




Design-in Guide

TrustSight Gen3+ LED Emergency Lighting Kit

October 23

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Introduction to this guide



TrustSight Emergency driver (EM) for built-in use

Thank you for choosing the Philips TrustSight Emergency driver (EM) for LED applications. In this guide you will find the information needed to integrate an emergency driver into a LED luminaire or LED system. This design-in guide describes the TrustSight LED Emergency kit developed for indoor lighting applications. We advise you to consult our websites for the latest up-to-date information.

Applications

Typical applications are linear or point source type of luminaires applied in: offices, public buildings, industrial and retail environments.

Information and support

Please consult your local Signify office or visit us at: www.philips.com/oem.

Design-in support

On request Design-in support from Signify is available. For this service please contact your Signify sales representative.

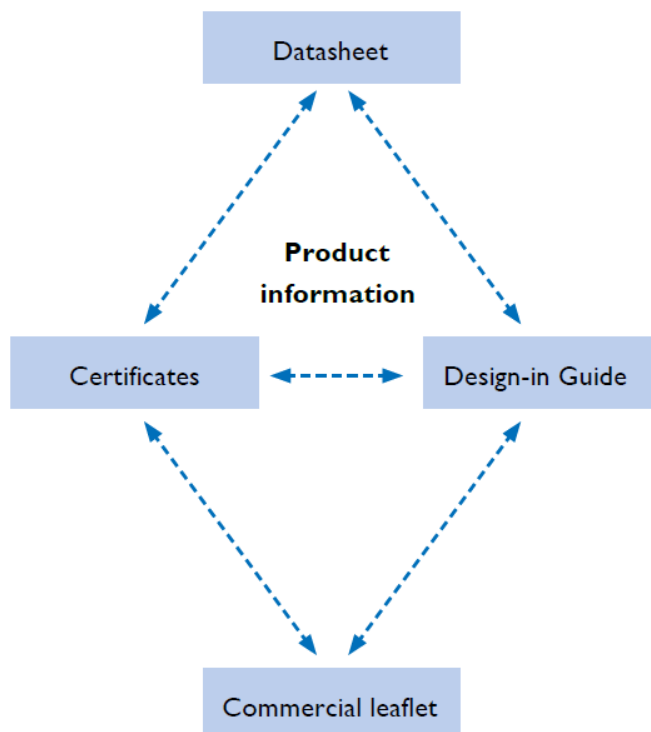
Determine which documents contain what information

In order to provide information in the best possible way, Signify's philosophy on product documentation is the following.

- Commercial leaflet contains product family information & system combinations
- Datasheet contains the product-specific specifications
- Design-in guide describes how the product must be used
- Driver certificates list up-to-date compliance with relevant product standards

All these documents can be found on the download page of the OEM website www.philips.com/oem. If you require any further information or support please consult your local Signify office.

TrustSight driver for independent application



Safety precautions



Safety warnings:

- Avoid touching live parts!
- Do not use drivers with damaged housing and/or connectors!
- Do not service the driver when the mains voltage is connected; this includes connecting or disconnecting the LED module!

Safety warnings and installation instructions

To be taken into account during design-in and manufacturing

- Do not use damaged products
- **Do not connect the battery to the battery harness unless the battery harness has been connected to the TrustSight driver to prevent accidental risk of battery short-circuit: risk of fire and personal injury!**
- The luminaire manufacturer is responsible for its own luminaire design and compliance with all relevant safety standards including the minimum required IP rating to protect the driver.
- The TrustSight Emergency drivers must be protected against ingress of and exposure to including but not limited to snow, water, ice, dust, insects or any other chemical agent - be it in the gaseous, vapor, liquid or solid form- which can be expected to have an adverse effect on the driver (e.g. use in wet /corrosive / dusty environments). It is the responsibility of both luminaire manufacturer and installer to prevent ingress and exposure. Any suggestion from Signify with reference to minimum required luminaire IP rating serves only as non-binding guidance; a higher IP rating may be required under certain application conditions to protect the driver. Common sense needs to be used in order to define the proper luminaire IP rating for the intended application.
- Do not service the driver when mains voltage is connected or when the driver is running in emergency mode; this includes connecting or disconnecting the LED module.
- The driver generates an output voltage which may be lethal. Connecting an LED module to an energized driver may damage both the LED module and driver.
- No components are allowed between the TrustSight LED driver and the LED module(s) other than connectors and wiring intended to connect the TrustSight driver to the LED module.
- Adequate earth and/or equipotential connections need to be provided whenever possible or applicable.
- Do not connect TrustSight low-voltage SELV drivers with AC- powered drivers having an output not rated as SELV.
- TrustSight drivers do **not** support use in high-risk task areas acc. IEC60598-2-22.
- The battery wires currently do not support independent operation with respect to compliance per IEC60598-2 clause 22.16 unless a fire and heat resistant supplementary insulation sleeve is put around the wires (not included). It is the responsibility of the OEM to select the proper type of sleeve.

Exception: A special LFP FRC battery pack (9290 021 40906) and FRC battery harness (9290 021 41006) is available for that purpose. See also the warning on p.6.

- Use only the TrustSight 15-55V version for independent applications. The TrustSight 45-300V driver supports built-in use only.
- Do not cover the TrustSight Independent version. Keep at least 5mm clearance around the top and both sides of the driver.
- Only TrustSight batteries are supported.

Signify Design-in support is available; please contact your Signify sales representative.

Introduction to the TrustSight Emergency Driver

Introduction

The TrustSight Emergency kit is a self-contained and/or maintained solution, designed to operate LED modules in case of a mains power failure. An unswitched mains line is used to continuously charge TrustSight batteries and keep them in a state of readiness. At the same time the unswitched mains line is being monitored in order to detect mains power failure. When this happens, the TrustSight LED Emergency driver uses the TrustSight battery as energy source and provides power to (a part of) the LED array.

TrustSight Emergency drivers are available in three different types in a LV SELV (15-55V) and HV (45-300V) type. The LV type supports use in independent applications as well.

TrustSight Basic

TrustSight Basic offers basic emergency functionality with manual testing feature.

TrustSight Pro

TrustSight Pro offers same as basic with additional self-test feature.

TrustSight DALI

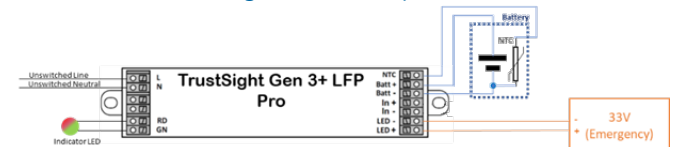
TrustSight DALI offers same as Pro version including DALI interface for use in DALI network (DALI-2 certified).

Please refer to the datasheet for more details.

Non-maintained

A non-maintained luminaire only operates when mains power fails. In case of a power failure the non-maintained luminaire will start-up on battery supply.

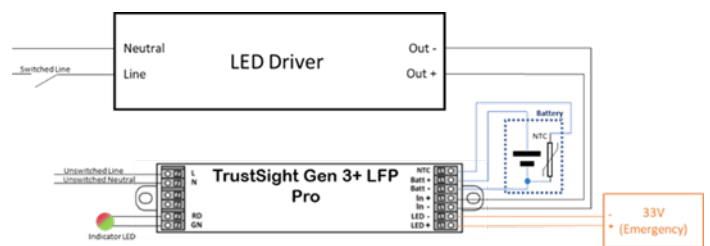
Non-maintained configuration: example schematic



Maintained

A maintained luminaire is designed to be lit continuously and will continue to work in case of a power failure. In case of a power failure the TrustSight driver will switch over the connected LED module to the battery supply.

