Enabling future-proof LED technology for dynamic LED markets

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Introduction to this guide

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 Xitanium LED drivers optimized for indoor spot and downlighting applications. We advise you to consult our websites for the latest up-to-date information.

Applications
The Xitanium Indoor Spot & Downlight LED drivers are designed to operate LED solutions for indoor lighting, like offices, public buildings and retail 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.

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 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 damaged housing and/or connectors!
- Do not service the driver when the mains voltage is connected; this includes connecting or disconnecting the LED module!

Important installation instructions

- Do not use damaged or defective contacts or housings.
- Do not use damaged products.
- Cap off all unused wires to prevent accidental contact with the luminaire or driver housing.
- 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 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 Philips with reference to minimum required luminaire IP rating serves only as non-binding guidance; a higher IP rating may be required under certain application conditions to protect the driver. Common sense needs to be used in order to define the proper luminaire IP rating for the intended application.
- Do not service the driver when the mains voltage is connected, this includes connecting or disconnecting the LED load as far as Core drivers are concerned.
- Do not cover the driver. Keep at least 5mm clearance around the top and both sides of the driver.
- Adequate protective earth and/or equipotential connections need to be provided whenever possible or applicable.

Signify Design-in support is available; please contact your Signify sales representative.
Introduction to Xitanium LED Indoor drivers
Spot & Downlight

Introduction
Xitanium LED Indoor Spot & Downlight drivers are designed to operate LED solutions for general indoor lighting applications such as downlighting and spot/accent lighting. In the coming years LEDs will continue to increase in efficiency, creating generation and complexity challenges for OEMs. 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 PCB solutions from different manufacturers.

Xitanium LED driver versions
The Xitanium LED drivers described in this guide are available in different versions 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 LED driver leaflet for the most up-to-date overview of our range. This leaflet can be found at www.philips.com/oem.

Xitanium LED driver segments
The Xitanium LED 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, fully programmable via the Philips MultiOne interface, configurable using the SimpleSet® feature via the Philips MultiOne interface and dimmable by means of DALI and Touch and Dim (TD). All statement drivers have the complete package of features like hotwiring, reduced ripple current, window functionality, LEDset, etc.

Performance drivers
Performance drivers have the same package of features like the statement drivers. The only difference is that these drivers are not programmable via MultiOne and DALI. Some performance drivers also 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.

Features
SimpleSet®
Philips SimpleSet new wireless programming technology allows luminaire manufacturers to quickly and easily program Xitanium LED 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) in case this provision is there in the selected driver. With the Touch and Dim (TD) drivers, the output current setting can also be programmed using the Philips MultiOne programming hardware interface and the matching software “MultiOne driver configurator”. Drivers with SimpleSet functionality 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 section Configurability.

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 smoothest and interference/flicker-free operation over the entire dimming range. See also p.35 on Temporal Light Artefacts and use of barcode scanners.

Wireless control
Select drivers can be controlled wirelessly via Casambi. This feature offers great flexibility without the need for additional control wiring.
Active cooling
Selected Xitanium LED drivers feature a 12VDC output to support active cooling. Please refer to the datasheet to find out whether a selected driver offers this feature.

Thermal derating
Thermal derating of an in-house designed LED PCB is possible by integrating a NTC (Negative Thermal Coefficient) resistor on the LED PCB. 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 (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 LED 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 for details. Please ensure that all electrical safety regulations are followed when working on a Xitanium driver while powered.

DC mains operation
Select Xitanium Indoor Spot & Downlight drivers are allowed to be connected to a DC power grid (e.g. central emergency system). The driver behavior once switched to DC input voltage can be programmed via MultiOne software on select drivers. More details about DC input voltage suitability and configurability can be found in the driver datasheet.

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 drivers only)**
The Corridor Mode is typically used in corridors, stairwells, entrance halls, storage rooms, etc. It is a simple function, available with the Xitanium Indoor Spot & Downlight TD LED drivers, 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 TD 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.

**Driver diagnostics (TD 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.
Linear housing design (LH)
The linear housing design incorporates three different mounting options:

- Independent
- Screw
- Click mounting

Screw-mounting and click-on parts are assembled within the independent housing.

