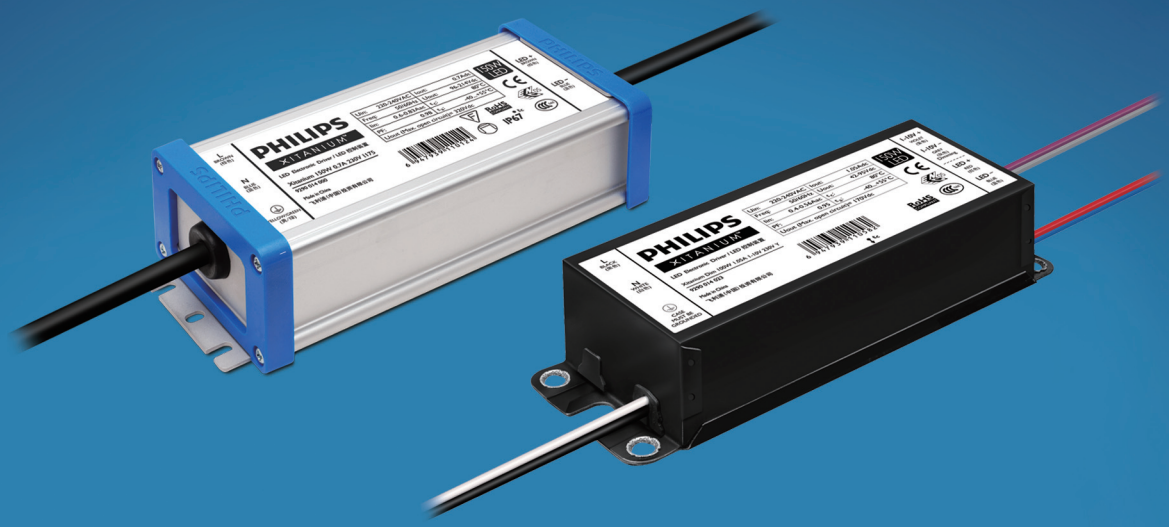
PHILIPS

Xitanium

LED outdoor drivers



Design-in Guide

Philips Xitanium Outdoor LED drivers

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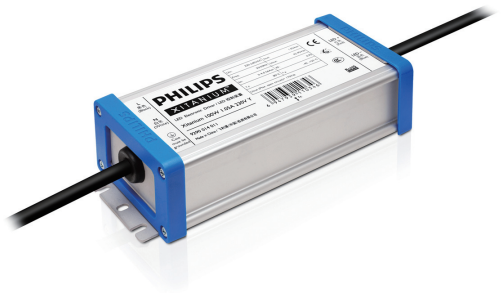


Example of IP67 Independent version

Example of Built-in version

Thank you for choosing Philips Xitanium Outdoor 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 Outdoor LED drivers optimized for outdoor application. We advise you to consult our websites for the latest up-to-date information.

Applications

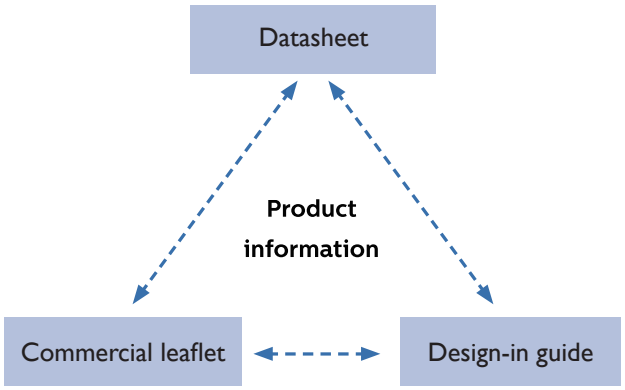
The Xitanium Outdoor LED drivers are designed to operate LED solutions for outdoor lighting, like flood, street, road lighting and open area environments. If you use Philips LED drivers in combination with Philips LED modules, specific design-in guides are available from below mentioned technology websites.

Classification

The Xitanium Outdoor IP67 classification independent & built in drivers listed below can only be used in:
Class I IEC isolation systems

Information or support

Please consult your local Philips office or visit:
www.philips.com/technology



Determine which documents contain what information

In order to provide information in the best possible way, Philips' 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 is to be designed-in

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

Safety precautions

Warnings:

- Avoid touching live parts!
- Do not use drivers with damaged housing and/or connectors!
- Do not use drivers with damaged wiring!
- Class I luminaires must be connected to protective earth!
- Do not service the driver when the mains voltage is connected; this includes connecting or disconnecting the LED load.

Safety warnings and 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.
- For the drivers with IP-rated connectors, the installers shall check that the seal of the connector is present and not damaged before connecting the male/female connectors.
- For connector version drivers, when luminaire manufacturers choose to cut off the connector, the original IP-rating cannot be guaranteed and becomes the responsibility of the luminaire manufacturers.
- The luminaire manufacturer is responsible for its own luminaire design and has to comply with all relevant safety standards.
- Philips offers the LED outdoor drivers with two different housing designs, built-in and independent. The built-in type drivers should not be exposed to the elements such as snow, water and ice. Exposure will lead to corrosion and even failure of the driver what should be avoided. It is the luminaire manufacturer's responsibility to prevent exposure.
  The independent type drivers can be exposed to the outdoor elements and installed apart from fixture.

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

Introduction to Xitanium Outdoor LED Drivers

IP67 Independent version

Built-in version

Introduction

Xitanium Outdoor LED drivers are designed to operate LED solutions for outdoor lighting applications such as flood, street, road lighting as well as open area environments.
The operating points are chosen specifically to match the most commonly used LEDs.

Xitanium LED driver versions

The Xitanium LED drivers described in this guide are available in different versions, e.g. fixed-output and dimmable (1-10V; PWM; Line Switch; DALI), 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 on the www.philips.com/technology website.

Features

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 (Rset). With our Programmable drivers, the output current setting can also be programmed using the Philips MultiOne programming hardware interface and the matching software "MultiOne driver configurator".
More information about AOC and how to set the output current can be found in de chapter "Electrical design"

Controllability

The Xitanium Indoor Linear LED drivers are available in 3 different versions:

- Fixed Output
- 1-10V dimming
- DALI
- PWM
- Line Switch

The way of controlling is shown in the name of the driver. If no dimming protocol is given in the name, the Xitanium driver can only be used as a fixed output driver. The output current can be set as described in the Electrical design chapter. More information about the dimming protocols can be found in the Controllability chapter.

Thermal de-rating

Thermal de-rating of your LED PCB is possible by integrating an NTC (Negative Thermal Coefficient) component on the LED PCB and connect this NTC to the driver's NTC input. More details about the NTC resistor can be found in the Chapter "Temperature design"

Module Temperature Protection (MTP, adjustable on programmable drivers only)

This feature helps to protect the LEDs when operated in a hot ambient environment. The driver helps to regulate LED module temperature by regulating the output current. An NTC (Negative Temperature Coefficient resistor) must be present on the LED module and connected to respective pins on the driver in order to be able to make use this feature. Programmable drivers allow for changing the dimming behavior.

More information can be found under chapter Thermal Management.

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 constant lumen output through the life of the light engine. Based on the type of LEDs used, heat management 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.
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 on www.philips.com/multione

DC operation

It is possible to connect the mains side of the Xitanium driver to a DC power net (e.g. central emergency system). Check for input requirements the drivers' datasheet which can be found on www.philips.com/technology

Naming of the LED outdoor driver

Example:

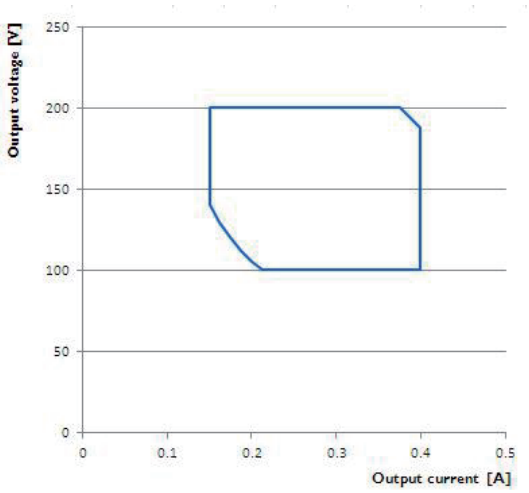
1. Xitanium 150W 1.05A 230V I175C I67

Xitanium:	Brand name for reliable, afforable LED drivers
150W:	Maximum output power
1.05A:	Output current
230V:	Mains AC input voltage
I175 :	Housing length
	I (Independent housing design)
C :	Connector version
I67:	IP rating

2. Xi FP 150W 0.2-0.7A SNLDAE prog + 230V S240 sXt

Xi:	Xitanium(Xi)
Driver family:	SR (sensor ready)
	FP (full prog)
	LP (lite prog)
150W:	Maximum output power
0.2-0.7A:	Output current range
SNLDAE:	S (simpleset)
	N (NTC input)
	L (line switch)
	D (DALI)
	A (AmpDim)
	E (DC Emergency)
	M (Energy Meter)
	P (Auxiliary Power supply)
230V:	Mains AC input voltage
S240:	Housing length
	S (stretch)
	C (compact)

Electrical Design-in



Example of a Driver Operating Window

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. 350mA, 500mA or 700mA. It is often necessary to replace a driver when more efficient LEDs or different LED boards become available.