Maintained configuration



Sustained

This is an exit or emergency luminaire with two or more light sources where at least one light source operates in non-maintained mode and is only illuminated when mains supply fails. The other light source operates on switched mains supply only. This is identical in functionality to having a Non-Maintained Luminaire and a Normal Luminaire both in the same housing. A sustained luminaires have two mains inputs: one input is connected to switched mains voltage while the other mains input is connected to permanent non-switched mains voltage which supplies power to charge the internal battery and to use as a signal to turn on the light source in the event of a power failure.

Features

The TrustSight emergency drivers are designed for easy design-in and ease to use:

- Constant output power
- Compact, low-profile batteries
- Easy wiring
- Compatible with all dimmable and non-dimmable constant current LED control gear in LV and HV versions.
- Over-voltage protected LED output
- Short-circuit proof LED output and battery connection
- Battery polarity reversal protection
- Deep discharge protection
- LFP temperature sensing

Batteries

Two different kind of battery technologies are supported by the TrustSight drivers:

- **NiMH (Nickel Metal Hydride)**
- **LFP (LiFePO₄, Lithium Iron Phosphate)**

Connection

The batteries are supplied with cables and corresponding connectors. Together with the emergency driver, a corresponding battery harness is shipped, which has two flying leads on one end and a connector on the other end. The insulation class of the battery insulation is basic.

Charging

The NiMH battery is required to be charged for (exactly) 24hrs according to EM specification. This battery accepts overcharging as it is charged with a low rate of 0.05C (1/20C). Only the LFP battery, which does have a maximum charging voltage, can and will indicate "full" state earlier than 24 hrs. The status of the battery is given by the LED indicator.

Periodic testing

Periodic testing of emergency lighting luminaires is automatically performed twice a year by the TrustSight driver in accordance with EN50172 clause 7.2.3 and 7.2.4. To maintain battery life over longer periods, the battery will be discharged completely. When the duration is longer than its rated duration of 3hrs, the battery is still good.

Compatibility between batteries and drivers Gen 3 and Gen 3+.

"TrustSight batteries and NiMH drivers are backwards compatible, LFP+ drivers are not."

All Gen 3 drivers are compatible with Gen 3 and Gen 3+ batteries. All Gen 3+ NiMH drivers are compatible with Gen 3 and Gen 3+ batteries.

All Gen 3+ LFP drivers are only compatible with Gen 3+ batteries and will not work with Gen3 batteries.

(Explanation: When there is no NTC connected to a Gen 3+ LFP driver, the battery will not be charged, and the LED indicator will flash in a slow RED sequence. (reference page 9))

Driver	3, 4 and 5 Cell NiMH Battery Gen3	3, 4 and 6 Cell LFP Battery Gen3	3, 4 and 6 Cell LFP Battery Gen3+
TSG3 Basic NiMH LV & HV	X		
TSG3 Pro NiMH LV & HV	X		
TSG3 DALI NiMH LV & HV	X		
TSG3+ Basic NiMH LV & HV	X		
TSG3+ Pro NiMH & HV	X		
TSG3+ DALI NiMH LV & HV	X		
TSG3 Basic LFP LV & HV		X	X
TSG3 Pro LFP LV & HV		X	X
TSG3 DALI LFP LV & HV		X	X
TSG3+ Basic LFP LV & HV			X
TSG3+ Pro LFP & HV			X
TSG3+ DALI LFP LV & HV			X

Compatibility between batteries and drivers Gen 3 and Gen 3+.



Warnings:

With the exception of the FRC version (Fire Resistance Compliant), the battery wires currently do not support independent operation with respect to compliance per IEC60598-2 clause 22.16 unless a fire and heat resistant supplementary insulation sleeve is put around the wires (not included). It is the responsibility of the OEM to select the proper type of sleeve.



Do not connect the battery to the battery harness unless the battery harness has been connected to the TrustSight driver to prevent accidental risk of battery short-circuit: risk of fire and personal injury!

Self-Test Pro driver

The TrustSight Pro version is equipped with a self-test functionality according IEC62034. 28 days after power-up the driver will perform a functional test of 30 seconds. Every 6th test (after half a year) will be a duration test. This test will run until the battery is fully discharged and the driver will verify if the capacity of the battery is sufficient to provide 3hrs emergency time. A duration test will only be performed if the battery is fully charged AND when the external lamp driver is off for 2 hrs. I.e.: in an office, the duration test will generally take place in the nightly hours. A 24/7 lighting situation will be detected as such if the lighting has been on for at least 72 hrs. In that case the duration test will be performed once its timer has elapsed.

Generally, in case of a failure, an error will be indicated by the LED status indicator. See p.9 for details. The indicated error applies to all TrustSight driver versions.

Self-test DALI driver

The TrustSight DALI version is equipped with a self-test functionality according IEC62034. Automatic tests will be performed according the Duration Test (DT) and Functional Test (FT) programmable interval times. The design and construction of an Automatic Test System (ATS) shall ensure that only authorized personnel can change the test duration and the frequency of tests.

The DT Interval Time can be set at "0", disabling the duration tests. This means that there will be no DT initiated by the driver and the DT must be initiated by ATS (lighting management system). The same applies to the FT interval time. Via DALI interface the FT and DT can be initiated with DALI commands. In DALI standard operating mode, the DT will be performed as long as the rated duration time (3hrs for TrustSight drivers) When DALI gear is in manufacturer-specific operating mode the DT command will run a duration test until the battery is fully discharged. The automatic DT will always run until the battery is fully discharged. Full discharges are recommended for battery maintenance.

Conditions for Self-test

The TrustSight driver must be permanently connected to mains power whenever a DT or FT is executed, and the battery must be charging or fully charged. A DT will only be performed when the battery is fully charged. A FT can be performed when the battery is partially charged.

When scheduling a test (functional or duration test) the operation of the AC-driver is also checked. When the AC-driver is powered up, the test can be postponed up to 3 days (in 24/7 lighting situations). When the AC-driver is off for at least 2 hours the test will be started.

Manual Test

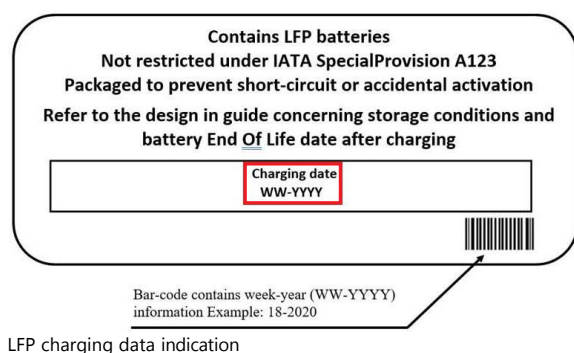
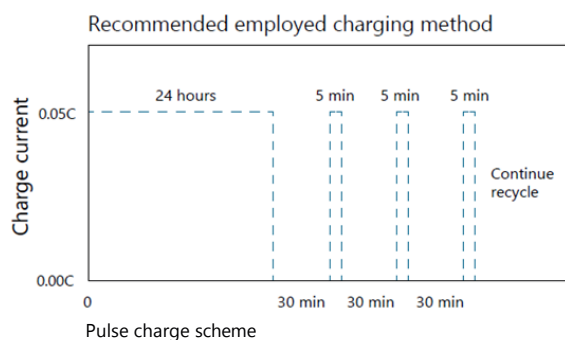
The TrustSight Basic version must be tested manually according to local regulations. This can be done by disconnecting the unswitched mains power and observing the performance of the system. It is also possible to initiate a DT or FT with the test switch function. For details, please see the Test Switch section.

