

PHILIPS



Fortimo

LED system

LLM Gen4



Design-in Guide

Outdoor LED **comfortable white light**

February 2015

Contents

Introduction to this guide	3	Installation instructions	14
Information and support	3	Mechanical fixation	14
Basics	3	Fixation of the module	14
Applications	3	Fixation of the driver	14
Product Range	3	Removing connector cables	15
		Fortimo LED LLM with Xitanium Programmable	
Recommendations	4	LED drivers	15
Design-in phase	4	Xitanium Programmable LED driver with 1 module	16
Design-in and manufacturing phase	4	Xitanium Programmable LED driver with 2 modules	17
Installation and service phase of luminaires	4	Replacing a module	18
		Using a long cable in a Fortimo LED LLM Gen4	
		system	18
Controllability	5	Quality	19
Potential controlling protocols	5	Compliance and approval marks	19
Lumistep	5	Sustainability	19
1-10 V dimming	6	IP rating, humidity and condensation	19
Constant Light Output	6	Photobiological safety	20
Current setting with Xitanium LED drivers	7	Radiance-based	20
Current setting with Xitanium PROG/LITE		Irradiance-based	20
LED drivers	7	EMC	20
Which Philips controls can be used?	7	Remote system operation	20
		Fusing Xitanium drivers	20
Thermal management	8	Class I and Class II applications	21
Operating temperatures	8	Warnings on use during storage, transportation	
Module temperature	8	and operation	21
Thermal measurements	9	During operation	21
Measurement of critical temperature point	9	System disposal	21
Measurement of critical temperature point with			
respect to CLO	10	Disclaimer	22
Thermal derating	10		
Heatsink design	11		
Heatsink material	12		
Thermal radiation and emissivity coefficient	12		
Thermal interface	12		
Xitanium LED driver temperature	13		
Important points for luminaire design	13		
Compatibility with Fortimo LED LLM Gen3			
thermal solutions	13		

Introduction to this guide



Philips Fortimo LED LLM Gen4



Interface cable for 3000 and 4500 lumen systems.

Thank you for choosing the Philips Fortimo LED LLM Gen4. In this guide you will find all the information required to design this module into a luminaire as well as valuable hints and tips.

Information and support

On our website at www.philips.com/technology, you will not only find information about this module but also

- design-in guides,
- datasheets
- family sheets
- optical files
- CAD files
- Certificates

of all these Philips LED products.

If you require any further information or support please consult your local Philips office or visit: www.philips.com/xitanium for Xitanium LED drivers and Xitanium PROG/LITE LED drivers. www.philips.com/outdoor for general information on outdoor products.

Basics

Each Fortimo LED LLM system consist of:

- One or more Fortimo LED LLM Gen4 module(s)
- One or more specified cable
- Compatible Xitanium LED driver

The Xitanium 75 W 0.35-0.70 A 1-10V 230 V sXt driver has an integrated cable. An additional interface cable, the picture on left, is shipped in the same box with the drivers to ensure compatibility with Fortimo LED LLM Gen4 modules. Please refer to the Installation instructions section for additional details.

Applications

The Fortimo LED LLM Gen4 module is a built-in module that has been developed primarily for outdoor applications but can also be used indoors (providing applicable IEC regulations are followed and thermal requirements are met).



The Fortimo LED LLM Gen4 with Xitanium driver can be used in:

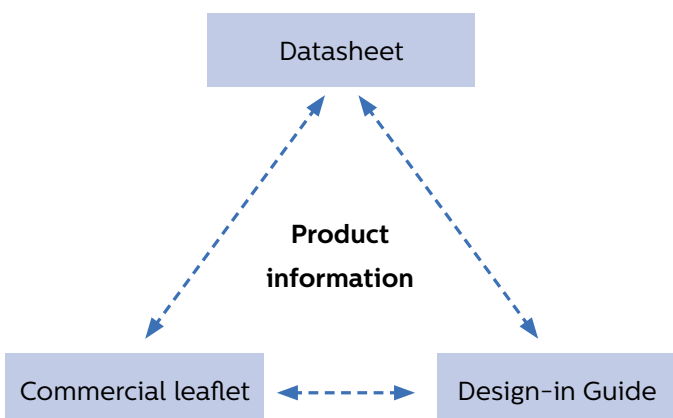
- Class I and Class II IEC systems

Product Range

The Fortimo LED LLM Gen4 module characteristics are described in:

- family sheet
- product datasheet

at www.philips.com/technology



Recommendations

The following recommendations and warnings should be taken into account when using Fortimo LED LLM Gen4 modules and Philips Xitanium drivers.

Design-in phase

- It is mandatory to use the approved Xitanium LED drivers. For a list of approved drivers please refer to the product datasheet.
- It is mandatory to design the luminaire enclosed in such a way that it can only be opened with special tools (by an electrician) in order to prevent accidental contact with live parts.
- Safety and IEC recommendations: the general IEC recommendations for luminaire design and national safety regulations (ENEC, CE, etc.) also apply to selected Fortimo LED LLM Gen4 modules and drivers. Luminaire manufacturers are advised to conform to the international standards for luminaire design (IEC 60598 - Luminaires).
- Do not apply mains power directly to the LED module.
- When using Xitanium Programmable LED drivers, the MTP and CLO profiles need to be activated and programmed.
- The programming of the drivers should be done via the MultiOne software. Tooling and way of working is explained on www.philips.com/MultiOne. Software is free downloadable from the same address.

Design-in and manufacturing phase

- Do not use damaged or defective modules.
- Do not drop the LED module or let any object fall on it as this may damage the module. Do not use the LED module if it has been dropped or an object has fallen on it and there are visible defects or damage.

Installation and service phase of luminaires

- The luminaire should not be serviced while the mains voltage is connected; this includes connecting or disconnecting the Fortimo LED LLM Gen4 cable.
- Hot switching is not allowed.