One of the key features of the Xitanium LED drivers is the adjustable output current (AOC), offering flexibility 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 handle. An example of an operating window is shown on the left. The area indicates the possible current /voltage combinations. The current you select will depend on the type and manufacturer of the LEDs 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 datasheets which can be downloaded on following website: www.philips.com/technology

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

* Note: when connecting Philips LED Lines to the driver, the type of LED board (LV or HV) determines this requirement. Hybrid LED boards can be used on both type of drivers, indicated in commercial leaflet LED Lines, to be found in the download section of www.philips.com/technology

** Note: for Philips LED Lines standard system configurations, driven at nominal current, are stated in the commercial leaflet LED Lines, to be found in the download section of www.philips.com/technology

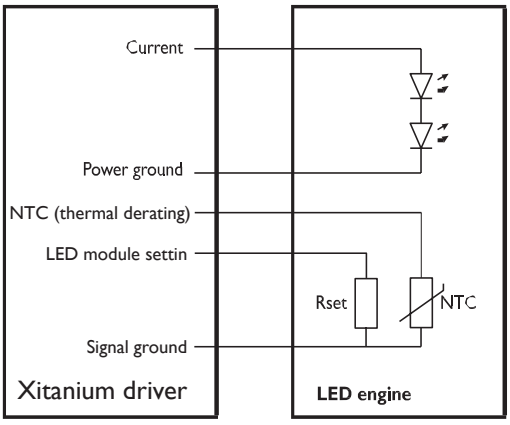
Note: for a HV scenario that allows a 2 chain parallel solution, you are likely to find with steps described a lower rated driver power (e.g. 75 W for 1 chain versus 36 W for 2 chain solution)

How to… Select an appropriate driver

Depending on you requirements several drivers can be found as a solution for you. The following steps can help selecting the preferred driver.

For a full overview of available driver models, please refer to the commercial leaflet Xitanium indoor linear LED drivers, to be found in the download section of www.philips.com/technology, as are the datasheets associated with the drivers you intend to use.

1. Determine your required drive current (Idrive) and voltage (Vf)
2. Calculate required power via Pdrive = Vf x Idrive (W)
3. Determine which type* of driver do you need; Isolated or Non-isolated Collect the associated datasheets from the website.
4. Does required current fit current range of driver? - Idriver minimum ≤ Idrive ≤ Idriver maximum?
5. Does required voltage fit voltage range of driver? - Vdriver minimum ≤ Vf ≤ Vdriver maximum?
6. Does required power fit power range of driver? - Pdriver minimum ≤ Pdrive ≤ Pdriver maximum?
7. Choose your type** of dimming



Schematically representation of the drivers' output interfaces

Driver wiring and pinning

Driver lead wires with corresponding functions can be seen in figures on the left. The function of each wire will be discussed further in detail in the following chapters.

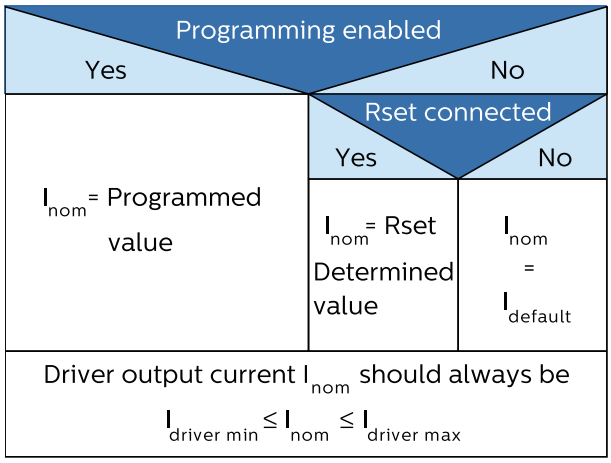
Note: currently all the Xitanium Indoor Linear LED drivers are single channel drivers. This means that for drivers with a double "+" and "-" output (see figure on the left) that these outputs are simply in parallel.

Adjustable Output Current (AOC) –set the driver output current

Output current can be set by placing an external resistor (LEDset and Rset) into the driver's Rset input. Next to that DALI driver versions allow also setting of the output current via software configuration.

Note: Rset is used as generic indication for Rset1, Rset2 or LEDset.

Note: LEDset and Rset-interface are not meant to be used as a control or dimming interface (for instance 1...10 V). If this is not observed, both performance and safety requirements of the installation may be affected.



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

How to… Determine AOC priority with TD drivers

Since the DALI drivers allow 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.

Historically there are two groups of DALI drivers; those which can dim down to 1% (newer) and those which can dim down to 10% (older).

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

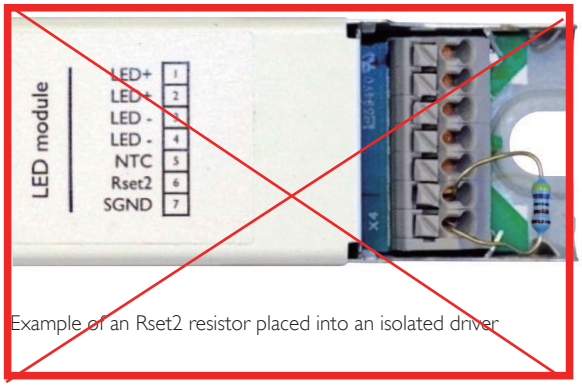
AOC programming has priority over Rset. For the priority selection criteria see table on the left.

Group 2: >1% minimum dim level (older drivers, 5% or 10% minimum dim level)

The value that sets the lowest current has priority over the other.
1. Iprogramming < IRset ? => priority for Iprogramming
2. IRset < Iprogramming ? => priority for IRset
E.g. programming 200 mA has priority over Rset which would generate 250 mA.
And Rset that generates 200 mA has priority over programming 250 mA.

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

Example of a Set'n'drive resistor featured by BJB, fitted with a leaded resistor inside and allowing both manual or robot placement



Example of an Rset2 resistor placed into an isolated driver

How to… Set the output current via Rset

Your lumen, your current

1 resistor value generates 1 current only at all window drivers as long as it fits within the driver window. That is 1 philosophy for all window drivers.

Why a resistor?

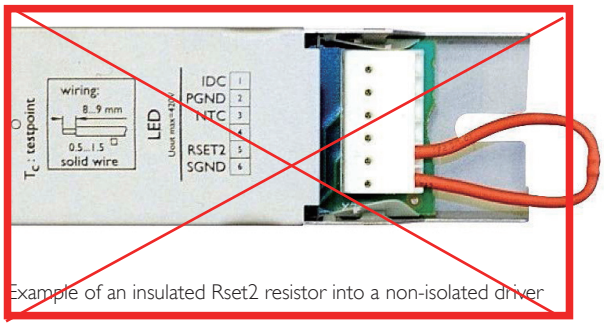
a) Worldwide standardized building block
b) Worldwide availability and well documented
c) Freedom for OEM to choose the value and supplier

Resistor placed into driver enables you to

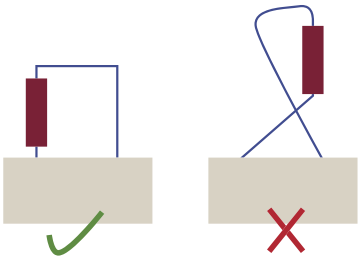
1. Connect different configurations, not just a unique solution
2. Drive different type of LED boards, not restricted to one type
3. Select and tune the current, hence flux or Tc

Resistor characteristics

By making use of a resistor component with a determined Ohm value you can set the required current for your LED module. This component can be a leaded standard 1% tolerance resistor of e.g. 0.125 W or 0.25 W, 50 V. Rset will not be part of the electrical chain driving the LEDs, meaning it does not dissipate power.
However, make sure it does not come into contact with the driver's housing. For safety reasons with non-isolated drivers the resistor must be insulated. Advice is to always insulate the resistor.



Example of an insulated Rset2 resistor into a non-isolated driver

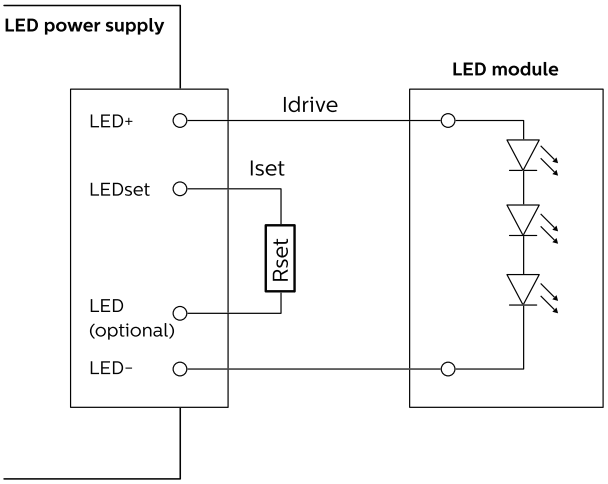


Examples of a resistor placed into the drivers' input is shown on the left.
2 different Rset resistors are utilized in the Xitanium programmable LED driver portfolio;

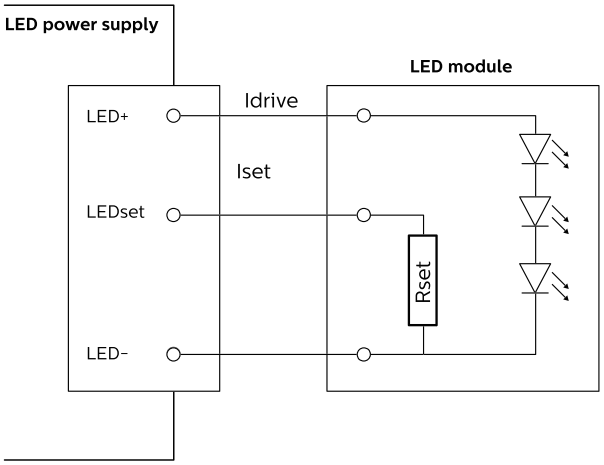
- Rset1 (older drivers); allows output current setting up to 700 mA
- Rset2; allows output current setting up to 2000 mA

In all documentation, Rset may refer to either Rset1 or Rset2, depending on the driver type. Please check the driver datasheet for which Rset (1 and/or 2) the driver you use reads.

Note: While inserting the resistor, please refer to the image on the left. The resistor must be inserted such that there is no possibility of a short caused by the leads. Especially when using non-isolated drivers, make sure the leads of the resistor are insulated. This way they cannot generate a potential safety risk, nor can the trip the earth leakage circuit breaker.