Battery lifetime

The batteries have a life time expectancy of 4 years when maintained properly, as shown in the table below. See also the datasheet.

NiMH battery type	Technical Data	International standards Clauses
Cells intended for permanent charge at elevated temperature	Yes	IEC 62133-1 :2017 IEC61951-2:2011 (type U)
Expected operation life under following conditions: Min - max continuous battery case temperature Maximum occasional temperature Number of discharges	> 4 years + 0 - 50°C (55°C @charging) + 65°C (1 month) 2 discharges per year (minimum requirement) Note: DALI version will by default have one automatic discharge per year	

LiFePO ₄ battery type	Technical Data	International standards Clauses
Cells intended for emergency lighting	Yes	IEC 62133: 2017
Expected operation life under following conditions: Min - max continuous battery case temperature Maximum occasional temperature Number of discharges	> 6 years + 0 - 55°C (55°C @charging) + 60°C (1 month) 2 discharges per year (minimum requirement) Note: DALI version will by default have one automatic discharge per year	



Battery charging

NiMH batteries are charged before shipment. They need to be used before the date indicated on the battery packaging due to self-discharging when stored at ambient storage temperature $t_{\text{storage}} \leq 30^{\circ}\text{C}$.

Initially, the NiMH battery is charged with a constant current, according to the manufacturer's specification. After 24 hours the battery will be fully charged, and the charger will continue with pulse-charging to keep the battery fully charged. The pulse charge scheme is shown on the left.

LiFePO₄ batteries are also charged before shipment. They need to be used within the next 12 months following the charge data as indicated on the battery packaging (see picture on the left) due to self-discharging when stored at $t_{\text{storage}} \leq 30^{\circ}\text{C}$. These batteries will be charged by the TrustSight driver per the CC-CV method.

LED status indicator

The LED status indicator shows whether:

- The system is in charging mode
- Batteries are fully charged
- A system error has occurred
- See also the overview table below. The indicator will have the same response for the Basic, Pro and DALI version.

High Brightness LED status indicator

For specific applications in which the visibility of the standard LED status indicator is insufficient, a High Brightness (HB) LED status indicator with improved visibility is available. Please refer to the datasheet for more details.



Warning:

- Do not exceed 2m cable length between TrustSight driver and LED status indicator.
- Do not combine a single LED status indicator with multiple TrustSight drivers. Each driver must have its own LED status indicator.
- Independent use: the LED status indicator wires must have an additional supplementary insulation sleeve when used with a non-SELV AC LED driver.
- For LFP batteries, we have a battery temperature protection. When the battery temperature is below 0°C or higher than 55°C , TSG3+ will not charge the battery.

LED status indicator

LED indicator (color / flashing)	Error condition	Cause	Solution
Green / no flashing		System OK, battery fully charged	
Off		Mains off, EM mode, Rest mode, test in progress	
Green / slow (0.25s on, 1.25s off)		System OK, battery is charging	
Green / fast (0.25s on, 0.25s off)		System OK, recently tested (< 5 days, Australia mode only)	
Red / no flashing	Battery voltage too high or too low	No battery connected Wrong or bad battery connected Battery pack replaced with different type	Connect battery Replace battery Reset the driver (see p.23)
Red / fast (0.25s on, 0.25s off)	Output voltage too low or too high No load connected or output shorted	Wrong LED load connected Wrong connection	Connect right load and perform functional test Connect right load and perform functional test
Red / slow (0.25s on, 1.25s off)	Failed test due to battery	Battery end of life Charger failure	Replace battery and perform duration test. Replace driver
Red-green / fast (0.25s on, 0.25s off)		DALI device identification	
Red / short (0.03s on, 0.97s off)	Battery temperature out of range (LFP+ only)	Battery temperature outside 0°C - 55°C range	Wait until temperature is within range
Green / short (0.03s on, 0.97s off)	Current battery levels in range.	Battery detection	Wait until battery detection is finished
Red / short (0.03s on, 0.97s off)	Current battery levels out of range.		

Test switch

An optional test switch can be connected to the TrustSight emergency driver. This switch can be connected in parallel to the indicator LED and be used in the following ways:

- Pressing the switch less than 10s: this will initiate a FT as long as switch is pressed.
- Pressing the switch > 10s: this will complete the FT when the battery is not fully charged.
- Pressing the switch > 10s when battery is fully charged: a DT will be performed (indicator stays green).

When the TrustSight driver is running in Emergency mode it is possible to electrically disconnect the battery by pressing the test switch for 3 seconds. This feature enables switching off the emergency system after a light-up factory test and prevents further battery discharge while keeping the battery physically connected to the TrustSight driver.

Automatic battery selection

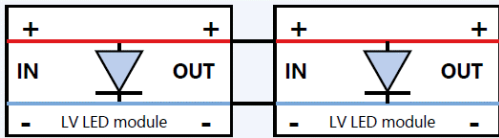
The TrustSight emergency drivers are equipped with an automatic battery detection feature. Depending on the technology of the connected battery, the driver will charge the battery accordingly and will detect the number of cells in the battery pack. The resulting output power during emergency mode will be set according to the detected amount of battery cells (see datasheet for details). After installation and power up the driver will detect the battery and start the automatic detection process.

- During automatic detection, the indicator LED will light up with short green flashes.
- Between minimum 6 and maximum 30 seconds the TrustSight driver will set the battery type (number of cells) and will set the emergency output power accordingly.

After that, the system is defined and fully operational. The battery type definition has influence on the performance during the self-test and on the battery charge method. When the automatic battery detection process is disrupted, e.g. by switching off the permanent mains, the detection process is stopped and the TrustSight emergency driver will go into emergency mode with the lowest output power. At a next power up, the automatic detection process will start again.

The automatic battery detection should be executed with nominally charged batteries. Overcharged or deep-discharged batteries will cause an incorrect detection of the battery pack.

Electrical design-in



Schematic representation of the wiring of 2 connected LV LED modules in an LV system, not needing a Return-End cable

Short introduction into High- and Low voltage systems

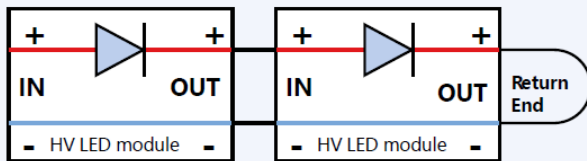
Low voltage system

Low Voltage (LV) systems typically use LV LED modules or Hybrid LED modules suitable for LV usage, connected to driver with insulated output. LV products make a parallel system; adding an LED module requires a higher current. The majority of the LV systems are point source systems which can be installed outside the luminaire (independent) or built-in the luminaire.



Warning

- Avoid touching live parts
- Avoid touching any bare components on the PCB, e.g. LEDs!
- Do not use damaged LED modules!



Schematic representation of the wiring of 2 connected HV LED modules, including the Return-End cable.

