Design-in guide

Philips Fortimo LED High Brightness Module

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Contents

Introduction to this guide

Philips Fortimo LED High Brightness Module system

Thank you for choosing the Philips Fortimo LED High Brightness Module and Xitanium drivers. In this guide you will find the information required to design this module into a luminaire, plus valuable hints and tips.

A detailed design-in guide specifically for the drivers is available on our website: www.philips.com/xitanium.

Information and support

On our website www.phililps.com/fortimo you will find not only information about the module but also a helpful design-in guide specifically for the Xitanium drivers and their related CAD files.

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

Support	www.philips.com/support
Fortimo module details and CAD files	www.philips.com/fortimo
Xitanium drivers	www.philips.com/xitanium
General info for OEMs	www.philips.com/oem

Introduction to the Fortimo LED High Brightness Module (HBM)

Philips Fortimo LED High Brightness Module

Philips Xitanium 75 W TD driver

Fortimo LED HBM cable 60 cm

Applications

Philips Fortimo LED HBM has been primarily designed for outdoor applications but can also be used indoors (providing applicable IEC regulations are followed).

Product description

To operate a system the following products are needed:

- A Fortimo LED High Brightness Module
- A compatible Xitanium driver, type 75 or 150 W Prog GL sXt
- A Fortimo LED HBM cable 60 cm.

Classification

The Fortimo High Brightness Module with the Xitanium driver can be used in:

- Class 1 UL system
- Class II IEC system.

About the module

A high quality of white light and a high level of efficiency can be achieved if the appropriate high-quality LED is selected. The protective housing allows easy handling during transport and installation, protects the LEDs from direct access/damage once mounted, and ensures the appropriate safety distance between the LEDs and any metal objects (for example a reflector) to ensure electrical safety. The connector allows quick and easy (re)placement of the module.

The range of LED High Brightness Modules

Philips Fortimo LED High Brightness Module types
Fortimo LED HBM 4000 45W/740
Fortimo LED HBM 4000 40W/641
Fortimo LED HBM 4000 35W/757
Fortimo LED HBM 6000 68W/740
Fortimo LED HBM 6000 59W/641
Fortimo LED HBM 6000 52W/757

Explanation of naming, using Fortimo LED HBM 4000 45W/740 as an example

• Fortimo	Concept family name
• HBM	High Brightness Module
• 4000	Typical lumen package
• 45W	Typical power consumption for a module
• /641	Indication of the color rendering (first digit) and color temperature (second and third digit). In the case of the High Brightness Module, the color rendering is CRI >70 for a color temperature (CCT) of 4000 K and 5700 K. For a color temperature of 4100 K the CRI is > 60.

Important recommendations and warnings

Warnings

- Avoid touching live parts!
- Do not use damaged LED modules!
- Luminaires must be earthed!

The following recommendations and warnings should be taken into account during the various phases of use of the Fortimo LED High Brightness Module (HBM) and drivers:

Design-in phase

- It is mandatory to design the luminaire in such a way that it can only be opened with special tools (by electricians) in order to prevent touching of live parts (e.g. HBM with a voltage potential of 120 V DC).
- Safety and IEC recommendations: the general IEC recommendations for luminaire design and national safety regulations (ENEC, CE, UL, etc.) also apply to selected Philips Fortimo LED HBM modules and drivers. Luminaire manufacturers are advised to conform to the international standards for luminaire design (IEC 60598-Luminaires).
- The luminaire must be constructed in such a way that the LED module cannot be touched by an end-user.
- Do not apply mains power to the LED module.

Design-in and manufacturing phase

- Do not use damaged or defective contacts or housings.
- Do not remove the wire and re-terminate contacts as the contact and housing are not repairable.
- Do not drop the LED module or let any object fall onto it as this may damage the insulation layer or the LEDs. Do not use the LED module if it has been dropped or an object has fallen onto it and there are visible defects or damage.

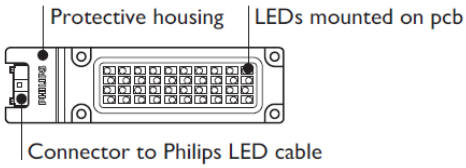
Installation and service phase of luminaires

- The luminaire should not be serviced when the mains voltage is connected; this includes connecting or disconnecting the Fortimo High Brightness cable.
- Do not remove the wire and re-terminate contacts of the modules as the contact and housing are not repairable.

Mechanical characteristics

Mechanical construction of the Fortimo HBM

The module consists of a PCB assembly with LEDs and additional components covered by a protective housing.