Rset resistor mounted directly onto the driver



Rset resistor mounted onto the LED module

Rset1 and Rset2 use different pins on 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 to you, if the exact determined value is not at hand.

How 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.

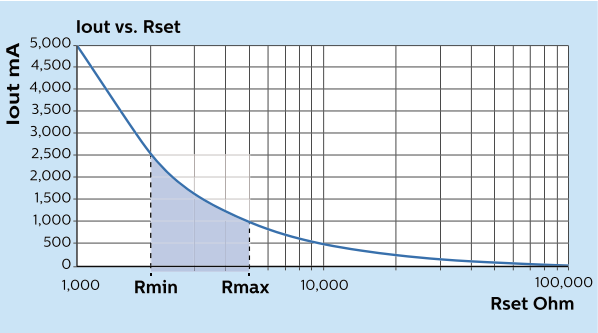
What does LEDset offer

Like Rset1 and Rset2, LEDset is an analogue interface, allowing basic 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 thermal dynamic resistors circuit

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 Rset is mounted on the LED module.
Alternatively a standard resistor can be put directly into the driver's LEDset input connectors.



The LEDset interface measures the current Iset which flows from a 5V constant voltage source within the LED driver through the setting resistor(s) Rset which is/are located either on the LED modules or directly into the driver's Rset-input.

The current Iset flowing through one setting resistor Rset is determined by the equation:

$$Iset\ [A] = 5\ [V] / Rset\ [\Omega]$$

A LED driver with LEDset interface is able to measure Iset and to set the LED driver output current Idrive dependent on the measured value of Iset according to the equation

$$Idrive = Iset \times 1000\ [A]$$

Therefore the overall relationship between the setting resistor and the LED driver output current Idrive is then given by

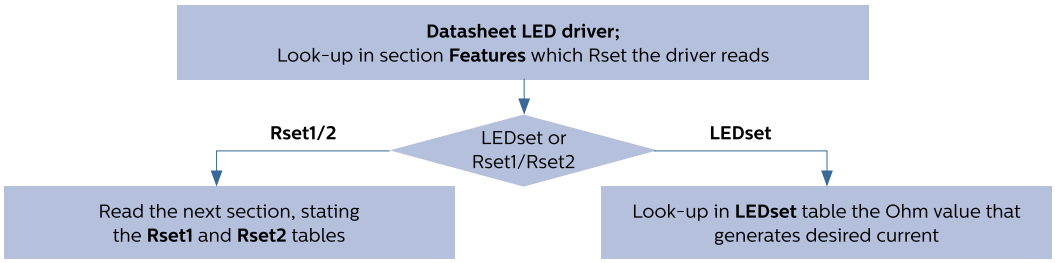
$$Idrive\ [A] = (5\ [V] / Rset\ [\Omega]) \times 1000$$

To calculate the required resistor value for a desired drive current Idrive use:

$$Rset\ [\Omega] = (5\ [V] / Idrive\ [A]) \times 1000$$

The LEDset interface is intended to cover a LED driver output current range from 0.05 A to 8 A. The corresponding resistor Rset is therefore within the range 100 kOhm to 625 Ohm.

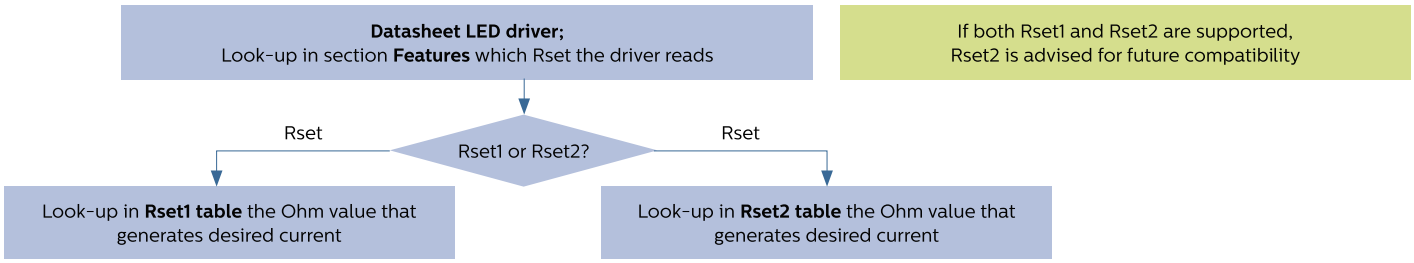
In addition, it is possible to add an over temperature protection circuit on the LED module which decreases the setting current in case of an over temperature event and thus limits or folds back the LED driver output current.



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.

LEDset – E96 series: table with E96 resistor values

LEDset [Ω]	Idrive [mA]	LEDset [Ω]	Iset [mA]	LEDset [Ω]	Iset [mA]	LEDset [Ω]	Iset [mA]
open	driver's default current	23700	211	11000	455	5110	978
49100	102	23600	212	10700	467	4910	1018
48700	103	23200	216	10500	476	4870	1027
47500	105	22100	226	10200	490	4750	1053
46400	108	21600	231	10000	500	4640	1078
45300	110	21000	238	9760	512	4530	1104
44200	113	20500	244	9530	525	4420	1131
43200	116	20000	250	9310	537	4320	1157
42200	118	19600	255	9090	550	4220	1185
41200	121	19100	262	8870	564	4120	1214
40200	124	18700	267	8660	577	4020	1244
39200	128	18200	275	8450	592	3920	1276
38300	131	17800	281	8250	606	3830	1305
37400	134	17400	287	8060	620	3740	1337
36500	137	16900	296	7870	635	3650	1370
35700	140	16500	303	7680	651	3570	1401
34800	144	16200	309	7500	667	3480	1437
34000	147	15800	316	7320	683	3400	1471
33200	151	15400	325	7150	699	3320	1506
32400	154	15000	333	6980	716	3240	1543
31600	158	14700	340	6810	734	3160	1582
30900	162	14300	350	6650	752	3090	1618
30100	166	14000	357	6490	770	3010	1661
29400	170	13700	365	6340	789	2940	1701
28700	174	13300	376	6190	808	2870	1742
28000	179	13000	385	6040	828	2800	1786
27400	182	12700	394	5900	847	2740	1825
26700	187	12400	403	5760	868	2670	1873
26100	192	12100	413	5620	890	2610	1916
25500	196	11800	424	5490	911	2550	1961
24900	201	11500	435	5360	933	2490	2008
24300	206	11300	442	5230	956	short	driver's max. current



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

Rset1 – E24 series

Ret1 [Ω]	Iset [mA]	Ret1 [Ω]	Iset [mA]	Ret1 [Ω]	Iset [mA]	Ret1 [Ω]	Iset [mA]
39	200	510	292	6k8	583	91k	690
43	201	560	300	7k5	591	100k	691
47	202	620	309	8k2	599	110k	692
51	203	680	318	9k1	60	120k	693
56	204	750	327	10k	614	130k	693
62	206	820	336	11k	621	150k	695
68	208	910	347	12k	627	160k	695
75	209	1k	358	13k	632	180k	696
82	210	1k1	369	15k	640	200k	696
91	212	1k2	379	16k	643	220k	697
100	215	1k3	388	18k	649	240k	697
110	217	1k5	406	20k	654	270k	698
120	219	1k6	414	22k	658	300k	698
130	221	1k8	429	24k	661	330k	698
150	226	2k	442	27k	665	360k	699
160	228	2k2	455	30k	669	390k	699
180	232	2k4	466	33k	671	430k	699
200	236	2k7	481	36k	674	470k	699
220	240	3k	494	39k	676	510k	699
240	244	3k3	505	43k	678	560k	700
270	250	3k6	517	47k	680	620k	700
300	256	3k9	525	51k	682	680k	700
330	261	4k3	536	56k	683	750k	700
360	267	4k7	546	62k	685	820k	700
390	272	5k1	555	68k	686	910k	700
430	279	5k6	564	75k	688	1M	700
470	286	6k2	574	82k	689	No Rset	default

Rset2 – E24 series

Ret1 [Ω]	Iset [mA]	Ret1 [Ω]	Iset [mA]	Ret1 [Ω]	Iset [mA]	Ret1 [Ω]	Iset [mA]
short	100	430	245	2k	733	9k1	1558
100	100	470	261	2k2	780	10k	1604
110	106	510	277	2k4	823	11k	1653
120	111	560	297	2k7	884	12k	1694
130	116	620	318	3k	941	13k	1730
150	121	680	340	3k3	993	15k	1793
160	130	750	368	3k6	1042	16k	1817
180	13	820	392	3k9	1086	18k	1864
200	146	910	422	4k3	1143	20k	1902
220	155	1k	452	4k7	1192	22k	1935
240	166	1k1	485	5k1	1238	24k	1965
270	176	1k2	515	5k6	1293	27k	2000
300	190	1k3	545	6k2	1350	No Rset	default
330	204	1k5	602	6k8	1402		
360	215	1k6	632	7k5	1454		
390	228	1k8	684	8k2	1503		

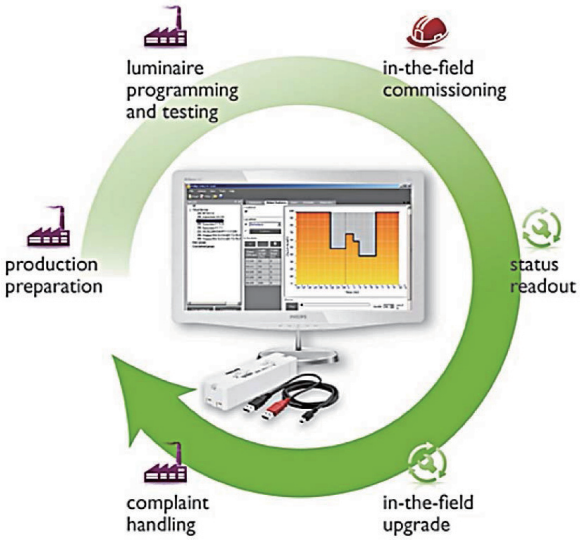
Rset priority behavior for drivers that read both Rset1 and Rset2

