

PHILIPS

Outdoor driver

Xtreme Surge
Protector



Design-in Guide

**Protect your outdoor
luminaires** against damaging
spikes and transients

March 2015

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Introduction to this guide



Philips Xtreme Surge Protector

Thank you for choosing the Philips Xtreme Surge Protector. These products will help protect your Outdoor luminaires against destructive spikes and transients, including high voltage and high current surges caused by indirect lightning strikes. This Design-in Guide provides instructions on how to install the Xtreme Surge Protector in your luminaire.

Information or support

If you require any further information or support please consult your local Philips office or visit:

Support

www.philips.com/support

[Xitanium drivers](http://www.philips.com/xitanium)

www.philips.com/xitanium

[OEM general info](#)

www.philips.com/technology

Attention point



Warning:

- Before installation or maintenance, switch off the power
- Avoid touching live parts

- Do not use damaged or defective contacts or housings.
- Do not use damaged products.
- Do not service the Xtreme Surge Protector when the mains voltage is connected.
- The luminaire manufacturer is responsible for its own luminaire design, this has to comply with all relevant safety standards.
- The Xtreme Surge Protector is intended for built-in use and should not be exposed to the elements such as snow, water and ice. It is the luminaire manufacturer's responsibility to prevent exposure.

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

Xtreme Surge Protector



Philips Xtreme Surge Protector I

The Philips Xtreme Surge Protector I is designed exclusively for use in insulation Class I outdoor luminaires.

Types of surge protection devices

The International Electrotechnical Commission (IEC) standard IEC/EN61643-11:2011 recognizes three types of surge protection devices.

Type 1

- Type 1 is recommended in specifically for service-sector and industrial buildings.
- The device is protected by a lightning protection system or a mesh cage. It protects electrical installations against quasi-direct lightning strikes.
- Type 1 is characterized by a 10/350 μ s current wave.

Type 2

- Type 2 is a common protection system for all low-voltage electrical installations. Installed in an electrical switchboard, this device prevents the spread of spikes and transients in electrical installations and protects the loads.
- Type 2 is characterized by an 8/20 μ s current wave.

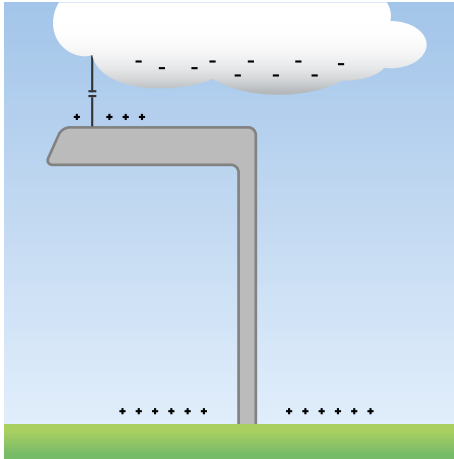
Type 3

- Type 3 is characterized by a combination of voltage waves (1.2/50 μ s) and current waves (8/20 μ s) and is intended mainly for local protection of sensitive equipment.

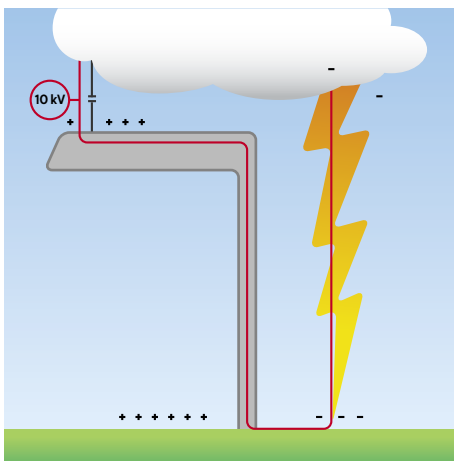
The Philips Xtreme Surge Protector is classified as Type 3 products