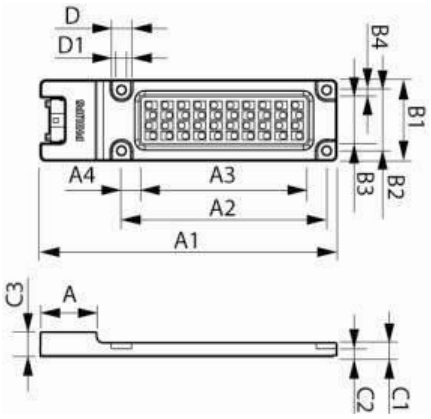
Protective housing

The protective housing allows easy handling during installation and transport. It protects the LEDs from direct access/damage when mounted and ensures the appropriate safety distance between the LEDs and any metal objects (for example a reflector) to ensure electrical safety. The connector allows quick and easy (re)placement of the module. It is only with this protective housing that ESD measures are not required.

Warning: do not remove the protective housing without proper ESD measures.

Dimensions of the High Brightness Module

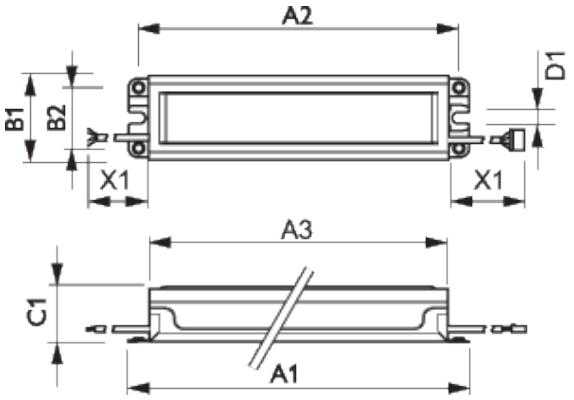
(mm nominal)



Dimensions in mm	A1	A2	A3	A4	A5	A6	B1	B2	B3	B4	C1	C2	C3	D1
Fortimo High Brightness Modules, all types	110	76	61.8	7.1	7.5	3.4	30.5	22.5	17.5	2.5	5	2.8	9	21

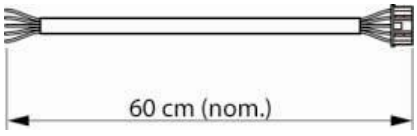
Dimensions of the Xitanium LED driver

(mm nominal)

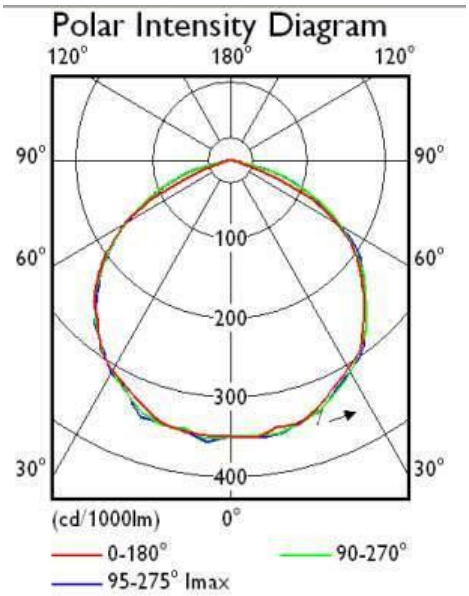


	A1	A2	A3	B1	B2	C2	D1	X1
Xitanium 75 W .35-.70A Prog GL sXt	240.5	226.2	211/1	59.1	42.9	37.1	6	500
Xitanium 150 W .35-.70A Prog GL sXt	240.5	226.2	211/1	59.1	42.9	37.1	6	500

Dimensions of the Fortimo LED HBM cable



Lighting characteristics



Polar diagram of Fortimo LED High Brightness Module

Light distribution

The light distribution of the Fortimo High Brightness Module is near lambertian and can be used for a multitude of applications, such as street lighting, area lighting, wall washing, urban lighting and others. The light distribution can best be controlled using a specular/near-specular reflector; solutions will be big and usually more expensive due to the relatively large light-emitting window lens.

Universal mounting position

The mounting direction of the Fortimo High Brightness Module is universal and it can therefore be adjusted to suit the application most effectively. For applications where a narrow batwing-like distribution is required we recommend the modules are used in pairs to make optimal use of the module.

