PHILIPS

Xitanium

LED indoor drivers

Linear

Design-in Guide

Xitanium **650V DC Input technology** for Industrial Applications

January 2025

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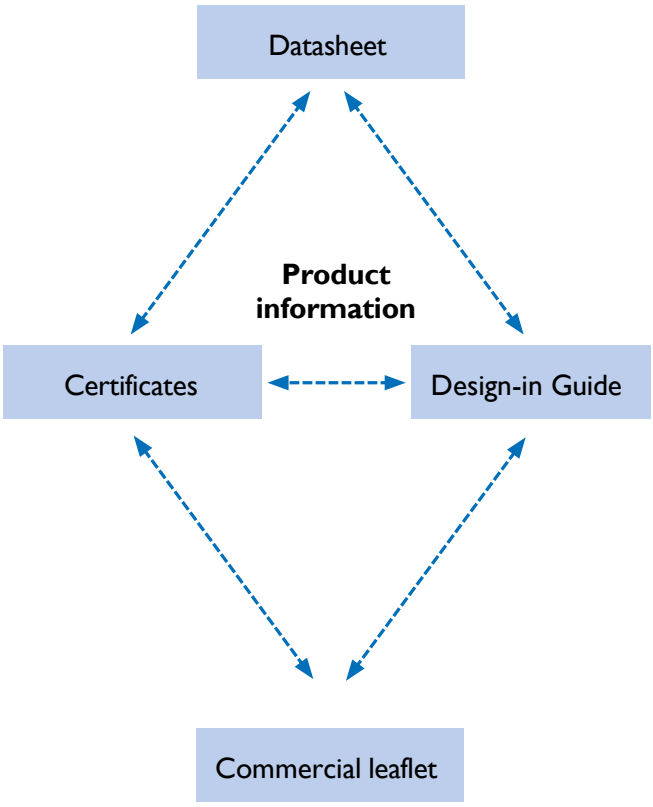
Introduction to this guide

Xitanium Industrial 650Vdc Driver



Thank you for choosing the Philips Xitanium Sensor Ready (D4i) driver. In this guide you will find the information needed to integrate these drivers into a LED luminaire or LED system.

This edition describes the configurable Industrial 650Vdc drivers. We advise you to consult our websites for the latest up-to-date information.

Applications

Philips Industrial 650Vdc drivers are the first of their kind for the applications with 650Vdc thus reducing cost for converters in industrial areas as well as reduce complexity and cost of wireless connected lighting systems in indoor industrial applications with DC grids. If you use Philips D4i 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 Philips office or visit: www.philips.com/oem www.philips.com/multione

Design-in support

Dedicated design-in support from Signify is available on request. For this service, please contact your local Signify representative.

Document overview

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 contain 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 at the OEM download page of the OEM website www.philips.com/oem. If you require any further information or support please consult your local Signify representative.

Warnings and instructions


Safety warnings:

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

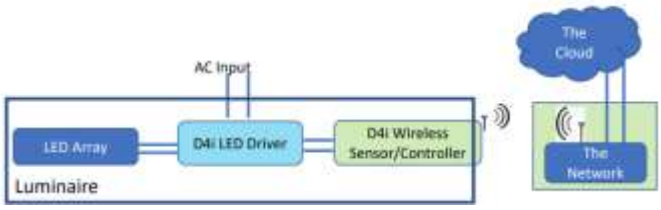
Safety warnings and installation instructions, to be taken into account during design-in and manufacturing

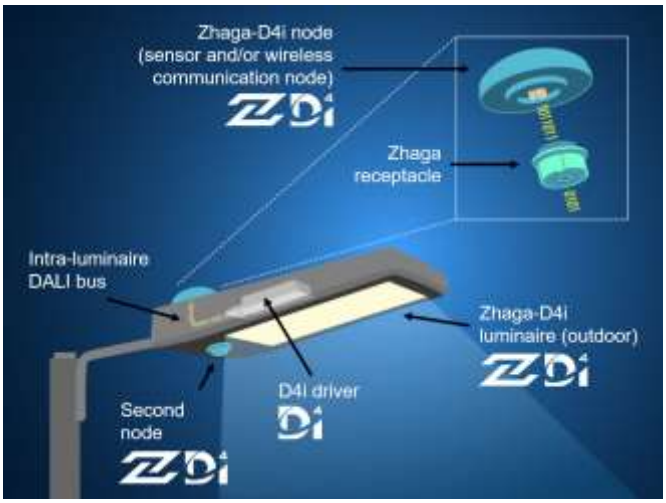
- Do not use damaged products
- Do not use the D4i interface of Xitanium LED 650V DC D4i drivers in wired luminaire-to-luminaire or in wired DALI network applications. Inter- and extra-luminaire use is not supported. All D4i and auxiliary supply wiring must remain within the luminaire (intra-luminaire use).
- The connection between SRG and PE terminals must be established permanently in the application for surge immunity reasons. (This connection only to be removed temporarily during dielectric strength testing and to be removed permanently in case of an external SPD)
- Do not connect DC grid voltage to the D4i interface; immediate driver failure will result.
- 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 LED D4i drivers are suitable for built-in use only and must be protected against ingress of and exposure to including but not limited to water, 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 a non-binding guidance; a different 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 application.
- Do not service the driver when DC Grid voltage is connected; this includes connecting or disconnecting the LED module. The driver generates an output voltage of the driver that may be lethal. Connecting a LED module to an energized driver may damage both the LED module and driver.
- No components are allowed between the LED driver and the LED module(s) other than connectors and wiring intended to connect the Xitanium driver to the LED module.
- Adequate earth and/or equipotential connections must be provided whenever possible or applicable.
- 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 Industrial 650Vdc D4i drivers