High voltage system

High Voltage (HV) systems typically use HV LED modules or Hybrid LED modules suitable for HV usage, connected to a driver with a non-insulated output. HV products make a series system; adding a LED module requires a higher voltage. The majority of the HV systems are built-in linear systems



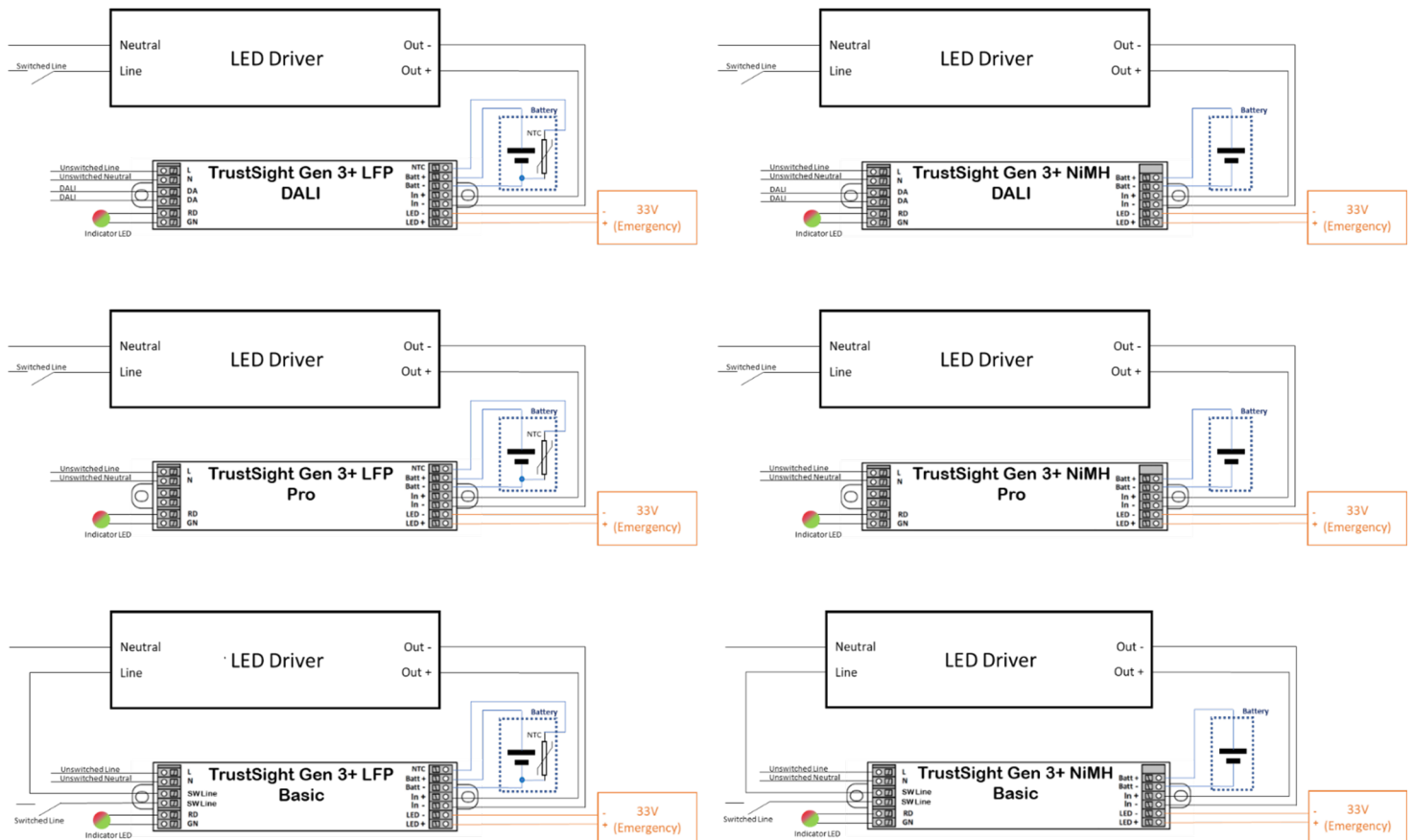
Warning

- Avoid touching live parts
- Avoid touching any bare components on the PCB, e.g. LEDs!
- Do not use damaged LED modules!
- Insulation Class I luminaires must be connected to protective earth!

Connection scheme

How to Configure a LV system with an EM system

A typical LV system in combination with an EM system consists of a LV SELV AC LED driver, a LED module and a TrustSight BASIC, PRO or DALI LV emergency driver. Typical examples of connection diagrams are shown below, using a LED module with a forward voltage between 15 V and 55 V.



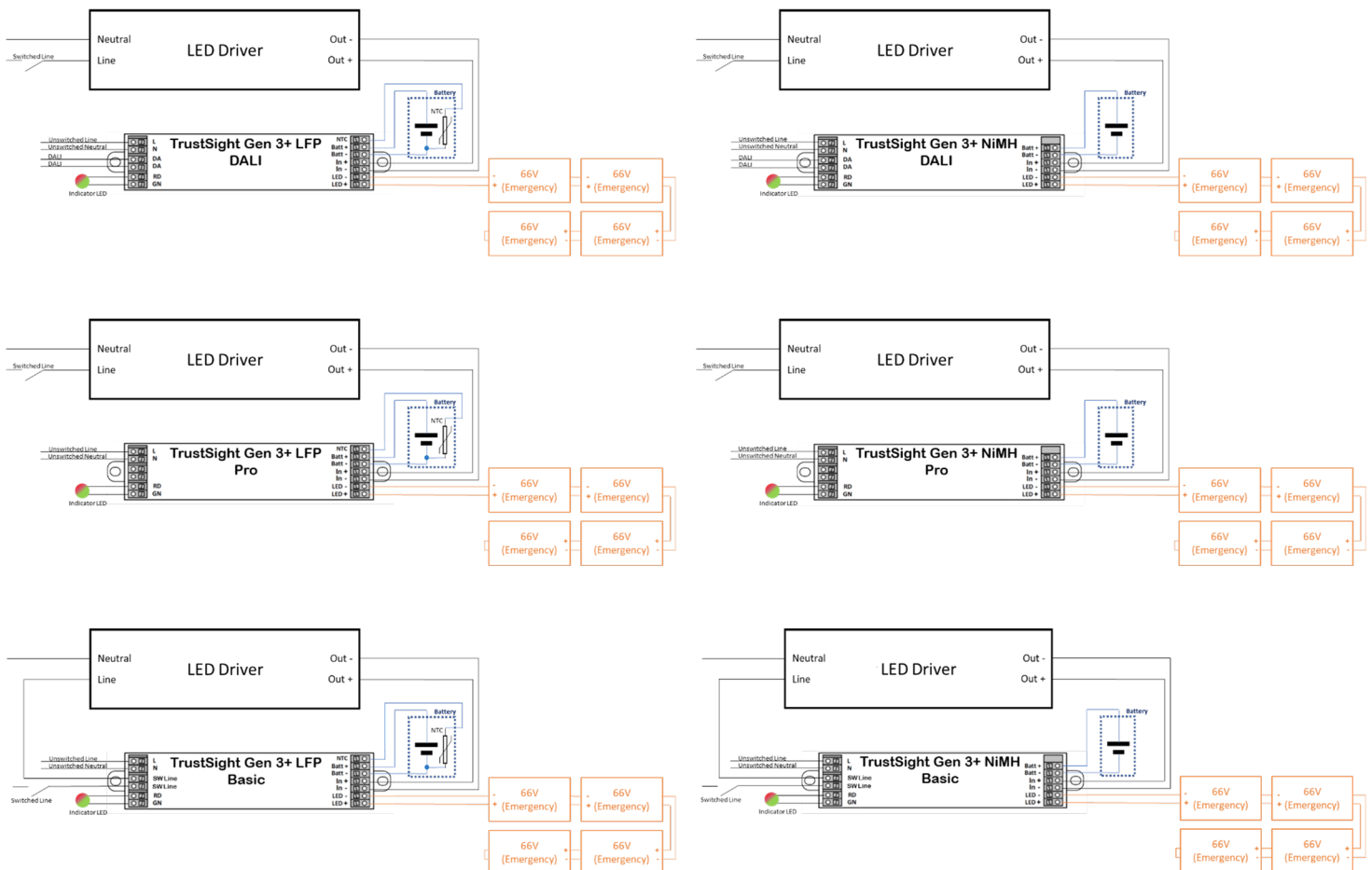
Warning: The TrustSight LV SELV driver does not support operation combined with non-SELV AC driver.