Square independent housing design (SH)
The square independent housing is equipped with a 12VDC power output for active cooling, strain relief possibility for all cables and loop-through functionality for the mains wiring.

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.

Small housing design (/s)
The /s driver is the most compact Xitanium driver within the performance segment. It has a shape identical to the Philips HID-PrimaVision driver, enabling an easy transformation of your luminaire from HID to LED.

Mini housing design (/m)
The /m driver has a size which is exactly the same as the Philips HID-PrimaVision Mini driver, thus helping you to easily transform your 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.

Note: This 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.

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.
**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
- **/s**: small housing
- **SH**: Square independent Housing
- **WH**: Wide Housing
- **LH**: Linear independent Housing
- **/m**: mini housing (HID-PrimaVision mini form factor)

**Example: Xitanium 17W LH 0.3-1A 24V TD/Is 230V**

- **Xitanium**: Brand name for highly efficient and extremely reliable LED drivers
- **17W**: Maximum output power
- **LH**: Linear Housing
- **0.3-1A**: Output current range
- **24V**: Maximum output voltage
- **TD**: Dimming protocol (Touch & Dim + DALI)
- **/I**: Independent housing design
- **s**: Small version
- **230V**: Rated mains AC input voltage

**Use in explosive atmospheres**

**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

**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 mA, 530 mA or 700 mA. 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 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, current and power 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 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). The operating window of every driver can be found in the datasheet.

The output current of 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.

**Warning:** 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.

---

1. Required set point for the LED solution
2. Current can be set to needs within range
3. Driver adapts to required voltage, given it fits range
4. Driver minimum power limit
5. Driver maximum power limit

Example Operating window of a Xitanium driver

Note: by means of dimming it is possible to go below the minimum value of the specified output current.
**How to Select an appropriate driver**

Depending on application requirements, several drivers can be compatible. The following steps as shown below can help you in selecting the correct driver for the actual application. For a complete overview of the available drivers, please refer to [www.philips.com/oem](http://www.philips.com/oem).

1. Determine your required driver current ($I_{drive}$) and voltage ($V_f$).
2. Calculate the required power ($P_{drive}$) where $P_{drive} = V_f \times I_{drive}$ (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, in the 17W LH 0.3-1A 24V TD/Is 230V, the minimum driver current is 0.3 A and maximum is 1 A.
   - $I_{drive\ min} \leq I_{drive} \leq I_{drive\ max}$?
5. Does the required voltage fit the voltage range of the driver? The voltage range of the driver can be seen in the name itself. For example, in the 17W LH 0.3-1A 24V TD/Is 230V, the maximum driver voltage is 24 V and the minimum is ~50% of this value, which is 12V in this case. The exact value can be checked from the datasheet as well.
   - $V_{drive\ min} \leq V_f \leq V_{drive\ max}$?
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, in the 17W LH 0.3-1A 24V TD/Is 230V, the maximum output power is 17 W.
   - $P_{drive\ min} \leq P_{drive} \leq P_{drive\ max}$?
7. Choose your preferred dimming. Please refer to the section Driver naming to look up what the naming tells you about the possibilities.
Connectors

Different connectors are used on the Philips Xitanium Indoor Spot & Downlight drivers. More info about the type of connector and wiring (diameter, 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-poke-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.

Poke-in Connectors

Most Xitanium LED drivers now feature poke-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 poke-in options. 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 poke-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.

DALI – Touch Dim Connectors

Blue push-in connectors are used to connect the Touch & Dim + DALI connection wires to the driver.
Connection details poke-in connectors
Mains, 12VDC output and the LEDset/Rset connections are provided by poke-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 resistor, please refer to the picture shown. The resistor must be inserted such that there is no possibility of a short-circuit.

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 driver versions allow also setting of the output current via software configuration without the need for a resistor.

Warning: LEDset and Rset interface are not meant to be used as a control or dimming interface (for instance 1...10V). Otherwise, driver damage may result.

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 to the minimum value.

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

In case the LEDset connections are being short-circuited, 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 on p.12). 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.