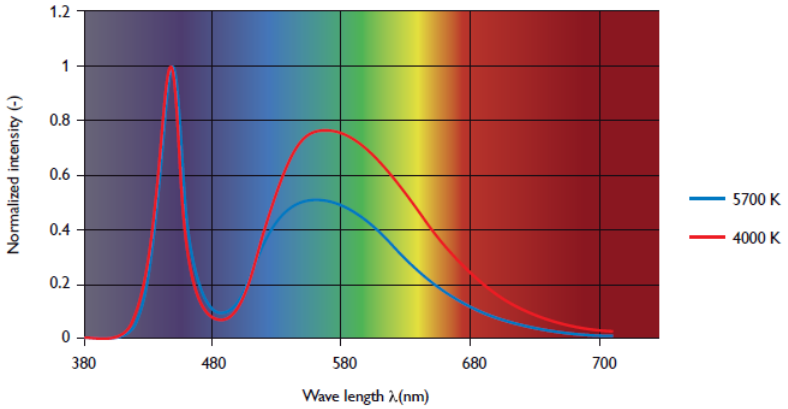
Optical files

On the Fortimo website (www.philips.com/fortimo) optical files can be downloaded in the following formats: CIB, IES, LDT, PHL, including a file with Ray-sets.

Photometric files such as CIB, IES, LDT and PHL can be used to check the HBM's far-field intensity distribution, which is near lambertian.

The initial reflector or luminaire design can be carried out using a lambertian emitter to gain simulation speed. The final design should always be verified using a simulation executed with a Ray-set for the HBM.

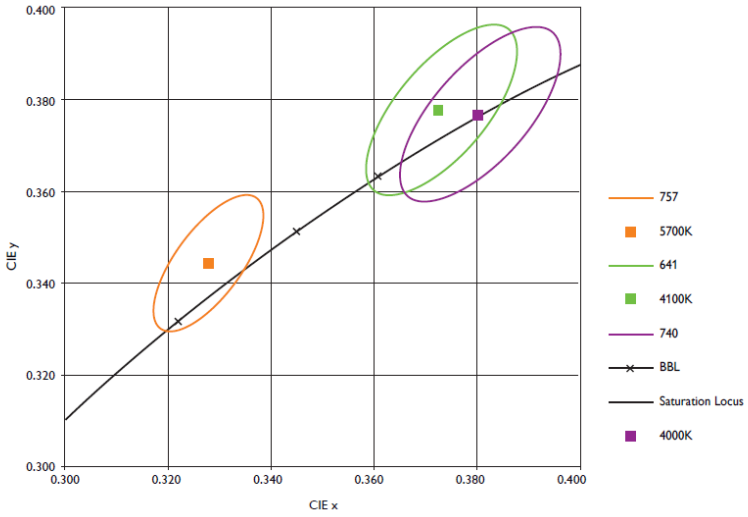
Spectral light distribution



Spectral light distribution for the Philips Fortimo LED HBM 4000 K and 5700 K

Color consistency (SDCM)

The target specification of the Fortimo High Brightness Module for color consistency is within 7 SDCM. This specification is similar to that of conventional discharge lamps used in outdoor lighting. SDCM stands for Standard Deviation of Color Matching and the value 7 refers to the size of an ellipse around the black body locus. Staying within this ellipse results in a consistency of light whereby there is no perceivable difference from one luminaire to another.

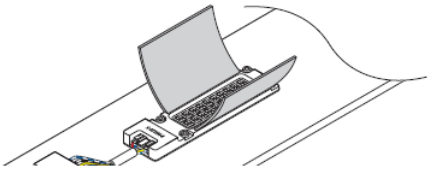


Color consistency (SDCM)

This figure shows color targets for the different color temperatures/CRI of the High Brightness Modules. These are specified in the operating conditions (Tc 70 °C). In the application a color shift is possible if the Tc temperature is significantly lower than in these targets.

Reflector design

A reflector may be mounted on the LED module housing, as shown in the drawing on the left. Please ensure that it is not possible for any metal parts to come into contact with the LEDs.



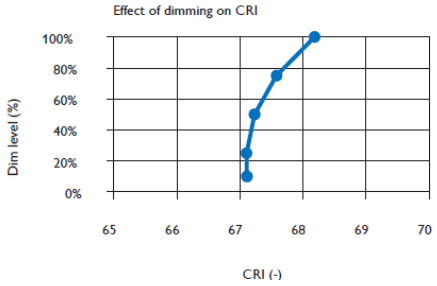
Reflector mounted on the module

Starting characteristics

After ignition or re-ignition of the driver the module will immediately produce the intended amount of light.

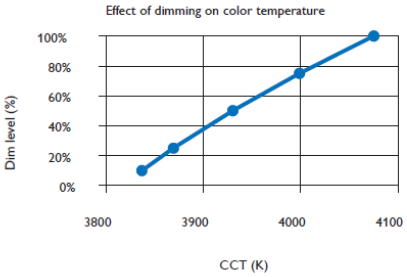
Effects of dimming

The following graphs show the effect of dimming on the typical module performance (here a Fortimo LED HBM 6000 59W/641 product is taken as an example). The exact behavior in an installation may vary from one module or product type to another.



