PHILIPS

Xitanium

LED Indoor drivers

Spot & Downlight

Design-in Guide

Reliable technology for stand-alone and connected LED solutions

August 2023

Contents

Introduction to this guide

Examples of Xitanium indoor Spot & downlight LED drivers

Thank you for choosing Philips Xitanium Indoor Spot & Downlight LED drivers. In this guide you will find the information needed to integrate these drivers into a LED luminaire or LED system.

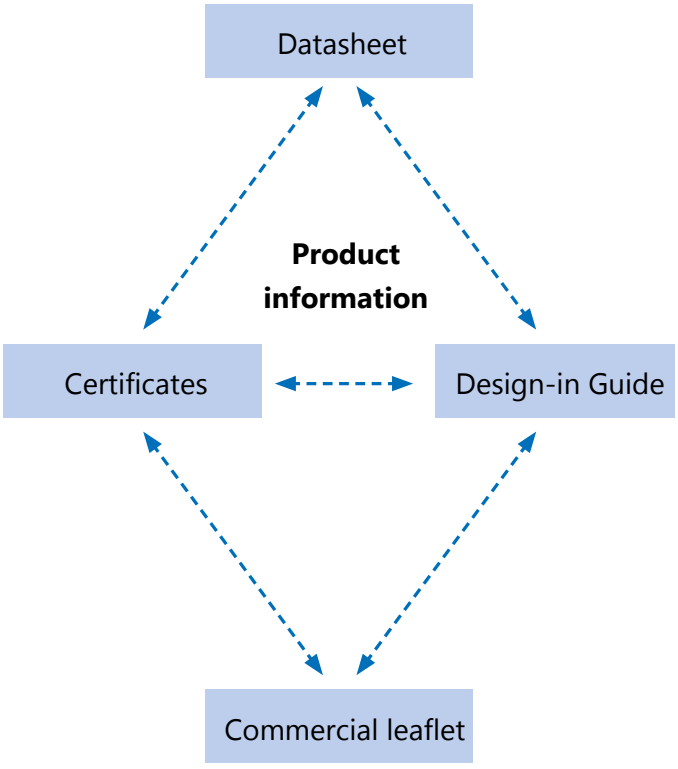
This edition describes the following driver types:

- Xitanium Dimmable DALI/Touch and Dim (TD)
- Xitanium Sensor Ready (SR, available in the course of 2022)
- Xitanium Single Current Dimmable (TE)
- Xitanium Single Current
- Xitanium Track Adapter (/a)
- Xitanium Wireless: MasterConnect (MC) and Casambi (CD)

Applications

The Xitanium Indoor Spot & Downlight LED drivers are designed to operate stand-alone and connected LED solutions for indoor lighting, like offices, public buildings and retail and consumer environments. If you use Philips LED drivers in combination with Philips LED modules, specific design-in guides are available from the below mentioned technology websites.

Philips Xitanium Indoor Spot & Downlight LED SR and Wireless drivers reduce complexity and cost of wireless connected lighting systems in indoor applications. If you use these drivers in combination with Philips Sensors and Philips LED modules, specific design-in guides are available from the below mentioned technology websites.



Information and support

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

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 and 3D file 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

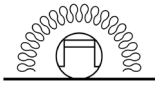
All these documents can be found on the download page of the OEM website www.philips.com/oem. If you require any further information or support please consult your local Signify office.

Warnings and safety instructions

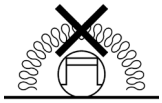
Safety warnings:

- 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!

Special remarks about RCM certification:
There are three types of applications in Australia/New Zealand, "IC", "Do not Cover", and "Non IC".
Please refer to product label for details.

IC classification 

An independent controlgear that can be abutted against normally flammable materials, including building insulation, and can be covered in normal use. Building elements, building insulation or debris have restricted access to the heated parts of the controlgear.

Do-not-cover classification 

An independent controlgear that can be used where normally flammable materials, including building insulation, are or may be present, but cannot be abutted against any material and cannot be covered in normal use.The control gear is suitable to abut normally flammable materials and to be covered by insulation inadvertently.

Non IC classification (no mark)

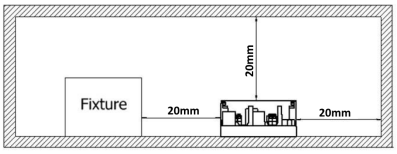
An independent controlgear that cannot be abutted against or covered by normally flammable materials or used in installations where building insulation or debris is, or may be, present in normal use.

Safety warnings Track drivers:

- Avoid contact of the driver with acid and alkaline solutions.
- Avoid contact of the driver with organic oils or other organic materials. At high temperature (≥60degree), the housing will be corroded by organic oils.
- High temperature and high humidity: Do not use the driver under high temperature and high humidity environment for long term, check the datasheet for specific details.

Important installation instructions

- Avoid touching live parts.
- Do not use drivers with damaged housing and/or connectors.
- Do not use drivers with damaged wiring.
- Insulation Class I luminaires must be connected to Protective Earth (PE).
- Adequate Protective Earth and/or equipotential connections need to be provided whenever possible or applicable.
- Do not use the SR control interface of Xitanium LED SR drivers in wired luminaire-to-luminaire network applications.
- Do not connect mains voltage to the SR interface; immediate driver failure may result.
- Do not switch the driver output unless "hot wiring" is supported.
- Do not service the driver when the mains voltage is connected.
- The luminaire manufacturer is responsible for its own luminaire design and compliance with all relevant safety standards including minimum required IP rating to protect the driver.
- The Xitanium Indoor Spot & Downlight LED drivers are intended for indoor use and must be protected against ingress of and exposure to including but not limited to 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.
- No components are allowed to be connected between the LED driver and the LED module(s) other than connectors and wiring intended to connect the Xitanium driver to the LED module.
- In case driver being used for the independent application, make sure to keep the driver dry, acidfree, oilfree, fatfree and at least 20mm distance from the body which is not the mounting surface to wall for the sufficient thermal dissipation and do not exceed the maximum ambient temperature (ta) stated on the device



Track drivers:

- Ensure proper electrical contact between between track driver and track, given inherent tolerances to track dimensions. Move the position of the track driver along the track if no proper contact can be established.
- It is recommended to mount the track driver in a vertical position. Mechanical strenght of the track driver is max. 50N: this force must not be exceeded.
- Signify Design-in support is available; please contact your Signify sales representative.

Disposal

Please, inform yourself about the local waste disposal, separation and collection system for electrical and electronic products and packaging. Please act according to your local rules and do not dispose of your packaging and old product with your normal household waste. The correct disposal of your product will help prevent potential negative consequences for the environment and human health.

Introduction to Xitanium Indoor Spot & Downlight LED drivers

Xitanium LED Drivers

Introduction

Xitanium Indoor Spot & Downlight LED drivers are designed to operate wired as well as wireless LED solutions for general indoor lighting applications such as downlighting and spot/ accent lighting. With Xitanium LED drivers, flexibility in luminaire design is assured thanks to an adjustable output current. Application-oriented operating windows offer the flexibility required to provide the stable lumen output and light quality levels that lighting specifiers and architects demand. The adjustable output current also enables operation of various LED module solutions from different suppliers.

Xitanium driver versions

Xitanium drivers described in this guide are available in different versions/sizes with different controllability options in a wide range of power ratings that enable the most popular light output levels for general lighting applications. We recommend you always check our Xitanium driver leaflet for the most up-to-date overview of our range. This leaflet can be found at www.philips.com/oem.

Xitanium driver segments

The Xitanium drivers described in this guide are categorized in different segments:

- Statement
- Performance
- Core

These segments are defined based on specifications, features and intended applications.

Statement drivers

Statement drivers are the most advanced Xitanium drivers. They are fully configurable via the Philips MultiOne interface, using the SimpleSet feature via the Philips MultiOne interface and can be controlled by means of Sensor Ready (SR), DALI and Touch and Dim (TD) or wireless communication. All statement drivers have the complete package of features like hot wiring, reduced output ripple current, window functionality, LEDset, etc.

Performance drivers

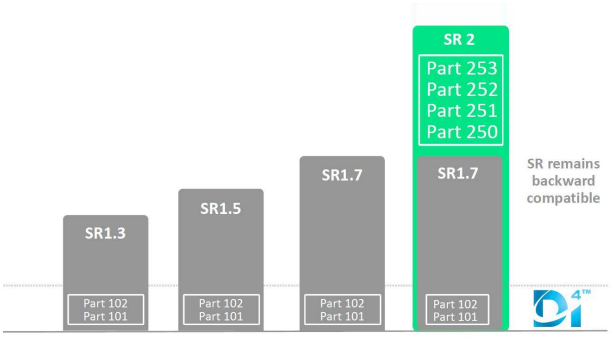
Performance drivers have the same package of features like the statement drivers. The only difference is tha these drivers are not programmable via MultiOne and DALI. Some performance drivers may have the SimpleSet functionality which can be used to configure the device via the Philips MultiOne interface. The Xitanium fixed output drivers and mains phase-cut dimmable Trailing Edge (TE) drivers are a part of this segment.

Core drivers

Core drivers are value-engineered Xitanium drivers. This implies that these drivers still have the window flexibility, the quality and reliability expected with Xitanium drivers, but they have optimized specifications for specific applications. It depends on the intended application which specification is adjusted.

Detailed driver specifications can be found in the Xitanium driver datasheets which can be downloaded via www.philips.com/oem.

Introduction to Xitanium SR drivers



Evolution of Sensor Ready (SR) intra-luminaire digital protocol

Xitanium SR drivers and SR Certified Products

Our Xitanium SR Spot & Downlight drivers offer great benefits for Lighting Management Systems. To ensure full component interoperability, Signify provides SR Certification. The performance of third-party SR controllers (e.g nodes, sensors) is tested and certified on our SR drivers to eliminate any interface problems. This means you can offer connected lighting solutions without having to worry about software capabilities and system investments.

We have a growing list of SR Certified Products that are compatible with our Philips Xitanium SR drivers. They cover a wide range of connected lighting solutions from trusted providers of controller and connectivity modules as well as building management systems.

In order to support the development of SR Certified Components, Signify has launched the SR Partner Program. SR partners will receive all required details of the Xitanium SR driver interface for electrical and DALI data exchange protocols. Signify also provides test and verification services. Successfully tested products can be recognized via the SR Certified logo:

Currently, our Xitanium SR Spot & Downlight drivers are compliant per SR specification v.2.1 and will continue to evolve. In addition, these drivers are compliant with the new DALI standard for intelligent IoT-ready luminaires, called D4i. and can be recognized by the D4i logo on their type plates. Philips driver compliance per D4i can be looked up in the driver datasheet at www.philips.com/oem or at www.digitalilluminationinterface.org/products.

Xitanium SR driver versions

The Xitanium SR drivers described in this guide will in time become available in multiple power and current ratings which enable the most popular light output levels for indoor applications. It is always highly recommended to check our latest Xitanium SR driver portfolio for the most up-to-date overview of our range. This leaflet can be downloaded at www.philips.com/oem.

Detailed technical specifications can be found in the Xitanium driver datasheets at www.philips.com/oem. You can also view product specifications and access the datasheets via the Easy Design-in tool at www.easydesignintool.com.

Sensor Ready Interface (DA+/DA-)

Xitanium SR drivers reduce complexity and cost of luminaires used in (wireless) connected lighting systems. They feature a digital SR interface to enable direct connection to any suitable controller or sensor. Functionality integrated into the SR driver eliminates auxiliary components such as power supplies and relay boxes used in many typical lighting controllers today. The result is a simpler, less expensive luminaire which enables turning every luminaire into a wireless node and a more reliable DC powered controller. The simple two-wire SR interface is compliant with Parts 207, 209 and D4i (Part 250/251/252/ 253).

Part 150 (auxiliary +24V power supply) is not applicable for Xitanium SR Spot & Downlight drivers since these drivers are not equipped with this supply.

Configurability Interface (tooling)

The Xitanium SR drivers are configurable. A tailored package of features and parameters in these drivers can be set via a specific tool. This tool is called MultiOne Configurator.

DALI Part 102

Select Xitanium Spot & Downlight drivers support Part 102 by enabling the configuration of 16 scene settings and associated fade time and power-on level via our wireless SimpleSet tool. This feature also supports quick and easy replacement of a (failed) driver by reading out these DALI variables from the replaced driver and transferring these to a replacement driver without the need for re-commissioning of the replacement driver. Please refer to the datasheet to look up whether Part 102 functionality is supported.

Features

SimpleSet

Philips SimpleSet new wireless programming technology -based on NFC technology- allows luminaire manufacturers to quickly and easily program Xitanium drivers at any stage during the manufacturing process, without a connection to mains power, offering great flexibility. As a result orders can be met faster, while reducing costs and inventory.

For more information, please visit www.philips.com/multione.