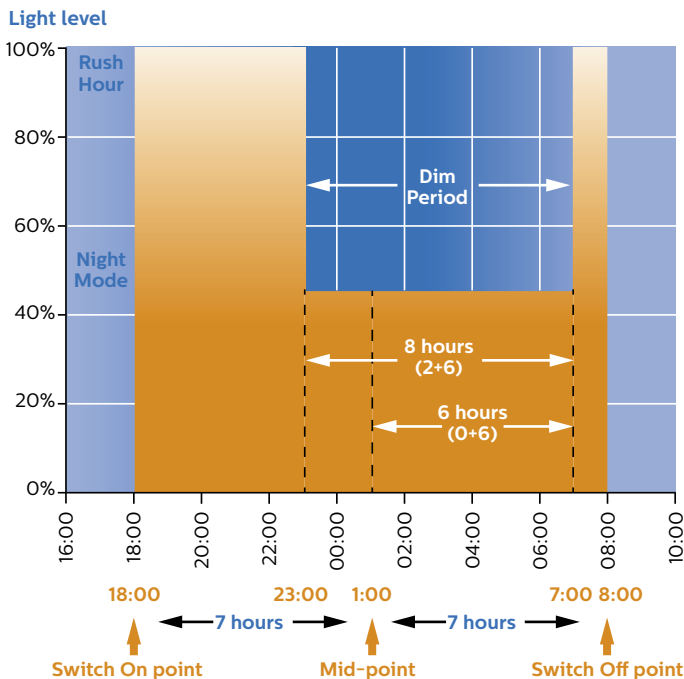
Controllability

Potential controlling protocols

The Fortimo LED LLM module is controllable with a range of integrated light control options.

- Adjustable Output Current
- Constant Light Output
- 1-10 V, AmpDim, DALI and Dynadimmer dimming

Note: All dedicated drivers offer a pre-programmed Constant Light Output (CLO) feature, resulting in 100% lumen maintenance at 50,000 hours.



LumiStep dimming.



Warning:

While it is technically feasible to dim Fortimo LED LLM Gen4 modules down to 10% of specified lumen package, Philips makes no statements on product performance for modules operating on an output current below 100 mA.

Specific features will depend on the Xitanium LED driver system selected.

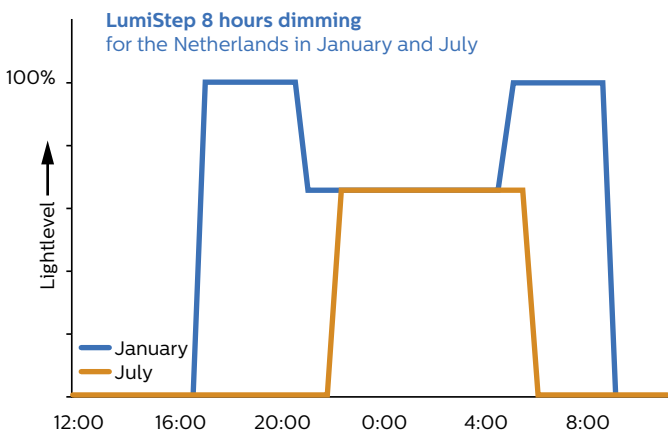
Please visit www.philips.com/getincontrol for complete information on the integrated light control options available in the Xitanium product range.

Lumistep

LumiStep is a stand-alone dimming protocol which dims the light level for a predetermined period (6 or 8 hours) every night: see figure at the left.

The intelligent software which controls the LumiStep protocol counts the time between the switch-on and switch-off points for three days in a row, and determines the middle point based on these inputs. The mid-point determines when dimming should start and stop.

As most lighting installations use sunrise and sunset times, the mid-point of the program is around the same point during the year. As LumiStep does not make adjustments for the duration of night, during summer months the standard dim period can be as long as the entire on period (See figure on the left).



LumiStep dimming profile differences.

1-10 V dimming

The dedicated Fortimo LED LLM driver for 4500 lm (please refer to the respective product datasheet) comes with 1-10 V dimming protocol option, this feature can be combined with SDU device to replicate LineSwitch (pilot line) functionality, or connected to the Philips Dynadimmer for standalone, multi-level dimming. For more information about these controls options, please visit our website:

- Philips Dynadimmer
- Philips SDU

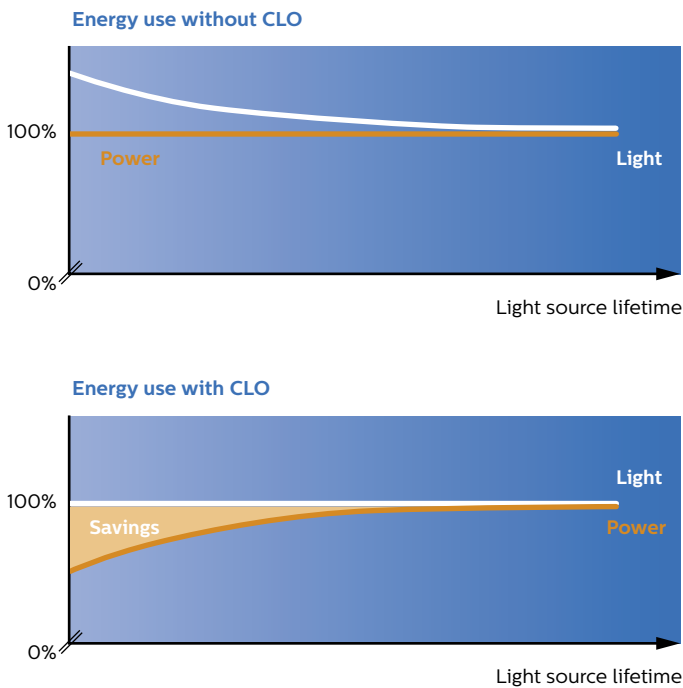
Constant Light Output

The Fortimo LED LLM system is equipped with the Constant Light Output (CLO) feature, which results in lumen maintenance of 100% at 50,000 hours (typical lifetime specification). This saves energy over the lifetime of the luminaire, preventing over-lighting at the beginning of the installation.

CLO reduces energy consumption and improves system reliability.

The CLO feature uses a predictive algorithm to increase the output current to the module over the specified lifetime of 50,000 hours. As the current increases, energy consumption also increases. The CLO feature can be combined with other dimming protocols for even greater energy savings.

When Fortimo LED LLM modules are used with non-dedicated Xitanium drivers, the CLO curve needs to be programmed. For the required inputs, please refer to table below. Between these points, linear interpolation should be used.



Energy savings with CLO.