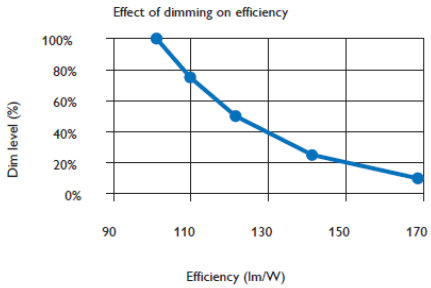
Effects of dimming on CRI

If the HBM module is dimmed, the product's CRI will shift due to the reduction in temperature.



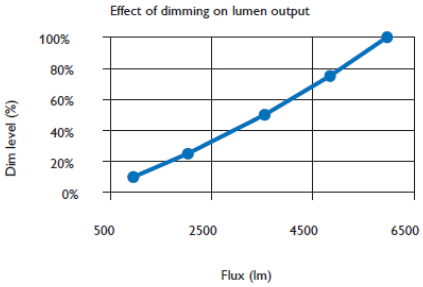
Effects of dimming on color temperature

As is the case with the CRI, the CCT also drops when the HBM module is used under dimmed conditions.



Effects of dimming on efficiency

As current and temperature are reduced, so the efficiency of the HBM rises.



Effects of dimming on lumen output

Dimming does not display a completely linear correlation with the percentage of dimming. This is due to the increase in efficiency as the current and temperature decrease.

Thermal management

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

Operating temperatures

Definitions

- Module temperature: temperature measured on the Tc point of the module
- Driver temperature: temperature measured on the Tc point of the module
- Ambient temperature: temperature outside the luminaire

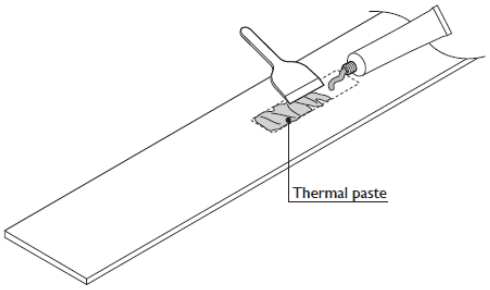
Temperature

A Tcase point has been defined on the module and driver to enable temperature measurement in a luminaire. This point can be found on the label of the driver or in the specification of the module. The specified temperature of this point is related to the temperature of components and solder-joints inside the driver or module. To ensure that the lifetime of the product is reached, the OEM must minimize the thermal resistance between the bottom side of the module and the outside of the luminaire.

Thermal resistance

The thermal resistance of a system is influenced by many aspects, the most important of which are listed here:

1. The number of interfaces between the module and the ambient, preferably only one, i.e. directly on the luminaire.
2. The thickness of the material used, e.g. for the luminaire housing. The thicker the material, the better the heat will be distributed throughout the material. If standard grade aluminum is used, a thickness of 3-5 mm is recommended.
3. The contact area, e.g. the outer side of the luminaire housing which is in contact with the ambient. Typically an area of 0.2 m^2 is required to cool one 6000 lm module in normal operating conditions.
4. A large outer surface area on the luminaire can be created by using a fin structure.
5. The thermal conductivity of the materials used between the module and the ambient. Aluminum is the preferred material here.



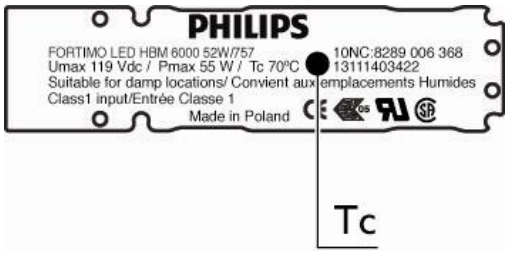
Interface between module and mounting plate filled with thermal paste

Thermal interface

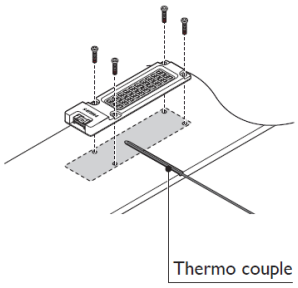
In the HBM the thermal interface is a critical item for design-in. This is due to the small area in combination with the thermal load, which means that the module has a high power density.

The thermal interface is the interface between the module and the mounting surface in the luminaire. To ensure good thermal contact the pressure applied to the module needs to be evenly distributed and ideally the interface should be filled with thermal paste.

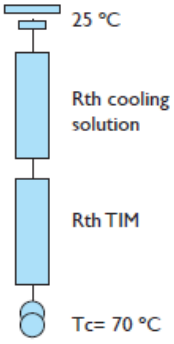
If the use of thermal paste is not appropriate, and some other thermal interface material such as phase change, graphite or a thermal pad is used, we strongly recommend that the additional installation instructions are followed.