Industrial 650Vdc drivers and D4i Certified Products

Our Industrial 650Vdc drivers offer great benefits for Lighting Management Systems. To ensure full component interoperability, Signify provides Industrial 650V Drivers with D4i Certification which also covers DALI-2. D4i certified drivers provide energy monitoring, store asset information, diagnostic data and identifies failure modes of the power source.

D4i is a certification program for interoperable DALI devices that enable smart, connected luminaires.

D4i systems help building an easier connected luminaire compared to conventional methods. With D4i it is possible to have a connected luminaire with fewer components, interoperability and higher reliability.
D4i Certified products can easily be recognized with the below logo on them:

Xitanium LED D4i driver versions

The Industrial 650Vdc driver described in this guide is as of now only available at 100W with the adjustable current ratings which enable the most popular light output levels for industrial DC grid applications. It is always highly recommended to check our latest Industrial 650Vdc 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.

Configurability Interface (tooling)

The Industrial 650Vdc D4i 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.

SimpleSet

Philips SimpleSet new wireless programming technology allows luminaire manufacturers to quickly and easily program Industrial 650Vdc D4i drivers in any stage of the manufacturing process, without a connection to DC Grid power, offering great flexibility

Sensor Ready Interface (DA+/DA-)

Industrial 650Vdc drivers reduce complexity and cost of luminaires used in (wireless) connected lighting systems. They feature a digital D4i interface to enable direct connection to any suitable controller or sensor. Functionality integrated into the D4i 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 that enables turning every luminaire into a wireless node and a more reliable DC powered controller. The simple two-wire D4i interface is (dependent on driver type) compliant with Part 207, 209 and D4i (Part 250/251/252/ 253).

Compatibility with regular DALI devices

D4I Certified Products are designed to fully benefit from the D4i driver capability. DALI compliant devices can also be applied in conjunction with Industrial 650Vdc drivers, yet functionality may be limited compared to use with a DALI driver in a DALI network.

DALI Part 102

The Industrial 650Vdc drivers described in this guide 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.

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 configured with the Philips MultiOne Software and the 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 user manual of MultiOne at www.philips.com/multione.

Dimming interface

Interfacing with the Industrial 650Vdc drivers can be done via the D4i interface.

Amplitude Modulation (AM) dimming

Philips Industrial 650Vdc drivers dim the output to the LEDs by means of continuous Amplitude Modulation (AM) dimming of the DC output current. No Pulse Width Modulation (PWM) is applied across any part of the entire output current range. AM dimming guarantees the smoothest and flicker-free operation over the entire dimming range.

Temporal Light Artifacts (flicker & stroboscopic effects)

A small inherent ripple is superimposed on the DC output current of Industrial 650Vdc drivers. This ripple consists of a high-frequency HF component. This ripple current has such a low amplitude that Temporal Light Artifacts (flicker & stroboscopic effects) with camera systems other than possibly those for high-speed slow-motion HD recording is not expected. The ripple value of HF components is specified in the driver datasheet. The typical values for TLA parameters short-term flicker value (PstLM) and Stroboscopic Visibility Measure (SVM) can also be found in the driver datasheet.

What does SVM mean?

- For objective assessment of stroboscopic effect, the Stroboscopic effect Visibility Measure (SVM) has been developed.
- The specification of the stroboscopic effect visibility meter and the test method for objective assessment of lighting equipment is published in IEC technical report IEC TR 63158.
- Stroboscopic effect is one of the particular temporal light artefacts.
- In common lighting applications, the stroboscopic effect is an unwanted effect which may become visible if a person is looking at a moving or rotating object which is illuminated by a time-modulated light source. The temporal light modulation may come from fluctuations of the light source itself or may be due to the application of certain dimming or light level regulation technologies. Another cause of light modulations is the incompatibility of a lamp with an external dimmer.

What does PstLM mean?

- PstLM measures the short-term flicker severity, where “st” means short term and ‘LM’ refers to the method of measuring flicker, as defined in the standards.
- A value of PstLM = 1 means that the probability that the average observer will notice flicker is 50 percent.
- The regulation specifies the required level of PstLM <= 1 at full load and applies to LED and OLEDs.

Hot-wiring

Xitanium LED D4i drivers do not support hot-wiring. In order to prevent damage to LED module and/or driver no connection or disconnection should be made to the driver output when DC Grid voltage is present. Please ensure that power is turned off before doing so.