Adjustable Output Current (AOC)

Flexibility in luminaire design is ensured by the adjustable output current (AOC). The adjustable output current enables operation of various LED configurations from different LED manufacturers whilst also ensuring the solution remains "future proof" for new LED generations. The output current can be set with an external resistor (LEDset/Rset) while Touch and Dim (TD) and SimpleSet drivers also support the programming of the output current instead, by means of Philips MultiOne programming hardware and software. Drivers with SimpleSet functionality can be configured with the Philips MultiOne Software and the wireless SimpleSet interface. More information about AOC and how to set the output current can be found in the section Electrical design-in. Information about configuring drivers with SimpleSet can be found in the section Configurability.

Amplitude Modulation (AM) output dimming

Philips Xitanium Indoor Spot & Downlight drivers dim the output to the LEDs by means of Amplitude Modulation (AM) dimming. This means that at no stage of the dimming, Pulse Width Modulation (PWM) at the output to the LEDs is involved. AM dimming guarantees the smoothest and interference/flicker-free operation over the entire dimming range.

Temporal Light Artefacts (flicker & stroboscopic effects)

A small inherent ripple is superimposed on the DC output current. This ripple consists of a low-frequency LF component (double the mains grid frequency) and a high-frequency HF component. This ripple current has such a low amplitude that Temporal Light Artifacts (TLA) with camera systems other than possibly those for high-speed slow-motion HD recording are not to be expected.

The ripple value of both LF and HF components are specified in the driver datasheet. The values for TLA parameters short- term flicker (P_{st}^{LM}) and Stroboscopic Visibility Measure (SVM) are below 0.5 and 1 for all Xitanium Indoor Spot & Downlight drivers.

Use of Barcode Scanners

Please note that certain ambient light conditions may interfere with 1D barcode scanners.

Wireless control

Select drivers can be controlled wirelessly via MasterConnect or Casambi. These features offer great flexibility without the need for additional control wiring.

Thermal derating

Thermal derating of an in-house designed LED module is possible by integrating a NTC (Negative Thermal Coefficient) resistor on the LED module. More details about the NTC resistor can be found in the Section Thermal design-in. Please refer to the datasheet to find out whether a selected driver offers this feature.

Controllability

The Xitanium Indoor Spot & Downlight drivers are available in the following versions:

- Fixed output current (no suffix)
- Trailing Edge dimming. Suffix: TE
- Touch and Dim + DALI. Suffix: TD

The method of control is shown in the naming suffix of the driver. If no dimming protocol is given in the name, the Xitanium driver can only be used as a fixed-output driver.

Hot wiring

All Xitanium Indoor Spot & Downlight drivers within the statement and performance segments can be serviced, connected or disconnected from the LED load when the mains voltage is connected. Please refer to the driver datasheet whether hot wiring is supported. Please ensure that all electrical safety regulations are followed when working on a Xitanium driver while powered up. See also. p.30.

DC mains operation (DCemDim)

Xitanium Indoor Spot & Downlight drivers support operation on a DC power grid (e.g. central emergency system). On select drivers, the driver behavior once switched to DC input voltage can be programmed via MultiOne software by means of the DC Emergency feature (DCemDim). By default, the output current of those drivers is reduced to 15% of its programmed output current at DC (emergency) operation. More details about DC input voltage can be found in the driver datasheet.

All Xitanium Indoor Spot & Downlight drivers supporting DC operation have a built-in fuse rated for AC and DC operation. Use of the external DC-rated fuse is not required.

Constant Light Output (CLO, programmable drivers only)

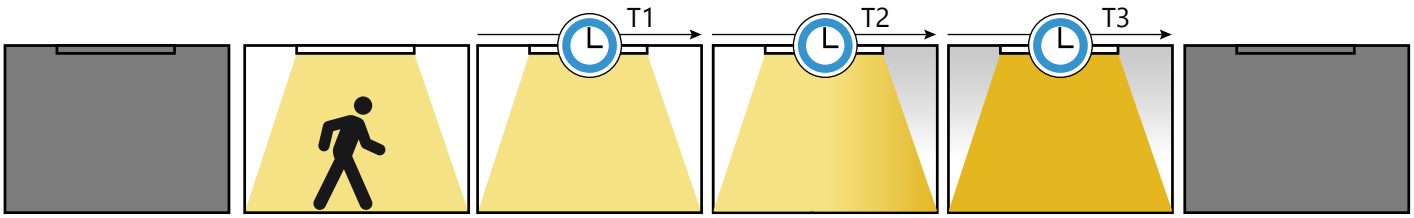
Traditional light sources suffer from depreciation in light output over time. This applies to LED light sources as well. The CLO feature enables LED solutions to deliver a constant lumen output throughout the life of the light engine. Based on the type of LEDs used, heat sinking and driver output current, it is possible to estimate the depreciation of light output for specific LEDs and this information can be entered into the driver. The driver counts the number of light source working hours and will increase the output current based on this input to enable CLO.

Since the CLO curve is not generic, the OEM needs to determine the appropriate CLO curve. This can be used to differentiate on e.g. lumen output or power consumption over lifetime.

The CLO feature can be programmed with the Philips MultiOne configurator tool. More information can be found at www.philips.com/multione.

Corridor Mode (TD and SR drivers only)

The Corridor Mode is typically used in corridors, stairwells, entrance halls, storage rooms, etc. It is a simple function that controls the light level when presence is detected by a simple mains on/off sensor. It is easy to use and can be activated using default parameters, so no programming via software is required. When the sensor detects presence, the light switches on. When it no longer detects any presence, instead of switching off the light immediately, the driver takes over control of the light level and dims it down to a background level. The settings can be customized using the Philips MultiOne configurator software. Please refer to the driver datasheet to check whether this feature is available.



Light is switched off | Presence detected, light on at normal level | No presence, light stays on at normal level | Light fades to background level | Light is switched off

Driver diagnostics (TD and SR drivers only)

On select TD drivers the Diagnostics functionality is available. The purpose of Diagnostics is to gather information and help diagnose the history of the driver and connected LED module. The diagnostics consist mainly of counters which keep track of specific variables like the number of startups of the driver, temperature of driver and LED modules, current and voltages etc.

When the driver is shutdown the diagnostics data is stored automatically in non-volatile memory.

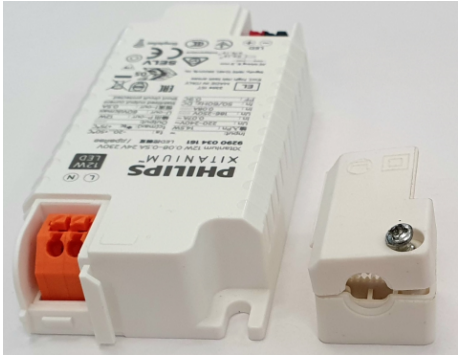
WH size

Strain relief blocks for the WH driver for independent application. Screws must be fastened with 0.8 ... 1.2Nm torque. The cable clamp supports cable diameters between 6 ... 10mm.

/m size

Strain relief blocks for the /m driver for independent application

/a size



/mf

Strain relief blocks for the /mf driver for independent application

Dimensions

Wide Housing design (WH)

The WH driver has a 3-in-1 housing design which makes it suited for built in applications and independent use with strain relief and the loop through option.

Mini housing design (/m)

The /m driver has a size and mounting footprint which is exactly the same as the Philips HID PrimaVision Mini electronic ballast, thus enabling easy transformation of a luminaire from HID to LED. This driver can be adapted for use in independent applications by the use of a strain relief cap that can be ordered separately, as an accessory. This will ensure that the driver is thermally protected and safe to use in ceilings.

Track adapter design (/a)

The /a driver has a form factor tailored for use in standard tracks, allowing for flexible and easy "plug & play" mounting.

Note: The strain relief accessory cannot be used with the 50W/m driver with Rset functionality (Xitanium 50W/m 0.7-1.5A 48V 230V, 12NC: 9290 009 34606). When using the strain relief caps along with the Mini DALI driver (in independent applications), please ensure that the diameter of the DALI cable and the mains cable is the same to achieve proper relief.

Note: The Mini driver (all /m versions) with strain relief caps in independent application needs to be placed on the ceiling plate such that the bottom of the assembly is completely covered by the supporting surface after installation.

Mini Flat housing design (/mf)

The /mf driver can be adapted for use in independent applications by the use of a strain relief cap (12NC: 929001431106) that can be ordered separately, as an accessory. This will ensure that the driver is thermally protected and safe to use in ceilings.

Driver naming

Drivers come in different sizes and with different options. The dimensions of the same housing type can also differ between different power packages. The actual dimensions and features can be found in the driver datasheet.

Naming suffixes of the drivers

I	: independent housing design
TE	: Trailing Edge phase-cut dimming
TD	: Touch and Dim + DALI dimming
CD	: Wireless control via Casambi
MC	: Wireless control via MasterConnect
/s	: small housing
WH	: Wide Housing
SR	: Sensor Ready interface
/m	: mini housing

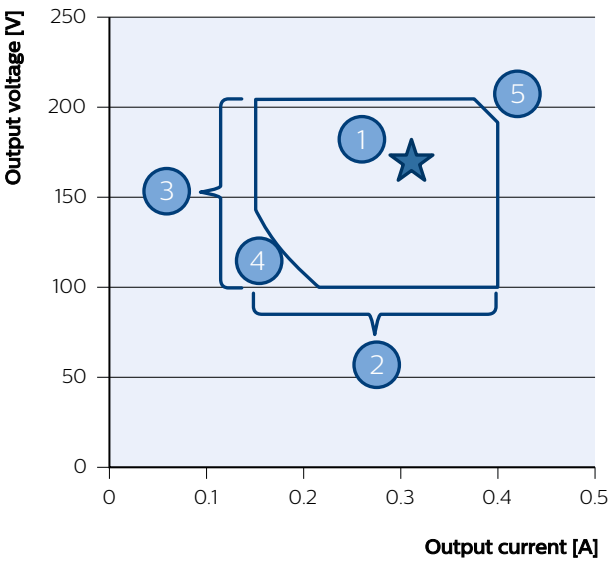
Example: Xitanium 20W WH 0.15-0.5A 54V SR Is 230V

Xitanium	: Brand name for highly efficient and extremely reliable LED drivers
20W	: Maximum output power
WH	: Wide Housing
0.15-0.5A	: Output current range
54V	: Maximum output voltage
SR	: Sensor Ready interface
I	: Independent housing design
s	: Small version
230V	: Rated mains AC input voltage

Use in hazardous environments

Note: Xitanium indoor Spot & Downlight drivers are **not** certified per standard IEC/EN 60079 and latest EU directive ATEX for use in hazardous environments in which there is risk of explosion. Therefore, these drivers do not directly support application in luminaires and lighting systems in such environments.

Electrical design-in



Example of a Driver Operating Window

Note: by means of dimming it is possible to go below the minimum value of the specified output current.

1. Required set point for the LED solution
2. Current can be set to needs within range
3. Driver adapts to required LED module voltage V_f, given it fits range
4. Driver minimum power limit
5. Driver maximum power limit
   Note: by means of dimming it is possible to go below the minimum value of the specified output current.

Xitanium driver operating window

LED technology is rapidly evolving. Using more efficient LEDs in a next generation means the same light output can be achieved with lower currents. At the same time, LEDs can be driven at different currents levels based on the application requirement. Typically, LED drivers are available in discrete current levels e. g. 350, 530 and 700mA. It is often necessary to replace a driver when more efficient LEDs or different LED boards become available.

One of the key features of the Xitanium LED drivers is the adjustable output current (AOC), offering flexibility, differentiation for the OEM and future-proof luminaire design. The Xitanium drivers can operate in a so called “operating window”. This power window is defined by the maximum and minimum ouput voltage (V), output current (A) and output power (W) that the driver can handle. An example of an operating window is shown on the left. The area indicates the possible current/voltage combinations. The current you select will depend on the type and manufacturer of the LEDs, the specific LED module configuration and the desired light output per LED. The voltage is the sum of the LEDs used (total V_f string). Both the operating window and default output current setting of every driver can be found in the driver datasheet.

The output current of these drivers can be set in three ways.

1. By connecting a specific resistor value to the driver LEDset/ Rset interface.
2. Drivers with SimpleSet can be configured using the Philips MultiOne software and SimpleSet interface.
3. TD driver versions can be programmed via the MultiOne interface in order to set the desired current. Please refer to www.philips.com/multione for more details.

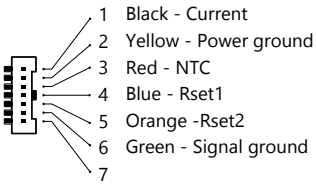
Note: the forward voltage Vf of the connected LED module **must** remain within the specified driver operating window voltage boundaries under all application conditions! Otherwise, reliable operation cannot be guaranteed.

How to Select an appropriate driver

For a complete overview of suitable driver(s) for your application, please use the Easy Design in Tool (EDIT) at www.easydesignintool.philips.com as starting point.