Temperature test point at bottom PCB



Thermocouple in a groove

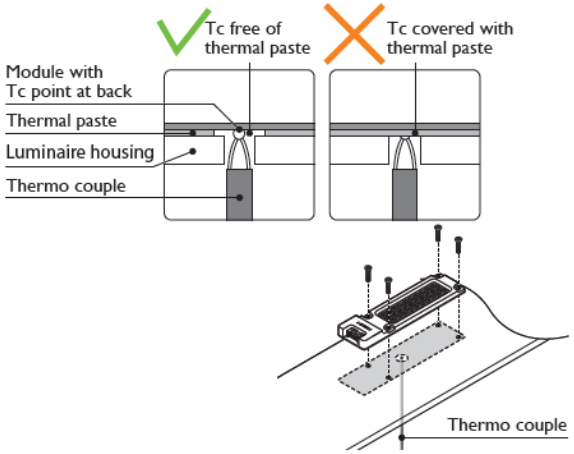


Thermal network

How to measure the temperature of the High Brightness Module?

At the back of the module there is a Tc point, which can be used for temperature measurements. For all measurements, the temperature must be stable before any reliable data can be obtained (depending on the size and material of the luminaire, between 0.5 and 3 hours).
In your reference luminaire you can make measure the temperature in two different ways via a thermo couple connected to the indicated Tc point at the back of the module:.
It is important that the Tc point is free of thermal paste when the thermo couple is connected for temperature measurements.

1. Via a hole through your reference luminaire housing (preferred), see drawing below



2. Via a groove in the reference luminaire housing, see drawing left.

Module temperature

The lifetime specifications of the Fortimo High Brightness Module have been based on a Tcase of 70 °C. All other important temperatures relating to the module are shown below. It is important to note that the lifetime of the product is influenced by both the maximum operating temperature and temperature difference in the ON and OFF state. If the average ambient temperature throughout the year is below 25 °C, the maximum temperature difference will be leading for the thermal design. If the average ambient temperature is above 25 °C, the maximum module temperature will be leading for the thermal design. The 'Temperature ranges' table shown below includes an overview of the temperature limits for the modules.

Relation of Tcase to Tambient

Tc increases with the ambient temperature. The temperature offset between Tambient and Tc depends on the thermal design of the luminaire. To emphasize the relation between T_c, T_{amb} and T_{diff} , the equation shown below describes the relationship. The T_{diff} is not influenced by fluctuations in the ambient temperature. This is a result of the thermal design of the luminaire. The lower the T_{diff}, the better the thermal design. Note that for a luminaire design this varies according to the thermal load of the module(s).

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

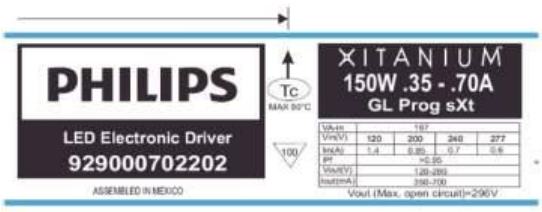
- solder joints of the LEDs and other components
- Die of the LEDs.

Temperature ranges	Symbol	T_{min}	T_{typ}	T_{max}	Description
Specified operating temperature	T_c		70		The temperature for which the product has been designed and specified
Operating module temperature	T_c	-20		75	The temperature range in which the module will operate according to specification
Storage/off state module temperature	T_s	-40		85	The temperature range in which the module can be **stored** or remain **inactive** without causing damage or leading to a reduction in lifetime. In practice this temperature is equal to the ambient temperature.
Ambient temperature	T_{amb}	-40	35	50	The ambient temperature range in which the module can be used. The thermal management of the luminaire needs to ensure the module remains within the operating temperature range when in use.
Temperature difference between module on and off state	T_{diff}			45	The maximum temperature difference between the ambient temperature and the module operating temperature

Thermal resistance calculations

The following overview shows the limits for the thermal resistance of the luminaire design including the maximum ambient and case temperature of the High Brightness Modules.

Product	Symbol	6000 lm 740	6000 lm 641	6000 lm 757	4000 lm 740	4000 lm 641	4000 lm 757
Electrical load	W	68	59	52	45	40	35
Thermal load	W	49	41	35	31	28	23
Preferred case temperature	°C	70	70	70	70	70	70
Typical ambient temperature	°C	25	25	25	25	25	25
Max allowed temperature difference	°C	45	45	45	45	45	45
Thermal resistance requirement (Rth)	°C/W	<0.92	<1.10	<1.29	<1.45	<1.61	<1.96



Label on the Xitanium driver to indicate Tc point

Xitanium driver temperature

The next important 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 on the Tc point shown on the label of the driver with a thermocouple.