Connection scheme

How to configure a HV system with an EM system

Due to the fact that a linear system can consist of multiple LED modules, a HV system has a lot of potential configurations possibilities. The following steps can help you in selecting the right one based on your requirements:

- Depending on how a system is built up it may be possible that part of the LED modules will be illuminated in EM mode.
- The TrustSight HV has an output voltage range of up to 300V that makes it possible to light up all LED modules in Emergency mode.
- Determine the LED driver- and LED module settings in normal operation mode
- Determine the required amount of lumen in an emergency situation
- Based on the applied LED module determine (from the module datasheet) the specified amount of lumen per watt (lm/w). Depending on EM-power configuration as specified in the TrustSight driver datasheet, the outcome of this calculation will be the amount of lumen in an emergency situation.

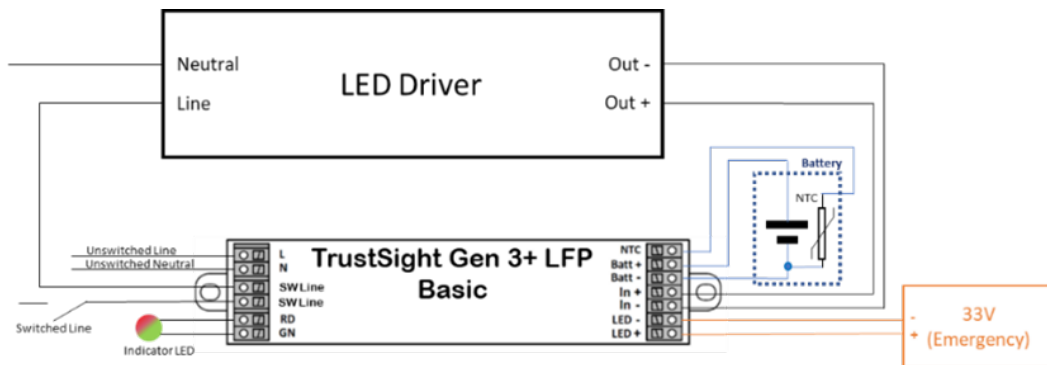


The amount of light in emergency mode

The amount of emergency light in lumen (lm) is determined by the delivered power by the TrustSight driver and the efficacy of the LED module(s) connected to the emergency driver.

Example

The application (as shown below) is equipped with a LED module with an LED efficacy of 150lm/W. The amount of lumen in emergency mode is: LED power x LED module efficacy = 2.7W x 150lm/W = 405lm.



More lumen in emergency mode

- Connect a LED module with a higher lumen efficacy
- Use a higher emergency power

Series operation

It is important to determine the total forward voltage of the in series connected LED modules. The number of LED modules which can be connected to an EM driver is limited by the maximum output voltage of either 55V or 300V, depending on TrustSight driver type.

Example 1

Optical characteristics - table per CCT

Fortimo LED SLM 2000 lm L13 830

Parameter	Min	Typ	Max	Unit
Luminous Flux	1810	2020	2230	lm
Module Efficiency		117		lm/W
Correlated Colour Temperature		3000		K
Colour Coordinates		(0.434, 0.403)		-
Colour Coordinates Premium White		(0.430, 0.395)		-
Colour Consistency		3		SDCM
CRI		>80		-
Radiation Angle		115		deg
Thermal Power			11.9	W
Energy efficiency label		A+		-

TrustSight Basic 15-55V LFP+, connected to SLM 2000 lm

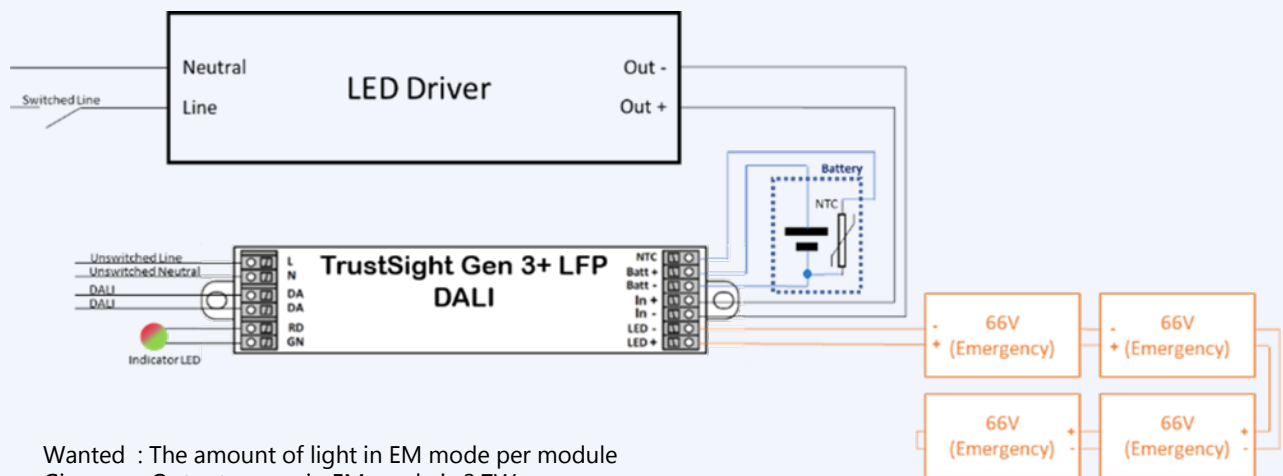
Wanted : The amount of light in EM mode

Given : Output power in EM mode is 2.7W

Needed : LED efficiency, see datasheet: 117 lm/W

$$\text{Answer: } 117 * 2.7 = 316 \text{ lm}$$

Example 2



Wanted : The amount of light in EM mode per module

Given : Output power in EM mode is 2.7W

Needed : LED efficiency, see datasheet LED-module LED Line 1 ft 1100 lm 1R HV3, 165 lm/W

$$\text{Answer: Each module consumes } 2.7 \text{ W} / 4 = 0.68 \text{ W so light output per LED-module is } 0.68 * 165 \text{ lm} = 111 \text{ lm}$$

How to... wire – general remarks

In the datasheet of the EM driver the following is specified:

- Wire diameter range
- Wire strip length
- Maximum output wiring length for EMC compliance

Direct wiring between LED driver, LED module, TrustSight EM driver and battery

Please note that no components are allowed between the LED driver EM-driver and LED modules other than connectors and wiring intended to connect the LED driver to the LED board. For example, it is not allowed to install a switch between the driver and LED boards.

Two wires into one connector hole

In some scenarios two wires need to be connected to one connector hole. In this case the pairing must be done outside the LED driver or EM-driver, resulting in only one wire going into the driver. Two wires into one connector hole are not supported.

Ferrules

The reliability of twin-wire ferrules (or wire end stop), accepting the wires intended to use, should be checked with the supplier of these ferrules.

Independent use

For independent use of TrustSight SELV drivers there are add-on strain reliefs available for input and output cables which can be attached to the existing EM TrustSight housing.