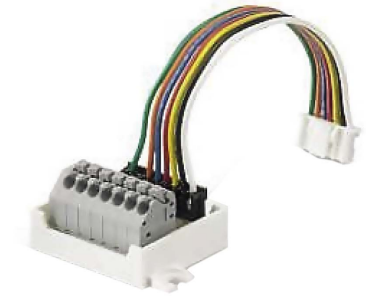
As an alternative, the following steps below will help in selecting suitable driver(s).

1. Determine your required output current I_{output} and voltage (V_f)
2. Calculate required output power P_{output} where $P_{output} = V_f \times I_{output}$ (W)
3. Select the datasheets from the website mentioned above based on the driver having a higher power than required.
4. Does required current fit current range of driver? $I_{output\_minimum} \leq I_{output} \leq I_{output\_maximum}$?
5. Does required voltage V_f fit driver voltage range ? $V_{driver\_minimum} \leq V_f \leq V_{driver\_maximum}$?
6. Does required power fit power range of driver? $P_{driver\_minimum} \leq P_{output} \leq P_{driver\_maximum}$?
7. Choose preferred type of control (TD/DALI, SR, TE, MC, CD or non-dimmable)

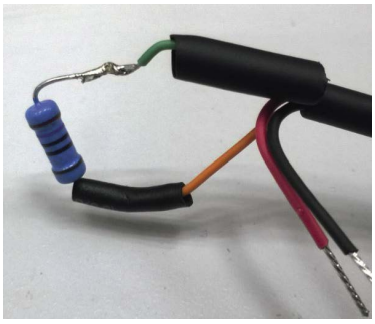


JST connector (driver side) pin layout

JST connector with soldered Rset resistor



Example of the JST to Push-in adapter



Example of resistor being integrated in the cable

Push-in connectors

Driver connections

Different connector types are used on Philips Xitanium Indoor Spot & Downlight drivers. More info about the type of connector and wiring (cross section area range, strip length, etc.) can be found in the datasheet.

JST Connectors

A few select Xitanium LED drivers feature a JST connector which combines the power connection to the LEDs with the Rset and NTC features. The pin layout for this connector is shown on the left. In case a JST connector is to be used to set the current via an Rset, there are 3 options:

1. Use a JST connector with a resistor soldered on to pins 6 and 7 for Rset2 and pins 5 and 7 for Rset1.
2. Use a JST-push-in adaptor
3. Integrate the resistor into the cable running from the driver to the module (valid for modules that have cables connecting the JST connector of the driver to the module). In this case, the resistor must be integrated into the wire connecting the appropriate pin for Rset 1 or Rset2.

Push-in Connectors

Most Xitanium LED drivers now feature push-in connectors on the input and output side of the driver for ease and flexibility.

Note: All new drivers and modules are moving away from JST connectors towards push-in types. Please refer to the driver (and module) datasheet for connectivity details. In case a choice is made to use a driver with a JST connector and a module with push-in connectors, there are special adapter cables available. More information can be found in the datasheets of our LED modules.

Mains Connectors

Orange push-in connectors are used to connect the drivers to the mains. The connector for Protective Earth (PE) is colored green (if present) while the connector for equipotential bonding purposes (EQUI) is pink (if present). Drivers of the SH or WH type have 2 connectors for each mains connection to enable loop-through functionality for independent applications.

DALI – Touch and Dim Connectors

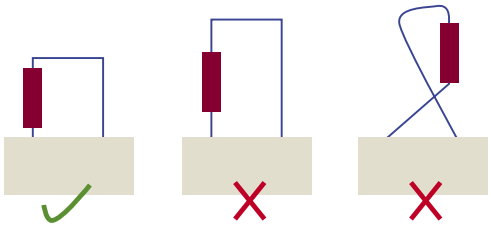
Blue push-in connectors are used to connect DALI/Touch and Dim wires to the driver.

How to... Use wires and cables

In the driver datasheet the following is specified:

- Supported wire cross section area range in mm^2
- Recommended strip length of the wires in mm
- Maximum output cable length in m (for CISPR15 EMC compliance)

Note: although the driver connectors may allow for quite small wire cross section areas (down to $0.2mm^2$) it is recommended for optimal connectivity to use mains and LED output wires having at least $0.5mm^2$ cross section area or whatever else is prescribed as a minimum in the driver datasheet. For currents between 1.0 and 2A (rms/DC) per connector, a minimum cross section of $0.75mm^2$ is advised.



Two wires into one connector hole

In some scenarios two wires need to be connected to one connector pole. In this case the pairing has to be done outside the driver, resulting in only one wire going into the driver. Insertion of two wires into one connector pole is not supported.

Ferrules

The compatibity of twin-wire ferrules (or wire end stops), accepting the wires intended for use, should be checked with the supplier of these ferrules.

Connection details push-in connectors

Mains, 12VDC fan output and the LEDset/Rset connections are provided by push-in connectors for select drivers. Please keep in mind the following while making the connection:

- Make sure to push in the connector springs before inserting the wires to ensure a good connection.
- While connecting the Rset/LEDset resistor, please refer to the picture shown on the left. The resistor must be inserted such that there is no possibility of a short-circuit betwen its leads. It is recommended to fully insulate the resistor body and its leads except for the ends by means of an insulation sleeve.

Adjustable Output Current (AOC) – set driver output current Output current can be set by placing an external resistor Rset/LEDset into the driver Rset/LEDset interface. Next to that, TD, SR, MC and CD driver versions allow also setting of the output current via software configuration without the need for a resistor.

Warning: The LEDset/Rset interface does not support use as a general control or dimming interface. Please use the 1-10V, DALI/TD or SR interface instead for that purpose.

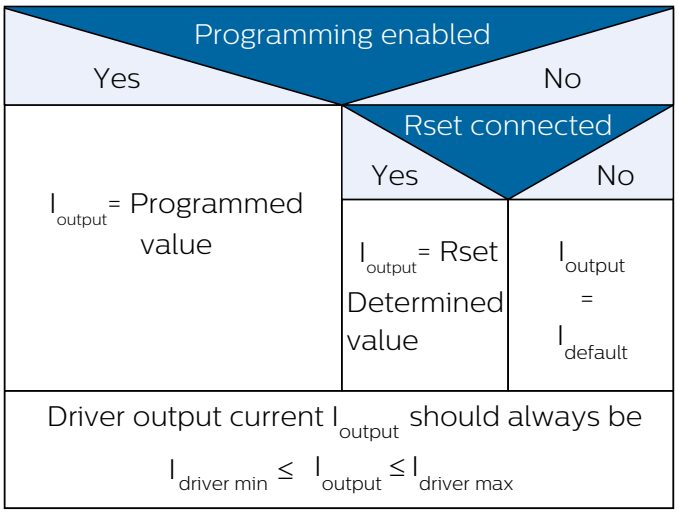
Default driver output current

The default output current is specified in the driver datasheet.

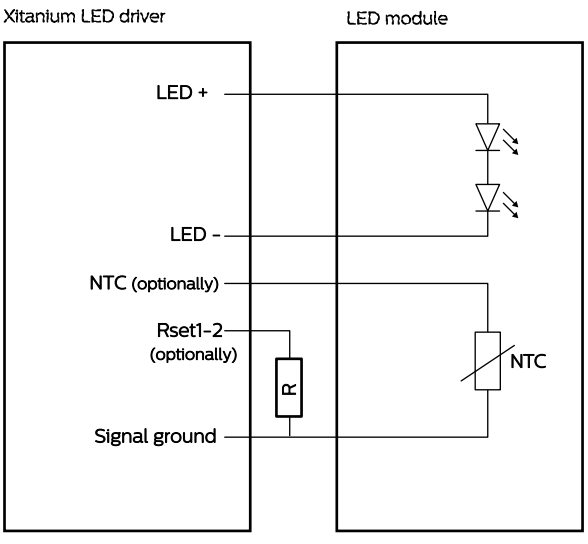
Drivers based on Rset1/Rset2 technology for setting the output current will go to the default output current if the Rset interface is open (no resistor connected), while shorting the Rset results in the output current going to the minimum value.

On the other hand, drivers based on LEDset technology have an undefined output current if the LEDset interface is either open-circuit (no resistor connected) or shorted. Both open-circuit and shorted situations must therefore be avoided in the application. It is imperative to connect a resistor to the LEDset interface prior to powering up the driver.

In case the LEDset interface is shorted, the output of the driver will go to its maximum specified output power ($P_{out,max}$). However, the forward voltage V_f of the connected LED module defines if at $P_{out,max}$ the maximum output current ($I_{out,max}$) is also reached (refer to the power window graph point 5, in the section Electrical design-in section). The output current accuracy in this situation is lower compared to the one in which a resistor is used to select and set the output current.



Priority selection citeria for Group 1 - 1% minimum dim level



Schematically representation of the driver output interfaces

Determine AOC priority with TD drivers

Since the TD drivers offer two methods to set the output current (AOC), it is good to take note of the priority of each method with respect to the other. There are two groups of TD drivers; those which can dim down to 1% (newer driver types) and those which can dim down to 10% (older types).

Group 1: 1% minimum dim level (newer drivers)

AOC programming has priority over Rset. For the priority selection criteria see table on the left.

Group 2: >1% minimum dim level

The value that sets the lowest current has priority over the other.

1. $I_{programming} < I_{Rset}$? => priority for $I_{programming}$
2. $I_{Rset} < I_{programming}$? => priority for I_{Rset}

E.g. programming 200 mA has priority over an Rset value which would generate 250 mA.
And an Rset value that generates 200 mA has priority over programming 250 mA.

Note: default current is stated in the driver's datasheet in the download section on www.philips.com/technology.

Why a resistor?

1. Worldwide standardized component
2. Worldwide availability and well-documented
3. Freedom to choose the supplier and value

Resistor placed into driver enables you to:

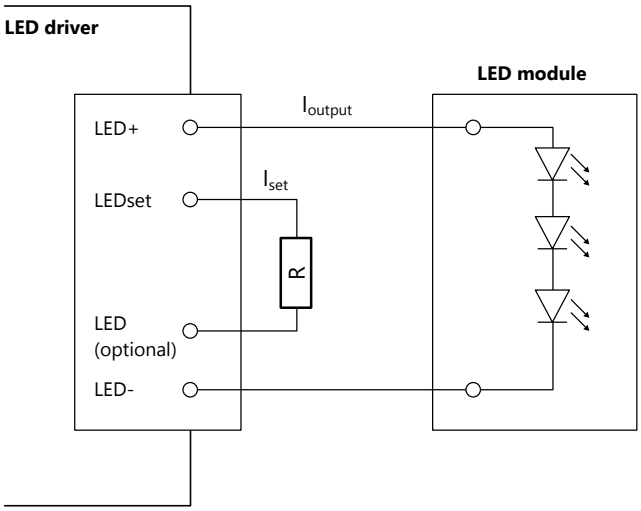
1. Connect different configurations, not just a unique solution
2. Drive different type of LED boards, not restricted to one type
3. Select and tune the current, hence flux or driver/LED module t_c

Setting the output current via Rset1/Rset2

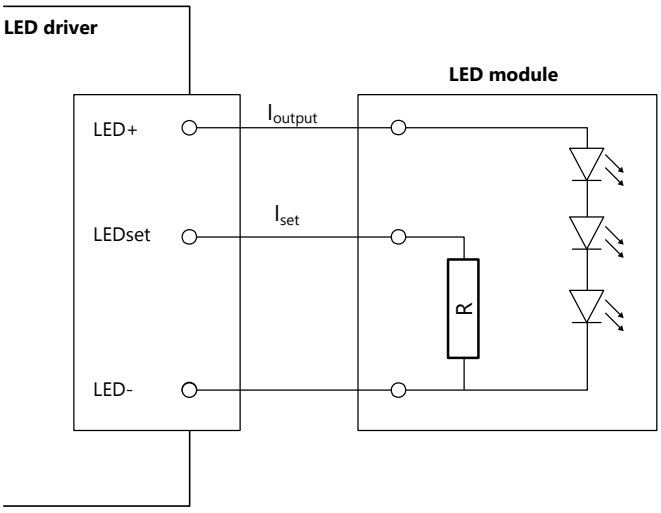
By use of a resistor with a certain resistance value the required output current for the used LED module can be set. A schematic block diagram is shown on the left. Three different Rset resistors can be used:

- Rset1 is used for drivers that have a maximum output current of 700mA.
- Rset2 is used for a wider selection of currents, 0.1A to 2A. Please refer to the following table for information.
- LEDSet is now an international standard and will be used in all Indoor drivers in the future. It can cover a wide range of currents from 0.05A to 8A.

The Rset/LEDset resistor must have a power rating of at last 0.125W and a voltage rating of at least 50V.