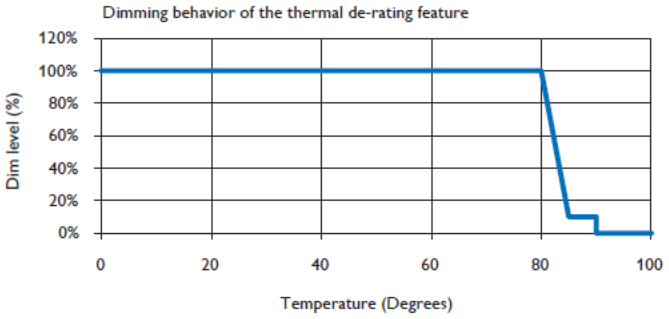
Thermal de-rating system

The Philips Fortimo High Brightness 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 typical case temperature conditions. These conditions can be caused, for example, by extreme ambient conditions around the luminaire or by underperformance of the application's heat management system.

How does it work?

The thermal de-rating system is programmed with default settings in the driver. It switches the system to a lower LED current level, when the case temperature rises above the specified limit. This means that at 80 °C the driver will start to dim the module and will ultimately dim it down to 10% power at 85 °C. If the temperature rises above 90 °C the driver will cut off all power to the module to let it cool down. When the temperature has dropped below this limit minus hysteresis, the system will resume normal operation again.

If for specific reasons you wish to use different settings, it is possible to do so by re-programming the driver. Details on how to adjust the settings in this way can be found in the Xitanium Programmable Drivers design-in guide.



Temperature de-rating feature

Advice to ensure maximum lifetime possible

- Ensure good thermal contact between module/driver and the coldest part of the luminaire.
- Place module(s) and driver at a distance from each other to obtain a more homogeneous temperature distribution in the luminaire.
- We recommend the modules are mounted on an aluminum housing that is at least 3 mm thick; thinner housings will limit the heat flow through the housing, thicker housings will improve the heat flow through the housing, resulting in a lower Tc at the module.

Summary: important points for luminaire design

- If multiple modules are being used, we recommend they are spread throughout the luminaire in order to distribute the thermal load.
- We recommend that reflectors are used in the design of optics.
- In order to accommodate every application, HBM modules can be dimmed and used in pairs to optimize the lumen package.
- Simplify the heat path from Tc to cold ambient air.
- Use good 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.
- If thermal interfaces are inevitable, use thermal interface materials (TIM) to ensure proper thermal contact, i.e. between module and luminaire housing.
- Ensure proper heat dissipation by using highly conductive materials and/or materials of sufficient thickness to increase effective use of the available cooling surface.
- Use anodized, painted surfaces rather than blank surfaces in order to increase the transfer of heat via thermal radiation.

Controllability

Dimming

As a system, the Philips Fortimo LED High Brightness Module with Xitanium driver supports dimming between 100% and 10%. The Xitanium TD driver supports Touch & Dim and DALI protocols. Please refer to the manual of the driver for detailed information.

Which Philips controls can be used?

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

Installation instructions

WARNING

The Fortimo High Brightness Module should always be replaced by a trained installer.

Special attention should be taken with regard to the following points.

- Do not service the system when the mains voltage is connected; this includes connection or disconnection of the cable.
- Before a new High Brightness Module is mounted, the old thermal interface must be removed and the area must be clean.

Electrostatic device (ESD) measures

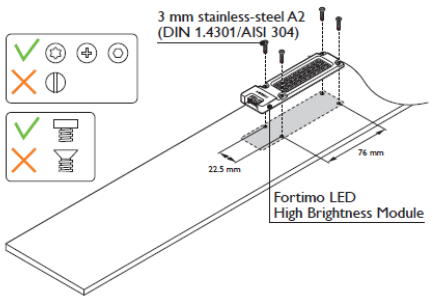
The Philips Fortimo LED High Brightness system does not require ESD measures in a production environment.

Mechanical fixation

The separate components (driver and module) of the Fortimo LED HBM system can be fixed in place securely using the mounting holes located on the module and driver. Please refer to the dimensional drawings for specific details such as pitches and diameters. The 3D CAD files can be downloaded from www.philips.com/fortimo.
Before fixing the High Brightness Module, ensure that the mounting surface is clean and flat without any protrusions or burrs. To ensure a reliable thermal and mechanical attachment, we recommend the flatness of the mounting surface should be ≤ 0.2 mm.
We strongly recommend a thin layer of thermal paste is used between the HBM module and the mounting surface. The entire bottom surface of the module needs to be covered with thermal paste. We also strongly recommend that thin layers of thermal paste are used, with the typical bond line being 30 to 50 microns. We do not recommend using other thermal interface materials as the thermal penalty of those materials is high. If other thermal interface materials are used, such as phase change, graphite or a thermal pad, we strongly recommend that additional pressure is applied in the middle of the module to ensure thermal performance.