Interconnecting LED drivers and LED modules

See the Design-In Guide for Xitanium Indoor LED drivers and LED modules at www.philips.com/technology.

Electromagnetic compatibility (EMC)

Electromagnetic compatibility (EMC) is the ability of a device or system to operate satisfactorily in its electromagnetic environment without causing unacceptable interference in practical situations. TrustSight EM LED drivers meet EMC requirements per CISPR15. This test is conducted with a reference luminaire, representing a common application that includes a LED driver, TrustSight emergency driver, LED load (incl. heatsink), battery and LED indicator.

Cable length and EMC

For each setup it is advised to perform EMC tests. It is recommended to place the battery as closely as possible to the TrustSight emergency-driver.

In plastic Class I luminaires a suitable LED driver needs to be selected with enough margin (overall > 6dB) to enable EMC compliance of the total luminaire. Alternatively, a metal luminaire for office applications needs to be selected (preferred).



Examples of what solutions could look like for pairing wires.

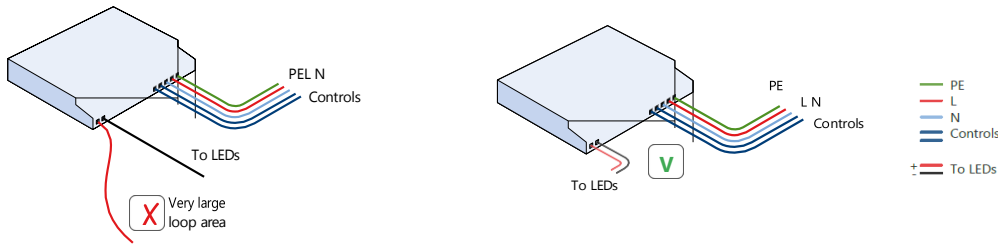


Twin-wire ferrules.

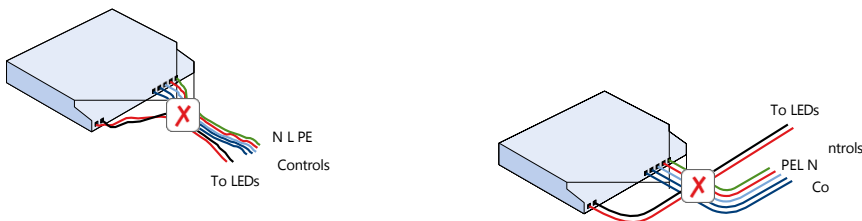
How to... improve EMC performance

Both applies to a point and linear EM driver. Below a point source LED driver is used as example.
The following practical precautions need to be taken into account in a lighting system to minimize EMC:

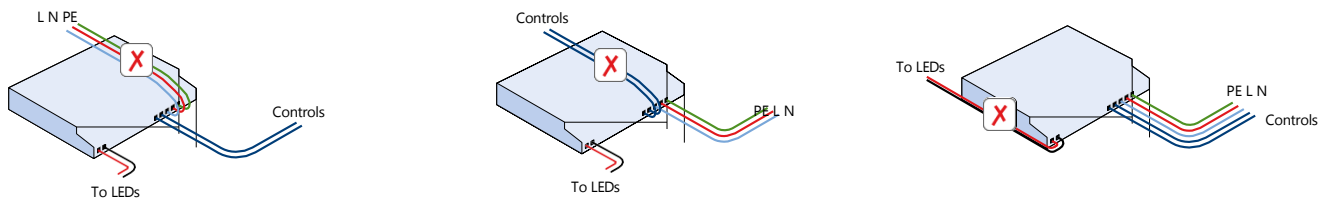
- Minimize the differential mode loop area of the lamp wires going from the driver to the light source by keeping the wires close together (bundling). This will minimize the magnetic field and reduce the radiated EMI.



- Minimize the common mode parasitic capacitance of the output wiring + light source to earth by keeping the length of the wires between driver and light source as short as possible. Keep the length of the incoming mains wire inside the luminaire as short as possible.
- Keep mains and control wires (DALI) as well as battery wires separated from the output wires. Do not bundle or cross the wires.



- Do not route any wiring over and/or along the driver enclosure to avoid any coupling/crosstalk with internal components of the driver.



Ground the lighting system chassis and other internal metal parts to protective earth (class I luminaires): do not let large metal parts electrically insulated from functional or protective earth. Always connect the protective/functional earth/equipotential connector or wire from the driver and use equipotential bonding wires for all large unconnected metal luminaire parts like luminaire housing, driver mounting plate, reflector, heatsink etc. Keep the protective/ functional earth/equipotential wires as short as possible to maximize their effectiveness and use, as much as possible, large metal areas (chassis, mounting plates, brackets) for earthing purposes instead. Establish a reliable electrical connection by using a toothed washer and screw(s) fastened with adequate torque.

Electrical insulation and protective earth



Warning

Connecting the luminaire to Protective Earth.

If the AC driver needs to be connected to Protective Earth (e.g. like linear Xitanium LED drivers) then also the luminaire needs to be connected to protective earth in order to comply with safety and EMC regulations. Please also consult the Design-In-Guide of the Xitanium Indoor Linear LED drivers on www.philips.com/oem.

Surge immunity

The TrustSight Emergency drivers have built-in surge immunity according IEC61000-4-5 as specified in the driver datasheet. Depending on mains grid conditions additional protection against excessive high surges may be required by adding an external Surge Protection Device.

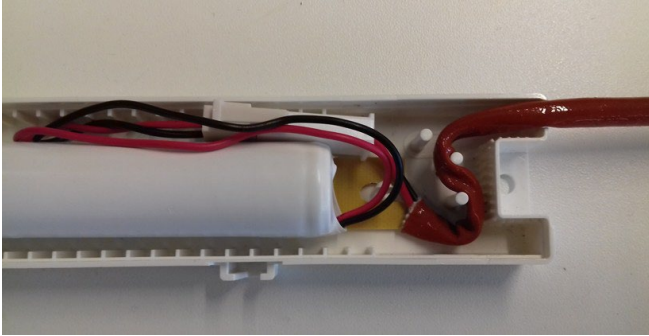
Touch current

The TrustSight Emergency LED drivers have no protective earth or equipotential connector. Therefore, the (parasitic) touch current contribution of the driver in an Insulation Class II luminaire will be negligible.

Insulation

The LED indicator and battery inputs have reinforced insulation towards mains input. The output of the TrustSight LV and HV driver has double insulation towards the mains input. The insulation between the LED indicator & battery towards the LED output is functional.

Mechanical design-in



Proper routing of battery sleeve for adequate strain relief

Dimensions

The dimensions of the TrustSight Emergency driver, indicator LED and battery packs can be found in the driver datasheet. Be sure to use all available mounting feet in order to achieve reliable fixation.

For independent applications separate strain reliefs for input and output cabling are available. Please note that only the TrustSight LV driver supports independent operation.

Special attention must be paid to the independent application with a separate battery box: the battery wiring sleeve (red) must be routed as shown in the picture on the left to achieve adequate strain relief.

For independent operation, a dedicated Fire Resistance Compliant (FRC) LFP battery and harness are available. Please refer to the datasheet for more details.



Warning:

The independent version of the TrustSight driver and battery are not allowed to be covered with insulation material or to be in contact with combustible materials. Minimum required clearance between top and both sides of the driver/battery housing is 5mm.

Thermal design-in

This section describes the thermal design-in details of a Philips TrustSight Emergency system. Points of attention are the t_c point temperature of the TrustSight driver and its lifetime as well as the battery temperature.