AC Grid (Mains) operation

Xitanium Industrial 650Vdc drivers are only suitable to use with industrial 650Vdc power systems.

OEM Write Protection (OWP)

OWP allows the OEM to protect their driver setting over the lifetime of the driver by using a password. Drivers equipped with OWP will show this in the feature list if read out by the MultiOne tool. Specific features and also the OWP feature itself can be enabled and protected with that password to prevent unauthorized changes. The password management is under the responsibility of the company which is setting it. Please refer to the driver datasheet to find whether a specific driver support OWP.

Driver diagnostics & maintenance

Xitanium LED D4i drivers offer a Diagnostics & Maintenance feature. The purpose of Diagnostics is to gather information and help diagnose the history of the driver and connected LED module for maintenance purposes. This feature consists mainly of counters which keep track of specific variables like the number of startups of the driver, operating hours, current and voltages etc. When the driver is shutdown, the diagnostics data is stored automatically in non-volatile memory. Diagnostics reg. non-D4i drivers can be accessed through the D4i interface with a password provided to D4i Certified partners. Diagnostics and maintenance data regulation
D4i-compliant drivers can be accessed according to Part 253.

More information on this feature can be found in the instruction manual of MultiOne Engineering at www.philips.com/multione.

Energy data

Industrial 650Vdc driver have built-in energy measurement capability and can report energy and actual power consumption data. Accuracy of the actual power measurement is higher of following 2 values: 0.5W or +/- 4% measured input power. This feature stores energy reporting data in the nonvolatile memory bank provision specified in DALI-2 Part 252 and the D4i Certified specification.

Luminaire data

Industrial 650Vdc drivers are equipped with the Luminaire Info feature. This feature supports the extraction of luminaire data as input for system asset management and enables the OEM to issue a unique Global Trade Identification Number (GTIN). It is compliant per Part 251.

Driver behavior on LED module fault conditions

Open load protection – If there is no LED module connected to the driver then the output current will drop to zero and the driver output voltage will rise to its maximum. When the driver detects this condition 5 times within 20 seconds then it will shut down to protect itself and to avoid a potentially unsafe situation. In order to reset open load protection, the DC grid must be switched off and on.

Output overvoltage detection – select driver types are equipped with intelligent LED module sensing circuitry. If the driver detects abnormal dynamic behavior of the connected LED module (reflected by rapid and/or irregular changes in forward voltage) then the driver will shut down its output.

Short-circuit protection – If the output + and - terminals of the driver are shorted then the output current will momentarily rise while the forward voltage will drop to zero. When the driver detects this then it will shut down to protect itself and to avoid a potentially unsafe situation.

Overpower protection – If the specified maximum output power is exceeded (e.g. use of an incompatible LED module) then the output current will be reduced until the rated driver output power is reached. This way the driver protects itself to avoid a potentially unsafe situation.

Automatic recovery – If the fault condition is resolved and the DC Grid is applied again, the LED-driver will start automatically its normal way of working at its designated operating point.

Use in hazardous areas

Warning: the use of lighting control gear in hazardous areas is bound to very strict safety regulations. Xitanium LED D4i drivers are not certified per standard IEC/EN 60079 and latest EU directive ATEX for use in hazardous areas in which there is risk of explosion. Therefore, Xitanium LED D4i drivers do not directly support application in luminaires and lighting systems in such environments.

Mechanical Design-in

LCN9630 SimpleSet Interface Tool

LCN9620 SimpleSet Interface Tool

Dimensions

Industrial 650Vdc drivers are available in different housing dimensions. The specific dimensions can be found in the driver datasheet. 3D CAD files are available to verify fit and can be found at www.philips.com/oem. It is recommended to build in drivers such that the driver housing and the driver input and output connectors are not affected by potential water ingress in the luminaire (e.g. due to luminaire sealing malfunction or condensation).

Mounting

It is highly recommended to mount the driver by using all available mounting feet to achieve optimal thermal contact and maximum mechanical robustness against shocks and vibration.

Mounting screw dimensions should be based on the specified fixing hole diameter in the driver datasheet. Oversized and undersized screws should not be used to prevent damage to the mounting feet or loose mounting. It is suggested to use mounting screws on both locations on the driver.

Allow for sufficient free space around the driver SimpleSet antenna if the driver is to be configured after mounting in the luminaire. The minimum recommended space is depending on the type of SimpleSet configuration tool. Using the tools as shown on the left, the minimum distance is 15 mm (+/- 1mm) for the LCN 9020. For the LCN 9030, tool, a minimum space of 8.3mm will suffice.

Depending on the application and the use in development, factory or field, another configuration tool can be selected. Please check the website www.philips.com/multione to find the correct type. Every published interface tool is officially approved for use with the MultiOne software. The tool type number can be found by checking the LCN label on the tool itself.

Note: the use of an unapproved tool may result in impaired driver- tool communication and configuration malfunctioning.