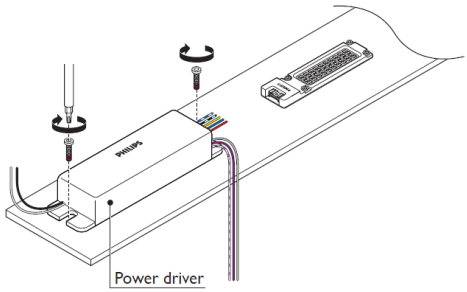
Module fixation

For fixation of the HBM module we recommend use of 3 mm stainless-steel A2 (DIN 1.4301/AISI 304) button-head screws with a pre-applied locking agent (crosshead, hexagon or torx driving). The butting diameter (D) of the button head must be within 6 and 7 mm (see picture). Never use countersunk screws! The maximum torques of the mounted screws should not exceed **30 Ncm**. The cover of the module may be damaged if this force is exceeded. The positioning of the screw holes must be accurate and perpendicular to the mounting surface in order to ensure good reliability.



Module fixation

Item	Value
Screw	3 mm stainless-steel A2 (DIN 1.4301/AISI 304)
Recommended torque on screws	20-30 Ncm
Preferred thermal interface material	Thermal paste/grease
Thermal paste layer thickness	0.1 mm max.



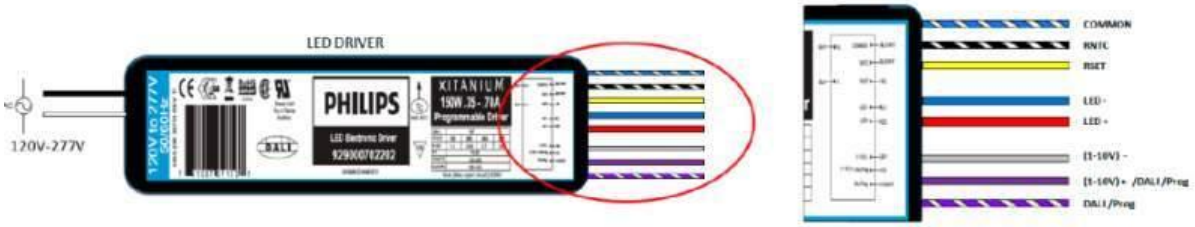
Fixation of the Xitanium driver

Fixation of the driver

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

Connection between module and driver

A cable is available to connect the module to the driver; the color coding of the cable has been aligned with the color coding of the driver to promote easy installation. Below is a table with details of the pinning on the High Brightness Module and the color coding on the driver and cable.

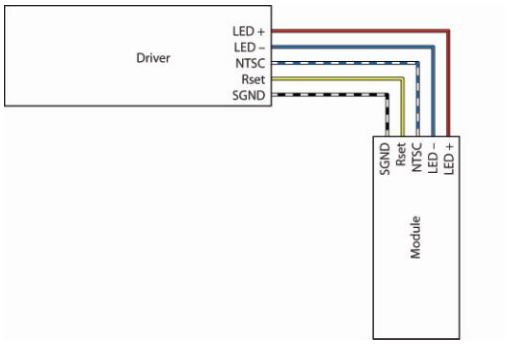


Color coding on the driver

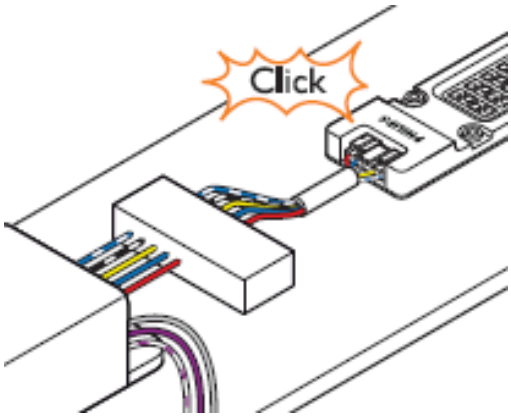
Parameter	Function	Color coding driver/cable	Comment
Pin 1	IDC, LED+	Red	
Pin 2	-		Spacer to support higher voltages
Pin 3	PGND, LED -	Blue	
Pin 4	NTC	Black/White	
Pin 5	Rset 1	Yellow	
Pin 6	Rset 2	t.b.d.	
Pin 7	SGND	Blue /White	Signal ground

Connecting one module to one driver

A standard cable is available for connecting the module to a driver (both the 75 W and 150 W driver can be used in this set-up, although we recommend the 75 W version is used in order to optimize efficiency). The color coding of the wires in this cable corresponds to that in the Xitanium driver. If a set-up with a single module and a single driver is used, the corresponding colors need to be connected to each other.