Only exceptions are: the non-isolated Xitanium 36W and 75W Fixed Output drivers with the output current potentially reaching up to 133% of the specified I_{out,max} (530mA).
Programming enabled

<table>
<thead>
<tr>
<th>Yes</th>
<th>No</th>
</tr>
</thead>
<tbody>
<tr>
<td>I\textsubscript{nom} = Programmed value</td>
<td>I\textsubscript{nom} = Determined by Rset value</td>
</tr>
</tbody>
</table>

Rset connected

<table>
<thead>
<tr>
<th>Yes</th>
<th>No</th>
</tr>
</thead>
<tbody>
<tr>
<td>I\textsubscript{nom} ≤ I\textsubscript{driver min}</td>
<td>I\textsubscript{nom} ≤ I\textsubscript{driver max}</td>
</tr>
</tbody>
</table>

Driver output current I\textsubscript{nom} should always be

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

**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 the table on the left.

**Group 2: >1% minimum dim level**

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

1. If \text{programming} < \text{Rset} => priority for \text{programming}
2. \text{Rset} < \text{programming} => priority for \text{Rset}

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

**Note:** default current is stated in the driver’s datasheet in the download section on [www.philips.com/technology](http://www.philips.com/technology).

**Why a resistor?**

1. Worldwide standardized building block
2. Worldwide availability and well documented
3. Freedom for OEM to choose the value and supplier

**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

**Setting the output current via Rset**

By use of a resistor with a certain value (minimum 125mW/50V rated) you can determine the required current for the used LED module. 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 intended to become 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.

**Schematic block diagram of Rset**

```
Current
| Power ground |
| NTC (thermal derating) |
| LED module setting |
| Signal ground |

Fortimo/Xitanium LED Driver

LED engine
```

Note: default current is stated in the driver’s datasheet in the download section on [www.philips.com/technology](http://www.philips.com/technology).

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```
Current
| Power ground |
| NTC (thermal derating) |
| LED module setting |
| Signal ground |