Thermal Design-In

Warning: Driver operation outside Ta(min)-Tc(max) range is not supported and driver warranty will be void.

Warning: 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 Tc point temperature of critical components. Do not apply local heatsinking to improve intended thermal driver performance and/or to artificially lower the temperature of the Tc point.

Note: Xitanium LED D4i drivers allow for a driver internal temperature readout through MultiOne Diagnostics feature. This readout is purely for diagnostic purposes and does not represent the driver tc point temperature. Therefore, this readout should not be used to define thermal suitability of the driver in the application.

Introduction

To facilitate design-in of LED drivers, the critical thermal management points of the LED driver are set out in this section. In Signify's product design phase all possible precautions have been taken to keep the component temperature as low as possible. However, the design of the luminaire and the ability to guide the heat out of the luminaire are of utmost importance. If these thermal points are taken into account this will ensure the optimum performance and lifetime of the system.

Driver case temperature point (tc point)

To achieve optimal lifetime and reliability, it is critical that the temperature of the components in the driver DC Grid within its rating. The driver case temperature point (tc) is a reference for the temperatures of the critical internal driver components. The location of the tc point is identified on the product label. The tc point is marked by the * or O symbol on the label of the driver.

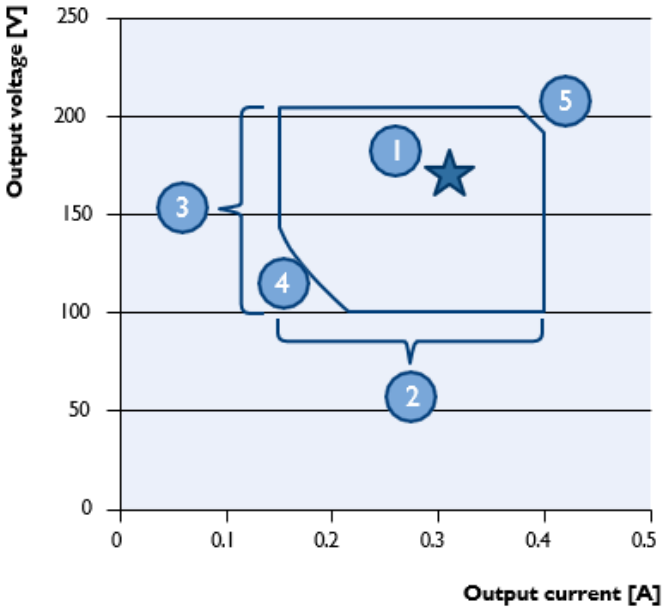
How to measure tc point temperature

The temperature of this point can be measured using a thermocouple that is firmly glued to this defined point on the driver housing. For a representative measurement the temperature of the tc 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).

Relation between tc and ambient temperature ta

The tc point temperature increases, by approximation, linearly with the driver ambient temperature (ta). The temperature offset between driver ta and tc depends on the thermal design of the luminaire and the actual delivered output power relative to the specified rated output power. A lower output power allows for a higher driver ambient temperature as long as the maximum specified driver tc temperature is not exceeded.
There are two driver tc values specified with corresponding lifetimes: tc(life) and tc(max). The rated driver lifetime can be achieved if the tc value remains between ta(min) and tc(life). If the driver continuously runs on tc(max) this will reduce the lifetime of the driver significantly. The approved driver ambient temperature range and specified tc(life) and tc(max) values and corresponding driver lifetimes are specified in the driver datasheet.

Electrical Design-In



Example Operating Window of a Industrial 650Vdc driver

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 Vf, 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 still evolving. The use of 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 mA, 700 or 1050 mA. It is often necessary to replace a driver when more efficient LEDs or different LED modules become available.

One of the key features of the Industrial 650Vdc drivers is the adjustable output current (AOC) feature, offering flexibility and future-proof luminaire design. The Xitanium drivers can operate in a certain "operating window". This window is defined by the maximum and minimum voltage and current that the driver can deliver. An example of an operating window is shown on the left. The area indicates the possible current/voltage combinations. The current selected will depend on the type and manufacturer of the LEDs or the specific LED configuration of the PCB design. The voltage is the sum of the LEDs used (total Vf string) and dependent on LED drive current and temperature. The operating window of every driver can be found in the driver datasheet.
The output current of these drivers can be configured in three ways:
1. SimpleSet: via Philips MultiOne software and SimpleSet interface.
2. D4i interface: via Philips MultiOne software and USB2DALI interface.

Warning: in order to ensure stable driver operation, the forward voltage Vf of the connected LED module must remain within the specified driver operating window voltage boundaries under all application conditions!

How to Select an appropriate driver

Depending on application requirements, several drivers may fit a specific application. The following steps will help in selecting the appropriate driver(s).