Module working hours	Power level
0	100%
5,000	102%
10,000	104%
15,000	106%
20,000	108%
25,000	110%
30,000	112%
35,000	114%
40,000	116%
45,000	118%
50,000	120%

Fortimo LED LLM Gen4 CLO curve all module types

Current setting with Xitanium LED drivers

Fortimo LED LLM modules can be used with drivers operating with both Rset1 and Rset2.

Please refer to the Design-in guide of your selected driver for further details.

The Design-in guide can be downloaded via our website at www.philips.com/xitanium.

Current setting with Xitanium PROG/LITE LED drivers

Fortimo LED LLM modules can be used with programmable drivers based on the MultiOne Configurator.

Please refer to the Design-in guide of your selected driver for further details.

The Design-in guide can be downloaded via our website at www.philips.com/xitanium.

Which Philips controls can be used?

Further information about our entire portfolio of control products is available at www.philips.com/getincontrol.

Thermal management



Fortimo LED LLM Gen4 module

The critical thermal management points for the module and driver are set out in this chapter in order to facilitate the design-in of the Fortimo LED LLM Gen4 system. Keeping these thermal points in mind will help to ensure the optimal performance and lifetime of the system.

Operating temperatures

Definitions

- *Module temperature*: temperature measured at the specified Tcase point (at the bottom) of the module.
- *Driver temperature*: temperature measured at the specified Tcase point of the driver
- *Ambient temperature*: temperature of the air surrounding the luminaire in the test environment or application.
- *Ambient temperature in lab environment*: air temperature in a testing area, in a controlled environment free from drafts
- *Average ambient temperature*: monthly average temperature based on at least 2 measurements daily, with minimum 8-hour intervals between measurements.

Module temperature

The only critical temperatures that need to be measured during design-in are:

- Ambient temperature around the luminaire.
- Tcase temperature at the bottom of the module.

For the full thermal specifications and temperature limits of the individual Fortimo LED LLM Gen4 modules, please refer to the respective product datasheet.

To achieve typical product lifetime characteristics, it is critical to ensure that the product is operating within specified temperature limits. These limits depend on both the product and the application, including luminaire design and ambient environment.



Warning:

- Maximum Tcase should never exceed Tcase max.;
- When the module exceeds Tcase max, the system driver will automatically dim the module;
- Thermal design should ensure that Tcase < 65 °C (beginning of life, with respect to CLO);
- Thermal design must ensure maximum ΔT (Tcase – Tamb) \leq 50 °C.

To define the correct temperature limit and validate thermal luminaire design, the maximum ambient temperature at which the luminaire will operate constitutes the initial key criteria.

Scenario 1

If the maximum ambient temperature ($T_{amb,max}$) is 15 °C or lower, the luminaire design needs to ensure that the module temperature does not exceed 65 °C when tested in a lab environment at 15 °C ambient. The thermal design must ensure a maximum ΔT ($T_{case} - T_{amb}$) ≤ 50 °C.

Scenario 2

When $T_{amb,max}$ exceeds 15 °C during module operating hours, the maximum T_{case} specified is 65 °C at the beginning of life, tested in a lab environment at $T_{amb,max}$.

Note: The ambient temperatures referred to above indicate average temperatures during the operational period of the module.

In terms of temperature, the critical components inside the module are:

- Solder joints of the components
- Junction of the LEDs

Thermal measurements

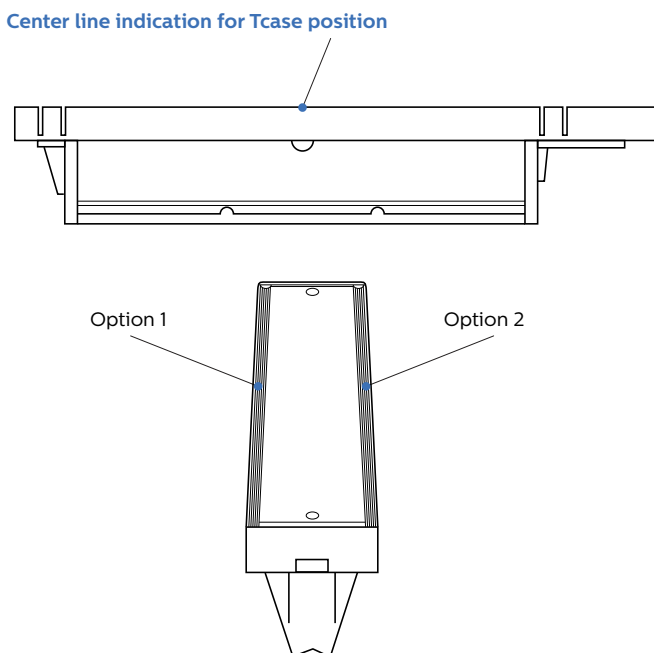
Critical temperature point (T_{case})

For LEDs, the junction temperature is the critical factor for operation. Since there is a direct relation between the case temperature and the LED junction temperature, it is sufficient to measure the aluminum casing of the Fortimo LED LLM module at its critical temperature point. If the case temperature at the T_{case} point exceeds the recommended T_{case} life of 65 °C, the performance of the LEDs and the Fortimo LED LLM system will be adversely affected in terms of light output, lifetime and lumen maintenance.

Measurement of critical temperature point

The T_{case} should be measured at its critical temperature point with a thermocouple on the bottom of the module, inside the left or right groove at the center point location - see figure at the left.

Note: In order to ensure accurate T_{case} test results, the case temperature should not vary by more than 1 °C for a period of at least 30 minutes.



Temperature test point on bottom of the module.

Critical module temperature point with respect to CLO

The Fortimo LED LLM Gen4 system with dedicated Fortimo drivers offers the pre-programmed Constant Light Output (CLO) feature. Over system lifetime the driver will automatically increase output current to the LED module in order to compensate for lumen depreciation and keep light output constant. For a thermal design developed to ensure the Tcase point $\leq 65\text{ }^{\circ}\text{C}$ at the beginning of life, this means that over lifetime the Tcase will rise above $65\text{ }^{\circ}\text{C}$, which is expected. This effect has been taken into account in the system lifetime predictions.

Thermal derating

Thermal derating with dedicated system drivers

The Fortimo LED LLM Gen4 system is equipped with a thermal de-rating system to prevent extreme lifetime degradation of the module when it is operated at temperatures exceeding its maximum specification, e.g. during peaks in ambient temperature around the luminaire or in case of underperformance of the heat management system.