Rset resistor mounted directly onto the driver



Rset resistor mounted onto the LED module

Rset1 and Rset2 use different pins in the JST connector of the driver. The Rset1 and Rset2 values with the corresponding drive currents are shown in following tables. It is advised to select the nearest lower resistor value that is available, if the exact determined value is not at hand. The Rset2 table shows the Rset values for currents up to 2A. The exact operating window can be found in the datasheet of the driver.

With the shift from JST connectors towards poke-in connectors, drivers with LEDSet will have poke-in connectors.

Rset1 and Rset2 use different pins on the driver (and on the JST connector).

The Rset1 and Rset2 values with the corresponding drive currents are shown in tables at p. 20/21. It is advised to select the nearest lower resistance for the required output current.

How to... set the output current via LEDset

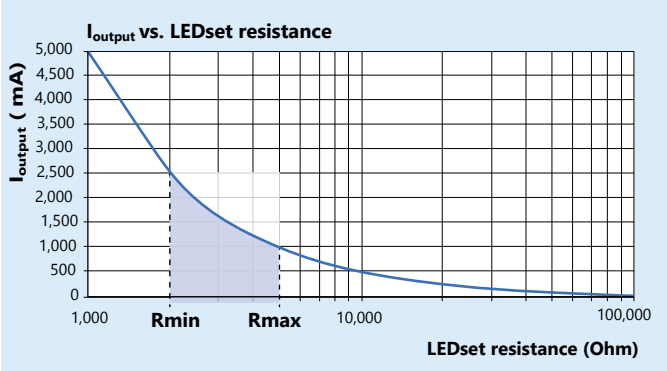
Rset1 and Rset2 have been the traditional ways to set the current in the Xitanium window drivers. Next generation drivers will now be introduced with LEDset. LEDset is introduced by several vendors in the market to provide an industry standardized Rset interface. LEDset is, in essence, like Rset1 and Rset2, where one resistor value leads to one output current value only, differing only in the look-up table. Please find the table for E96 resistor values in the next section.

What does LEDset offer

Like Rset1 and Rset2, LEDset is an analogue interface, allowing basic output current setting. The interface supports the following functions:

- Output current setting of the constant current LED driver to LED modules
- Thermal protection of the LED module(s) via an NTC resistor

Please refer to the driver datasheet for more Rset/LEDset connectivity details.



How does LEDset work

LEDset is based on a 2-wire connection between LED driver and one or more LED modules as shown on the previous page. A standard resistor R can be put directly into the driver LEDset interface or on the LED module.

The LEDset interface measures the current i_{set} which flows from a 5V constant voltage source within the LED driver through the LEDset setting resistor R.

The current i_{set} flowing through LEDset setting resistor R is determined by the equation:

$$i_{set}\ [A] = 5\ [V] / R\ [\Omega]$$

A driver with LEDset interface is able to measure i_{set} and to set the driver output current I_{output} dependent on the measured value of i_{set} according to this equation:

$$I_{output} = i_{set} \times 1000\ [A]$$

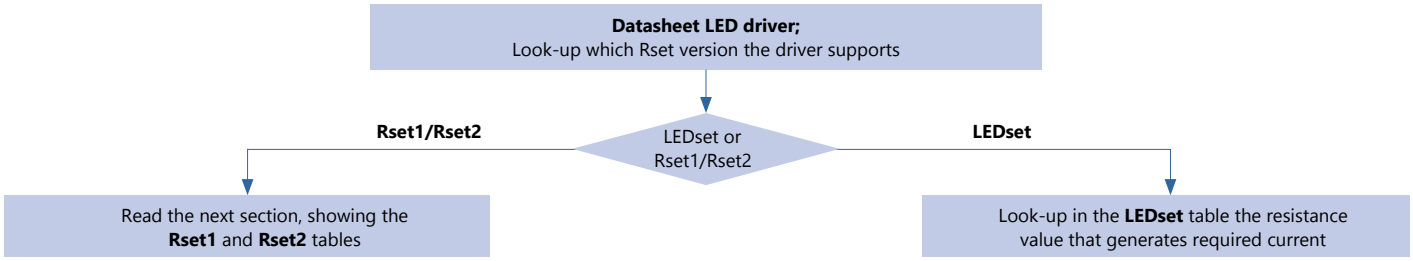
Therefore the overall relationship between the setting resistor R and I_{output} is then given by:

$$I_{output}\ [A] = (5\ [V] / R\ [\Omega]) \times 1000$$

To calculate the required LEDset resistor value R for a desired output current I_{output} :

$$R\ [\Omega] = (5\ [V] / I_{output}\ [A]) \times 1000$$

The LEDset interface is intended to cover an output current range from 0.05A to 8A. The corresponding value for the LEDset resistor R is therefore within the range from 100kOhm to 625Ohm. The actual supported minimum and maximum output current values are dependent on driver type and can be found in the driver datasheet.

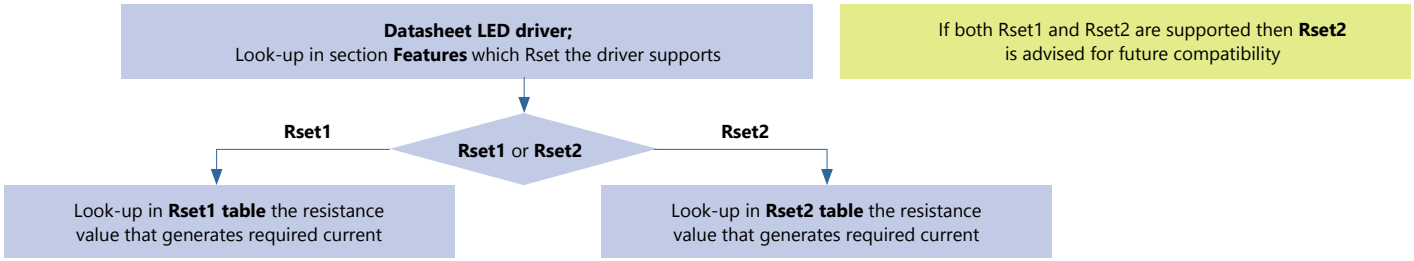


Note on E-series: in electronics, international standard IEC 60063 defines preferred number series for amongst others resistors. It subdivides the interval between subsequent values from 1 to 10 into 6, 12, 24, 48, 96 etc. steps. These subdivisions ensure that when some arbitrary value is replaced with the nearest preferred number, the maximum relative error will be on the order of 20%, 10%, 5%, 1% etc.

LEDset resistor table (E96 series)

R [Ω]	Iout [mA]	R [Ω]	Iout [mA]	R [Ω]	Iout [mA]	R [Ω]	Iout [mA]
open	avoid*	23700	211	11000	455	5110	978
100000	50	23200	216	10700	467	4990	1002
83333	60	22600	221	10500	476	4870	1027
71428	70	22100	226	10200	490	4750	1053
62500	80	21500	233	10000	500	4640	1078
55555	90	21000	238	9760	512	4530	1104
49900	100	20500	244	9530	525	4420	1131
47500	105	20000	250	9310	537	4320	1157
45300	110	19600	255	9090	550	4220	1185
41200	121	19100	262	8870	564	4120	1214
40200	124	18700	267	8660	577	4020	1244
39200	128	18200	275	8450	592	3920	1276
38300	131	17800	281	8250	606	3830	1305
37400	134	17400	287	8060	620	3740	1337
36500	137	16900	296	7870	635	3650	1370
35700	140	16500	303	7680	651	3570	1401
34800	144	16200	309	7500	667	3480	1437
34000	147	15800	316	7320	683	3400	1471
33200	151	15400	325	7150	699	3320	1506
32400	154	15000	333	6980	716	3240	1543
31600	158	14700	340	6810	734	3160	1582
30900	162	14300	350	6650	752	3090	1618
30100	166	14000	357	6490	770	3010	1661
29400	170	13700	365	6340	789	2940	1701
28700	174	13300	376	6190	808	2870	1742
28000	179	13000	385	6040	828	2800	1786
27400	182	12700	394	5900	847	2740	1825
26700	187	12400	403	5760	868	2670	1873
26100	192	12100	413	5620	890	2610	1916
25500	196	11800	424	5490	911	2550	1961
24900	201	11500	435	5360	933	2490	2008
24300	206	11300	442	5230	956	short	avoid*

*: Avoid leaving the LEDset interface as open-circuit or shorted. Always connect a LEDset resistor in the range of 2490 ... 100,000 Ohm.
Leaving the LEDset interface open-circuit is only supported in case the driver supports disabling the AOC External Rset feature by MultiOne software.



Note on E-series: in electronics, international standard IEC 60063 defines preferred number series for amongst others resistors. It subdivides the interval between subsequent values from 1 to 10 into 6, 12, 24, 48, 96 etc. steps. These subdivisions ensure that when some arbitrary value is replaced with the nearest preferred number, the maximum relative error will be on the order of 20%, 10%, 5%, 1% etc.

Note: next page shows extended Rset2 table: E96 values, stating smaller increments

Rset1 - Resistor table (E24 series)

R [Ω]	Iout [mA]	R [Ω]	Iout [mA]	R [Ω]	Iout [mA]	R [Ω]	Iout [mA]
39	200	510	292	6k8	583	91k	690
43	201	560	300	7k5	591	100k	691
47	202	620	309	8k2	599	110k	692
51	203	680	318	9k1	60	120k	693
56	204	750	327	10k	614	130k	693
62	206	820	336	11k	621	150k	695
68	208	910	347	12k	627	160k	695
75	209	1k	358	13k	632	180k	696
82	210	1k1	369	15k	640	200k	696
91	212	1k2	379	16k	643	220k	697
100	215	1k3	388	18k	649	240k	697
110	217	1k5	406	20k	654	270k	698
120	219	1k6	414	22k	658	300k	698
130	221	1k8	429	24k	661	330k	698
150	226	2k	442	27k	665	360k	699
160	228	2k2	455	30k	669	390k	699
180	232	2k4	466	33k	671	430k	699
200	236	2k7	481	36k	674	470k	699
220	240	3k	494	39k	676	510k	699
240	244	3k3	505	43k	678	560k	700
270	250	3k6	517	47k	680	620k	700
300	256	3k9	525	51k	682	680k	700
330	261	4k3	536	56k	683	750k	700
360	267	4k7	546	62k	685	820k	700
390	272	5k1	555	68k	686	910k	700
430	279	5k6	564	75k	688	1M	700
470	286	6k2	574	82k	689	Open	default

Rset2 - Resistor table (E24 series)

R [Ω]	Iout [mA]	R [Ω]	Iout [mA]	R [Ω]	Iout [mA]	R [Ω]	Iout [mA]
shorted	min.	430	245	2k	733	9k1	1558
100	100	470	261	2k2	780	10k	1604
110	106	510	277	2k4	823	11k	1653
120	111	560	297	2k7	884	12k	1694
130	116	620	318	3k	941	13k	1730
150	121	680	340	3k3	993	15k	1793
160	130	750	368	3k6	1042	16k	1817
180	13	820	392	3k9	1086	18k	1864
200	146	910	422	4k3	1143	20k	1902
220	155	1k	452	4k7	1192	22k	1935
240	166	1k1	485	5k1	1238	24k	1965
270	176	1k2	515	5k6	1293	27k	2000
300	190	1k3	545	6k2	1350	open	default
330	204	1k5	602	6k8	1402		
360	215	1k6	632	7k5	1454		
390	228	1k8	684	8k2	1503		

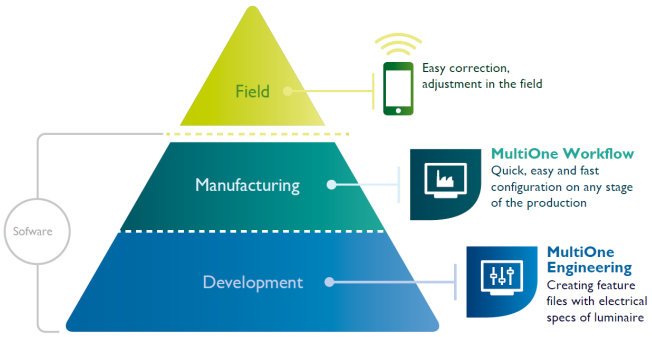
Rset priority for drivers supporting Rset1 and Rset2

Rset1	Rset1	Driver status
Open	Open	Driver default output current (see datasheet)
Rset	Open	Rset1
Open	Rset	Rset2
Rset	Rset	Rset2
Shorted	Open	Rset1 (driver minimum current, see datasheet)
Shorted	Shorted	Rset2 (driver minimum current, see datasheet)
Open	Shorted	Rset2 (driver minimum current, see datasheet)

Please refer to the datasheet to look up which Rset type(s) the driver supports.