Fortimo/Xitanium LED Driver

LED engine
```
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 current Xitanium indoor Spot & Downlight drivers have a maximum current of 1.5A. 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 functionality.

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 resistor value that is available to you if the exact determined value is not at hand.

To set the output current via LEDSet
Rset 1 and Rset 2 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
How does LEDset work

LEDset is based on a 3-wire connection between LED driver and one or more LED modules as shown in the figure on the left. Only one additional wire, besides the two LED current supply wires, is used for transferring information from the LED module(s) to the LED driver, provided the LEDset resistor is mounted on the LED module. Alternatively a standard resistor can be put directly into the driver LEDset connectors.

The LEDset interface measures the current $I_{set}$ which flows from a 5V constant voltage source within the LED driver through the LEDset resistor which is located either on the LED modules or directly at the driver LEDset connectors.

The current $I_{set}$ flowing through the LEDset resistor is determined by the equation:

$$I_{set}[A] = \frac{5[V]}{R_{LEDset}[Ω]}$$

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

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

Therefore the overall relationship between the setting resistor and the LED driver output current $I_{drive}$ is then given by:

$$I_{drive}[A] = (5[V] / LEDset[Ω]) \times 1000$$

To calculate the required resistor value for a desired drive current $I_{drive}$ use:

$$LEDset[Ω] = \frac{5[V]}{I_{drive}[A]} \times 1000$$

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

In addition, it is possible to add an over temperature protection circuit on the LED module which decreases the setting current in case of an over temperature event and thus limits or folds back the LED driver output current.
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.

**Datasheet LED driver:**
Look-up in section Features which Rset the driver reads

Read the next section, stating the Rset1 and Rset2 tables

Look-up in LEDset table the Ohm value that generates desired current

---

**LEDset resistor table (E96 series)**

<table>
<thead>
<tr>
<th></th>
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* Avoid leaving the LEDset interface as open-circuit or short-circuit. Always connect a LEDset resistor in the range of 2490 ... 100,000 Ohm. Leaving the LEDset interface open-circuit is supported, provided the driver supports disabling the AOC External Rset feature by MultiOne software.
Datasheet LED driver; Look-up in section Features which Rset the driver reads

If both Rset1 and Rset2 are supported, Rset2 is advised for future compatibility

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

Look-up in Rset1 table the Ohm value that generates desired current

Look-up in Rset2 table the Ohm value that generates desired current

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.

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### Rset priority behavior for drivers that read both Rset1 and Rset2

- **Open** Open Driver default current (see datasheet)
- **Rset** Open Rset1
- **Open** Rset Rset2
- **Rset** Rset Rset2
- **Short** Open Rset1 (driver minimum current, see datasheet)
- **Short** Short Rset2 (driver minimum current, see datasheet)
- **Open** Short Rset2 (driver minimum current, see datasheet)

Please refer to the datasheet of the driver you use to find which Rset or Rsets the driver actually reads.
Rset2 resistor table (E96 series), covering smaller increments but covering same range as the E24 series on previous page

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**Programming the output current**
The Xitanium TD drivers offer a full 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 installation. This can be done with the Philips MultiOne configurator. The MultiOne configurator is an intuitive tool that unlocks the full potential of all programmable 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. With the latest selected drivers, SimpleSet functionality is also supported via MultiOne. Please refer to the driver datasheet to find out whether your driver supports SimpleSet or not.

For more information on MultiOne go to the section Configurability or visit www.philips.com/multione. This site contains detailed information on how to install the software and how to program the driver.

**Mains operating conditions**
Xitanium Indoor Spot & Downlight drivers are designed for operation and performance by power sources or grids providing a clean and symmetric sinusoidal voltage wave form and do not support operation on power sources including but not limited to having e.g. a square-wave voltage or a “modified sine wave” form.

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 majority of our Xitanium Spot & Downlight drivers are rated for 250Vrms between the mains and the Touch & Dim control input, as can be caused by a different phase of the power grid in an installation in the field. Future drivers may have a value rated higher than 250 V by design.