The thermal de-rating system is a default setting in the dedicated Fortimo LED LLM system drivers. When the case temperature rises above the specified limit typically $75\text{ }^{\circ}\text{C}$, a thermal circuit will be engaged, reducing output current to the module. Depending on the module temperature, the current will be between 100% and the minimum dim level. Due to the component spread in the LED LLM module and driver, the dim trigger point will typically fall somewhere between $75 - 80\text{ }^{\circ}\text{C}$. The trigger point is also dependent on the thermal design of the luminaire. This variance will also apply to the module shut-off point.

Note: The thermal circuit is used in all Fortimo LED LLM modules. It is only active if connected correctly to the driver.

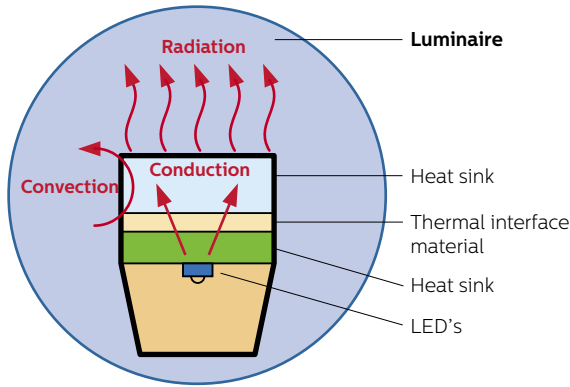
Thermal derating with Xitanium Programmable LED drivers

When using Fortimo LED LLM Gen4 modules in combination with Xitanium LED Programmable drivers, it is necessary to activate and program the correct Module Temperature Protection (MTP) settings.



Warning:

The thermal circuit is only a failsafe in order to protect the module against overheating during peaks in ambient temperatures or in case of faulty heatsink design. The optimum performance is only achieved if the Tcase stays below $65\text{ }^{\circ}\text{C}$ at the specified maximum ambient, measured according to the procedure described above.



Three types of heat transport

Heatsink design

The heat produced by the Fortimo LED LLM driver and module in the luminaire (or similar housing) must be dissipated to the surroundings. If this is not taken care of it will have an adverse effect on system performance and lifetime.

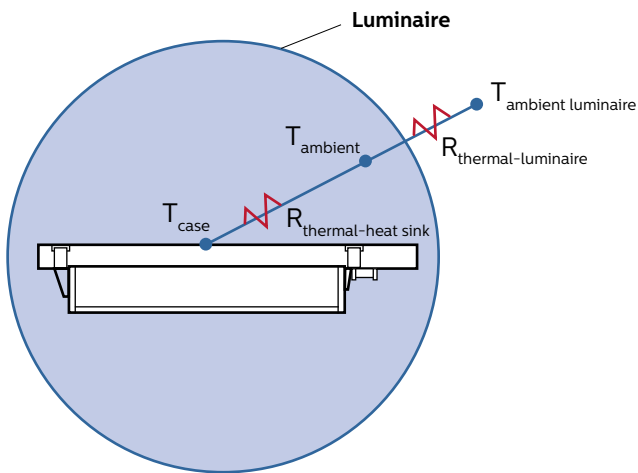
For thermal specifications of individual modules, please refer to the respective product datasheet. To ensure optimum performance, it is essential that the critical temperature of the module stays below 65 °C. The thermal management can be done in three ways: convection, conduction and radiation or a combination of these.

Note: The objective of this chapter is not to indicate exactly how to calculate a heatsink, but to give some guidelines on how to improve its performance.

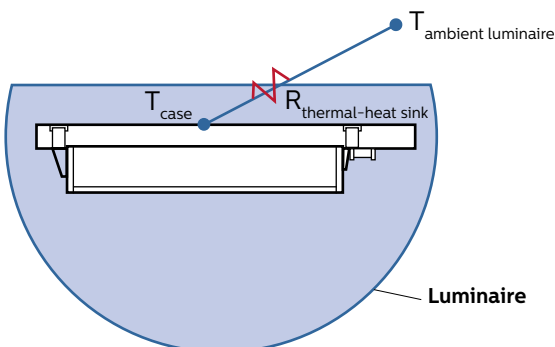
Two thermal design concepts are shown for passive cooling of the Fortimo LED module:

- Concept A: regular heatsink design
- Concept B: luminaire as part of heatsink

To simplify thermal management, the heatsink can be designed in such a way that it becomes one with the luminaire housing. By making the housing of the luminaire an integral part of heat management, it is possible to reduce the surface area of the internal heatsink, possibly also reducing the size of the luminaire. The main objective is to extract the heat from the module and dissipate it into the ambient air. The two simplified thermal network models are depicted in the concept figures on the left.



Concept A: regular heatsink design



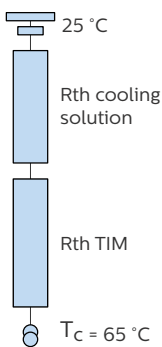
Concept B: luminaire as part of heatsink

Material	W/mK
Copper	400
Aluminium	200
Brass	100
Steel	50
Corrosion-resistant steel	15

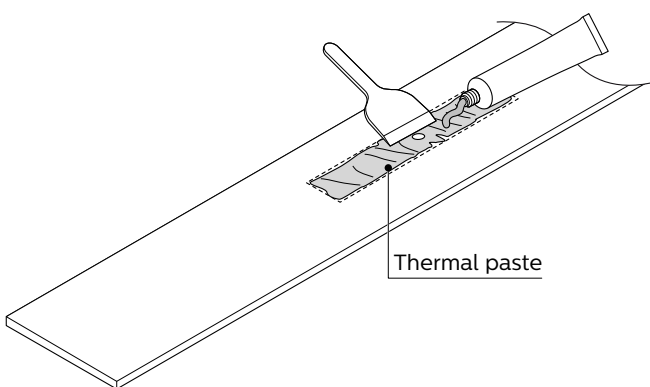
Thermal conductivity

Material	Finish	Emissivity coefficient
Aluminium	New/polished	0.04 - 0.06
	Blank	0.20 - 0.30
	Anodized	0.80 - 0.95
Steel	New/polished	0.10
	Painted/coated	0.80 - 0.95

Thermal emissivity coefficients of common materials



Thermal network



Interface between module and mounting plate filled with thermal paste.