Rset2 resistor table for finetuning (E96 series)

R [Ω]	Iout [mA]	R [Ω]	Iout [mA]	R [Ω]	Iout [mA]	R [Ω]	Iout [mA]	R [Ω]	Iout [mA]	R [Ω]	Iout [mA]
shorted	min.	255	171	665	335	1740	669	4530	1171	11800	1686
100	100	261	173	681	341	1780	679	4640	1185	12100	1698
102	101	267	175	698	347	1820	689	4750	1198	12400	1708
105	103	274	178	715	354	1870	701	4870	1212	12700	1719
107	104	280	181	732	361	1910	711	4910	1216	13000	1730
110	105	287	184	750	368	1960	724	5110	1239	13300	1739
113	107	294	187	768	374	2000	733	5230	1253	13700	1752
115	108	301	191	787	381	2050	745	5360	1267	14000	1761
118	110	309	194	806	387	2100	757	5490	1281	14300	1771
121	111	316	197	825	394	2160	770	5620	1295	14700	1783
124	113	324	201	845	400	2210	782	5760	1308	15000	1793
127	115	332	204	866	407	2320	806	5900	1322	15400	1802
130	116	340	207	887	414	2360	815	6040	1335	15800	1812
133	118	348	210	909	422	2370	817	6190	1349	16200	1822
137	119	357	214	931	429	2430	829	6340	1362	16500	1829
140	120	365	217	953	436	2490	841	6490	1375	16900	1838
143	122	374	221	976	444	2550	853	6650	1389	17400	1850
147	123	383	225	1000	452	2610	865	6810	1403	17800	1859
150	125	392	229	1020	459	2670	877	6980	1415	18200	1867
154	127	402	233	1050	469	2740	891	7150	1428	18700	1877
158	129	412	237	1070	475	2800	903	7320	1441	19100	1885
162	131	422	241	1100	485	2870	916	7500	1454	19600	1894
165	132	432	246	1130	494	2940	929	7680	1467	20000	1902
169	134	442	250	1150	500	3010	943	7870	1480	20500	1910
174	136	453	254	1180	509	3090	956	8060	1493	21000	1918
178	137	464	259	1210	518	3160	968	8250	1506	21600	1928
182	139	475	263	1240	527	3240	982	8450	1518	22100	1936
187	141	487	268	1270	536	3320	996	8660	1531	23200	1952
191	143	491	270	1300	545	3400	1009	8870	1544	23600	1959
196	145	511	278	1330	554	3480	1022	9090	1557	23700	1960
200	146	523	282	1370	565	3570	1037	9310	1569	24300	1968
205	148	536	287	1400	574	3650	1049	9530	1580	24900	1975
210	151	549	292	1430	582	3740	1062	9760	1592	25500	1982
216	153	562	297	1470	594	3830	1075	10000	1604	26100	1989
221	155	576	302	1500	602	3920	1088	10200	1614	26700	1996
232	161	590	307	1540	614	4020	1103	10500	1629	27000	2000
236	163	604	313	1580	626	4120	1117	10700	1639	open-circuit	default
237	164	619	318	1620	638	4220	1131	11000	1653		
243	167	634	323	1650	645	4320	1145	11300	1666		
249	169	649	329	1690	656	4420	1158	11500	1674		



Programming the output current

Xitanium Indoor Spot & Downlight drivers offer a tailored range of controls, enabling customizable luminaire design and performance. It is possible to control light output levels, preset dimming protocols and set system specifications in the factory and even in the complete installations. This can be done with the Philips MultiOne configurator. The MultiOne configurator is an intuitive tool that unlocks the full potential of all configurable drivers from Signify, ensuring that the driver performance matches the needs of the lighting solution. It offers unprecedented flexibility, before, during and after the product installation. Programming of new Xitanium LED drivers can be done either by SimpleSet and/or by the DALI/TD or SR interface.

Please check refer to the driver datasheet to find out which configuration option(s) are supported.

For more information on MultiOne installation – software and programming: go to www.philips.com/multione.

Mains operating conditions

Xitanium Indoor Spot & Downlight drivers support operation on power sources or grids providing a clean and symmetrical sinusoidal AC voltage wave form. Drivers rated for DC operation support operation on a clean DC voltage as well as on a rectified sinewave input voltage ("joker voltage"). Operation on power sources including but not limited to having e.g. a square-wave voltage form or a "modified sinewave" is not supported.

The drivers are able to withstand high and low mains voltages for a limited period of time. This includes under- and overvoltage due to malfunction such as a loose neutral wire in a 3-phase grid.

Xitanium Indoor Spot & Downlight drivers are designed to be operated at mains under- and overvoltage conditions per IEC requirements for specified performance and operational safety. The applicable voltage ranges can be found in the driver datasheet.

The applicable lower limit for driver performance is lowest rated voltage -8% while -10% applies for driver operational safety.

The applicable upper limit for driver performance is highest rated voltage +6 % while +10 % applies to driver operational safety.

For optimal driver performance it is always recommended to operate drivers within the specified voltage **performance** range.

Allowable voltage difference between mains input and control input

The driver Touch and Dim interface is rated for use in a 3-phase 230/400V grid, therefore supporting the use of Touch and Dim control from one phase while power to the driver is supplied by one of the other two phases.

Low mains voltage

A continuous low AC voltage (<202VAC) may have an adverse effect on the driver lifetime. The output power will be limited accordingly. A low voltage will not cause the driver to fail over a maximum period of 48 hours at minimum operating AC voltage and maximum driver ambient temperature.

Excessive high mains voltage

An excessive high mains voltage will stress the driver and have an adverse effect on the lifetime. Xitanium Indoor Spot & Downlight drivers will survive an input overvoltage of 265 ... 320VAC for a period of max. 48 hours and 320 ... 350VAC for a period of max. 2 hours.

A loose neutral condition in a 3-phase grid has to be avoided as this may reduce the lifetime dramatically. Immediate driver failure may result when the driver is connected to 400VAC as a result of a connection error or loose neutral in a 3-phase 230/400VAC grid.

DC emergency operation

Select Xitanium Indoor Spot & Downlight drivers are able to operate on DC voltage on the mains input, e.g. when connected to a central DC emergency grid. These drivers support operation both a flat DC input voltage as well as operation on a rectified sinewave "joker" input voltage. Depending on driver type, the driver is released in compliance with lamp control gear standards as stated under “Emergency standards” in section “Quality” at the end of this document. As a result these drivers are suitable for emergency luminaires in compliance with IEC 60598-2-22, *excluding high-risk task areas.*

The mains input of DC-rated drivers is not polarity-sensitive for DC input voltage and the driver is fully CISPR15 EMC-compliant when operated on a DC grid.

On selected drivers the feature DC emergency dimming (DCemDim) is available, allowing a predefined dim level of the driver output current when switched to DC (factory default: 15%). More on setting parameters of DCemDim can be found in the section for Controllability. For specific input requirements please check the driver datasheet.

Drivers which are not equipped with the DCemDim feature will maintain the same output current when switched over from an AC to a DC grid.

Depending on driver type, EL marking may apply. For those drivers the corresponding Emergency Output Factor EOFx range can be found in the driver datasheet.

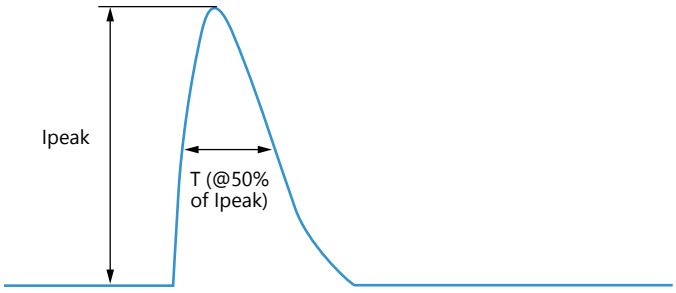
Inrush current

The term inrush current refers to the briefly occurring high input peak current which flows into the driver during the moment of connection to mains; see the illustration on the left. Typically, the amplitude is much greater than the steady-state input current.The cumulative inrush current of a, given, combined number of drivers may cause Mains Circuit Breakers (MCB) to trip or a fuse to melt. In such a case, either one or a combination of the following measures need to be taken to prevent nuisance tripping:

1: Replace existing MCB for a less sensitive type (e.g. exchange B type for C type
2: Distribute the group of drivers over multiple MCB groups or phases
3: Power up drivers sequentially instead of simultaneously
4: Install external inrush-current limiting devices

Inrush parameters are driver-specific and can be found in the driver datasheet.

Note: the amplitude and pulse time of the inrush current are not in any way affected by the driver feature Adjustable Startup Time (AST).



Graphical representation of inrush current

MCB type	Rating (A)	Relative number of LED drivers (%)
B	4	25
B	6	40
B	10	63
B	13	81
B	16	100 (reference)
B	20	125
B	25	156
B	32	200
B	40	250
C	4	42
C	6	63
C	10	104
C	13	135
C	16	170
C	20	208
C	25	260
C	32	340
C	40	415
D	4	80
D	6	130
D	10	210
D	13	280
D	16	350
D	20	470
D	25	550
D	32	700
D	40	940
L, I	16	108
L, I	10	65
G, U, II	16	212
G, U, II	10	127
K, III	16	254
K, III	10	154

The max. recommended amount of drivers in the table above is based on inrush current and only serves as guidance. The actual maximum amount in the application may differ; it is dependent steady-state current, MCB brand/type and inherent MCB tolerances.

Note: Keep in mind that in case a D type MCB is used that the steady-state current may be the limiting factor instead!

Maximum recommended number of drivers per MCB

The maximum recommended amount of drivers on a 16 A type B Miniature Circuit Breaker (MCB) is stated in the driver datasheet. In the conversion table on the left that stated amount is used as reference (100%). The maximum quantity of drivers on different types of MCB can be calculated by the reference (see driver datasheet) x Relative number (last column).

Example:
If the datasheet states a max number on 16A type B= 20 drivers then for a 13A type C the max. amount of drivers be 20 x 135% = 27 drivers.

Notes:

- Specified inrush current data is based on a average mains grid with an impedance of 400 mΩ + 800µH. Deviating mains grid impedance is of minor importance regarding the maximum amount of drivers per MCB.
- Specified maximum number of drivers is based on simultaneous switch-on, e.g. by a central switch or relay.
- For multiple MCBs in one cabinet the de-rating of the MCB manufacturer for steady-state load needs to be followed. If the actual de-rating is unknown then it is recommended to use a steady-state current de-rating of 0.8 by default. No de-rating is needed in respect to inrush current as this is not part of the thermal properties of the cabinet.
- The maximum number of drivers that can be connected to one 30mA Residential Current Device (RCD) is *typically* 30. However, the actual maximum amount depends on RCD brand and type so the actual number may vary and will have to be defined on-site.

Surge immunity

The Xitanium Indoor Spot & Downlight drivers have sufficient built-in surge immunity for general indoor lighting use. The actual immunity level can be found in the driver datasheet. In order to achieve these high immunity levels the driver EQUI terminal (if present) must be connected to the metal parts of the luminaire and LED module heatsink (Insulation Class I: also to earth).

Depending on local application conditions, additional protection against excessive high surge voltages may be required. Increased immunity can be achieved by adding a external Surge Protection Device (SPD)

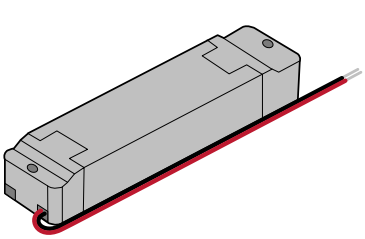
Touch current

Xitanium indoor Spot & Downlight drivers which support built-in use for Insulation Class II luminaires are designed to meet touch current requirements per lighting control gear standard IEC 61347-1 in order to enable an easy design-in in Insulation Class II luminaires per IEC60598-1. The specified peak values can be found in the driver datasheet and refer to single-driver only level. Do not leave the EQUI terminal disconnected to lower the luminaire touch current; impaired EMC and surge performance will result.

Electromagnetic compatibility (EMC)

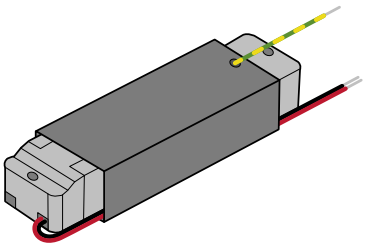
Electromagnetic compatibility (EMC) is the ability of a device or system to operate satisfactorily in its electromagnetic environment without causing unacceptable interference with other systems or being too susceptible for external emissions from other systems. Xitanium LED indoor Spot & Downlight drivers meet EMC requirements per CISPR15 for conducted and radiated emissions. This test is conducted with a reference setup that includes a driver and an LED module + heat sink combination mounted on a metal plate and is verified in Insulation Class I and II configurations.

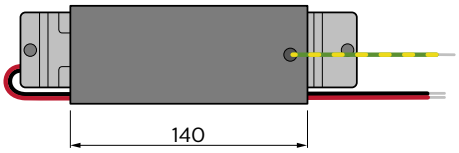
The reference set-up defined for point-source drivers used in a plastic Class II luminaire is visualized below:

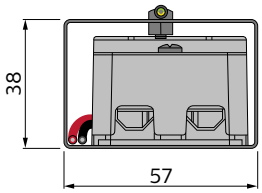


The output wiring routed along the total enclosure, although not recommended, is very common in track-luminaires and simply had to be defined this way as reference.