Rset1	Rset1	Driver status
Open	Open	Driver's default current (see datasheet)
Rset	Open	Rset1
Open	Rset	Rset2
Rset	Rset	Rset2
Short	Open	Rset1 (driver's minimum current, see datasheet)
Short	Short	Rset2 (driver's minimum current, see datasheet)
Open	Short	Rset2 (driver's 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 – E96 series: table with E96 resistor values, stating smaller increments but covering same range as the E24 series on previous page

Rset2 [Ω]	Iset [mA]	Rset2 [Ω]	Iset [mA]	Rset2 [Ω]	Iset [mA]	Rset2 [Ω]	Iset [mA]	Rset2 [Ω]	Iset [mA]	Rset2 [Ω]	Iset [mA]
short	min.	255	171	665	335	1740	669	4530	1171	11800	1686
100	100	261	173	681	341	1780	679	4640	1185	12100	1698
102	101	267	175	698	347	1820	689	4750	1198	12400	1708
105	103	274	178	715	354	1870	701	4870	1212	12700	1719
107	104	280	181	732	361	1910	711	4910	1216	13000	1730
110	105	287	184	750	368	1960	724	5110	1239	13300	1739
113	107	294	187	768	374	2000	733	5230	1253	13700	1752
115	108	301	191	787	381	2050	745	5360	1267	14000	1761
118	110	309	194	806	387	2100	757	5490	1281	14300	1771
121	111	316	197	825	394	2160	770	5620	1295	14700	1783
124	113	324	201	845	400	2210	782	5760	1308	15000	1793
127	115	332	204	866	407	2320	806	5900	1322	15400	1802
130	116	340	207	887	414	2360	815	6040	1335	15800	1812
133	118	348	210	909	422	2370	817	6190	1349	16200	1822
137	119	357	214	931	429	2430	829	6340	1362	16500	1829
140	120	365	217	953	436	2490	841	6490	1375	16900	1838
143	122	374	221	976	444	2550	853	6650	1389	17400	1850
147	123	383	225	1000	452	2610	865	6810	1403	17800	1859
150	125	392	229	1020	459	2670	877	6980	1415	18200	1867
154	127	402	233	1050	469	2740	891	7150	1428	18700	1877
158	129	412	237	1070	475	2800	903	7320	1441	19100	1885
162	131	422	241	1100	485	2870	916	7500	1454	19600	1894
165	132	432	246	1130	494	2940	929	7680	1467	20000	1902
169	134	442	250	1150	500	3010	943	7870	1480	20500	1910
174	136	453	254	1180	509	3090	956	8060	1493	21000	1918
178	137	464	259	1210	518	3160	968	8250	1506	21600	1928
182	139	475	263	1240	527	3240	982	8450	1518	22100	1936
187	141	487	268	1270	536	3320	996	8660	1531	23200	1952
191	143	491	270	1300	545	3400	1009	8870	1544	23600	1959
196	145	511	278	1330	554	3480	1022	9090	1557	23700	1960
200	146	523	282	1370	565	3570	1037	9310	1569	24300	1968
205	148	536	287	1400	574	3650	1049	9530	1580	24900	1975
210	151	549	292	1430	582	3740	1062	9760	1592	25500	1982
216	153	562	297	1470	594	3830	1075	10000	1604	26100	1989
221	155	576	302	1500	602	3920	1088	10200	1614	26700	1996
232	161	590	307	1540	614	4020	1103	10500	1629	27000	2000
236	163	604	313	1580	626	4120	1117	10700	1639	open	default
237	164	619	318	1620	638	4220	1131	11000	1653		
243	167	634	323	1650	645	4320	1145	11300	1666		
249	169	649	329	1690	656	4420	1158	11500	1674		



How to… Program the output current

1 interface – connecting to indoor & outdoor, LED & conventional

The Xitanium Programmable 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 installations in the field. This can be done with the Philips MultiOne configurator software. The MultiOne configurator software 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.

Connecting to a programmable driver

Xitanium Programmable 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.

For more information and latest version please visit www.philips.com/multione.
This site contains detailed information on how to install the software and how to program the driver.

Mains voltage fluctuations

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

Allowable voltage difference between mains input and control input (TD version)

The majority of our LED-drivers do comply with a voltage isolation difference up to 250V between mains and the Touch and Dim control input, as can be caused by a different phase of the power grid in an installation in the field.
Future drivers might have a value higher than 250 V by design.

Low mains voltage

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

High mains voltage

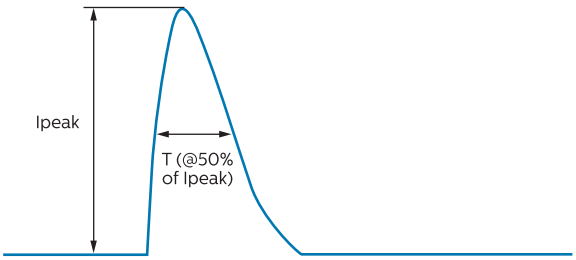
A high mains AC voltage will stress the driver and have an adverse effect on its lifetime (maximum of 264-320 V for a period of 48 hours).

DC, DCemDIM and Emergency operation

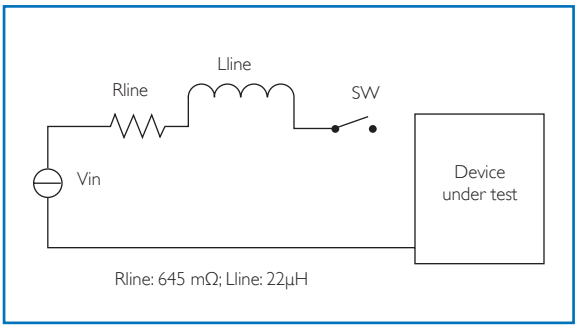
The Xitanium Indoor Linear LED drivers are able to operate on DC voltage on the mains input, like when connected to a central DC emergency grid. Depending on the type, Xitanium LED drivers are released in compliance with lamp control gear standards as stated under "Emergency standards" in section "Quality" at the end of this document. As a result these drivers are suitable for emergency luminaires in compliance with IEC 60598-2-22, excluding high-risk task areas.

Please note the allowed DC voltage range accepted by the driver is stated in the driver's datasheet. Values outside that range will have an adverse effect of the driver's performance and possibly reliability.

On selected drivers DCemDIM is available, allowing a pre-defined dim level of the driver's output when switched to DC. More on setting parameters of DCemDIM in section Controllability. For specific input requirements, please check the driver's datasheet at the download section on www.philips.com/technology.



Graphical representation of inrush current



Inrush current

'Inrush current' refers to the briefly occurring high input current which flows into the driver during the initial start-up to charge the capacitors on the input side. Typically, the amplitude is much greater than the operating or steady-state current, as illustrated.

The experimental setup for measuring the inrush current of the Xitanium LED Programmable driver is shown. For the test setup, a line impedance of 645 mΩ / 22 µH (nom values) is used (NEMA 410 standard requires a line impedance comprised of 450 mΩ / 100 µH for inrush current measurement). For the measurements, an input DC voltage equal to the peak of the corresponding line voltage is applied (via the capacitor bank).

On a system with an ABB S261 B16 miniature circuit breaker, up to a maximum certain number of Xitanium LED programmable drivers can be connected in parallel without the miniature circuit breaker tripping at driver turn-on. The exact maximum number can be found in the applicable driver datasheet. Please note that the inrush current does not increase proportionally with the number of drivers connected in parallel; i.e. for "N" drivers connected in parallel does not equal "N" times the inrush current for one driver.

MCB type	Rating (A)	Relative number of LED drivers (%)
B	16	100 (stated i n datasheet)
B	10	63
B	13 8	1
B	20	125
B	25	156
C	16	170
C	10	104
C	13	135
C	20	208
C	25	260
L, I 1	6	108
L, I 1	0	65
G, U, II 1	6	212
G, U, II 1	0	127
K, III 1	6	254
K, III 1	0	154

Conversion Table for maximum number of drivers on Different types of Miniature Circuit Breakers.

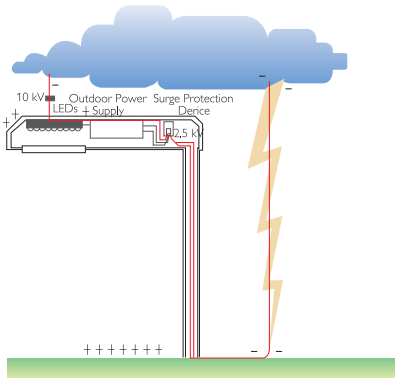
How to… Determine the number of drivers on a MCB

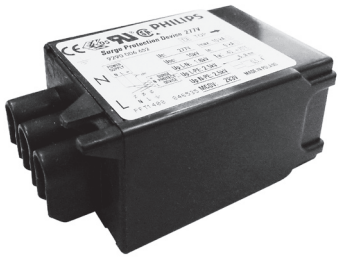
The maximum amount of drivers on a 16A type B Miniature Circuit Breaker (MCB) is stated in the driver's datasheet on www.philips.com/technology.
In the conversion table on the left that stated amount is used as reference (100%).
The maximum quantity of drivers on different types of MCB can be calculated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

Example;
If datasheet states: max number on type B, 16 A = 20, then for type C, 13 A the value will be 20 x 135% = 27.