For a complete overview of the available drivers, please refer to www.philips.com/oem or use the Easy Design in Tool (EDIT) at www.easydesignintool.philips.com.
1. Determine the required driver current (Idrive) and voltage (Vf)

2. Calculate the required power (Pdrive) where: Pdrive = Vf x Idrive (W)

3. Select the datasheets from the website mentioned above based on the driver having a higher power than required.

4. Does the required current fit the current range of the driver? The current range of the driver can be seen in the name itself. For example, for driver Xitanium 75W

0.7 – 2.0A 54V 230V, the minimum programmable driver current is 0.7A and maximum is 2.0A.

5. Does the required voltage fit the voltage range of the driver? The exact value can be found in in the driver datasheet.

6. Does the required power fit the power range of the driver? In the naming of the driver, you can see the maximum possible output power. For example, for the driver mentioned above, the maximum output power is 75W.

Programming the output current

The Industrial 650Vdc drivers offer an 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 configurable drivers from Philips, ensuring that the driver performance matches the needs of the lighting solution. It offers unprecedented flexibility, before, during and after the product installation.

Configuration of Industrial 650Vdc drivers can be done either by using the SimpleSet tool or the D4i interface.

For more information on MultiOne please refer to the section Driver Configuration or visit: www.philips.com/ multione. This site contains detailed information on how to install the software and how to program the driver.

Connectors

Xitanium LED D4i drivers are equipped with push-in connectors. More info about connectivity (wiring diagram, wire diameters, strip length) can be found in the driver datasheet.

In some scenarios two wires need to be connected to one connector terminal. In this case, the pairing must be done outside the driver, resulting in only one wire going into the connector terminal. Two wires into one connector terminal are not supported.
The reliability of twin-wire ferrules (or wire end stop), accepting the wires intended to use, should be checked with the supplier of these ferrules.

Cables

For safe and reliable operation users must consider using cables which are suitable for 650Vdc grid operation. For the right cable size for input and output connections please refer to the product datasheet.

DC Grid operating conditions

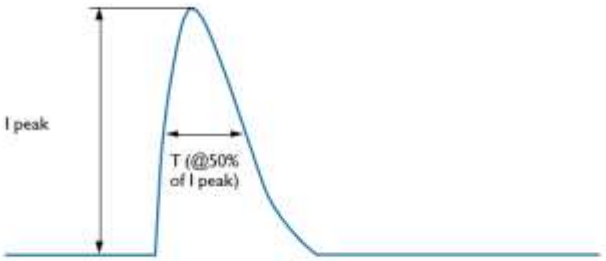
Xitanium Industrial 650Vdc drivers only support operation on power sources or grids providing a clean DC voltage. Our Industrial 650Vdc Drivers have an input voltage range of 400-800Vdc, however how driver behaves in this range can be explained in 3 stages:

400-620Vdc: The driver will work in emergency mode and will continue at the power set by the end-user.

620-750Vdc: The driver will run in its performance range.

760-800Vdc: The driver will operate but outside performance range.

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



Graphical representation of inrush current

Inrush current

The term 'Inrush current' refers to the briefly occurring high input current which flows into the driver during the moment of connection to DC Grid; 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 a Miniature Circuit Breaker (MCB) to trip. In such a case, either one or a combination of the following measures need to be taken to prevent nuisance tripping:

- Replace existing MCB for a less sensitive type (e.g. exchange B type for C type).
- Distribute the group of drivers over multiple MCB groups or phases.
- Power up drivers sequentially instead of simultaneously.
- A pre-charge procedure can be applied to reduce the system inrush current of a DC grid installation. This pre-charge procedure describes the power up of a DC grid by using an in-between DC grid voltage level before increasing to the nominal/final voltage level of the DC grid. For this functionality, please refer to the start-up and shut-down voltage of the Industrial 650V DC driver which can be found on the datasheet. The pre-charge voltage level(s) should be chosen at such voltage that, after starting the Industrial 650V DC driver, the DC grid voltage should not dip below the shut-down voltage to prevent repetitive on/off behavior in the lighting installation.

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

Note: the use of an external inrush limiting device may enable a larger number of drivers to be connected to a MCB. Signify has not tested the effectiveness and compatibility of such devices in the application. It is the responsibility of both luminaire manufacturer and installer to ensure compatibility as well as compliance with national electrical codes when either device is used in the application.

Fuse type Selection

AC and DC circuit breakers are not interchangeable, please select a circuit breaker with correct DC specifications. Using a pure AC circuit breaker in a DC power grid can pose risks and may not effectively interrupt fault currents. Possible arcing inside a circuit breaker, during a fault, is extinguished by the AC current zero crossing. Using an AC circuit breaker in a DC power grid may lead to a sustained arc and related hazards. To prevent these arc related hazards, DC circuit breakers are equipped with specific designs which create fast increasing contact distances. DC circuit breakers have higher grade insulation materials as DC voltage degrades insulation materials faster than AC voltages at same level. Please respect the minimum 6kA breaking capability as stated in IEC60296.