Compatibility with other products

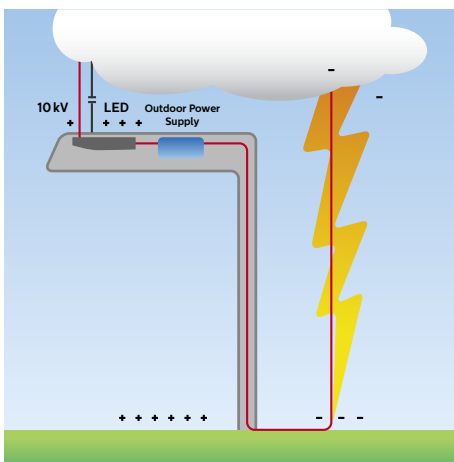
The Philips Xtreme Surge Protector can be used in combination with various electronic control gears for different lamp types (e.g. LED, HID and fluorescent lamps). It adds additional surge protection to a gear which has its own built-in surge protection. In this design-in guide the focus will be only on LED applications.



Charge build-up



Large currents caused by indirect lightning hit



Surge currents damage to the luminaire

Challenge for Outdoor lighting

Outdoor luminaires are used in various types of applications, such as street and road lighting, parking areas and tunnels. In many of these installations there is a risk of extreme surges (e.g. those caused by lightning strikes).

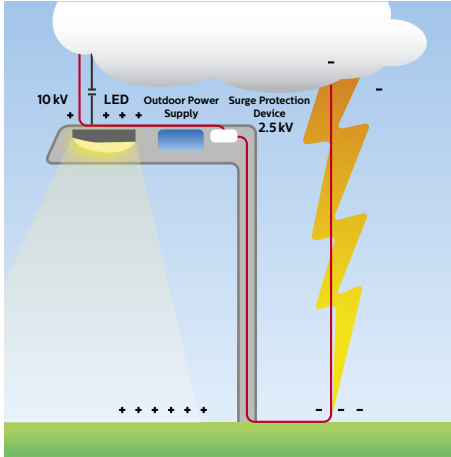
A direct hit will most likely destroy the electrical components in a luminaire. Even an indirect hit near the lighting installation might cause severe damage.

Charge is built up between the cloud and earth, until the potential difference between cloud and earth is high enough to initiate a lightning strike. Following the strike, the charge on the luminaire is returned from the luminaire via line & neutral back to the cloud (red line) since current always flows in a closed loop back to its origin.

A voltage between the L and N terminals of the driver (differential mode) as well as between the driver terminals and the luminaire (common mode) is being built up and an electrical breakdown between mains wiring and the luminaire will occur.

The resulting surge voltage and surge current of this electrical breakdown can reach critical levels which can destroy the driver and/or LED module. The path of the surge current can go through the LED module and the driver (shown in the red line) or through the driver only as shown in third figure on the left.

Alternatively, in a TT distribution system where an insulation Class I luminaire is applied, a lightning strike at some distance may cause high common mode energy surge on the mains lines where the local earth connection forms the return path. In that situation, a high common mode voltage will stress the driver and LED module.



Surge currents are diverted from the LED module and driver via the Surge Protector, protecting the luminaire

Surge protection as solution

A reliable way to increase the outdoor luminaire protection against excessive surges is to use the Philips Xtreme Surge Protector.

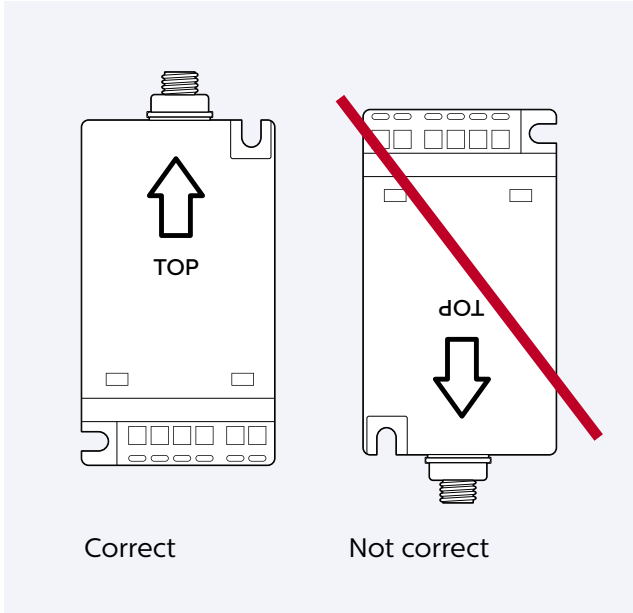
The Xtreme SPD will limit the differential and common mode surge voltage build-up inside the luminaire while at the same time offering a diversion path with a lower breakdown voltage. The energy of the voltage surge is returned as a surge current, via the Xtreme SPD, to ground and eventually back to the cloud. As such, it will protect both the driver and LED module against damaging surge stress. See figure on the left.