**Low mains voltage**
A continuous low AC voltage (<198 V) may negatively the driver lifetime and should be avoided. 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.
High mains voltage
Xitanium Indoor Spot & Downlight drivers will survive an input overvoltage of 264 ... 320VAC for a period of max. 48 hours and 320 ... 350VAC for a period of max. 2 hours. However, running drivers at excessive high mains voltage will result in electrical overstress and will have an adverse effect on the lifetime. This condition must be avoided.

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

DC, DCemDim and Emergency operation
Depending on the Xitanium LED driver type, they are released in compliance with IEC 61347-2-13 Annex J or IEC 61347-2-7 lamp control gear standards. As a result these drivers are suitable for emergency luminaires in compliance with IEC 60598-2-22, excluding high-risk task areas. 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.

Note: All drivers rated for DC input voltage have an internal fuse rated for DC operation and do not require an external DC rated fuse. These drivers are compliant per CISPR15 for EMC performance when operating on a DC grid.

Note: The allowed DC voltage range accepted by the driver is stated in the driver datasheet. Socalled “joker” input voltage is supported. Values outside the specified DC input voltage range will have an adverse effect on the driver performance. Drivers which do not support DC operation must not be connected to a DC grid.

On selected drivers DCemDIM is available, allowing a predefined dim level of the driver’s output when switched to DC. More on setting parameters of DCemDIM can be found in the section for Controllability. For specific input requirements, please check 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).
To Determine the Number of Drivers on a MCB

The maximum 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 an 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 differ per driver and 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 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.

<table>
<thead>
<tr>
<th>MCB type</th>
<th>Rating (A)</th>
<th>Relative number of LED drivers (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>B 2</td>
<td>16</td>
<td>100 (reference)</td>
</tr>
<tr>
<td>B 10</td>
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<tr>
<td>K, III 10</td>
<td>10</td>
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</table>

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

Philips has successfully performed EMC tests for systems with a 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 length exceeds 60cm.
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 ground 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 Philips 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 metal parts electrically insulated. Always connect the driver FE/EQUI connector (if present) for equipotential bonding.
Insulated drivers (SELV output) + loopthrough

These 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 earth terminals on the driver housing indicates the possibility of either termination of the PE conductor or to serve other (Insulation Class I) equipment (feed-through) in independent applications. These drivers are inherently classified as Insulation Class II equipment by construction and certified as such; they do not rely on a PE connection for safety.

This means that these isolated drivers (SELV output) can be used in both Insulation Class I and Class II applications under the following conditions:

- **Built-in use Insulation Class I 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 the PE conductor present in the luminaire may be connected 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 PE connectors to any accessible luminaire part as only basic insulation is present between the PE connectors and mains (live parts)! The only way to reconstruct the double/reinforced insulation associated with Insulation Class II will then be to isolate 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.

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

- **Independent use:** when using the E-terminal for feeding through to other (Insulation Class I) equipment it must always be connected to Protective Earth (PE): the E-indication is uniquely reserved for connection to PE.

**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_{rem} <120 Vdc and that the output circuitry is double-insulated from the mains input.

---

**SELV**

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

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**Indication of Protective Earth (PE) conductor looping-in (feed-through) to other (Insulation Class I) equipment: functionality 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 directly depicted on the abel of the driver.**
Introduction

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 programmable 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. Programming of drivers can be done via the DALI interface (when present) or via SimpleSet.

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

Introduction
This chapter describes two aspects of the thermal design of the Xitanium indoor Spot & Downlight drivers:
1. The driver itself and relationship between Tc point and lifetime of the driver