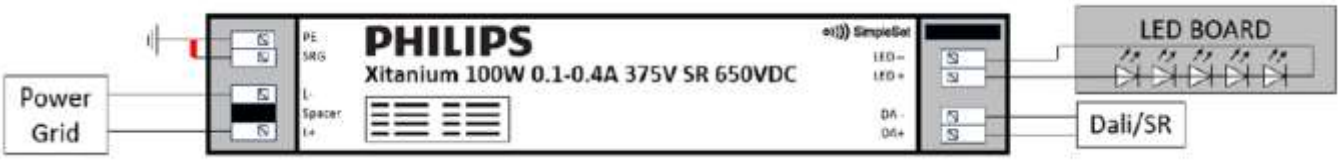
How to Determine the Number of Drivers on a MCB

The maximum recommended amount of drivers connected to a Miniature Circuit Breaker (MCB) can be calculated with the help of the conversion table shown on the left. In this table the stated amount for a 16A B type MCB is used as reference (100%). The maximum recommended amount of drivers for different types of MCB can be calculated by this formula:

Surge immunity

Xitanium LED D4i drivers have elevated surge immunity. Depending on the DC Grid connected, additional protection against excessive high surge voltages may be required by adding a Surge Protection Device. The actual driver immunity level can differ per driver and can be found in the driver's datasheet.

Warning: For Xitanium Industrial 650Vdc Drivers the connection between SRG and PE terminals (red highlighted connection on the picture right) **must** be established permanently in the application for surge immunity reasons. This connection only to be removed temporarily during dielectric strength testing and to be removed permanently in case and external SPD is added.



Protective conductor current

Xitanium LED D4i drivers are designed to meet safety requirements per IEC 61347-1 standard. The specified value of the protective conductor current can be found in the driver datasheet. The test is done on driver level only. In a luminaire, this current may be higher, since the LED module may introduce additional current due to its inherent parasitic capacitance. Therefore, precautions may be required on luminaire level. In a luminaire, the cumulative protective conductor current may be higher, since the LED module may introduce additional current. Precautions may be required on the luminaire level if multiple drivers are used in a single luminaire.

Electro-Magnetic Compatibility (EMC)

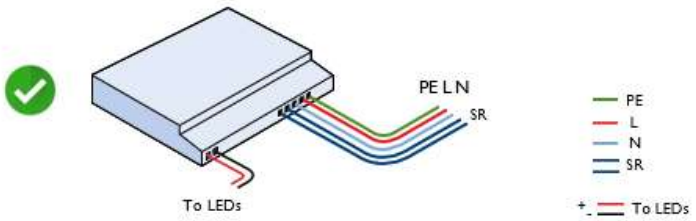
Electro-Magnetic Compatibility (EMC) is the ability of a device or system to operate satisfactorily in its electromagnetic environment without causing unacceptable interference while having sufficient immunity. Xitanium LED D4i drivers meet EMC requirements per CISPR15 for conducted and radiated emissions. 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 configuration.

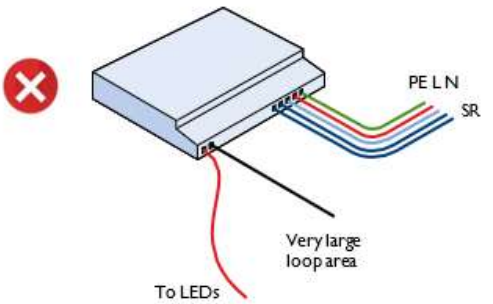
Cable length and EMC

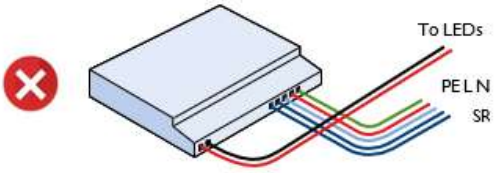
Signify has successfully performed EMC tests for a total output cable length of 6m. Selected drivers may allow for a longer length; please refer to the driver datasheet to look up the applicable maximum value. Since EMC performance of the luminaire is heavily dependent on the wiring itself, we advise for lengths exceeding the maximum specified length to repeat EMC testing to ensure compliance.

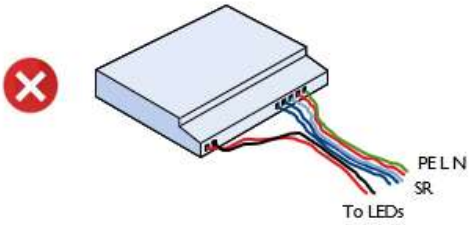
Remote mounting and EMC

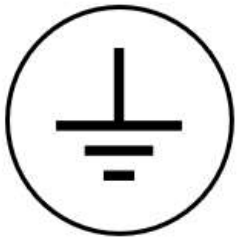
Industrial 650Vdc LED Indoor Linear drivers are primarily intended for built-in use only inside/on a luminaire. Remote mounting or independent use will require additional measures like strain reliefs and may require additional measures for EMC compliance.











Symbol for Protective Earth (PE)

Warnings for non-isolated drivers:

- Do not touch any non-insulated live parts, even on the output (secondary) side!
- This includes the LEDset component.
- Make sure to fully insulate the LEDset to prevent it from accidentally touching the driver housing.