Heatsink material

The type of material used has a large influence on the final result. For example, a comparison of the thermal conductivity (k) of copper with that of corrosion resistant steel (see Table at the left) shows that a substantially smaller heatsink can be made with copper. The best material for heatsinks is (soft) aluminum. The thickness (H) of the heatsink is also of major importance. Assuming that identical heatsinks made with from different material are used, a similar effect would be achieved with 1 mm copper, 2 mm aluminum, 4 mm brass, 8 mm steel or 26 mm corrosion-resistant steel.

Thermal radiation and emissivity coefficient

Thermal radiation forms a substantial part of the total heat transfer. The amount of thermal radiation is highly dependent on the emissivity coefficient of the surface. For example, a polished aluminum surface has a very low emissivity coefficient, while a painted surface has a very high one. A higher emissivity coefficient means better transfer of heat.

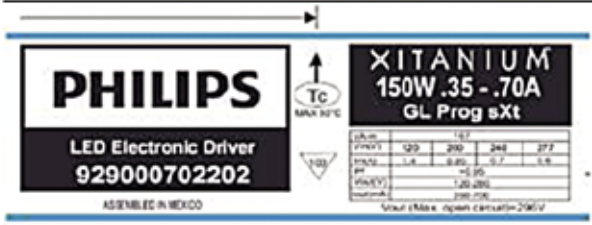
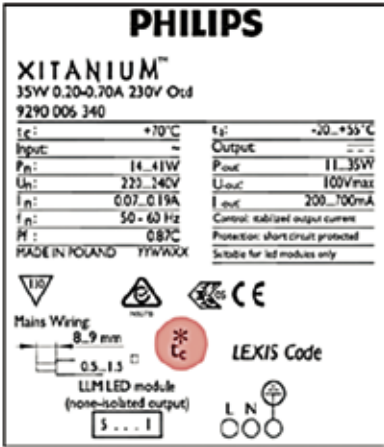
Thermal interface

The thermal interface is the interface between the module and the mounting surface in the luminaire. To ensure good thermal contact, it is recommended that the contact area be covered with thermal interface material, e.g. thermal paste (see figure on the left). If the use of thermal paste is not appropriate, and some other thermal interface material is used (e.g. phase change or thermal pad) it is strongly recommended that the installation instructions for the selected interface materials be followed.



Warning:

The use of thermal interface materials other than thermal paste might require a larger heatsink.



Labels on the Xitanium drivers indicates Tcase point

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

Xitanium LED driver temperature

The next key component is the driver, which influences the lifetime and reliability of the system. It is important to ensure good contact between the driver and the luminaire as this enables the heat to dissipate efficiently. The driver temperature can be measured with a thermocouple at the Tcase point, shown on the driver label (Figure on the left).

Critical driver temperature point with respect to CLO

Over lifetime the dedicated Fortimo LED LLM system drivers with CLO will increase their power output. As a result, the driver losses will increase accordingly, which in turn will lead to higher Tcase temperatures. This temperature effect is expected and has been taken into account in the lifetime predictions of the Fortimo LED LLM system. For the thermal design it is sufficient to ensure that the Tcase temperature of the driver is within specification for Tcase life at the beginning of life.

For the thermal specifications of the dedicated Fortimo LED LLM system drivers please refer to the respective product datasheet.

For Xitanium Programmable LED drivers, please refer to individual product datasheets for T_{case} life information.

Important points for luminaire design

- Ensure good thermal contact between the module/driver and the coldest part of the luminaire.
- Place the module(s) and driver at a distance from each other to obtain a more homogeneous temperature distribution in the luminaire.
- When mounting modules directly on the luminaire housing, we recommend using aluminum that is at least 3 mm thick; thinner material will limit the heat flow through the luminaire housing. Thicker material will improve the heat flow through the luminaire housing, resulting in a lower Tcase of the module.
- Use anodized, painted surfaces rather than blank surfaces in order to increase the transfer of heat via thermal radiation.
- In order to accommodate every application, Fortimo LED LLM Gen4 modules can be dimmed or used in pairs to optimize the lumen package.
- Use highly thermally conductive materials (e.g. aluminum) in the primary heat path.
- Limit the number of thermal interfaces in the primary heat path towards the ambient air.

Compatibility with Fortimo LED LLM Gen3 thermal solutions

Fortimo LED LLM Gen4 modules are thermally backwards compatible with Fortimo LED LLM Gen3.

Installation instructions



Warning:

The Fortimo LED LLM Gen4 should always be replaced by a trained installer.

Special attention should be paid to the following points:

- Do not service the system when the mains voltage is connected; this includes connecting or disconnecting the cable
- Before a new Fortimo LED LLM Gen4 is mounted, the old thermal interface must be removed and the area must be cleaned

Mechanical fixation

The separate components (driver and module/s) of the Fortimo LED LLM Gen4 system can be fixed in place securely using the mounting holes located on the module(s) and driver.

Please refer to the dimensional drawings for specific details. The 3D CAD files can be downloaded from the www.philips.com/Fortimo.

For fixation of the system we advise using an M4 hexagon socket head cap screw (DIN 912 / ISO 4762) with an M4 spring lock washer for screws with cylindrical heads (DIN 7980) of A2 stainless steel (DIN 1.4301 / AISI 304). It is not allowed to use screws with a head diameter larger than 8 mm.

Fixation of the module

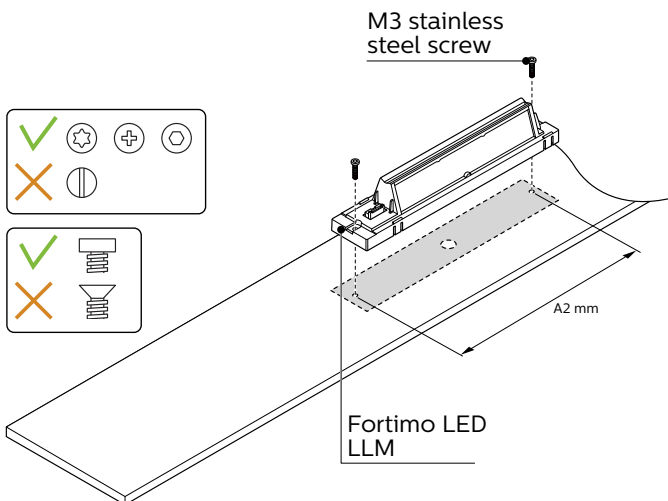
Before fixing the Fortimo LED LLM module, ensure that the mounting surface is clean and flat, without any protrusions or pits. To ensure a reliable thermal and mechanical attachment, we recommend that the flatness of the mounting surface should be ≤ 0.2 mm. For the best thermal performance, use a thin layer of thermal paste between the module and the mounting surface. The entire bottom surface of the module needs to be covered with thermal paste, with a typical bond line of 30 to 50 microns. Other thermal interface materials can be used but will require more cooling from the luminaire (i.e. more contact surface between the luminaire and the ambient air).