To facilitate a proper design-in of this system, the critical thermal management points are explained in this section. The design of the luminaire and the ability to guide the heat out of the luminaire are of utmost importance. If these thermal points are taken into account this will ensure the optimum performance and lifetime of a TrustSight system.

Case point temperature (t_c point)

To achieve optimal lifetime and reliability, it is critical that the temperature of the components in the driver remains within their ratings. The case temperature point t_c is a reference point for the temperatures of the critical internal driver components. The location of the t_c point is identified on the product label. The t_c point is marked by a $^{\circ}$ or $*$ symbol on the label of the driver.

How and when to measure t_c point temperature

The t_c point temperature must be measured by means of a thermocouple which is firmly glued to the indicated t_c point on the driver housing. The corresponding battery type must be connected to the driver. For a representative measurement the t_c point temperature must be measured with a fully charged battery in pulse-charge mode. The driver will be in pulse-charge regime after it has been connected permanently to mains voltage for at least 24 hours. When in pulse-charge mode the t_c point temperature will fluctuate in sync with the battery pulse-charging current. The highest t_c point temperature must then be taken as reference to define thermal compatibility in a luminaire or system and it must not exceed the specified t_{c_max} value as specified in the driver datasheet.

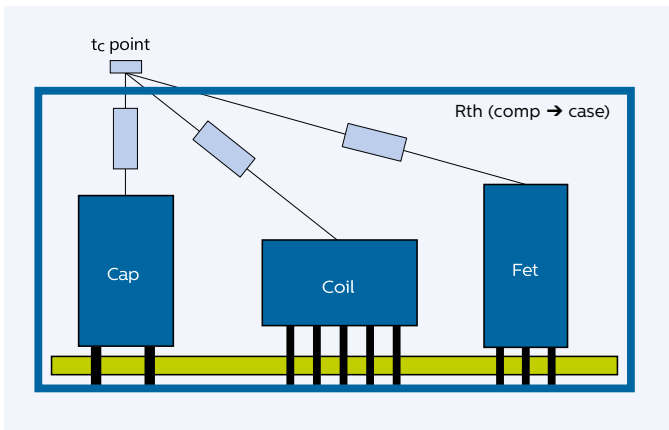
Note: during charging of an empty or partially-charged battery, the t_c point temperature will periodically be higher than during pulse-charging regime. The temperature is then allowed to periodically exceed the specified t_c (max) value for a duration of max. 24h. Please refer to the datasheet for more details.

Relation between t_c and ambient temperature t_a

The t_c point temperature increases, by approximation, linearly with the ambient temperature t_a . The temperature offset between t_a and t_c depends on the thermal design of the luminaire. The TrustSight driver has been designed for indoor use: the minimum and maximum t_a values in the application should be respected. For approved t_a range and maximum t_c temperatures please check the driver datasheet.

Battery storage and operating temperature

The batteries are pre-charged before shipment to extend their shelf life. The indicated date on the batteries is valid when the batteries are stored within the specified temperature range. Please refer to page 8 for temperature limits for the different battery technologies. The battery has no dedicated t_c point for thermal verification. It is advised to glue a thermocouple to the center part of the battery body to measure its temperature. Operating or storing the batteries outside the specified temperature ranges as shown on page 8 and in the datasheet will reduce the lifetime of the batteries and must be avoided.



Schematic representation of internal thermal resistances and driver t_c point



High operating temperature and high output current

With high temperature ambient ($>45^{\circ}\text{C}$) and AC LED driver output current of $>1.5\text{A}$, please check the specifications with the design-in team. For this service please contact your Signify sales representative.

DALI

Digital Addressable Lighting Interface, or DALI, is a digital communication protocol popular in the lighting industry. It is an IEC standard and there are many control devices from Philips and other manufacturers that communicate using DALI. The voltage across DALI wires is typically 16V and it is polarity-insensitive. For more information on DALI, refer to the IEC specification for DALI protocol or visit: www.digitalilluminationinterface.org

- IEC 62386: 102 - General requirements - Control gear.
- IEC 62386: 207 - Particular requirements for control gear
 - LED modules.
- IEC 62386: 202 - Particular requirements for control gear
 - Self-contained emergency lighting.

The DALI standard allows additional emergency features to be configured as options.

Every emergency gear conforming to the DALI emergency gear standard IEC 62386-202 is able to carry out an emergency test when commanded across the DALI bus – either a short (function) test or a discharge (duration) test.

The emergency gear carries out the test autonomously when requested to do so; it selects its battery as the power source during the test, so that there is no need to interrupt its permanent mains supply. Once the test is complete the test results can then be read over the DALI bus. In the event that the permanent mains supply fails during a test, the DALI emergency gear immediately stops the test and goes into full emergency operation, so that the requirement for the escape lighting to illuminate quickly, reliably and unconditionally is met.

Each DALI emergency gear is individually addressable on its DALI bus and each gear can be commanded individually to carry out an emergency test. So rather than testing all the emergency luminaires in one zone together each emergency luminaire in the zone can be tested at a different time, therefore ensuring the safety of the zone at all times.

If the emergency and normal drivers in a luminaire are both DALI gear, then each can be separately addressed on the same DALI bus. This allows common wiring to be used for both normal lighting control and emergency test control. During a failure of the permanent mains supply, the TrustSight driver acts autonomously to provide escape lighting, regardless of the state of the DALI bus.

Device features		Comman...	Traceability	Scheduler	Query	Energy
Summary						
DALI 202						
Emergency level:		254				
Prolong time:		0 min				
Function test interval:		0 days				
Duration test interval:		1 weeks				
Test execution timeout:		0 days				
Lamp emergency time:		1 h				
Lamp total operation time:		4 h				
Emergency						
Output power:		100 %				
Region selection:		Europe				
Duration test:		180 min				
SelfTest mode:		DALI				
Function test interval:		0				
Duration test interval:		1				
Enable manual selection:		No				
Battery type:		LFP				
Battery capacity:		3-cells (1S3P) for 2W				
Luminaire Info						
Content format ID:		Unformatted content				
GTIN (EAN13):		281474976710655				
Identification number:						
Additional info (42):						

Default test times are factory pre-set, in accordance with the DALI standard EN 62386-202, to conduct an automatic function test every 7 days and a duration test every 52 weeks. Since the DELAY time is factory pre-set to Zero, all units are tested at the same time. Test times can be changed via DALI by means of MultiOne software. See below.

Set able Emergency items via Device features in MultiOne:

- Output power in EM mode (between 50 and 100%)
- Region selection (Europe and Australia)
- Function Test interval
- Duration Test interval
- Battery cell count
- Selftest mode

Via the diagnostic tab several logged items can be viewed:

- lamp emergency time
- lamp total operation time
- Last duration test time
- Time since last duration time
- Total numbers of discharge cycles

Via SimpleSet the same device features can be set and diagnostic items can be checked.