2. Module Temperature Protection (MTP) function to ensure lifetime of LED module/PCB.
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 (t_c point)
To achieve optimal lifetime and reliability, it is critical that the temperatures of the components in the driver remains within their ratings. The driver case point temperature (t_c) is a reference for the temperatures of the critical internal driver components. The location of the tc point is identified on the driver type plate and is marked by a ● or * symbol.

How to measure t_c point temperature
Its temperature can be measured using a thermocouple that is firmly glued to the surface of the driver housing. For a representative measurement the temperature of the temperature case 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 temperature and ambient
The t_c temperature increases, by approximation, linearly with the driver ambient temperature (t_a). The temperature offset between driver t_c and t_a depends on the thermal design of the luminaire and the actual delivered output power relative to the specified nominal output power. A lower output power allows for a higher driver ambient temperature as long as the maximum specified driver t_c(max) temperature is not exceeded.

There are two driver t_c values specified with corresponding lifetimes: t_c(life) and t_c(max). The values may be equal or different, depending on driver type. The rated driver lifetime can be achieved if the t_c value remains between t_c(min) and t_c(life). Reduced driver lifetime will result if the driver is running up to t_c(max). The approved driver ambient temperature range and specified t_c(life) and t_c(max) values and corresponding driver lifetimes are specified in the driver datasheet.

Warning: The specified t_c(max) and minimum t_a temperature limit values are not allowed to be exceeded in the application; otherwise 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 t_c point temperature or any other surface hotspot- will not 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.
**LED Module Temperature Protection (MTP)**

This feature helps to protect the LED module when operated during abnormal thermal application conditions. The thermal design of a LED module should be designed in such a way that the specified temperature of the LED module ($t_{c\text{(life)}}$ or $t_{c\text{(max)}}$) is not exceeded under normal application conditions. The utilization of an NTC resistor interface (Negative Temperature Coefficient resistor) serves the purpose to help achieve the useful lifetime of the LED module if external thermal influences result in the temperature for lifetime $t_{c\text{(life)}}$ being exceeded. If this occurs then the light output will be reduced to keep the temperature of the LED module below a predefined critical temperature.

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

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

**MTP behavior setting (programmable drivers only)**

It is possible to set the temperature at which the MTP feature is activated, defined by “MTP warn” and the slope, defined by “MTP max”. Using the MultiOne Configurator software these settings can be changed.

**Example: setting the thermal de-rating point via NTC**

See the graph below. The LED driver will start reducing the light output when the NTC reaches a value of 2900 Ω. The NTC should be selected such that 2900 Ω represents the desired critical temperature inside your LED module/PCB.

E.g. the Fortimo LED DLM Gen3+ LED module has a defined $t_c$ life of 65 °C. Taking the tolerances of the NTC into account results in ±5 °C variation. This gives a typical value for the NTC of 71 ±5 °C. By choosing this setting of 71 °C, we ensure that the driver will not dim the output, due to a too high temperature, before the module reaches 65 °C. The following graph shows a typical R vs. T curve of the NTC resistor. To match 2900 Ω at this temperature, the NTC of 15 kΩ has been selected.

![Graph showing R vs. T curve of the NTC resistor](image-url)
Controllability

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 the new digital Xitanium drivers (The dimming range can be found in the datasheet). The control input complies with EN 60929 (Annex E) and is compatible with Philips Lighting control equipment

Standby power: < 0.5W
Control input insulation: basic, ≥ 1500 VAC

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 16 V (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 short circuit or open circuit
- Select between logarithmic or linear dimming curves
- ...

For more information on driver compliance per DALI, refer to www.digitalilluminationinterface.org/products for latest status.
Wireless control (Casambi)
Select Philips Xitanium indoor point LED drivers support wireless control based on Casambi protocol. These drivers can be recognized by the suffix CD in the driver name and 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).

During integration of the CD driver in a luminaire one has to pay attention that the driver antenna communication with external control devices is not blocked by nearby metal luminaire planes. As a starting point, it is recommended to provide a 2x4 cm window close the antenna position in order to allow over the air communication to enter and exit the luminaire. Whether this window size is sufficient needs to be verified in the actual application.