Fixation of the driver

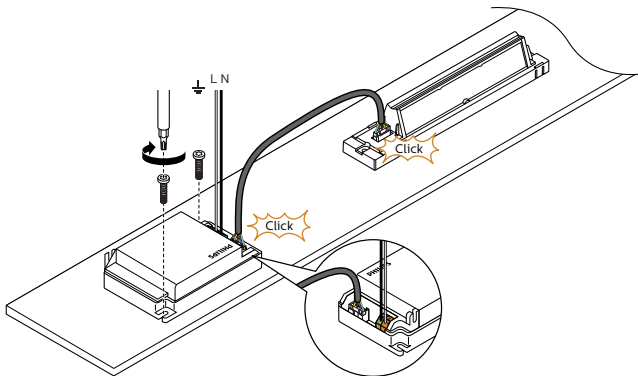
The Xitanium driver has screw holes on the short ends of the casing. The driver should be mounted securely on a flat area of the luminaire, using all mounting holes.

Fortimo LED LLM system with dedicated drivers for Fortimo LED LLM 1100, 1800 lm and 3000 lm systems, a cable is available to connect the module to the driver (See figure on top next page).

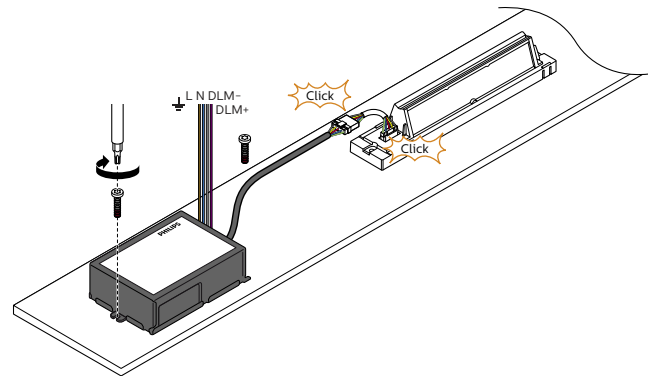
For Fortimo LED LLM 4500 lm systems, a cable is integrated into the dedicated Xitanium driver. To ensure compatibility with Gen4 modules, an additional interface cable is included with the driver. The interface cable must be connected



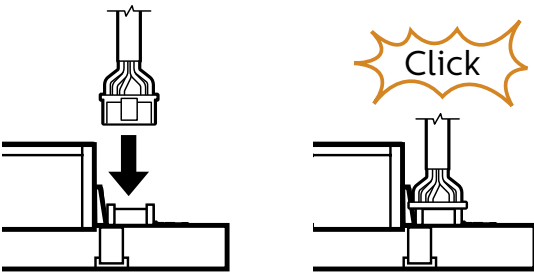
Fixation of the LLM Gen 3 module.



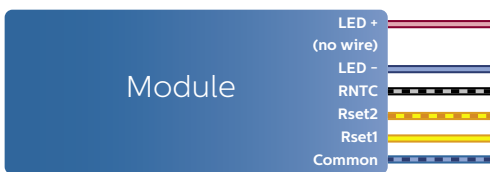
Fixation of the dedicated Xitanium driver for 1100, 1800 and 3000 lm systems.



Fixation of the dedicated Xitanium driver for 4500 lm systems.



Connecting cable to module.



Cable wiring to driver.

Connecting cables

Mate connectors gently in a straight line, pressing down the whole of the connector. When the mating operation is properly completed there is an audible click. If there is no click, full contact has not been made. Remove the connector and repeat the process. The number of connection attempts should be kept to a minimum.

Removing connector cables

Press lock-release lever to release the cable connector completely. Remove the connector straight along the mating axis. Do not pull on the cable forcibly without unlocking first; such handling may cause breakage.

Fortimo LED LLM with Xitanium Programmable LED drivers

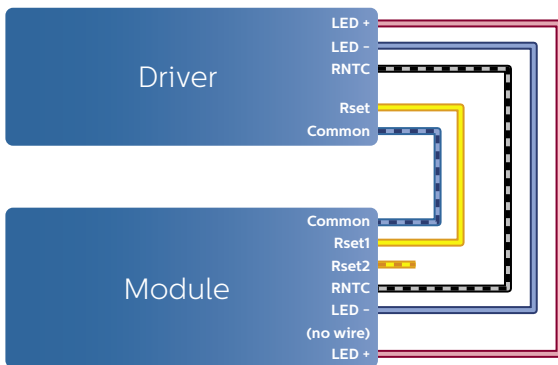
The Fortimo LED LLM Gen4 is compatible with both Rset1, Rset2 and programmable-only Xitanium LED drivers. Please note that Fortimo LED LLM modules can only be used in combination with specific Xitanium LED drivers. Please refer to the respective product datasheet for approved combinations.

A standard cable is available for connecting the module to a driver. The color coding of the wires in the cable corresponds to the wiring of the Xitanium drivers.

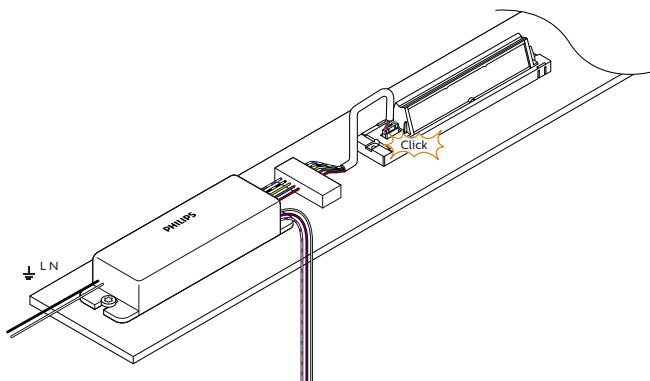
When using Fortimo LED LLM Gen4 modules in combination with Xitanium Programmable LED drivers, it is necessary to activate and program the correct Constant Light Output (CLO), correct output current (AOC) for drivers having no Rset functionality, and Module Temperature Protection (MTP) settings. To simplify programming, the Fortimo LED LLM Gen4 MTP profiles for both Xitanium Prog and Prog+ LED drivers is available on request from your Philips sales representative.