Network		Device features		Energy meter	Diagnostics	Installer	Luminaire (Fixture) Information	
Network		Summary		Content format ID:		Unformatted content		
Groups		Emergency		Luminaire manufacturer GTIN (EAN13):				
All devices		Luminaire Info		Identification number:				
Virtual devices				Additional info (236):				
TrustSight DALI 15-55V LFP+ 1.0						<input type="checkbox"/> Use device UID		

Device features		Energy meter	Diagnostics	Installer
Emergency				
Summary		Output power: <input type="text" value="100"/> %		
DALI 202		Region selection: <input type="text" value="Europe"/>		
Emergency		Duration test acceptance time: <input type="text" value="180"/> Minutes		
Luminaire Info		SelfTest mode: <input type="text" value="DALI"/>		
		Function test interval: <input type="text" value="7"/> Days		
		Duration test interval: <input type="text" value="52"/> Weeks		
		Battery type: <input type="text" value="LFP"/>		
		Battery capacity: <input type="text" value="6-cells (3S2P) for 5W"/> <input type="checkbox"/> Enable manual selection		

When making a feature file, the user can decide to add specific device info in that feature file (device name and version). Furthermore, is in MultiOne Workflow an option to check whether the feature file is specifically made for the connected driver. Both options regarding the feature file make it possible to use a feature file created for one type of device, for a completely other type. In case of Emergency is it possible to define a battery capacity for a type of device, related to a battery type and configure a device of another type and even with another battery type. In the design-in documentation of the emergency drivers, this possibility with potential "bad" consequences should be noted to prevent complaints from customers.

Reset to factory default

In certain cases, it may be required that the TrustSight driver be reset to factory default settings. This can be achieved in the following way:

1. Apply mains power and apply 12Vdc on battery input (apply at the same time or within 2s)
2. After 1s the LED indicator will start flashing fast RED for 2s (4 times)
3. Remove 12Vdc on battery input while the LED is flashing.
4. After 1s the LED indicator will light up continuously GREEN for 2s.
5. Disconnect mains power.

The driver has now been reset to its factory default settings.

How to set Australia mode:

For application in Australia the driver can be set accordingly by using MultiOne (DALI / NFC) to change to Australia mode or by taking these steps:

1. Apply mains power and apply 12Vdc on battery input (apply at the same time or within 2s)
2. After 1s the LED indicator will start flashing fast RED for 2s (4 times)
3. Remove 12Vdc on battery input while the LED is flashing. Press the test button. The LED indicator will extinguish.
4. Disconnect mains power after 4s.

The driver has now been set in Australia mode.

Notes:

In ergo, pressing the test button during the procedure will reset the device with Australia mode enabled. Not pressing the button will reset the device with Australia mode disabled.

Not removing the 12Vdc within 3s or applying for at least 1.5s will not perform the factory reset.

Note that applying an invalid battery voltage will trigger battery failure state (RED indicator LED), which when mains is lost, will not produce emergency light.

To verify the successful execution, first connect a valid battery and then apply mains power. Battery detection happens within 7s. There are short green flashes in that detection period. Remove mains power well within 7s to ensure that the driver stays in autodetect mode.

To verify that Australia mode is active, press the test button for at least 10s while the battery is being charged. The 30s functional test is then started. When the test succeeds, the LED indicator will flash fast green (for 5 days). This is specific for Australia mode.

Quality and Reliability

Relevant Standards

Compliance and approval	Generated disturbances (EMI/EMC)
EN 55015 A2/CISPR15	Conducted EMI 9 kHz-30 MHz
EN 55015 A2/CISPR15	Radiated EMI 30 MHz-300 MHz
IEC 61000-3-2	Limits for mains input current harmonics
IEC 61000-3-3	EMC – Limitation of voltage fluctuation and flicker in low-voltage supply systems for equipment rated up to 16 A
Immunity	
IEC / EN 61547, A12000	Equipment for general lighting purposes – EMC immunity requirements
IEC / EN 61000-4-2	Electrostatic Discharge
IEC / EN 61000-4-3	Radiated radio frequency, electromagnetic field immunity
IEC / EN 61000-4-4	Electrical fast transient/burst immunity
IEC / EN 61000-4-5	Surge immunity
IEC / EN 61000-4-6	Conducted disturbances induced by RF fields
IEC / EN 61000-4-11	Voltage dips, short interrupts, voltage variations
Performance	
IEC 62384	DC or AC supplied electronic control gear for LED modules - Performance requirements
IEC 62386	Digital Addressable Lighting Interface (DALI)
Safety standards	
IEC / EN / AS/NZS 61347-1	General and safety requirements
IEC / EN / AS/NZS 61347-2-13	LED Particular requirements for DC or AC supplied electronic control gears for LED modules
Emergency standards	
IEC / EN 61347-2-7	Particular requirements for DC supplied electronic ballasts for emergency lighting
IEC / EN 62034	Automatic test systems for battery powered emergency escape lighting

RCM independent control gear classification

Regulation AS/NZS 60598.2.2	Applies when the control gear is built inside constructions	
Clearance type	Description	Distance
Height clearance to building element (HCB)	Minimum distance between the top of the control gear and any building element above it	5mm
Minimum insulation clearance (MIC)	Minimum distance between the top of the control gear and the building insulation above it	5mm
Side clearance to building element (SCB)	Minimum distance between the side of the control gear and any building element	5mm
Side clearance to insulation (SCI)	Minimum distance between the side of the control gear and any building insulation	5mm
RISK OF FIRE	BUILDING INSULATION MUST NOT COVER THE CONTROL GEAR	

Please refer to the driver certificates for more details at www.philips.com/oem.

System Disposal

We recommend that the TrustSight Emergency drivers, batteries and other TrustSight components are disposed of in an appropriate way at the end of their (economic) lifetime. The drivers are in effect normal pieces of electronic equipment containing components that are currently not considered to be harmful to the environment. We therefore recommend that these parts are disposed of as normal electronic waste, in accordance with local regulations.

Battery installation at OEM

After the TrustSight Emergency has been installed in a luminaire, the luminaire should not be left powered up in emergency mode (battery-powered light) to prevent the batteries from being drained for a long time. After mains disconnect, the battery should be disconnected and (after a few seconds) connected again. In this way, no energy will be drained from the battery (except for its self-discharge during the time before installation).

Mains voltage fluctuations

The driver is able to withstand high and low mains voltages for limited periods of time.





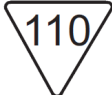











Mains undervoltage

Continuous mains undervoltage (<198VAC) has no adverse effect on the driver lifetime. However, according IEC 61347-2-7 Ed.3 Clause 21, below 195VAC mains the TrustSight is allowed to go into emergency mode.

Mains overvoltage

Mains overvoltage will stress the driver and will have an adverse effect on the lifetime (maximum 320Vac for a period of 48 hours, 350Vac for 1 hour). For optimal driver performance it is always recommended to operate drivers within the specified voltage performance range.

Marking

Symbol	Description	Symbol	Description
	CE marking		FELV control terminal marked "Risk of electric shock" are not safe to touch. Dimming connected to FELV control terminal shall be insulated for Low Voltage supply of the control gear. Any terminals connected to the FELV circuit shall be protected against accidental contact. Risk of electrical shock. May result in serious injury or death. Disconnect power before servicing or installing.
	ENEC marking the European certification mark for electrical products that gives a product access to the markets of countries in the European Union, EFTA, and a number of Eastern European countries. 05 indicates certifying body KEMA/DEKRA.		RCM marking
	F-marking, temperature declared, thermally protected ballast/transformer(s) symbol acc. IEC61347-1 Clause 7.1. m, 110 °C		Kitemark marking
	Control gear classified as being provided with an automatic test function shall be marked with this symbol.		The Eurasian Conformity mark
	Electronic control gear complying with IEC61347-2-7 shall be marked with this symbol.		UK Conformity Assessed marking
	Electronic independent control gear classified as "Do not cover" acc. AS/NZS 60598-1.		SELV
	WEEE		Double isolated
	SimpleSet programming marking		
	DALI 2 marking		

Disclaimer

Note that the information provided in this document is subject to change.

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Date of release: October 24, 2023
www.philips.com/oem