Notes

1. Data is based on a mains supply with an impedance of 400 mΩ (equal to 15 m of 2.5 mm^2 cable and another 20 m to the middle of the power distribution) in the worst-case scenario. With an impedance of 800 m^2 the number of drivers can be increased by 10%.
2. Measurements will be verified in real installations; data is therefore subject to change.
3. In some cases the maximum number of drivers is not determined by the MCB but by the maximum electrical load of the installation.
4. Note that the maximum number of drivers is given when these are all switched on at the same time, e.g. by a wall switch.
5. Measurements were carried out on a single-pole MCB. For multiple MCBs it is advisable to reduce the number of drivers by 20%.
6. The maximum number of drivers that can be connected to one 30 mA Residential Current Detector is 30.





Example of SPD

Surge protection

The challenge for Outdoor lighting

Outdoor lighting systems 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. lightning strikes). A direct hit will most likely destroy the components in a luminaire. Even an indirect hit near the lighting installation might cause severe damage.

External SPD offers the maximum protection for Outdoor LED investments

Pole-mounted roadway lighting would typically fall into the more severe High Exposure location.
In C62.41.2 standard, for Location Category C (outside, service entrance and equipment), a protection level of 10 kV or more is required. There is almost no way to make the luminaire system surviving without any extra protection.
Installing an external SPD can offer the maximum protection for Outdoor LED luminaire.

	Standard teste		Optional teste
	1.2/50 µs Voltage genarator	8/20 µs Current genarator	
Exposure	Minimium open-circuit voltage to be applied to SPD	Current to be driven through the SPD[2]	100 kHz Ring Wave for front-of-wave response evaluation
Low	6 kV	3 kA[3]	3 kA[3]
High	10 kV	10 kA	10 kA

Surge Protection Devices (SPDs) intended for Location Category C

Leakage current

The Xitanium Outdoor LED drivers are designed to meet touch current requirements per IEC 61347-1 standard. The specified maximum values are 0.7 mA peak for IEC and 0.75 mA RMS for UL norms. The test is done with the driver alone. In a luminaire, touch current may be higher, since the LED load may introduce additional touch current.
Precautions may be required on the luminaire level and if multiple drivers are used in a single luminaire.

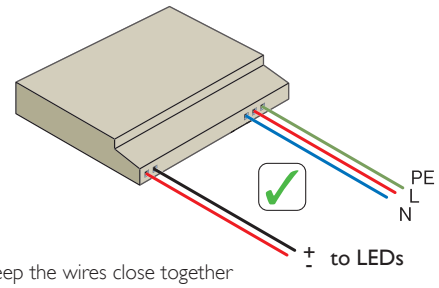
Electromagnetic compatibility (EMC)

Electromagnetic compatibility (EMC) is the ability of a device or system to operate satisfactorily in its electromagnetic environment without causing unacceptable interference in practical situations. Xitanium Outdoor LED drivers meet EMC requirements per CISPR15 ed 7.2. This test is conducted with a reference setup that includes a driver and an LED load/heat sink combination mounted on a metal plate.

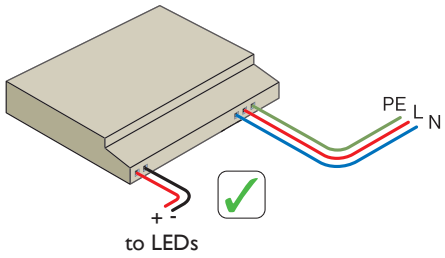
Improvement in EMI Performance

The following practical precautions need to be taken into account in a lighting system to minimize EMI:

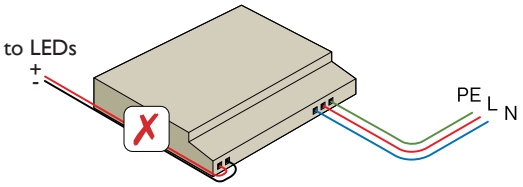
- Minimize the differential mode loop area of the lamp wires going from the driver to the light source by keeping the wires close together (bundling). This will minimize the magnetic field and reduce the radiated EMI. Long linear light sources are also part of that loop.
- Minimize the common mode parasitic capacitance of the output wiring + light source to earth by keeping the length of the wires between driver and light source as short as possible. Keep the length of the incoming mains wire inside the luminaire as short as possible.
- Keep mains separated from the output wires (do not bundle).
- Do not route any wiring over and/or along the driver enclosure to avoid any coupling/crosstalk with internal components of the driver.



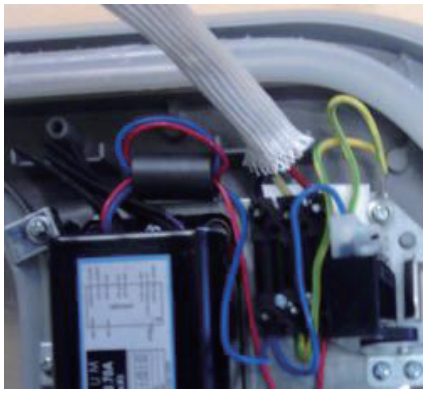
keep the wires close together



keep mains separated from the output wires



do not route any wiring over and/or along the driver enclosure



Adding ferrite core to wires can improve EMI performance

- Ground the lighting system chassis and other internal metal parts to protective earth (class I luminaires), do not let large metal parts electrically insulated from functional or protective earth. Always connect the protective/functional earth/equipotential connector or wire from the driver and use equipotential bonding wires for all large metal parts like driver mounting plate, reflector, heatsink etc. Keep the protective/ functional earth/equipotential wires as short as possible to maximize their effectiveness and use, as much as possible, large metal areas (chassis, mounting plates, brackets) for earthing purposes instead. Establish a reliable electrical connection by using a toothed washer and screw(s) fastened with adequate torque.
- For Class II it is advised to establish a functional earth connection between all larger conductive, non-accessible luminaire parts and the driver to remedy potential EMC problems.
- Sometimes, radiated EMC compliance cannot be achieved, necessitating the use of a 100 … 300 Ωaxial ferrite bead(s) for either mains or lamp wiring (effective for interference between 30 MHz and 300 MHz), or coupling the wires through ferrite cores within the luminaire may improve the overall EMC performance. However, selection of the type and characteristics of the additional filter depends on what frequency components have to be damped and by how much.

Adhering to these rules will help in EMC compliance. For further questions, please contact your local Philips representative. Alternatively the Philips Lighting OEM Design-In team could be consulted for a possible solution.

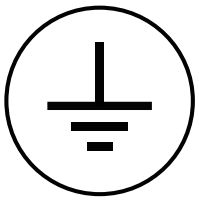
How to… Improve EMI performance

As mentioned before, the total amount of parasitic current needs to be minimized. For that reason, the following practical precautions need to be taken into account in a lighting system to minimize EMI:

- Minimize the Differential Mode loop area of the lamp wires going from the driver to the light source by keeping the wires close together (bundling). This will minimize the magnetic field and reduce the radiated EMI. Long linear light sources are also part of that loop.
- Minimize the Common Mode parasitic capacitance of the output wiring + light source to earth by keeping the length of the wires between driver and light source as short as possible. Also minimize the copper cooling area on the LED PCB and keep the length of the incoming mains wire inside the luminaire as short as possible.
- Keep mains and control wires (DALI, 0-10 V) separated from the output wires (do not bundle).
- Ground the lighting system chassis and other internal metal parts to earth (class I luminaires) and do not let large metal parts "float". Always use the safety or functional earth connector or wire from the lamp driver. Or use equipotential connecting wires for all internal floating metal parts which are inaccessable (class II luminaires). Keep safety and functional earth wires as short as possible to minimize their inductance, use as much as possible large metal areas (chassis, mounting plates, brackets) for earthing purposes instead.
- For Class II it is advised to establish a functional earth connection between all larger conductive, non-accessible luminaire parts and the driver to remedy potential EMC problems.

- Sometimes, radiated EMC compliance cannot be achieved, necessitating the use of a 100 … 300Ω axial ferrite bead(s) for either mains or lamp wiring (effective for interference between 30 MHz and 300 MHz), or coupling the wires through ferrite cores within the luminaire may improve the overall EMC performance. However, selection of the type and characteristics of the additional filter depends on what frequency components have to be damped and by how much.

Adhering to these rules will help in EMC compliance. For further questions, please contact your local Philips representative. Alternatively the Philips Lighting OEM Design-In team could be consulted for a posible solution.



Symbol for Protective Earth (PE)

Electrical isolation and protective earth

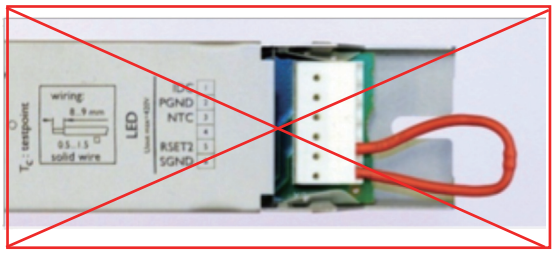
One way to split the Xitanium Indoor Linear LED drivers is by isolated and non-isolated driver versions.

Non-isolated drivers

These drivers have no isolation from the primary to the secondary side and basic isolation (single isolation foil) between all the electronic circuits and the chassis, hence the presence of the Protective Earth (PE) symbol (see image on the left) on the driver housing.

Example of an insulated Rset

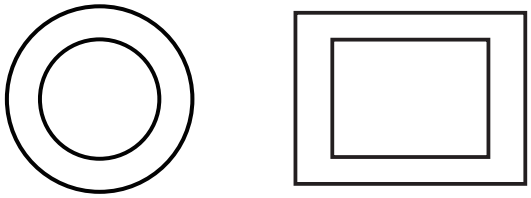
Non-isolated drivers can be used in Class I luminaires. Be aware that all output connections of these drivers are not touch-safe when the driver is switched on. An adequate earth connection needs to be made to all electrical conductive parts in the luminaire. The bottom part (unpainted) of the driver housing can be used to create earth contact to the luminaire housing, as the earth connector is internally connected to the driver housing. An intermitting earth contact should be prevented, as this is potentially unsafe and can cause a degraded performance. Most drivers in this group typically can generate output drive voltages higher than 60VDC. Always test the quality of your earth contacts between all relevant conductive parts.