For more information on Casambi please visit: https://casambi.com/
Touch and Dim (TD)
For Xitanium drivers with Touch and Dim function a switched mains is used to dim the light. The switching ON and OFF is also done via this control input. This means that it is no longer necessary to use a power switch to interrupt the mains circuit. The 230 V supply voltage is always available at the LED driver (even when switched OFF), and light can be switched or dimmed by momentarily connecting the mains to the dim input. A short push will switch the lighting on or off, depending on the previous situation. If the switch is held pushed in, the light will dim up or down, depending on what is opposite from the last dimming direction. The driver will count the number of mains cycles and act on that.

Touch and Dim function Contact duration Driver function
Ignore < 40ms Disregard push
Short push >40 ms and <0.5s Toggle the lamp ON/OFF
Long push >0.5s and <10s Dim the lamp up or down
Reset push >10s Synchronize drivers
Corridor (if applicable) >60s Switch to Corridor mode

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 number of drivers, which is 30 per dimming unit. If there is a power failure, the driver will store the current light level. As soon as mains power returns, the driver will recall this stored light level. If it was dimmed to e.g. 50%, it will come back at 50%. If it was switched off, it will remain switched off.

If the installation has to be extended by one or more luminaires then the dimming direction of the newly connected luminaires may be different from that of those already connected. To solve this problem a synchronization feature is incorporated in the drivers and it can be invoked at any time. If the switch is pressed for at least 10 seconds all drivers will go to a predefined 37% light level and the dimming direction will be set to downwards.

Light level for Upper and lower limits for dim direction
Upper toggle limit: 70% (DALI arc level 241)
The lower toggle limit can be calculated as follows:
lower toggle limit = physical minimum level + 10%
Some examples are given in the following Table:

<table>
<thead>
<tr>
<th>Dim range 1-100%</th>
<th>Dim range 5-100%</th>
<th>Dim range 10-100%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Light level</td>
<td>DALI arc level</td>
<td>Light level</td>
</tr>
<tr>
<td>Lower toggle limit</td>
<td>11%</td>
<td>15%</td>
</tr>
<tr>
<td>173</td>
<td>185</td>
<td>195</td>
</tr>
</tbody>
</table>
**Trailing Edge (TE) phase-cut dimming**

Trailing edge 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. The TE compatible Xitanium LED drivers are tested during the development of the Xitanium LED drivers with the list below of recommended TE dimmers.

<table>
<thead>
<tr>
<th>Manufacturer</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>SG</td>
<td>LEDDIM 400</td>
</tr>
<tr>
<td>Elko</td>
<td>316 GLED</td>
</tr>
<tr>
<td>Elko</td>
<td>315 GLE</td>
</tr>
<tr>
<td>Elko</td>
<td>315 GLE 2-pol</td>
</tr>
<tr>
<td>Micromatic</td>
<td>UNILED+ 325</td>
</tr>
<tr>
<td>Moeller Eaton</td>
<td>x-comfort, type CDAE-01/02</td>
</tr>
<tr>
<td>Elko</td>
<td>420 GLE/I</td>
</tr>
<tr>
<td>Elko</td>
<td>630 GLE</td>
</tr>
<tr>
<td>ABB</td>
<td>Busch 2247U</td>
</tr>
<tr>
<td>ABB</td>
<td>6523 UC3GL</td>
</tr>
</tbody>
</table>

**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.

**Application guidelines**

**TD as fixed output**

When a TD driver is used without any controls, it operates as a fixed output driver. However, fluctuations on the power line or other similar interferences might trigger a Touch & Dim lamp OFF command (this issue does not exist in the latest drivers). Due to the fact that no control interface is connected, the system cannot be switched on again. To prevent this, Philips recommends to shortcut the DALI interface. The DALI interface is also used for connecting the Touch & Dim controls and by shortcutting this interface, accidental triggering of OFF commands is prevented. DALI shortcutting is required for the following drivers:

<table>
<thead>
<tr>
<th>Driver</th>
<th>12nc Code</th>
</tr>
</thead>
<tbody>
<tr>
<td>Xitanium 50W 0.3-1A 62V TD/TE 230V</td>
<td>9290 006 61203</td>
</tr>
<tr>
<td>Xitanium 50W SH 0.3-1A 62V TD/TE/I 230V</td>
<td>9290 006 17203</td>
</tr>
<tr>
<td>Xitanium 50W LH 0.3-1A 62V TD/TE/I 230V</td>
<td>9290 006 17103</td>
</tr>
<tr>
<td>Xitanium 25W 0.3-1A 36V TD/Is 230V</td>
<td>9290 004 85803</td>
</tr>
<tr>
<td>Xitanium 25W 0.3-1A 36V TD/I 230V</td>
<td>9290 006 00403</td>
</tr>
<tr>
<td>Fortimo LED driver 1100-3000 TD</td>
<td>9290 004 65003</td>
</tr>
<tr>
<td>Fortimo LED driver 1100-3000 TD/I</td>
<td>9290 004 65203</td>
</tr>
</tbody>
</table>

For all other drivers, this is not necessary. If control cables are already connected to the control input of the LED-driver but are not yet in use, it’s advised to short-circuit these cables.
RC filter for Touch and Dim interfaces