EMC performance precautions

The following practical precautions need to be considered 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 DC Grid wire inside the luminaire as short as possible.

• Keep DC Grid and D4i control wires separated from the LED output wires. Do not bundle or cross the LED output wires with either D4i or DC Grid L+N wires.

• Keep the earth wires as short as possible to maximize their effectiveness and use, as much as possible, large metal areas (chassis, mounting plates, brackets) for earthing purposes instead. Establish a reliable electrical connection by using a toothed washer and screw(s) fastened with adequate 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.

Electrical insulation and protective earth

Non-isolated drivers

Xitanium LED D4i drivers have no insulation between the DC Grid input and the LED output. Therefore, all internal driver parts are live. Basic insulation is present between all internal live parts and the metal driver chassis; therefore, the driver housing must be connected to Protective Earth as indicated by the Protective Earth (PE) symbol as shown on the left.

Non-isolated drivers are designed for use in Class I luminaires and do not support use in Insulation Class II applications without further additional safety measures on luminaire level.

Warning: all output connections of non-isolated drivers are live and thus not safe to touch; Therefore, the driver housing must be connected to Protective Earth (PE) as indicated by the PE symbol as shown on the left to ensure electrical safety. The bottom part of the driver housing (unpainted) may be used to create a protective earth contact to the luminaire housing, as the earth connector is internally connected to the driver housing. An intermittent earth contact should be prevented, as this is potentially unsafe and can cause negatively luminaire

Two-wire sensor connected to driver SR interface

Sensor Ready Interface

The simple two-wire D4i interface supports these key functions:

• Switchable built-in D4i bus power supply 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 D4i driver(s) and control device, using standard DALI protocol via a polarized D4i 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)

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

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

- Industrial 650Vdc drivers have the ability to supply the D4I bus with a built-in DALI PSU. This PSU can be disabled and enabled. By factory default, the DALI PSU is enabled and ready for use with an external control device. The DALI PSU is compliant per DALI Part 250.
- The DALI PSU is capable of delivering a minimum current of 52mA (ISR) to the DALI bus and the connected device(s).
- The DALI PSU will never supply more than 60mA (ISR_MAX).
- The DALI bus voltage is depending on the controller load and the amount of DALI PSUs connected in parallel. See the graph on the left for the typical VI curve for one DALI PSU.
- When the internal DALI PSU is switched OFF the DALI driver will extract a maximum of 2mA from the DALI bus (like standard DALI gear).

Warnings:

Industrial 650Vdc drivers: A maximum of four DALI interfaces with enabled DALI PSU are allowed to be connected in parallel in order not to exceed the maximum allowable DALI bus current of 250mA. If more than four D4i interfaces are connected in parallel then the DALI 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.

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.

Luminaire control devices

Most luminaire controllers intended to be used in a DALI system will be powered from the DALI bus. When communication is present on the DALI 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 D4i system

• DALI bus polarity must be respected when more than one D4I interface is connected in parallel.
• The total available DALI bus current (ISR_MAX_TOTAL) must not exceed 250mA. This current can be determined by adding up ISR_MAX of all connected and enabled DALI PSUs. As a consequence a maximum of four enabled DALI PSUs are allowed to be connected in parallel.
• The total current delivered to the DALI bus (ID4I_DELIVERED) can be determined by adding DALI of all connected enabled D4I PSUs.
• The total current extracted from the DALI bus (ID4I_EXTRACTED) can be determined by adding up consuming devices like D4I drivers with disabled DALI PSU, other DALI gear and control devices (max. 2mA/ device).
• To guarantee good communication, a margin of 8mA is needed to drive the DALI bus itself (ID4I_MARGIN).
• The following rule should be respected: ID4I_EXTRACTED + ID4I_MARGIN ≤ ID4I_DELIVERED.

Caution:

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

Typical examples

1. One D4i driver is connected to a control device. The DALI PSU of this driver is enabled. The specification of the control device states that the extracted peak current is 40mA. Will this D4i system have good communication?
Answer: one D4i PSU is involved, so D4i bus polarity is irrelevant.
ID4I_MAX_TOTAL = 60mA. This is ≤ 250mA. ID4I_DELIVERED = 52mA
ID4I_EXTRACTED = 40mA ID4I_MARGIN = 8mA
Result: 40 + 8mA ≤ 52mA
Conclusion: this system will function properly.

2. Is it allowed to add an D4i driver with disabled D4i PSU to this D4I system?
Answer: an D4i driver with disabled D4i PSU extracts 2mA from the DALI bus.
ID4I_EXTRACTED = 40 + 2 = 42mA. 42 + 8mA ≤ 52mA
Conclusion: this system will function properly.

3. Can this D4I PSU also be switched on?
Answer: yes, but polarity of both D4I PSUs should be observed.
ID4I_TOTAL = 2 * 60 = 120mA. This is ≤ 250mA Conclusion: this system will function properly.

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

Configuration options

Digital D4i communication

Driver control via D4i 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 D4i interface, as per D4i Certified specification or D4i standard.