Example of an insulated Rset

Warnings for non-isolated drivers:

- Do not touch any non-insulated live parts, even on the output (secondary) side!
- Any live part on the output (secondary) side should not be touchable during normal operation. This includes the NTC component and Rset component.
- Make sure to insulate the Rset to prevent it from touching the housing.



Built in version | Independent version

Symbol for Double Isolation between primary and secondary side of a driver, in combination with built-in usage.

Isolated drivers (SELV output)

Drivers in this group cannot generate output voltages higher than 60 VDC. By design these drivers are intended for built-in use, not suited for independent use. The driver must be placed in a suitable adequate enclosure according to the applicable norms and standards. Hence the double circle symbol is to be used, not the double-square symbol (Amendment 2 of safety standard IEC61347-1).

However, these isolated drivers (SELV output) can be used in both Class I and Class II luminaires under the following conditions:

- When used for Class I the protective earth connection should be present (see previous section "Non-isolated drivers").
- When used for Class II (and SELV), the driver should be incorporated in the luminaire in such a way that

a) The driver housing is electrically insulated with respect to electrical conductive materials, such as the housing or reflector and as such not touchable during installation or operation.
b) All metal luminaire parts (chassis, heat sink, metallic reflector) connected to the driver housing are not allowed to be accessible by bare hand, or
c) Any accessible conductive luminaire parts should have basic isolation towards the non-accessible luminaire parts and/or driver housing.

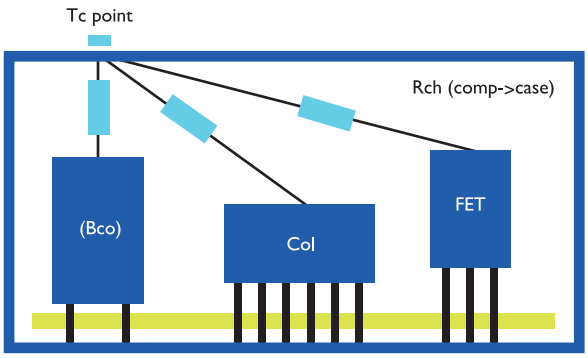
Note: for Class II, EMC requirements should be met without PE connection

Xitanium LED drivers meet the IEC 61347-1 safety standard

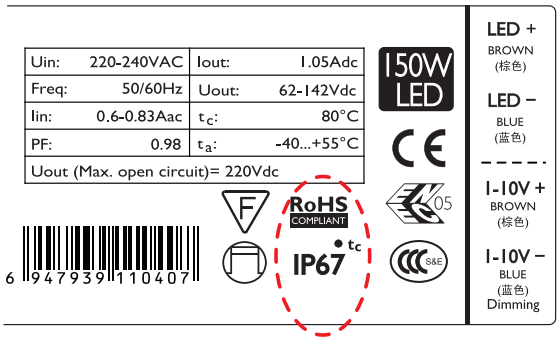
In accordance to this standard, the following safety requirements are met:

- Basic isolation between the Primary and Secondary side wires
- Driver output voltage < 1000 VDC
- Insulation test voltage 1500 V (1000 V + 2 X 250 V)
- Double isolation between all wires and chassis: Insulation test voltage: 3750 V.

Thermal Design-In



Schematically representation of internal thermal paths to the driver Tc point



Tc point position on driver housing

Introduction

This chapter describes the relationship between the Xtanium Outdoor LED drivers in association with Tc point and lifetime.

Definitions

- Case temperature: temperature measured at the Tc point of the driver
- Ambient temperature (Tamb): temperature outside the driver

When switched off >2 hours, temperature at Tc point is likely to equal Tamb

Case Temperature Point (Tc point)

To achieve optimal lifetime and reliability, it is critical that the temperature of the components in the driver remains within its rating. In the LED driver design, all precautions are taken to ensure that the components within the driver are at the lowest possible temperatures.

All temperature measurements are related to a Tcase point (Tc) on the driver. 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. Tc point is marked by the-sign on the label of the driver.

Since there is a direct relation between the case temperature (Tc) and the driver components inside the driver, it is sufficient to measure the temperature at the Tc point of the LED driver. This Tc point must not exceed the maximum values stated in the associated datasheet in the download section on www.philips.com/technology

How to… Measure Tc at the Tc point

The location of the Tc point is identified on the product label. Tc point is inside the dot or on the side of the case at the location of the pointed arrow (See ellipse in figures on the left). The temperature can be measured using for example a thermocouple that is firmly glued to the driver housing. For a representative measurement the temperature must be stable before any reliable data can be obtained (typically > 0.5 hours).

Relation between Tc and ambient temperature

The Tc increases by approximation linear with the ambient temperature (Tamb). The temperature offset between Tamb and Tc depends on the thermal design of the luminaire. The Xitanium Outdoor LED driver has been designed for outdoor use. For approved ambient temperature range please check the associated driver datasheet on www.philps.com/technology

Driver lifetime

The lifetime of LED drivers depends on the temperature during operation. This means there is a relationship between the Tc point on the LED driver and its lifetime. Xitanium Outdoor LED drivers have a specified minimum lifetime of 50,000 hours with a minimum of 90% survivors at the specified Tc-max (see also respective datasheet).

Module Temperature Protection (MTP)

NTC and thermal design

This feature helps to protect the LEDs when operated in a hot ambient environment. The thermal design of an LED module/PCB should be designed in such a way that the temperature of the LED board (Tc-life) is not exceeded under normal application conditions. The utilization of a Negative Temperature Coefficient (NTC) component serves the purpose to help achieve the lifetime of the LED module or LED PCB if external thermal influences result in the temperature for lifetime (Tlife) being exceeded. When this occurs the light output will be regulated to remain below the critical temperature by the driver dimming down.

Two NTC part numbers which are supported, while the third option enables correct operation in combination with Philips LED modules.

1. 15 k NTC - Vishay 15 kOhm ± 2% NTC, B25/85=3700, 2381 615 54153
2. 15 k NTC - Murata 15 k, Part number NCP15XW153E03RC (with a Separate 390 ohms resistor in series with the NTC)
3. On selected Philips LED light engines (currently no LED Lines)

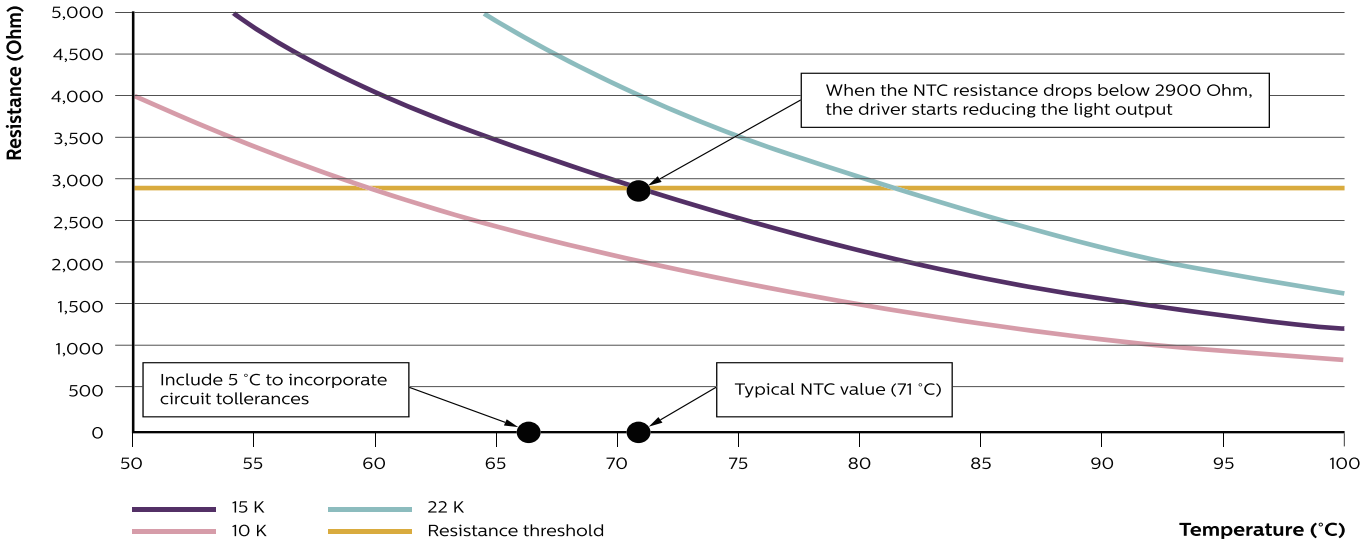
Setting the thermal de-rating point via NTC

The LED driver will start reducing the light output when the NTC reaches a value of 2966 Ω. The NTC should be selected such that 2966 Ω represents the desired critical temperature inside your LED module/PCB.

Take for example an LED board with a defined Tc-life of 65 °C. Taking the tolerances of the NTC into account results in ±5 °C. 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 an NTC resistor. To match 2966 Ω at this temperature, the NTC of 15 kΩ ±2% has been selected.

Setting MTP behavior (programmable drivers only)

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



NTC resistance as function of temperature

Mechanical Design-In

IP rating

Below guide should be followed to ensure the right IP rated driver being selected according to OEMs' gearbox type

OEMs' Gearbox	Protection from moisture	IP67	IP66	IP65	Built-in
		IP6X: Dust tight	IP6X: Dust tight	IP6X: Dust tight	N.A
		IPX7: 0.15-1m protected against the effects of immersion	IPX6: protected against the power water jet	IPX5: protected against water jets	N.A
No gearbox	Water immersion longer than 30 mins	✗	✗	✗	✗
	Water immersion less than 30 mins	✓	✗	✗	✗
	Water jets	✓	✓ *	✗	✗
	Water splashing	✓	✓ *	✓ *	✗
Open gearbox (with holes)	Water immersion longer than 30 mins	✗	✗	✗	✗
	Water immersion less than 30 mins	✓	✗	✗	✗
	Water jets	✓	✓	✓	✗
	Water splashing	✓	✓	✓	✗
Sealed gearbox (IP65+)	N.A	✓	✓	✓	✓

* For the applications without gearbox protection, the IP66/65 driver has to be mounted in such a manner that it is not directly exposed to external environmental elements such as hailstones, snow, sand storms, etc.