The Xtreme SPD is capable of handling multiple surges with a nominal voltage up to 10 kV and current up to 10 kA.

The Xtreme SPD has to be connected to the protective earth connection of the luminaire.

Please refer to Electrical design for more information.

Mechanical design



Mounting direction

Casing

The Philips Xtreme Surge Protector is suitable for use in all outdoor luminaires. Thermally protected Voltage Dependent Resistors (VDR) and surge arresters are used internally for surge protection. The design assures good thermal stability of the Xtreme SPD over lifetime and a low case temperature even if the device is used beyond its end of life.

The Xtreme SPD has been tested for thermal stability and is compliant with standards IEC/EN61643-11.

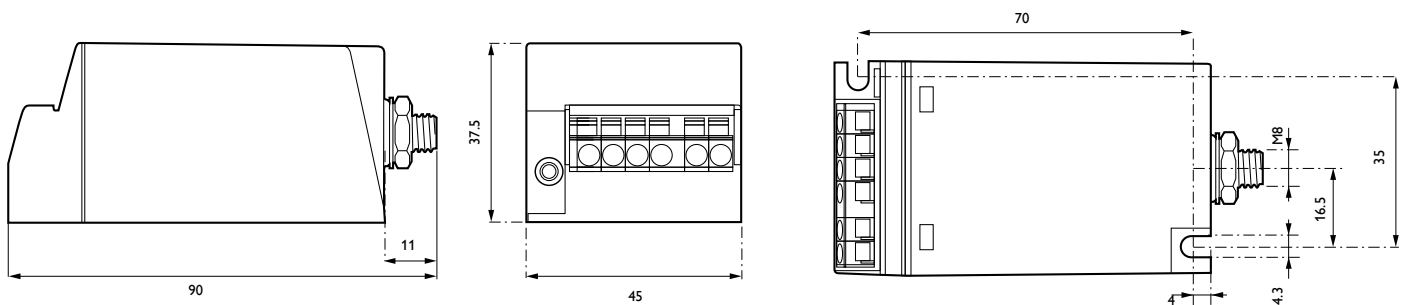
Installation

The Xtreme SPD is released as a built-in device and is intended for mounting inside a luminaire. Remote mounting of the Xtreme SPD such as in a pole or switching cabinet is not recommended since it may reduce its surge protection effectiveness and it may be subject to ingress of water and dirt.

On the label you will find an arrow indicating the mounting position of the product. It is important to mount the device with the connection terminals facing downward to prevent any damage resulting from water entering the product.

Product dimensions

Specification item	Value	Unit
Mounting length	70	mm
Overall length	90	mm
Case Width	45	mm
Case Height	37.5	mm
Fixing hole diameter	M4	
Fixing screw type	M8	
Max. screw torque	0.8	Nm
Weight	66/70	gr



All dimensions are mentioned in mm

CAD drawings

3D CAD drawings are available on www.philips.com/technology or available via your local sales representative.

SPD connections

The Xtreme SPD connectors are capable of handling solid core and stranded wires with a cross sectional area of 0.5 ... 2.5 mm². Required strip length: 10 ... 11 mm. Maximum allowable steady-state current through the connectors in 20 A.

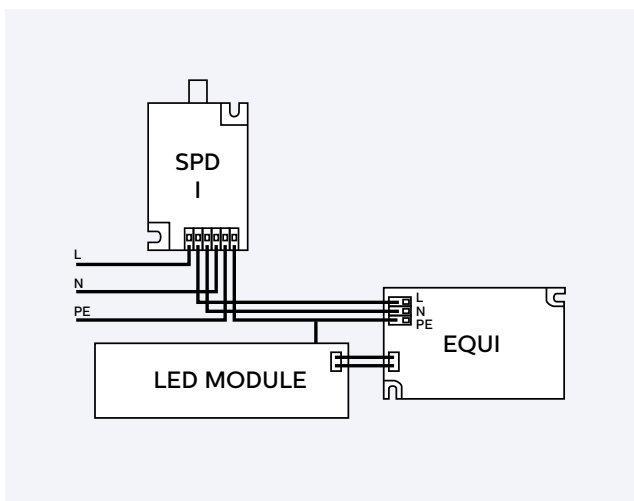
The SPD should be connected as shown in figure's on the left in order to achieve optimal surge protection.