Connector pin	Function	Color coding of driver cable
Pin 1	LED+	Red
Pin 2	-	No wire
Pin 3	LED-	Blue
Pin 4	RNTC	Black/White
Pin 5	Rset2	Yellow/Black
Pin 6	Rset1	Yellow
Pin 7	Common	Blue/White

Fortimo LED LLM wire color coding



Color coding (one module connected to one driver)



Fortimo LED LLM system with Xitanium Prog LED driver (1 module)

Note:

- The Rset2 wire should be left unconnected when using Rset1 drivers, and vice versa.
- Both Rset1 and Rset2 wires should be left disconnected in case a programmable-only AOC driver is being used.
- The unused Rset wires should be clipped short and wrapped with an insulating material e.g. a fiberglass insulating sleeve.

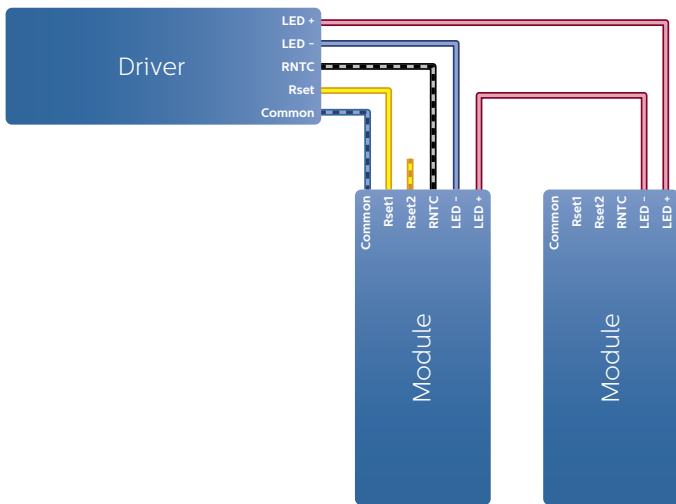
Xitanium Programmable LED driver with 1 module

In a system with a single module and a single driver, the matching colors simply need to be connected for easy installation.

The figure on the left illustrates the connection between a Xitanium Programmable LED driver and a single LLM module.

The system consists of:

- 1x Fortimo LED LLM module
- 1x Xitanium Prog LED sXt driver (Rset1)
- 1x Cable Fortimo 7 PA to 6 wire – 600 mm



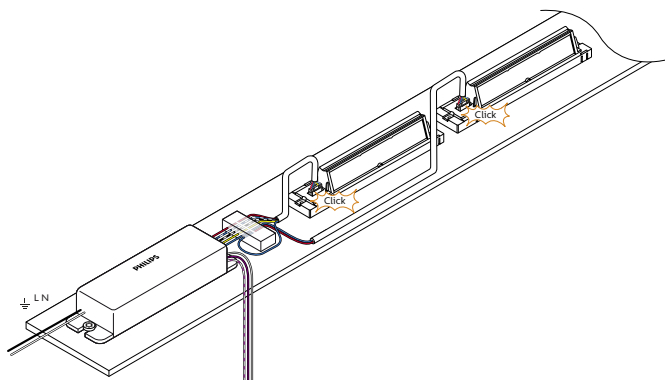
Color coding (two modules connected to one driver)

Xitanium Programmable LED driver with 2 modules
 It is possible to connect two modules in series to one Xitanium driver by using two cables. It is important to note that the driver can only communicate with one of the modules. Because the output current setting and Module Temperature Protection read-out are only available on one of the two modules, it is essential to use modules from the same batch. This will ensure the correct performance of the system. The production date code on the module label identifies the batch.

Figure illustrates the connection between a Xitanium Programmable LED driver and two LLM modules.

The system consists of:

- 2x Fortimo LED LLM modules
- 1x Xitanium LED sXt driver (Rset1)
- 2x Cable Fortimo 7 PA to 6 wire – 600 mm

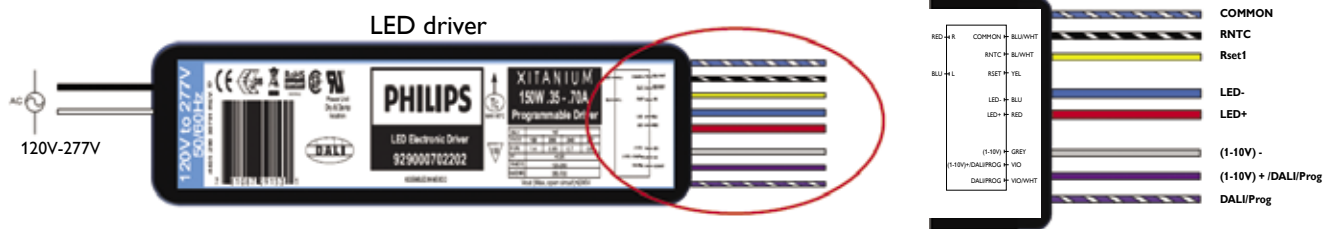


Fortimo LED LLM system with Xitanium Prog LED driver (2 modules)



Warning:

- The Rset2 wire should be left unconnected when using Rset1 drivers and vice versa.
- Both Rset1 and Rset2 wires should be left disconnected in case a programmable-only AOC driver is being used
- The unused Rset wires should be clipped short and wrapped with an insulating material e.g. a fiberglass insulating sleeve.
- When a system consists of multiple LLM modules connected to a single driver, only one module is monitored by the NTC and RSET
- A robust thermal design is strongly advised
- Always use multiple modules of the same type and batch



Wire color-coding on Xitanium LED driver with Rset1

Replacing a module

System replacement

When replacing modules in a system with Constant Light Output (CLO), it is advisable to replace the complete light engine (module + driver) to ensure correct functionality of the CLO programming. Replacing only the module after the driver has been operational in the field will result in over-lighting.