Driver IP mapping for typical application

Application	Gearbox	Applicable Driver IP rating
Road/Tunnel/Flood	w/o gearbox	IP67/IP66
Road/Tunnel/Flood	w/ open gearbox	IP67/IP66
Road/Tunnel/Flood	w/ sealed gearbox(IP65+)	IP67/IP66/IP65/Built-in

IP67 fixed output connector version

IP67 1-10V dimmable output connecter version

1-10V Dimming connector

Driver output connector

Mains input connector

Installation

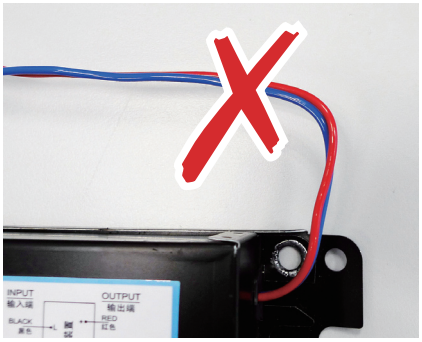
To secure the long term reliability of the driver and application, below instructions have to be followed strictly:

For IP67 independent drivers

1. It's recommended to mount the driver, including connectors on the cooler area of the luminaire. Verification of the Tc is always mandatory.
2. Putting too much stress on the cables or bending the cables with too much angle can cause seals to leak. The diameter of the bending circle should not exceed 25mm.
3. The water proof connector has to be fully tightened to prevent the water leaking into the connection in the filed application.
4. Water could be absorbed through the end of cable. The end of cable shall be sealed inside an IP65+ chamber.
5. Intense exposure to sunlight (UV) will make the seals brittle over time causing water leaks. It's recommended to cover the electrical connections to avoid this risk, also to avoid cables being damaged by wildlife.
6. Cannot be used in a marine environment without additional protection against salt.
7. In a Class I system the driver has to be well connected to the protective earth of the installation for safety and reliability consideration.

Notes:

1. Driver is certified to be used with the controls co-located within the Luminaire.
2. Driver is certified to be used without luminaire, a listed external EMI filter attached to controls to adapt the field applications.
3. Driver is only suitable for Class I system.



Design-in guide Philips Xitanium Outdoor LED drivers

For built-in drivers

1. The drivers must be installed within a sealed enclosure with IP65+rating.
2. The wires should not be bended more than 3 times in same position, and the bending angle at outlet position should not exceed 60° to prevent wire breaking. A circle is suggested to be used to avoid too much bend angle when we have to make the wires go reverse direction.
3. In actual application, if it's necessary to add extra weight at the wires, eg. bead, the extra weight should be fixed properly so as not to bring extra stress to the wires to avoid the wire break in vibration.
4. The grounding can be achieved via the screw hole. A grooved metal washer is suggested to be used for better grounding reliability.
5. The driver is only suitable for Class I system, so it has to be well connected to the protective earth of the installation for safety and reliability consideration.

Note:

1. Driver is certified to be used with the controls co-located within the Luminaire.
2. Driver is only suitable for Class I system.

Controllability

Control characteristics

Control input

Regulating level (module dimming)	100% down to 10% 100% down to 5% 100% down to 1% (H2-2013) The driver's dimming range is stated in the respective datasheet on www.philips.com/technology . The control input complies with EN 60929 (Annex E) and is compatible with Philips Lighting control equipment
Standby power consumption	< 500 mW
Control input insulation, basic	≥ 1500 V AC

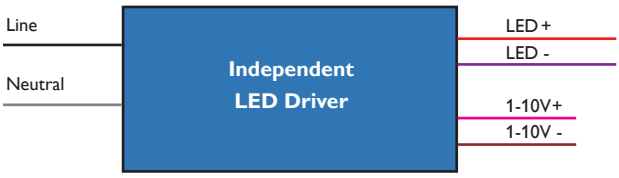
Dynamic resistance

The Xitanium drivers are designed to driver and dim LED loads with a specified minimum dynamic resistance of the load, stated in the drivers' datasheet. This has been tested and released with the Philips Fortimo LED modules. LED loads which have a dynamic resistance outside the specification of the driver may cause instabilities and should not be used in combination with this driver.

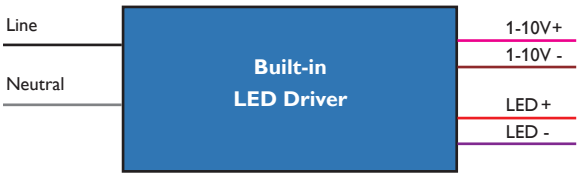
When instabilities during deep dimming (e.g. to 1%) are observed, it is recommended to increase the minimum dim level by adjusting the DALI minimum dim level.

Non-dimmable

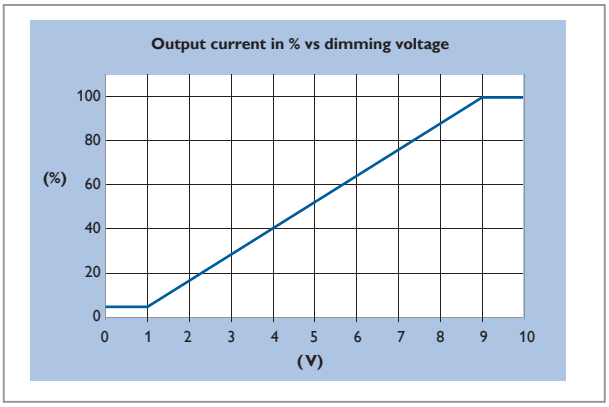
The current of the non-dimmable Xitanium drivers can be set with Rset within the operating window. During normal operation, the set current cannot be changed.



LED driver with 1-10V dimming interface



LED driver with 1-10V dimming interface



Output current in % vs dimming voltage

1-10V Dimming

1-10V is a commonly used dimming interface for LED drivers. The interface requires 2 wires (1-10V + and -) to connect an LED driver to a 1-10V dimmer (Figure left). The LED driver provides approximately 150µA sourcing current to the dimmer. A dimming curve is shown in Figure left.

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 for outdoor drivers.

When long dimming wires are required in some applications, maximum length of the dimming wires can be estimated based on voltage drop on the dimming wires. The recommended max voltage drop on the two wires is 100mV.

DALI

Digital Addressable Lighting Interface, or DALI, is a digital communication protocol popular in the lighting industry. It is an IEC standard and there are many control devices from Philips and other manufacturers that communicate using DALI. The voltage across DALI wires is typically 16V (refer IEC specification for details) and it is polarity insensitive. The DALI wires can be run alongside input main wires and the maximum current on a DALI line is limited to 250mA.

Using DALI, it is possible to send dimming commands (1-254 levels), set fade rates and fade times, query driver or LED status, etc. Linear drivers also respond to LED-specific DALI commands e.g. query if the LED module is short circuit or open circuit; select between logarithmic or linear dimming curves, etc. Typically up to 64 DALI drivers can be on one DALI bus.

For more information on DALI, refer to the IEC specification for DALI protocol.

- **IEC 62386:**
  102 – General requirements – Control gear
- **IEC 62386:**
  207 – Particular requirements for control gear – LED modules.

Philips MultiOne hardware interface

Example of a shorted DALI interface

How to… Connect to and program driver

Connecting to a programmable driver

Xitanium Indoor Linear 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 Programmable drivers only. Check the datasheet for the driver's ability on www.philips.com/technology.

For the latest version of the MultiOne configurator software please check www.philips.com/multione.

How to… See the programming taking effect

Programming time

Depending on the selected features to program, the programming time varies between 2 up to about 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 programmable LED drivers, the mains power needs to be cycled. For newer drivers (1% minimum dim level) On/Off via standby is also sufficient.

Configurability

Introduction

This chapter describes the way you can configure the drivers with the MultiOne Configurator.
Please check the datasheet of the driver on www.philips.com/technology to know if your driver supports configurability.

The characteristics of the MultiOne configurator are:

- One tool for all Philips configurable drivers: Xitanium LED Indoor and Outdoor drivers; HF-R Indoor fluorescent gear; DynaVision Xtreme HID electronic gear…
- Future proof by design: modular approach, very scalable and backwards compatible
- Provides access to all features built in the driver
- Tool combines configuration with debugging
- Settings of the drivers can be changed any point in the product lifecycle.

This configurator consists of:

1. Philips MultiOne Interface tool
2. USB cable (connection to PC or laptop)
3. Philips MultiOne Software

MultiOne Interface USB2DALI

Philips MultiOne Interface tool

There are 2 versions of MultiOne interface tooling depending on the type of communication:

1. LCN8600/00 MultiOne Interface USB2DALI

The interface that can be used with the MultiOne PC software to commission, configure, diagnose drivers via the DALI interface

MultiOne SimpleSet® interface

2. LCN9600 MultiOne SimpleSet® interface

The interface that can be used with the MultiOne PC software to configure drivers wirelessly using SimpleSet® technology.

Note: The programming of the drivers with SimpleSet must be done while disconnected from mains.

When ordering the MultiOne Interface, the correct USB cable will be supplied with the interface tool. The tool can be ordered via your Philips sales representative or via the Philips OEM webshop, http://oemwebshop.philips.com.