Connection Xt SPD I

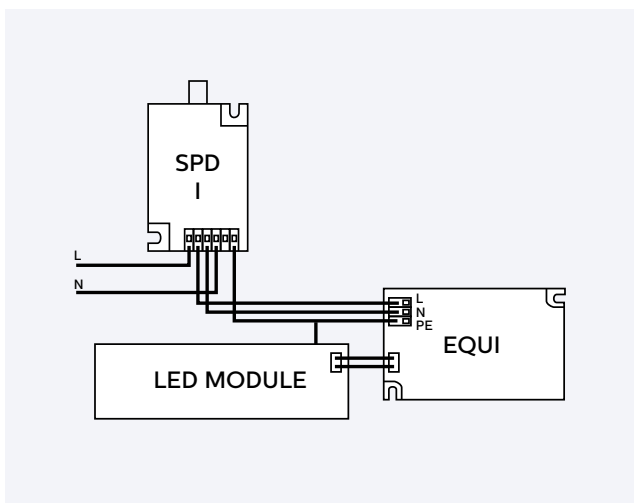
Signal	Description	Color
LINE	Line connection	Black
LINE	Line connection	Black
NEUTRAL	Neutral connection	White
NEUTRAL	Neutral connection	White
GND	Ground connection	Green
GND	Ground connection	Green

Failure indicator

The Xtreme SPD is equipped with an optical failure indicator by means of a green indicator light. If mains voltage is applied and the indicator light is off then the Xtreme SPD needs to be replaced.



Recommended SPD connection with PE available



Recommended SPD connection with no PE available



Warning:

The configuration on the left is only possible with isolated LED module!!

Electrical design



Warning:

- Before installation or maintenance, switch off the power
- Avoid touching live parts

Protection levels

The figure's on the left show the clamped 1.2/50 μs surge voltage differential mode and common mode waveforms and its protection levels U_p as function of clamped 8/20 μs surge current I_c .

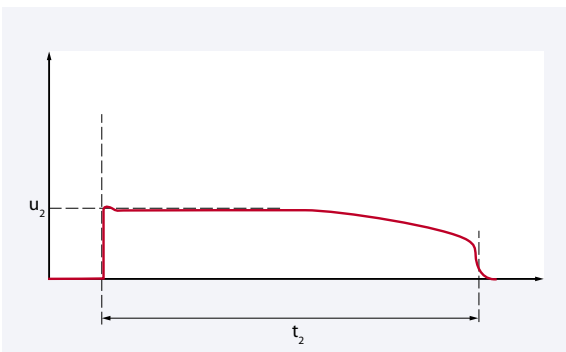
The tables lists the protection level values as function of the clamped surge current I_c .

The initial common mode clamping voltage U_1 has an extreme short duration (approx. 100 ns) and will be completely absorbed by the driver; it will not result in significant surge stress to the connected LED module and can be ignored.

Xt SPD I

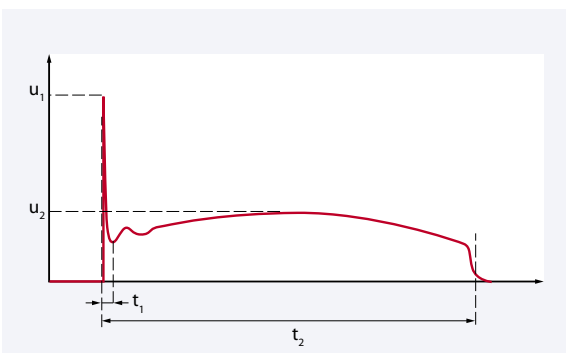
I_c 8/20 μs	Differential mode U_2	Common mode U_1/U_2
1 kA	1100 V	1100 V / 1050 V
3 kA	1250 V	1700 V / 1300 V
5 kA	1350 V	1800 V / 1450 V
10 kA	1500 V	1900 V / 1850 V