Replacing a module when 2 modules are connected to 1 driver

Special attention is required when replacing a module in a 2-module/1-driver configuration. Since the driver can only read out information from a single module, in the event of failure we recommend replacing both modules, as current settings can vary from batch to batch over time as LED performance improves. If the installer does not replace both modules it is possible that one of them will be driven at the wrong current and will not produce the specified lumen output. The production date code on the module label identifies the batch.

Using a long cable in a Fortimo LED LLM Gen4 system

It is possible to use a connection between the module(s) and the driver that is longer than the standard cable. When using AWG24 cables, the connection can be extended to 10 meters without affecting the power supply to the module. It is not advisable to use the communication Rset, RNTC and Common wires because of possible interference. The Length of communication wires should not exceed 60cm.



Warning:

When using a long cable between module and driver, extra care should be taken in the design of EMI, surge and noise suppression.

Quality

Compliance and approval marks

The Philips Fortimo LED LLM Gen4 LED module bears the CE mark indicating that it complies with the appropriate European EU directives.

To ensure luminaire approval, the conditions of acceptance need to be fulfilled. Details can be requested from your local sales representative. All luminaire manufacturers are advised to conform to the international luminaire standards (IEC 60598-1) and to national standards of luminaire design.

Sustainability

Fortimo LED LLM Gen4 modules are compliant with European Directive 2011/65/EU, recasting 2002/95/EC on Restriction of the Use of Certain Hazardous Substances in Electrical and Electronic Equipment (RoHS). The modules comply with Reach, as defined by the EU Chemical Agency.

IP rating, humidity and condensation

Fortimo LED LLM Gen4 systems are build-in systems



Warning:

The Fortimo LED LLM Gen4 has been developed and released for use in dry and damp locations.

- Do not use in locations where condensation is present
- If there is a possibility that condensation could come into contact with the modules, the system/ luminaire builder must take precautions to prevent this.

Item	Symbol	Result: Risk group
Pin 1	E _S	Exempt
Pin 2	E _{UVA}	Exempt
Pin 3	L _B	RG1
Pin 4	L _R	Exempt
Pin 5	E _{IR}	Exempt

Fortimo LED LLM Gen4 photobiological measurement results

Photobiological safety

The photobiological safety standard IEC 62471 ('Photobiological safety of lamps and lamp systems') gives guidance on evaluating the photobiological safety of lamps and lamp systems, including luminaires. This standard specifies the exposure limits, reference measurement technique and classification scheme. It should be used for the evaluation and control of photobiological hazards from all electrically powered, incoherent broadband sources of optical radiation, including LEDs, in the wavelength range of 200 to 3000 nm. The following hazard categories are defined:

Radiance-based

- Blue light L_B 300 – 700 nm
- Retinal Thermal L_R 300 – 1400 nm
- Retinal Thermal Weak Stimulus L_{IR} 780 – 1400 nm

Irradiance-based

- Blue light E_S 200 – 400 nm
- Retinal Thermal E_{UVA} 315 – 400 nm
- Retinal Thermal E_B 300 – 700 nm
- Retinal Thermal Weak Stimulus E_{IR} 780 – 3000 nm

Conclusion regarding photobiological safety

No safety measures are required.

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. In general, LED modules have no effect on the EMC of a luminaire. The Fortimo LED LLM Gen4 was tested with a Xitanium driver and a LLM dedicated cable in a reference luminaire and no EMC issues were observed.

Remote system operation

Please consult the design-in guide for Xitanium LED drivers.

Fusing Xitanium drivers

Please consult the design-in guide for the drivers at www.philips.com/xitanium.

Driver insulation requirement	Luminaire class			
	I	II	I	II
	1100-3000 lm		4500 lm	
Not insulated	✓	✓	✗	✗
Basic insulated	✓	✓	✓	✓
Double insulated	✓	✓	✓	✓

Class I and II luminaire design component requirements

Class I and Class II applications

When the Fortimo LED LLM Gen4 4500 lm is combined with a basic insulated driver, it can be used in both Class I and Class II applications. The Fortimo LED LLM Gen4 1100 lm, 1800 lm and 3000 lm can be used in both Class I and Class II applications independent of the driver isolation.

Warnings on use during storage, transportation and operation

- Store in a dark place
- Do not expose to sunlight
- Maintain temperature between -40 and +85 °C
- Relative humidity (RH) between 5% and 85%

During operation

Fortimo LED LLM Gen 4 modules must be operated within the specifications found in the product leaflet and design-in guide. Please contact your local sales representative for additional information.

System disposal

We recommend that the Fortimo LED LLM Gen4 and its components are disposed of in an appropriate way at the end of their (economic) lifetime. The modules are in effect normal pieces of electronic equipment containing components that are currently not considered to be harmful to the environment. We therefore recommend that these parts are disposed of as normal electronic waste, in accordance with local regulations.

Disclaimer

Philips will perform the testing of the LED systems to high standards of workmanship. The tests are carried out with reference to the EN/IEC standards, if any, which are regarded by Philips as being of major importance for the application of the lamp gear and the lamp within the fixture for horticultural applications.

The design-in guide, regarding the testing and design in of the LED system provided by Philips, is not an official testing certificate, and cannot be regarded as a document for official release of the fixture. The OEM is liable for the official testing by a certified test body and all markings, such as CE and ENEC marks, on the fixture assembly.

The design-in guide is for information purposes only and may contain recommendations for detecting weak points in the design of the system (lamp – lamp gear – fixture), if any.

Specifically mentioned materials and/or tools from third parties are only indicative: other equivalent equipment may be used but it is recommended that you contact Philips for verification.

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As Philips does not have control over manufacturing of the fixtures, Philips cannot be held liable for the fixture assembly.

Philips will not accept claims for any damage caused by implementing the recommendations.

No warranty whatsoever may be claimed by the OEM with regard to the content and/or quality of the design-in guide or any other advice, or the conclusions and/or recommendations in the design-in guide or any other document, either express or implied, and Philips expressly disclaims any implied warranties of any kind, including without limitation any warranties of satisfactory quality, fitness for a particular purpose or non-infringement and any warranties regarding the design-in guide or any other advice or the use of the results of any activity performed while testing the fixture with respect to its correctness, quality, accuracy, completeness, reliability, performance or otherwise.

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The OEM must bring any claim for damages within ninety (90) days of the day of the event giving rise to any such claim, and all lawsuits relative to any such claim.



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