Philips MultiOne Software

There are 2 versions of MultiOne Software depending on functionality and location:

1. MultiOne Engineering

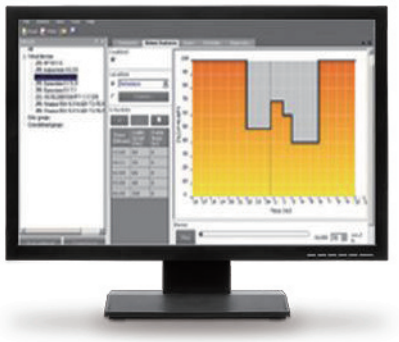
Especially developed to access all functionality of the driver; to configure, diagnose and prepare the configuration file for the production environment. Includes also:

- DALI commands, scheduler.
- SimpleSet®.

2. MultiOne Workflow

Developed to configure all devices or subassemblies in the production environment or field in a simple and quick way.

Get your software (free downloadable) or check if you have the latest version via the website, http://www.philips.com/multione.



System requirements

The MultiOne configurator must be connected to a system with minimum system requirements:

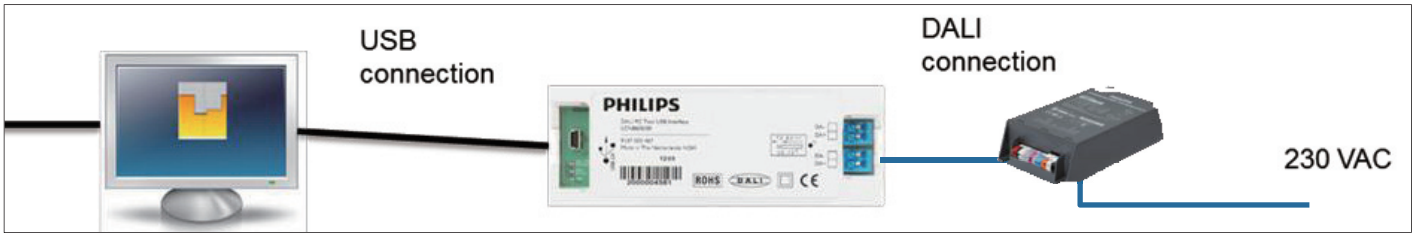
- Windows PC or Laptop
- Microsoft Windows XP + SP3 or Windows 7, Windows 8.0, Windows 8.1
- USB 2.0 ports (preferable two free ports)
- Min 35 MB of free disk space
- Microsoft.NET Framework 3.5 SP1 (!)

Getting Started

Connect the USB cable of the MultiOne Configurator between the PC and the configuration tool.
To install the software, launch the installation file for the latest version and follow the instructions on your screen. The installation wizard will guides through the process of installing the software and will asks where the software needs to be installed, if a shortcut is needed on the desktop and a new program is also created in the Start Menu.

More information on how to program a driver, can be found in getting started and the instruction manual on the website, http://www.philips.com/multione.

MultiOne System



Settings

The Xitanium configurable LED drivers have a fixed set of features and factory settings when supplied. The set of features is defined in the datasheet of the driver.
The default settings of the driver can be found in the driver datasheet in the download section on www.philips.com/technology

Quality and Reliability

Switching & cycling lifetime of LED drivers

Impact of on and off switching on lifetime of electronic drivers in LED systems

In this section a description is presented of the impact of mains voltage switching on the lifetime of electronic drivers in lighting systems. Because switching on and off the lighting has an impact on different failure modes, a distinction has to be made between switching on and off, and thermal cycling.

Electrical failures due to switching Vmains on and off

Before the lighting is switched on in the electronic circuit all capacitors are uncharged. By a simple toggle of the mains voltage all capacitors will be charged, causing peak currents in the circuit. Inductors react to this by creating peak voltages. Occurrence of peak currents & voltages during starting is inevitable. The circuit design and component selection should be of sufficient quality that no components are overstressed during the starting conditions. If the quality is not sufficient, failures will occur at a certain rate over time. The failure rate will be influenced by usage conditions such as temperature and mains voltage. The failure rate will be further enhanced by irregular mains voltage events such as dips, surges or black outs. For a good quality design all conditions and components are carefully checked. In general LED systems and products are designed to withstand >100,000 switches under the specified use conditions.

Mechanical failures due to thermal cycling

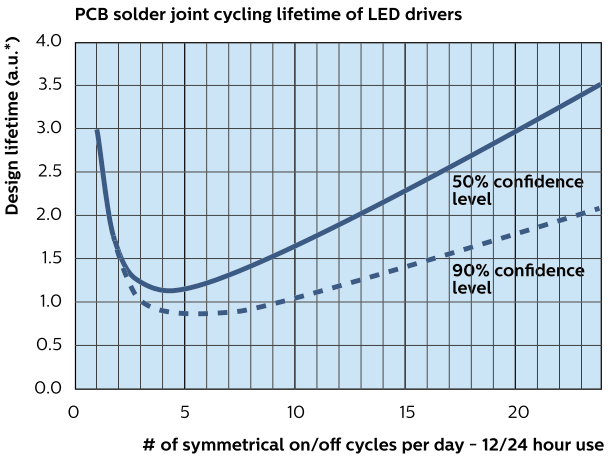
A completely different failure mode which is also due to switching on and off the light is the failure of solder joints, due to thermal cycling. Stresses in solder joints are caused by the differences of the thermal expansion coefficients (CTE's) of printed circuit board, solder and component materials.

Due to heating up and cooling down mechanical stresses build up in the solder, which eventually result in cracking and finally failure of the joint. In most cases failure of one solder joint means the end of the product. The solder joint failure mechanism is also referred to as solder joint fatigue. This is a typical wear out failure mechanism with a negligible failure rate for many years, but for which after the typical lifetime has passed, failures come at an accelerated speed.

Electronic Drivers for LED lighting are typically designed to last 50,000 operational hours. The reference for this lifetime is a typical user profile of 10-12 hr usage and up to 3x switching on and off every day. In the worst case this could mean 25,000 switches at a regular rate 2 hrs on, 2 hrs off. For a 100,000 hr specified product, the driver has to survive twice the number of switches. For the electrical stresses during switching there is no problem switching many more times, even up to >100,000 times. However for the solder joints there can be a risk for the lifetime of the product.

Impact of thermal cycles per day on the driver lifetime

As the drivers are typically designed to withstand 3 full thermal cycles every day, lifetime will reduce with an increasing cycling frequency. However this reduction will be limited by the heating time of the product in the application. As the heating time of a driver in real applications varies typically between 60 and 120 minutes, maximum and minimum driver temperature will not be reached when the cycling frequency is faster than 60 minutes. Because the solder-joint damage relates to a higher power of the temperature difference between hot and cold condition, the negative effect on lifetime reduces for the higher cycling frequencies. This is expressed in the above graph.



*) arbitrary unit value 1.0 means product design - lifetime will be reached (typical 50,000 h). Longer lifetimes can be limited by other failure modes.

Because of the large variation and differentiation between drivers and applications, it is an impossible task to specify the above graph for every driver and application specifically. Therefore only the critical conditions are listed for which there could be a risk to the cycling lifetime of the driver.

Critical conditions for the driver lifetime due to thermal cycling are:

- Small driver / system (short heating time) without appropriate heat sinking (high T_max).
- Large difference between T_max and temperature in off state T_min (e.g. > 50 °C). See also next paragraph.
- Application @ temperatures < -20 °C T_ambient.

Especially if the above parameters occur in combination with each other there can be a risk for thermal cycling lifetime. To improve cycling lifetime when required, it is most relevant to decrease the T_max by appropriate heat sinking of the driver. As a rule of thumb 10 °C diminished ΔT between Tcase on/off, will add 30% to cycling performance.

Impact of product ambient temperature on cycling performance

In the first approximation the solder joint lifetime is independent of the ambient temperature. The driving parameter for the solder joint failure fatigue is the temperature difference between T_max during the 'on' state and T_min during the 'off' state. The way the driver is built in to a luminaire is very important as this can decrease the temperature difference. Appropriate heat sinking of the driver is the most effective way to improve the driver cycling lifetime. As a rule of thumb 10 °C diminished ΔT between Tcase on/off, will add 30% to cycling performance.

For potted products additional failure mechanisms can occur at temperatures <-20 °C, which can increase the impact of thermal cycling on the product lifetime.

Standards the drivers are tested against

The tables below state the standards the drivers are tested against. Consequently the drivers do carry CE and ENEC, as stated in the driver's datasheet.

Compliance and approval	Generated disturbances, EMI and EMC
EN 55015 A2/CISPR15	Conducted EMI 9 kHz-30 MHz
EN 55015 A2/CISPR15	Radiated EMI 30 MHz-300 MHz
IEC 61000-3-2 A1 + A2	Limits for harmonic current emissions
IEC 61000-3-3	EMC – Limitation of voltage fluctuation and flicker in low voltage supply systems for equipment rated up to 16 A

Immunity	Generated disturbances, EMI and EMC
IEC / EN 61547, A12000	Equipment for general lighting purposes – EMC immunity requirements
IEC / EN 61000-4-2	Electrostatic Discharge
IEC / EN 61000-4-3 A1	Radiated radio frequency, electromagnetic field immunity
IEC / EN 61000-4-4	Electrical fast transient/burst immunity
IEC / EN 61000-4-5	Surge immunity
IEC / EN 61000-4-6	Conducted disturbances induced by RF fields
IEC / EN 61000-4-11	Voltage dips, short interrupts, voltage variations

Performance	Generated disturbances, EMI and EMC
IEC 62384	DC or AC supplied electronic control gear for LED modules - Performance requirements
IEC 62386	Digital Addressable Lighting Interface (DALI)

Safety standards	Generated disturbances, EMI and EMC
IEC 61347-1	General and safety requirements
IEC 61347-2-13	LED Particular requirements for DC or AC supplied electronic control gears for LED modules

Emergency standards	Generated disturbances, EMI and EMC
IEC 61347-2-3	Particular additional safety requirement for AC/DC supplied electronic ballasts for emergency lighting
IEC 61347-2-7	Particular requirements for DC supplied electronic ballasts for emergency lighting

16 May 2015
Data subject to change

www.philips.com/Technology