Protection level U_p



Differential mode L-N

Protection level U_p



Common mode (L+N – PE, L+N – ground)

Wiring

Achieving the specified protection levels on page 10 is possible if:

- incoming mains wires are routed first to the Xtreme SPD and from there on to the driver input.
- mains wires between the Xtreme SPD and driver are kept as short as possible.
- ground wire between the Xtreme SPD and the luminaire housing / LED module heatsink is kept as short as possible.

It is therefore not recommended to remotely mount the Xtreme SPD such as in a pole or remote distribution box. In cases remote mounting is the only option, it is necessary to perform additional measurements in the luminaire to define the maximum achievable protection levels.

When connecting the Xtreme SPD, it is strongly advised to adhere to the following EMC guidelines:

- keep all wires short
- keep wiring loop areas small
- ensure that mains wires are kept separate from low-voltage signal circuit wires.

Respecting these rules, will minimize the distance and wire length between the Xtreme SPD and the mains voltage entry point.

Insulation Class I and Class II luminaires

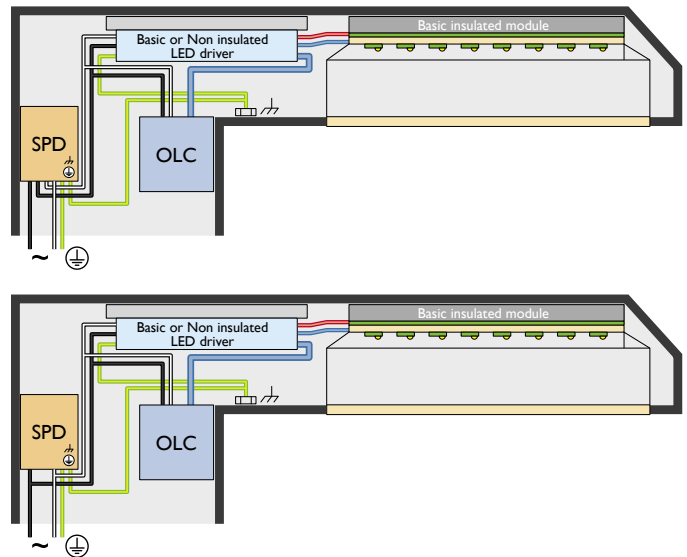
The main differences between an insulation Class I and insulation Class II luminaire are about its fail-safe construction with respect to electrical safety.

In a Class I luminaire, electrical safety is achieved by a combination of basic insulation between live parts and accessible parts and establishing a protective earth connection (PE) to accessible parts (luminaire housing). Luminaire insulation strength is based on basic system insulation requirements.

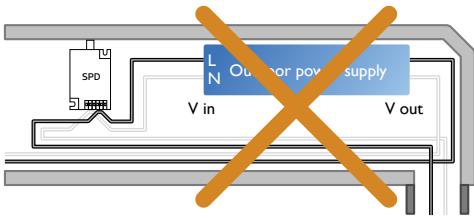
A Class II luminaire does not have a protective earth. In this case, electrical safety is achieved by providing double or reinforced insulation which are subject to elevated insulation strength requirements.

Wiring in an insulation Class I luminaire

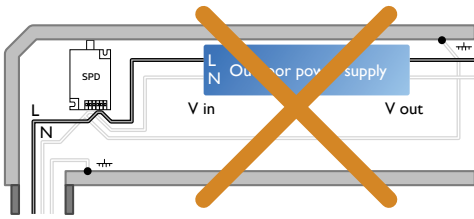
In an insulation Class I luminaire, both Xtreme SPD versions (I and I/II) are suitable. This configuration offers product safety as well as optimal protection against high surges.