The reference set-up defined for point-source drivers used in a Class I fixture is visualized below under different viewing angles including dimensions:





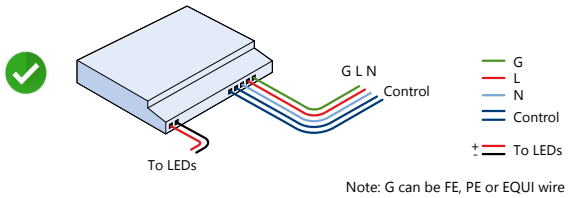


To represent a standard metal (track) luminaire the metal sleeve around the driver has been defined having approximately the same dimensions as the inside of the commonly used track luminaire.

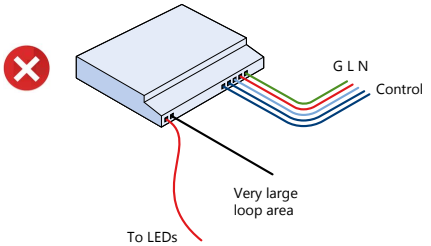
The distance from plastic housing towards the metal sleeve may influence the EMC performance. This metal sleeve must be connected to earth to represent the Class I application. The mains wiring should be kept as short as possible and be routed with maximum distance from the output wiring going to the LEDs.

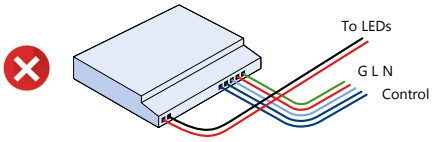
Cable length and EMC

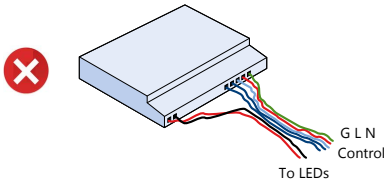
Signify has successfully performed EMC tests for systems with an output cable length of 60cm. For longer cables compatibility may be met for distances up to 2 ... 4m, depending on driver type. It is advised to repeat these tests if the output cable length exceeds 60cm.

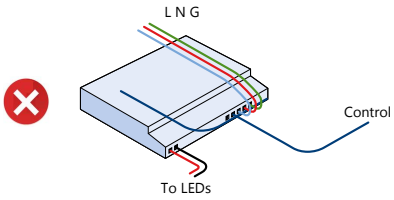


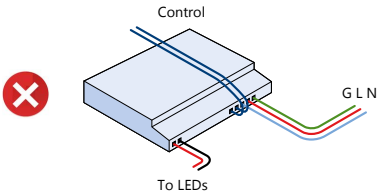
Note: G can be FE, PE or EQUI wire

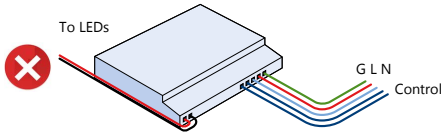


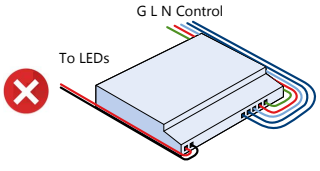












EMC performance precautions

The following practical precautions need to be taken into account in a lighting system for optimal EMC performance:

• Minimize the loop area of the LED output wires going from the driver to the LED module by keeping the output wires close together (bundling).

• Minimize the parasitic capacitive coupling of the LED output wiring towards earth by keeping the wiring length as short as possible.

• Keep the length of the incoming mains wire inside the luminaire as short as possible.

• Keep mains and control wires separated from the LED output wires. Do not bundle or cross the output wires with control/input wires or cables.

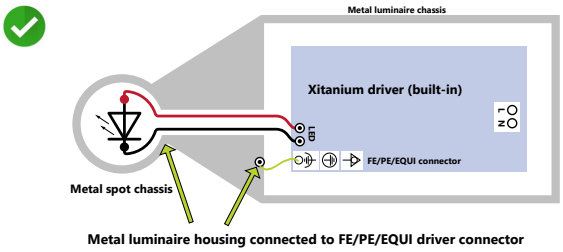
• Do not route any wiring over and/or along the driver enclosure to avoid any noise coupling/crosstalk with internal driver circuitry

• Keep wire G as short as possible to maximize its 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 mounting torque.

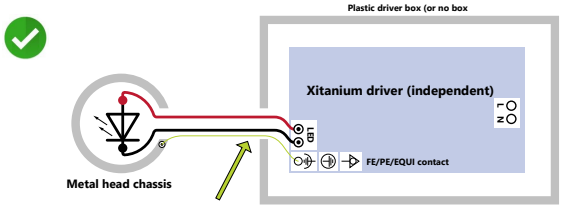
Adhering to these rules will help to achieve EMC compliance. For further questions and/or design-in support please contact your local Signify representative.

Insulation Class I application: ground the luminaire chassis and other large internal metal luminaire parts (driver mounting plate, reflector, canopy, heat sink etc.) to Protective Earth. **Always** connect the driver PE/FE/EQUI connector (if present) to Protective Earth .

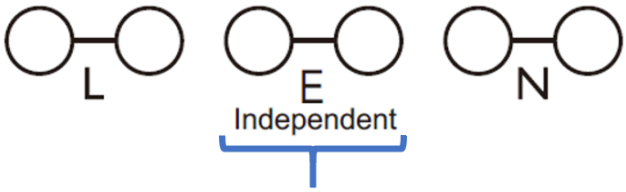
Insulation Class II application: use equipotential bonding wires between all large metal luminaire parts (driver mounting plate, canopy, heat sink etc.) Do not keep large metalparts electrically insulated. **Always** connect the driver FE/EQUI connector (if present) for equipotential bonding.



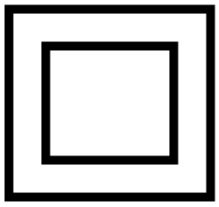
Metal luminaire housing connected to FE/PE/EQUI driver connector



Metal spot luminaire chassis of an independent configuration connected to driver FE/PE/EQUI connector.

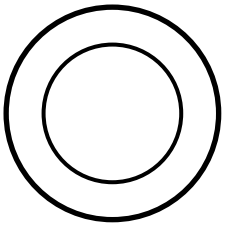


E connector: indication of Protective Earth (PE) conductor for loop-in or loop-through to other (Insulation Class I) equipment. This functionality is restricted to independent use only.



Symbol for double/reinforced insulation between accessible enclosure or any other passive accessible part and live parts: Applicable to independent Insulation Class II drivers/ equipment only.

This symbol is present on connector cap(s) of strain-reliefs for independent use if not removed.



Symbol having the exact same meaning as the double square above, but applicable for built-in drivers only. This symbol is present on the driver label/type plate.

SELV

Indication of 'Safety/Separated-Extra-Low-Voltage output circuit.

Insulated SELV drivers + loop-through

The Xitanium Indoor Spot & Downlight drivers have double or reinforced insulation from the primary to the secondary SELV output and have a plastic enclosure. The presence of the letter 'E' at both PE terminals on the driver housing refers to the independent application and indicates the possibility of either termination of the Protective Earth (PE) conductor (loop-in) or to serve as loop-through to other equipment via a loop-through mains cable. These drivers are inherently classified as Insulation Class II equipment by construction and certified as such. Therefore, Xitanium Spot & Downlight drivers do not rely on a PE connection for safety.

This means that these drivers can be used in both Insulation Class I and Class II applications as well as for independent use under the following conditions:

Built-in use - Insulation Class I luminaire

When this driver is built in, luminaire EMC requirements will be met without connecting the luminaire chassis to PE. However, if challenging luminaire conditions require further EMC improvement then the luminaire chassis may be connected to PE for improved EMC performance.

Built-in use - Insulation Class II luminaire

When this driver is built in, EMC requirements will be met without PE connection. However, if challenging luminaire conditions require further EMC improvement then it is*not* allowed to connect the driver PE connectors to any accessible luminaire part as only basic insulation is present between the PE connectors and mains connectors (live parts)! The only way to reconstruct the double/ reinforced insulation associated with Insulation Class II will then be to insulate all accessible parts (luminaire chassis, connected luminaire parts) to a level of at least basic/supplementary insulation with respect to the test-finger accessing these parts.

For built-in application into a Class II luminaires it is important to keep a clearance area of at least 2.5mm around the input and output connectors (i.e. no conductive parts at a closer distance than 2.5mm distance). This is a guideline in order to meet the double/reinforced requirements of an Insulation Class II luminaire.

Independent use

In case the E connectors are used for loop-through towards other (Insulation Class I) equipment then these connectors must always be connected to Protective Earth (PE). The E connectors are uniquely intended for connection to Protective Earth (PE) and for loop-through purposes.

Warning: if the driver is used for built-in purposes (irrespective of luminaire Insulation Class) then the PE connectors may *not* be used for loop-through as this is restricted to independent use only!

Electrical insulation

All Xitanium Indoor Spot & Downlight LED drivers are classified as SELV. This means that the output voltage does not exceed the SELV voltage limitations (<50 $VAC_{rms,}$ <120 Vdc and that the output circuitry is double-insulated from the mains input.

Sensor Ready Interface

Xitanium Indoor Spot & Downlight SR drivers have a simple two-wire SR interface, supporting these key functions:

- Switchable built-in SR bus power supply (SR PSU) to provide power to the connected control device (Part 250)
- Memory Bank 1 Extension to store luminaire data (Part 251)
- Two-way digital communication between the SR driver(s) and control device, using standard DALI protocol via a polarized SR bus:
    - Standard DALI dimming, ON/OFF
    - Power and energy reporting utilizing the power monitoring integrated in the driver (Part 252)
    - Diagnostic and Maintenance information (Part 253)

- The control device is allowed to be separate from the driver in case of independent driver use. Max. recommend distance between the driver and the control device is 2m.

See www.digitalilluminationinterface.org/d4i for more info.

Warning: although communication via the SR (DA+/DA-) interface is based on DALI protocol, the interface itself is **not** a DALI interface! The SR bus does **not** support inter-luminaire use in a wired DALI network.

Built-in SR bus power supply unit (SR PSU)

- The Xitanium SR driver has the ability to supply the SR bus with a built-in power DC supply that can be enabled and disabled. By factory default this SR PSU is enabled and ready to be used with an external control device. The SR SPU can be disabled/re-enabled with MultiOne configuration tools and software.

- The SR PSU is capable of delivering a minimum current of 52 mA (ISR) to the SR bus and the connected device(s). The SR PSU will never supply more than 60mA (ISR_MAX).

- The SR bus voltage will be between 12V and 20VDC depending on the connected device load and the amount of SR PSUs connected in parallel. See the graph on the next page for the typical VI curve for one SR PSU.

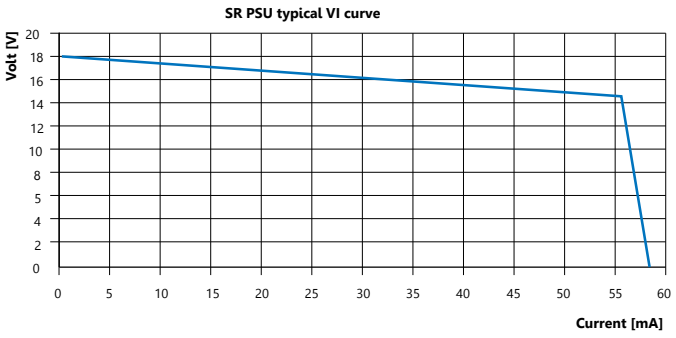
- When the SR PSU is disabled then the SR interface will extract a maximum of 2mA from the SR bus (like standard DALI gear).

Warning:
A maximum of **four** enabled SR PSUs are allowed to be connected in parallel in order not to exceed the maximum allowable SR bus current of 250mA. If more than four SR interfaces are connected in parallel then the SR PSUs of additional drivers must be disabled.

For your convenience it is suggested that disabling is done individually *before* mounting the driver in the luminaire or on th ceiling: disabling the supplies of multiple already mounted and connected drivers via MultiOne software won't be possible afterwards without having to access each driver physically.

Control devices

Most control devices intended to be used in an SR system will be powered from the SR bus. When communication is present on the SR bus, the bus gets pulled down by the data packages. This reduces the average current available for the power consuming control device. When communicating the average available current can drop with 50%. This should be taken into account when designing the control device. The extracted peak current (ISR_EXTRACTED) should be limited by the control device.