Standby power consumption

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

Driver configuration

Introduction

Select Xitanium Indoor Linear D4i 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 the drivers can be done either by via SimpleSet or via the D4i interface.

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

Control Features

Adjustable output current (AOC)

AOC limits the driver output current to match the application requirement. The limited output current is then dimmable over the full user controllable dim range; the AOC level [mA] being the 100% light level.

The default AOC value can be found in the driver datasheet.

Adjustable Light Output (ALO)

ALO limits the light output of the driver to match the application requirement. The limited light output is then dimmable over the full user controllable dim range; the ALO level [%] being the 100% light level. Setting an ALO minimum level prevents the light from dropping below the set level during dimming conditions. This is a useful feature if a minimum light level needs to be maintained under all conditions.

ALO can also be used to permanently set the AOC value at a level below the minimum programmable AOC level. E.g. if the min. programmable AOC value of a driver is 200mA while the required AOC value is 160mA then the ALO feature must be enabled and set at 80%.

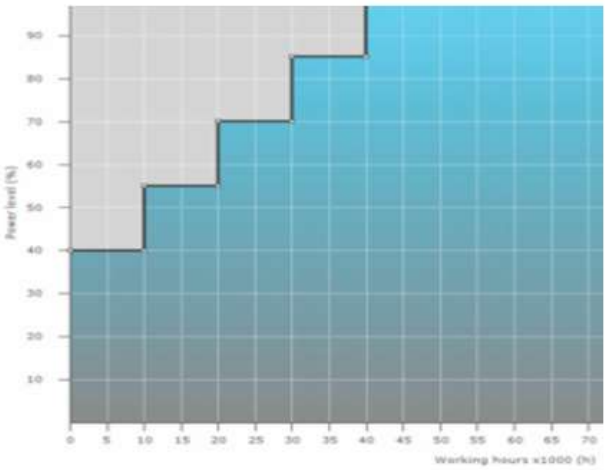
Depending on driver type, there are 2 ALO versions available: one version with and one without the option to set the ALO minimum level. Please refer to the driver datasheet to find out which ALO version is supported.

DALI PSU

Xitanium LED D4i drivers are equipped with an integrated Power Supply Unit (PSU) to power controller and nodes via the DALI communication bus. This PSU can be disabled if power is not needed. The PSU must be disabled if more than four DALI PSUs are connected in parallel to prevent DALI bus current exceeding 250mA.

Min Dim Level

The adjustable minimum dim level feature allows users to set the minimum dim level to their own needs via MultiOne interface. This feature is to prevent unwanted light behavior might be present during the low dim levels. For our Industrial 650V DC driver the minimum dim level is 5%.



Example of a CLO profile

Constant Light Output setting (CLO)

Traditional light sources like fluorescent and HID suffer from depreciation in light output over time. This applies to LED light sources as well. The CLO feature enables LED solutions to deliver constant lumen output through the life of the light engine. Based on the type of LEDs used, heat sinking and driver 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 output current based on this input to enable CLO.

Example with CLO

When the CLO feature is enabled, the driver nominal output current will be defined by the CLO percentage as shown by the equation below:
Driver target nominal output current =
CLO [%] x AOC [mA]

Assume a driver with a current range of 300-1000 mA. For example, in the CLO profile shown in the ilustration on the left, between 20-30 working kh, the CLO percentage is set at 70%. Assuming the nominal AOC is set to 800 mA, the driver output current with CLO enabled will be 0.7 x 800 = 560 mA from 20 to 30kh.

Please take into account what the AOC (driver current) needs to be when CLO reaches 100%. This value might be higher than the nominal current stated in the datasheet of the LED module. Since the CLO curve is not generic, the OEM needs to determine the appropriate CLO curve for a given luminaire. This can be used to differentiate on e.g. lumen output or power consumption over lifetime.

OEM Write Protection (OWP)

By enabling the OWP feature the OEM can prevent unauthorized changes of crucial driver settings. The OWP feature is based on password protection that will be set in the driver so the preconfigured data of OEM write-protected driver features can only be modified by providing the correct password. Depending on the type of driver the OEM can protect the following:

• a set of features (fixed)

• a selection of individual features (free selection) To know which features are locked you see a small lock symbol on each feature while trying to write the driver.

How to program this feature is described in the user manual of MultiOne Engineering at www.philips.com/ multione. The password is needed to change the protected features of this driver. Without the password these features cannot be modified.

Encrypted in the feature file, the password can be easy programmed in production via the MultiOne workflow software. New drivers or replacement drivers can be programmed on this way. Already programmed drivers with password are protected and will give an error. They can only be changed using the correct password.

It is important for the OEM to set up a password management system, keeping feature file and password together in the BoM of the luminaire. The password management is under the responsibility of the OEM who sets it. In case of a lost password, the OEM is advised to contact the local Signify representative.

Compliance and approval

Driver compliances and approvals can be found in the published driver Declarations of Conformity (DoC) and ENEC/CB certificates as published on www.philips.com/oem. For further questions please contact your local Philips sales representative. System 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.

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