When a Touch and Dim interface is used that works with the mains AC voltage (Touch & Dim can work with several voltages) and in combination with long cable lengths, big voltage peaks might occur. These voltage peaks can have an unwanted effect on the performance of some of the Xitanium LED drivers. To prevent this it is recommended to add a simple RC (using a positive temperature coefficient thermistor) filter in the system for every Touch and Dim interface that is used for the select drivers listed below. The picture on the left shows the diagram of a Touch and Dim controlled system with the extra RC-filter. The RC filter consists of following components:

- **PTC Resistor:** \( R = 80-150 \text{ Ohm} \) \hspace{1em} **Max Voltage Rating** \( >250 \text{ V} \)
- **Capacitor:** \( C = 330 \text{ nF} \) \hspace{1em} **Type** X2 275VAC

The following drivers need an RC filter for the Touch and Dim interfaces:

<table>
<thead>
<tr>
<th>Driver</th>
<th>12nc Code</th>
</tr>
</thead>
<tbody>
<tr>
<td>Xitanium 50W 0.3-1A 62V TD/TE 230V</td>
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<td>Xitanium 50W SH 0.3-1A 62V TD/TE/I 230V</td>
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<tr>
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<td>Fortimo LED driver 1100-3000 TD</td>
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</tr>
<tr>
<td>Fortimo LED driver 1100-3000 TD/I</td>
<td>9290 004 65203</td>
</tr>
</tbody>
</table>

**Temporal Light Artefacts (flicker & stroboscopic effects)**
A small inherent ripple is superimposed on the DC output current of Philips LED Xtreme drivers. 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 Artefacts (flicker & stroboscopic effects) with camera systems other than possibly those for high-speed slow-motion HD recording is not 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 value \( (\text{Pst}\_\text{Im}) \) and Stroboscopic Visibility Measure \( (\text{SVM}) \) 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.
To Connect to and program a TD driver
Connecting to a programmable driver

Xitanium Indoor Down- and Spotlight LED drivers are programmed via the Philips MultiOne configurator software. To do so, the driver must be connected to the computer via the MultiOne hardware interface. This can be done with TD drivers only. Please refer to the driver datasheet for the driver programming capability.

For the latest version of the MultiOne configurator software and detailed description on the possibilities, please check www.philips.com/multione.

To see the programming taking effect
Programming time

Depending on the selected features to program, the programming time varies between 2 - 15 seconds. It is possible to program up to 64 drivers at the same time. In case of group programming there is no individual confirmation (verification) from each driver.

In order to have the programmed values take effect for Xitanium Indoor Spot & Downlight LED drivers, the mains power needs to be cycled. For newer drivers (1% minimum dim level) a On/Off command via standby is also sufficient.
## Quality

### Compliance and approval

<table>
<thead>
<tr>
<th>Standard</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>EN 55015 A2/CISPR15</td>
<td>Conducted EMI 9 kHz-30 MHz</td>
</tr>
<tr>
<td>EN 55015 A2/CISPR15</td>
<td>Radiated EMI 30 MHz-300 MHz</td>
</tr>
<tr>
<td>IEC 61000-3-2 A1 + A2</td>
<td>Limits for harmonic current emissions</td>
</tr>
<tr>
<td>IEC 61000-3-3</td>
<td>EMC – Limitation of voltage fluctuation and flicker in low voltage supply systems for equipment rated up to 16 A</td>
</tr>
</tbody>
</table>

### Immunity

<table>
<thead>
<tr>
<th>Standard</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>IEC / EN 61547, A12000</td>
<td>Equipment for general lighting purposes – EMC immunity requirements</td>
</tr>
<tr>
<td>IEC / EN 61000-4-2</td>
<td>Electrostatic Discharge</td>
</tr>
<tr>
<td>IEC / EN 61000-4-3 A1</td>
<td>Radiated radio frequency, electromagnetic field immunity</td>
</tr>
<tr>
<td>IEC / EN 61000-4-4</td>
<td>Electrical fast transient/burst immunity</td>
</tr>
<tr>
<td>IEC / EN 61000-4-5</td>
<td>Surge immunity</td>
</tr>
<tr>
<td>IEC / EN 61000-4-6</td>
<td>Conducted disturbances induced by RF fields</td>
</tr>
<tr>
<td>IEC / EN 61000-4-11</td>
<td>Voltage dips, short interrupts, voltage variations</td>
</tr>
</tbody>
</table>

### Performance

<table>
<thead>
<tr>
<th>Standard</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>IEC 62384</td>
<td>DC or AC supplied electronic control gear for LED modules - Performance requirements</td>
</tr>
<tr>
<td>IEC 62386</td>
<td>Digital Addressable Lighting Interface (DALI)</td>
</tr>
</tbody>
</table>

### Safety standards

<table>
<thead>
<tr>
<th>Standard</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>IEC 61347-1</td>
<td>General and safety requirements</td>
</tr>
<tr>
<td>IEC 61347-2-13</td>
<td>Particular requirements for DC or AC supplied electronic control gear for LED modules</td>
</tr>
</tbody>
</table>

### Emergency standards

<table>
<thead>
<tr>
<th>Standard</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>IEC 61347-2-13 Annex J</td>
<td>Particular additional safety requirement for AC, AC/DC or DC supplied electronic control gear for emergency lighting</td>
</tr>
<tr>
<td>IEC 61347-2-7</td>
<td>Particular requirements for DC supplied electronic ballasts for emergency lighting</td>
</tr>
</tbody>
</table>

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.

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