Rules for building an SR system

- SR bus polarity must be respected when more than one SR interface is connected in parallel.
- The total maximum SR bus current (ISR_MAX_TOTAL) must not exceed 250mA. This current can be determined by adding up ISR_MAX of all connected and enabled SR PSUs. As a consequence a maximum of **four** enabled SR PSUs are allowed to be connected in parallel. The total current delivered to the SR bus (ISR_DELIVERED) can be determined by adding ISR of all connected enabled SR PSUs.
- The total current extracted from the SR bus (ISR_EXTRACTED) can be determined by adding up consuming devices like SR drivers with disabled SR PSU, other DALI gear and control devices.
- To guarantee good communication, a margin of 8mA is needed to drive the SR bus itself (ISR_MARGIN).
- The following rule should be respected:
  ISR_EXTRACTED + ISR_MARGIN ≤ ISR_DELIVERED.

Caution:

When the above rules are not taken into account, communication cannot be guaranteed and damage to components may occur.

Typical examples

1. One SR driver is connected to a control device. The SR PSU of this driver is enabled. The specification of the control device states that the extracted peak current is 40mA. Will this SR system have good communication?

Answer: one SR PSU is involved, so SR bus polarity is irrelevant.
ISR_MAX_TOTAL = 60mA. This is ≤ 250mA > OK
ISR_DELIVERED = 52mA
ISR_EXTRACTED = 40mA
ISR_MARGIN = 8mA
Result: 40 + 8mA ≤ 52mA
Conclusion: this system will function properly.

2. Is it allowed to add an SR driver with disabled SR PSU to this SR system?

Answer: an SR driver with disabled SR PSU extracts 2mA from the SR bus.
ISR_EXTRACTED = 40 + 2 = 42mA.
42 + 8mA ≤ 52mA > OK
Conclusion: this system will function properly.

3. Can this SR PSU also be enabled?

Answer: yes, but polarity of both SR supplies should be observed.
ISR_TOTAL = 2 * 60 = 120mA. This is ≤ 250mA > OK
Conclusion: this system will function properly.

	Configuration		
Configurable driver parameter	(Factory default)	SimpleSet	SR Interface using MultiOne Tool
Adjustable Output Current (AOC)	•	•	•
SR PSU (ON/OFF)		•	•
Standard DALI Configurable Parameters			•

Configuration options

Digital SR communication

Driver control via SR bus commands is possible through the standard digital interface based on DALI protocol.

- Note that the output current at 100% level is determined by the driver. The minimum current that can be supplied by the driver is specified in the datasheet. The lowest dim level is defined by the higher of the two values: Minimum output current or 10% dim level.
- The driver also supports many logged and realtime diagnostic features/parameters which can be accessed via the SR interface, as per SR Certified specification or D4i standard.

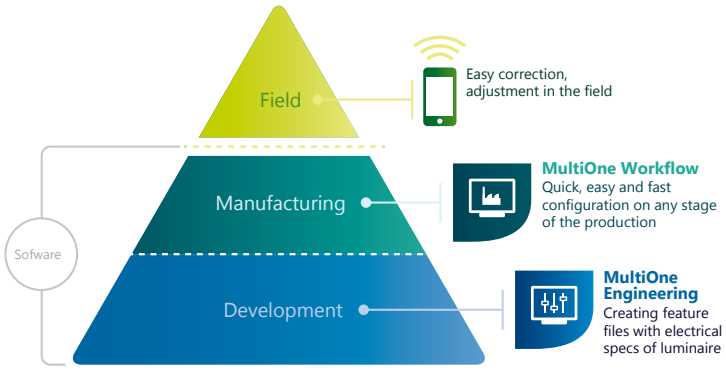
Standby power consumption

Xitanium LED SR Spot & Downlight drivers consume <0.50W per driver when in standby mode. This standby power is excluding power consumed by a sensor connected to the SR bus. The SR PSU - if enabled- remains active when the driver is in standby mode.

Output open-load and short-circuit conditions

Xitanium LED Spot & Downlight Linear drivers can withstand output open-load and short-circuit conditions. These are to be considered abnormal driver conditions for those driver types which do not support "hot wiring". Consequently, it is not recommended to use these drivers as such. Neither is it recommended to switch the output of these drivers by means of e.g. relays ("hot switching") to connect or disconnect LED modules. Please refer to the driver datasheet whether "hot wiring" is supported or not.

Configurability



Introduction

Select Xitanium indoor Spot & Downlight drivers offer a extensive range of controls, enabling customizable luminaire design and performance. It is possible to control light output levels, preset dimming protocols and set system specifications in the factory and even in the complete installations. This can be done with the Philips MultiOne configurator. The MultiOne configurator is an intuitive tool that unlocks the full potential of all Philips programmable drivers, ensuring that the driver performance matches the needs of the lighting solution. It offers unprecedented flexibility, before, during and after the product installation. Depending on driver type, programming of drivers can be done via the DALI interface or via SimpleSet.

For more information on MultiOne installation – software and programming: go to www.philips.com/multione.

Thermal design-in

Introduction

This section describes the aspects of the thermal design-in of the Xitanium Indoor Spot & Downlight drivers.

In order to facilitate thermal design-in of a LED driver, the critical thermal management points of the LED driver are set out in this section. Please familiarize youself with the following key aspects to achieve optimal thermal design-in of the driver.

1: Driver case temperature point (t_c point)

The driver case point temperature (t_c) is the ***only*** reference for the temperatures of the critical internal driver components. The location of the t_c point is identified on the driver type plate and is marked by a * or ^{O} symbol. Please use ***only*** the t_c point as reference to define thermal suitability of a driver in the application. Its temperature can be measured using a thermocouple that is firmly glued to the t_c point surface on the driver housing. For a representative measurement the temperature of the t_c point must be stable before any reliable data can be obtained (typically > 3 hours or when the temperature difference is less than 1°C within one hour).

2: Driver t_{c_life} value

The specified full driver lifetime and corresponding failure rate will apply as long as the t_c point temperature remains between the lower t_{a_min} and upper t_{c_life} limits.

3: Driver t_{c_max} value

Select driver types support running at a higher temperature than the specified t_{c_life} temperature, up to the t_{c_max} temperature. Keep in mind that doing so will be at the expense of the driver lifetime and failure rate. A graphical representation thereof can be found in the driver datasheet. Running the driver above the specified t_{c_max} temperature is ***not*** supported and will negatively affect driver lifetime and void driver warranty. The ***only*** way to verify whether either t_{c_life} or t_{c_max} is exceeded in the application is by using a thermocouple. Please refer to the driver datasheet for the specified t_{c_life} and t_{c_max} values.

4: Driver minimum ambient temperature (t_{a_min})

This lower limit value as specified in the driver datasheet stipulates the minimum ***luminaire*** ambient temperature at which the driver can be used, e.g. in frozen storage warehouses or (sub)arctic areas. Using the driver below its specified minimum t_{a_min} value is not supported and will negatively affect driver performance and lifetime. Driver warranty will then be void.

5: Driver maximum ambient temperature (t_{a_max})

Typically, the driver t_c point will reach its specified t_{c_max} value at the specified driver ambient t_{a_max} temperature ***inside*** the luminaire. However, if the driver is not running at full output power then the actual t_c point temperature may be lower than the t_{c_max} value. In that case a higher driver t_a is supported up to the point when the specified t_{c_max} value is reached.

6: Driver temperture readout in MultiOne Diagnostics

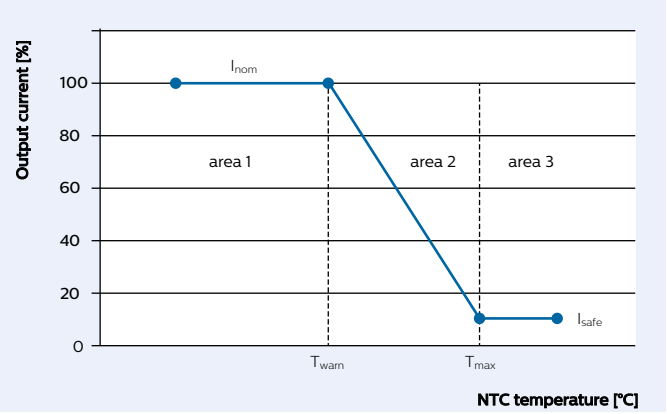
The "Driver temperature" readout via the Diagnostics function in MultiOne software represents the temperature of a driver-internal thermal sensor. Please do not use this readout to define thermal suitability of a driver for a given luminaire; this temperature readout does not represent the tc point temperature and does not correspond 1:1 with the tc point temperature. It is therefore not suitable as a reference for thermal design-in.

(cont'd on next page)

(cont'd)
The thermal design-in of the driver inside the luminaire also influences the relation between the driver t_a temperature and t_c temperature. E.g. mounting the driver on an effective heatsink or placing it further away from LED modules will lower the t_c value at a given t_a. The t_c point temperature is always leading with respect to t_{c_life} or t_{c_max}.

In general, lowering the *overall* driver temperature will increase the driver lifetime since the temperature of critical components inside the driver will be lower. However, applying only local heatsinking of the driver -e.g. to lower the t_c point temperature or any other surface hotspot- will not necessarily lower the temperature of critical components. Do not apply local heatsinking to improve intended thermal driver performance and/or to artificially lower the temperature of the t_c point.

Driver output current vs. NTC temperature



Area 1: temperature of NTC < T_{warn}.
The driver is operating at nominal output current, no temperature derating is active.

Area 2: T_{warn} < temperature of NTC < T_{max}.
Temperature derating is active, the LED driver dims down the output current linearly between I_{nom} and I_{safe}. The temperature of the LED module is monitored to adjust the current. Once the temperature becomes lower than T_{warn}, the output current will be back to its normal level I_{nom}.

Area 3: temperature of NTC > T_{max}.
The LED driver limits the output current to a specified minimum value, I_{safe}. The temperature of the LED module NTC is monitored to adjust the current and will go back to Area 2 once the temperature decreases below T_{max}.

LED Module Temperature Protection (MTP)

This feature helps to protect the LED module when operated in a hot ambient environment. The thermal design of an LED module should be designed in such a way that the temperature of the LED module (tc-life) is not exceeded under normal application conditions. The utilization of a Negative Temperature Coefficient (NTC) resistor serves the purpose to help achieve the lifetime of the LED module if external thermal influences result in the temperature for lifetime (t_life) being exceeded. When this occurs the light output will be scaled back to reduce the running temperature of the LED module. See the illustration on the left for a more detailed explanation.

The following NTC part numbers are supported in combination with Philips Xitanium LED drivers:

1. 10 kilo Ohm NTC - Murata
   p/n NCP18XH103J03R or NCU18XH103J60R
2. 15 kilo Ohm NTC - Vishay
   p/n NTCS0805E3153GMT (previous p/n: 2381 615 54153)
3. 15 kilo Ohm NTC - Murata
   p/n NCP15XW153E03RC (+ separate 390 ohms resistor in series with this NTC)

Other NTC types are supported. The applicable values for R(25°C) and β however need to be specified separately during MTP configuration in MultiOne for proper MTP behavior.

Note for LEDset drivers
Once MTP ("NTC on LEDset") is enabled the LEDset functionality is no longer enabled. AOC setting can then be done by either DALI or SimpleSet programming, depending on driver type.

For more information on MTP configuration please refer to the MultiOne user guide at www.philips.com/multione.

Controllability

WARNING: FELV terminals marked “Risk of electric shock” are not safe to touch.

Danger: electricity

WARNING: Circuits connected to any FELV control terminal shall be insulated for the LV supply voltage of the controlgear and terminals connected to the FELV circuit shall be protected against accidental contact.

Amplitude Modulation (AM) output dimming

Philips Xitanium indoor Spot & Downlight LED drivers dim the output to the LEDs by means of Amplitude Modulation (AM) dimming. This means that at no stage of the dimming, Pulse Width Modulation (PWM) at the output to the LEDs is involved. AM dimming guarantees the most smooth and flicker-free operation over the entire dimming range.

Control characteristics

Control input

Regulating level :	10 to 100%
(module dimming) :	1 to 100% for new driver types. The actual dimming range can be found in the datasheet. The control input complies with EN 60929 (Annex E) and is compatible with Philips Lighting 1-10V control equipment

TD: DALI - Touch and Dim

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 (refer IEC specification for details) and it is polarity insensitive. Using DALI, it is possible to send dimming commands (1-254 levels), set fade rates and fade times, query driver or LED status, etc. Once the mains power returns after a power failure, the driver will activate the power-on level according to IEC 62386: 102. The Xitanium LED drivers also respond to LED-specific DALI commands, for example:

- Query if the LED module is shorted or open circuit
- Select between logarithmic or linear dimming curves
- ...

Warning: the driver DALI control interface is classified as FELV and is not safe to touch! See the illustration on the left for more details.

For more information on driver compliance per DALI, refer to www.digitalilluminationinterface.org/products for latest status.

