normal operation of the LED driver.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

If the active output dimming level is already lower that the limit restricted by Internal thermal protection, then the output is not affected. This 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.

Connections and Mechanical Data

Wire size	0.5 mm² – 1.5 mm²
Wire type	Solid core and fine-stranded
Wire insulation	According to EN 60598
Maximum driver to LED wire length	1.5 m
Weight	273 g
IP rating	IP20

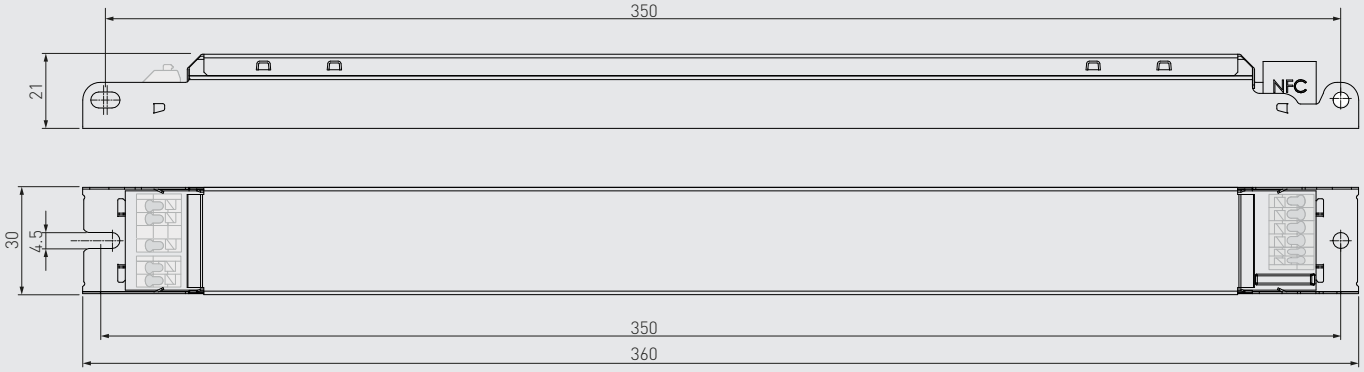
Connections



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)



The LED-Iset resistor/current setting values are adjusted according to the LEDset specification. The resistor value for each required output current can thus be calculated from the formula R [Ω] = (5 [V] / I_out [A]) * 1000. Below are the available LED-Iset resistors from Helvar Components, pre-adjusted for the most common output currents.

Helvar Components LED-Iset resistors and currents (Nominal I_{out} (±5 % tol.*))

LED-Iset resistor model	MAX	1150 mA	1100 mA	1050 mA	1000 mA	950 mA	900 mA	850 mA	800 mA	750 mA	700 mA	650 mA	600 mA	550 mA	500 mA	450 mA	400 mA	350 mA	300 mA	250 mA	200 mA	150 mA	100 mA	No resistor
I_{out} (mA)	1200	1150	1100	1050	1000	950	900	850	800	750	700	650	600	550	500	450	400	350	300	250	200	150	100	350
Order code	T90000	T91150	T91100	T91050	T91000	T90950	T90900	T90850	T90800	T90750	T90700	T90650	T90600	T90550	T90500	T90450	T90400	T90350	T90300	T90250	T90200	T90150	T90100	N/A
Resistance values (Ω)	0	4.32k	4.53k	4.75k	4.99k	5.23k	5.6k	5.9k	6.2k	6.65k	7.15k	7.68k	8.25k	9.09k	10k	11k	12.4k	14.3k	16.5k	20k	24.9k	33.2k	50.0k	∞

*) At 350 - 1200 mA current range.

The current can be adjusted also with normal resistors by selecting suitable resistor value (formula R [Ω] = (5 [V] / I_out [A]) * 1000). Reference resistor values can be found below order code in the table above.

LL50iC-DA-100-1200 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 resistor

LL50iC-DA-100-1200 LED driver features a constant current output adjustable via current setting resistor in addition to NFC and DALI.

- An external resistor can be inserted in to the current setting terminal, allowing the user to adjust the LED driver output current.
- When no external resistor is connected, then the LED driver will operate at 350 mA output current, unless programmed otherwise.
- LED-Iset current setting can be overridden with NFC / DALI output current programming via Helvar Driver Configurator (Iset by SW parameter).
- A standard through-hole resistor can be used for the current setting. To achieve the most accurate output current it is recommended to select a quality low tolerance resistor. Minimum diameter for resistor leg is 0.51mm.
- Always connect the current setting resistor only into the terminals marked with LED-Iset on the LED driver label.
- For the resistor/current values, refer to the table on page 6.

LED driver earthing

- LL50iC-DA-100-1200 is LED driver suitable for 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.

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

LL50iC-DA-100-1200 LED driver is supported by Helvar Driver Configurator software. With the LL50iC-DA-100-1200 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.

Lamp failure functionality

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.

NTC trigger

When NTC is enabled via Helvar Driver Configurator, driver follows NTC feature behaviour. Default NTC trigger point is 8,2 kΩ, after which the driver starts to decrease the output level.

Internal overtemperature

When the driver exceeds the Tc max operating temperature, soon above that point the driver will start decreasing the maximum output current. Details about the operation in page 5 "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.

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.

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.helvarcomponents.com.

Information and conformity

Helvar Components

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).

Double insulated control gear suitable for built-in use.

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

DALI-2 certified control gear.

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.

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