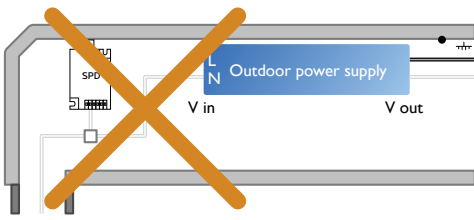
Correct wiring in an insulation. Class I luminaire



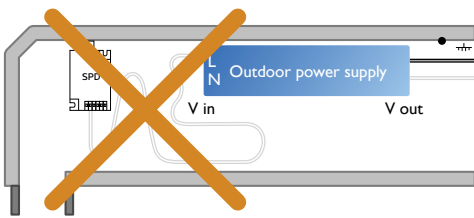
Example of Incorrect wiring



Example of Incorrect wiring



Example of Incorrect wiring



Example of Incorrect wiring

Incorrect wiring

If the Xtreme SPD is not wired correctly then it will not be able to protect up to the specified protection levels and damage to the luminaire may result.

Examples of incorrect wiring include:

- Installing unprotected wires (wires which are not routed through the Xtreme Surge Protector) in parallel with the protected output wires of the driver
- Crossing of mains and output wires, mains and output wires bundled together.
- Crossing of unprotected and protected wires
- Not connecting the input and output wires as a star point to the SPD
- Unnecessary long wiring between the SPD and the driver.
- Unnecessary long ground wiring between the SPD and protective earth or luminaire chassis.

Fusing and mains power distribution system

Standard outdoor applications require fusing to protect the installation. Fusing above 20 A is not allowed when applying the Xtreme SPD. Lower fusing values are allowed but may require shorter fusing servicing intervals since lower fusing values can handle less surge events before tripping.

The SPD has a power consumption below 0.01 W and does not impact the inrush current so luminaire fusing is not affected by the Xtreme SPD.

In a TN mains power distribution system the neutral conductor (N) is connected to the earthed star point of a distribution transformer and is either connected to the star point via a separate conductor (TN-S) or it is (partly) combined with the protective earth conductor (TN-C, TN-C-S). The Protective Earth (PE) wire is also connected to the same star point and part of the distribution wiring to the end user.

In a TT mains power distribution system, the PE conductor is not part of the distribution wiring to the end user. Protective earth is locally sourced at the end user by means of an earth pin.

In an IT mains power distribution system, the star point of the distribution transformer is isolated from earth. The N and PE conductors are not wired to the end user. The end user has to source a local earth conductor if needed.

Insulation class	Application field					
	TN	TNC	TNS	TNCS	TT	IT
Class I	✓	✓	✓	✓	✓	✓

The Surge Protector I is released for these distribution systems

Insulation class	Application field					
	TN	TNC	TNS	TNCS	TT	IT
Class II	✓	✓	✓	✓	✓	✓
Class I	✓	✓	✓	✓	✓	✓

The Surge Protector I/II is released for these distribution systems

Quality / Testing

Compliance testing during luminaire release and manufacturing

The guidelines below describe how to test a Class I luminaire with the Philips Xtreme Surge Protector.

Type testing of luminaire (at certified body):

Overvoltage protective devices which are connected to earth or a ground point shall be used only in fixed luminaires. A fixed luminaire is a luminaire that cannot be easily moved from one place to another, either because the fixing is such that it can only be removed with the aid of a tool, or because it is intended for use out of arm's reach.

Overvoltage protective devices which comply with IEC 61643 can be disconnected from the circuit for the dielectric strength test of IEC60598-1 sub clause 10.2.2, but only for fixed luminaires.

Factory testing (100%)

The ENEC 303 advises routine testing for luminaire manufactures to test electric insulation strength of insulation Class I luminaires as described in clause 1.3 (also known as high-pot test). Due to the nature of the Philips Xtreme SPD I, an insulation strength test would automatically result in a failure as the trigger level of the Xtreme Surge Protector I is below the testing voltage. In such a case, the note described in clause 1.3 allows that the insulation test may be carried out applying 500 VDC for 1 sec, with the insulation resistance of not less than 2 MΩ.

Sustainability

All components and materials used in the Xtreme Surge Protector is RoHS / REACH compliant.

Standards

Standaard	Description
IEC61643-11	Surge protective devices connected to low-voltage power distribution systems
SPD specified for test class	T3



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Data subject to change.



www.philips.com/surgeprotection