MC driver grouping attention points

- Maximum number of wireless drivers in a group: **40**
  (with no ZGP sensors or ZGP switches being part of the group)
- Maximum number of wireless drivers in a group with ZGP device(s): **25**
- Maximum number of switches in a group: **5**
- Maximum number of ZGP sensors in a group: **15**
  (minus the number of switches)

Wireless control

MasterConnect (MC)

Select Philips Xitanium Indoor Spot & Downlight drivers support wireless control based on Philips MasterConnect protocol. These drivers can be recognized by the suffix MC in the driver name. They are equipped with a radio antenna and can be controlled wirelessly via an external controller (sensor or switch) or via the Philips MasterConnect field app. Please refer to the MC brochure and user manuals at www.philips.com/oem and to the listing on the left for more details about how to commission and control a system with wireless MC drivers. For more information about how to design-in a wireless MC driver in a luminaire, please refer to the section Mechanical design-in: wireless MC drivers at p.36 of this document.

For more information on MasterConnect please visit www.philips.com/oem

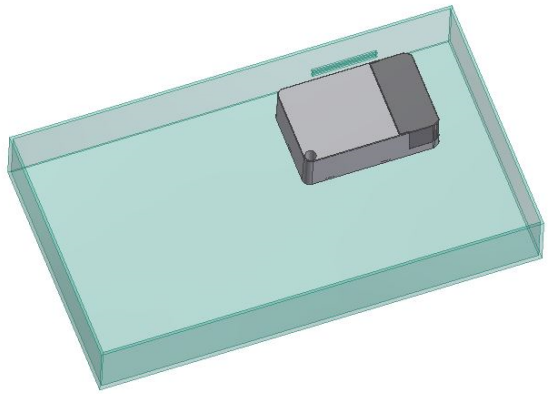
Casambi (CD)

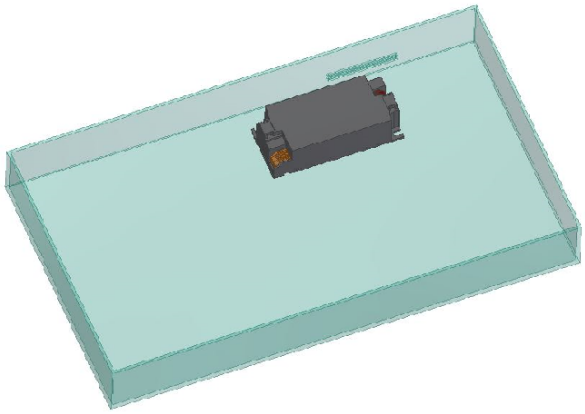
Other Philips Xitanium Indoor Spot & Downlight drivers also support wireless control but the corresponding protocol for those drivers is based on Casambi protocol instead. These drivers can be recognized by the suffix CD in the driver name. These drivers are equipped with an internal communication antenna to allow communication over the air between drivers and a control device (e.g. a sensor or a smartphone equipped with the applicable Casambi control app).

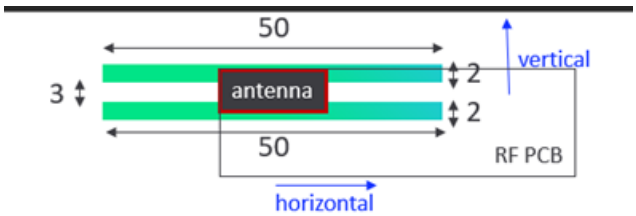
For more information on Casambi please visit: https://casambi.com/

On the next page more details are given for proper mechanical integration of Xitanium Spot & Downlight MasterConnect drivers to ensure good wireless communication between drivers and control devices.

Mechanical design-in: wireless MC drivers







Recommended dimensions of the two antenna slots:

Recommended dimensions of the two antenna slots:

- 2.0mm (±0.2mm) x 50mm (±5mm).
- two slots parallel with 3.0mm (±0.2mm) inbetween distance

General guidelines for proper integration of wireless Philips Xitanium Spot & Downlight MasterConnect drivers

- Follow general EMC guidelines as stipulated at p.25 and 26.
- Avoid placing metal parts close to the radio antenna as indicated on the driver type plate.
- Keep at least 5mm clearance between the radio antenna and any metal part or wire.

The radio performance of the driver is depending on luminaire properties. In general, luminaires can be distinguished into four distinct types from radio performance perspective:

1: Fully or partly plastic luminaires ➔ no particular measures are required for radio performance.

2: Folded sheet metal luminaire ➔ in general no particular measures are required for radio performance. Keep at least 10mm clearance between the radio antenna and metal parts.

3: Extruded metal or cast metal luminaires. ➔ special attention needed for optimal radio performance. See below for details.

4: Track luminaires ➔ no particular measures are required for radio performance.

Folded metal sheet and extruded/cast luminaires

These types of luminaires generally attenuate the radio signals significantly and may result in bad radio performance. When releasing a radio-equipped driver in these luminaires a Total Radiated Power (TRP) measurement is recommended. Release limit should be > -7dBm.

General measures which may improve the radio performance for these luminaires are:

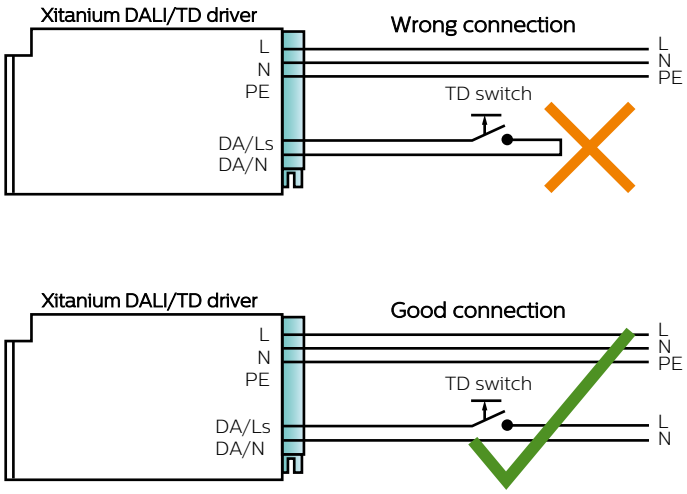
-Apply a set of two slots in the luminaire and place the radio-equipped driver in such a position that the radio antenna is facing these slots. The slots do not need the be covered from electrical safety point of view. The radio antenna for the radio-equipped driver is indicated by the white plastic cover. The antenna is in the upper part of this cover. See the drawing on the left for more details.

Apply a round or rectangular hole covered with plastic and place the radio-equipped driver in such a position that the radio antenna is close to this (covered) hole. For the hole to be effective the largest dimension should be at least 20mm.

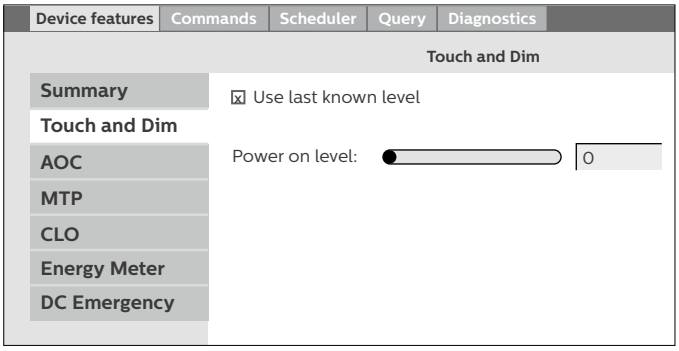
Note: These integration guidelines do not apply to Xitanium Track MC drivers since these drivers have their own dedicated plastic housing.

MC driver/sensor distance limitations

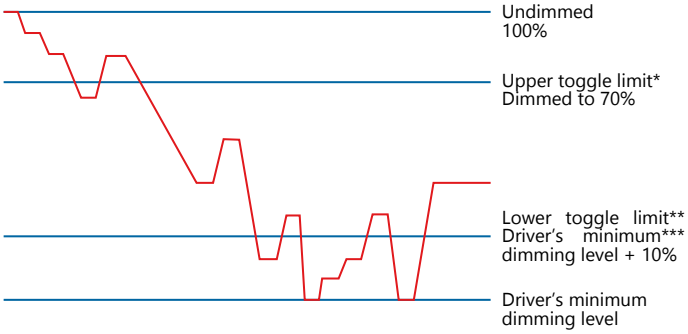
- Max. guaranteed luminaire-to-luminaire distance: **5m** line-of sight (metal housing luminaires)
- Typical (but to be verified) luminaire-to-luminaire distance: **10m** line-of sight (plastic housing luminaires)
- Max distance switch-to-first-luminaire: **7.5m** line-of sight
- Max. BLE range for user to luminaire/sensor: **7.5m** line-of-sight (depending on smartphone brand and model)
- Field configuration: via BLE. Parametric setting set via the Philips MC field app



Appropriate connection to the dimmable driver using the Touch and Dim protocol



Screenshot from MultiOne - Touch and Dim tab



* Always decrease lightlevel above the upper toggle limit

** Always increase light level under the lower toggle limit

*** Example: a driver with dimming minimum of 10% leads to lower toggle level of 10% + 10% = 20%.
1% leads to lower toggle level of 10% + 1% = 11%"

Touch and Dim action	Contact duration	Driver response
Ignore	< 40ms	Ignore
Short push	40ms to 0.5s	Toggle on/off
Long push	0.5 to 10s	Regulate light up or down
Reset push	> 10s	Driver synchronization

Touch and Dim timing table

Touch and Dim (TD)

For Xitanium Spot & Downlight drivers equipped with the Touch and Dim function mains voltage can serve as a control signal to dim and turn on/off the light by applying mains voltage to the DA/Ls and DA/N control interface (= TD interface). This means that it is no longer necessary to use a power switch to interrupt power to the driver mains input. Mains voltage is permanently present at the LED driver mains input (even when the light is switched off) and light can be switched on or regulated by momentarily applying mains voltage to the TD interface via the TD switch. A short push will switch the lighting on or off, depending on the previous situation. See the electric connection diagram on the left.

Touch and Dim behavior

When the light is turned off via the TD switch (short push), the driver will store the current light level. As soon as the driver is turned back on again (short push) the driver will recall this stored light level. If it was dimmed to e.g. 60% at turn-off then it will come back on at 60%.

IIf the TD switch is pushed for a longer period of time, the light will dim up or down, depending on what is opposite from the last dimming direction. See the graph and timing table on the bottom left for details.

The initial light level after mains power-on or after a blackout can be configured via MultiOne (see screenshot on the left). When the "Use last known level" tick box is checked, the light level at the last mains power-off is restored. When left unchecked, a "Power on level" value can be entered. The value range of this level is between 0 (light = off) and 254 (100%). Note that this range is according to the arc power levels specified in IEC 62386:102.

If the installation has to be extended by one or more light points/drivers, the dimming direction of the newly connected modules may be opposite from that of those already connected. In order to solve this, a synchronization feature is built into the drivers and can be invoked at any time by pressing the TD switch for at least 10 seconds: all drivers will then go to 37% light level and the dimming direction of all drivers will be set to downwards.

Touch and Dim wiring

Special wiring, such as twisted pairs or special cables, is not required to install a Touch and Dim system. All wiring is standard mains wiring and the switch is a standard push-to-make switch. There is no limit to the length of the dim cable or the number of switches connected. The only limitation is the maximum amount of drivers, which is 30 per dimming unit.

The Touch and Dim interface is rated for use in a 3-phase 230/400V grid, therefore supporting the use of Touch and Dim control from one phase while power to the driver is supplied by one of the other two phases.

Trailing Edge (TE) phase-cut dimming

Trailing edge phase-cut dimmers control the power of the load by varying the duty cycle (ratio on vs. on+off time) of the mains voltage to the driver. TE-compatible Xitanium Spot & Downlight drivers support operation on TE dimmers as listed below.

Driver operation on Leading Edge phase-cut dimmers is *not* supported.

Manufacturer	Dimmer type
SG	LEDDIM 400
Elko	316 GLED
Elko	315 GLE
Elko	315 GLE 2-pol
Micromatic	UNILED+ 325
Moeller Eaton	x-comfort, type CDAE-01/02
Elko	420 GLE/I
Elko	630 GLE
ABB	Busch 2247U
ABB	6523 UCJGL

Non-Dimmable

The current of the non-dimmable Xitanium drivers can be set with Rset within the operating window. During normal operation, the set current cannot be changed.

Quality

Compliance and approval	Generated disturbances, EMI and 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 A1 + A2	Limits for harmonic current emissions
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 A1	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 61347-1	General and safety requirements
IEC 61347-2-13	Particular requirements for DC or AC supplied electronic control gear for LED modules
Emergency standards	
IEC 61347-2-13 Annex J	Particular additional safety requirement for AC, AC/DC or DC supplied electronic control gear for emergency lighting
IEC 61347-2-7	Particular requirements for DC supplied electronic ballasts for emergency lighting

Please refer also to the driver certificates for latest status at www.philips.com/oem.

System Disposal

We recommend that the Xitanium LED drivers and its 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.

Disclaimer

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

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