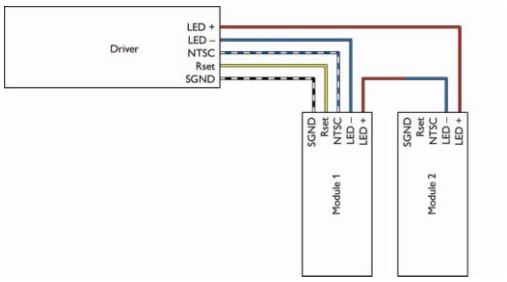


Color coding (one module connected)

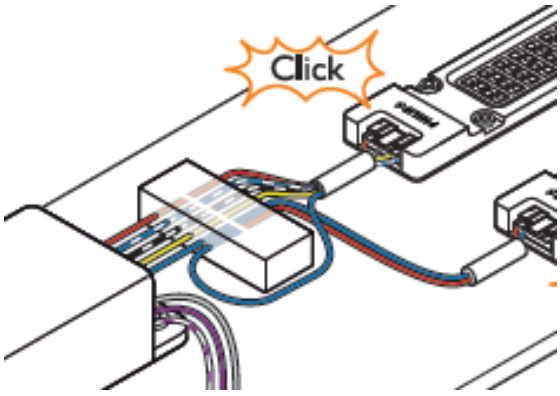


Connecting two modules to one driver

A second possibility is to connect two of the 4000 or 6000 lm modules in series to a 150 W Xitanium driver using two LED cables. It is important to note that the driver can only communicate with one of the modules. This means that current sensing and NTC read-out are only available on one of the two modules. We strongly recommend that the information is read out from the module with the highest Tc in the application.



Color coding (two modules connected to one driver)



Replacing a module when two modules are connected to one driver

Special attention is required when replacing a module in this configuration. Due to the fact that the driver can only read out information from a single module, in the event of a failure we recommend that both modules are replaced because the current setting 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 the modules will be driven at the wrong current and will then not produce the expected lumen output.

Quality

Compliance and approval marks

The Fortimo High Brightness system is ENEC, UL and CSA-approved and complies with CE regulations. To ensure luminaire approval, the conditions of acceptance need to be fulfilled. Module-related data can be found in IEC 62031 and UL8750. All luminaire manufacturers are advised to conform to the international standards of luminaire design (IEC 60598-Luminaires).

Sustainability

The Fortimo High Brightness system is compliant with RoHS and REACH requirements.

Conditions of acceptance

Details can be requested from your local sales representative.

IP rating, humidity and condensation

The Fortimo LED HBM systems are build-in systems and therefore have no IP classification. They are not designed for operation in the open air. The OEM is responsible for proper IP classification and approbation of the luminaire.
The High Brightness Module has been developed and released for use in damp locations and not for 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.

Photobiological safety

As of March 2007, LEDs and LED-based products for general lighting are no longer included in the scope of the Eye Safety standard for lasers, IEC 60825-1 'Safety of laser products'. The new lamp standard, IEC 62471 'Photobiological safety of lamps and lamp systems', which covers incoherent light sources, now applies. This international standard gives guidance on evaluating the photobiological safety of lamps and lamp systems including luminaires. It specifically defines the exposure limits, reference measurement technique and classification scheme for the evaluation and control of photobiological hazards from all electrically powered incoherent broadband sources of optical radiation, including LEDs but excluding lasers, in the wavelength range from 200 nm to 3000 nm. In the photobiological safety standard, hazard categories are defined as follows:

Radiance-based

• Blue Light	L_B	300 – 700 nm
• Retinal Thermal	L_R	380 – 1400 nm
• Retinal Thermal Weak Stimulus	L_{IR}	780 – 1400 nm

Irradiance-based

• Actinic UV Skin & Eye	E_S	200 – 400 nm
• Eye UVA	E_{UVA}	315 – 400 nm
• Blue Light Small Sources	E_B	300 – 700 nm
• Eye IR	E_{IR}	780 – 3000 nm

Fortimo High Brightness Module measurement results

Item	Symbol	Result: Risk group
Actinic UV	Es	Exempt
Near-UV	EUVA	Exempt
Retinal Blue Light	LB	1
Retinal thermal	LR	Exempt
Infrared Eye	EIR	Exempt

Conclusion for 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 HBM module was tested with the Xitanium driver in a reference luminaire and no issues were observed.

Remote system operation

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

Fusing Xitanium drivers

Please consult the design-in guide for the drivers at www. Philips.com/Xitanium.

Class I and Class II applications

The requirements for Class I and Class II systems vary from IEC to UL. The following overview explains which class applies when, and in which classification the High Brightness system belongs.

IEC Class	Classification
I	Metal parts connected to protective earth No insulation required between L2 and heat spreader
II	Supplementary insulation between L2 and heat sink Insulation test voltage 1000+2Uwork >2.5 mm creepage and >1.5 mm clearance (@ 250 V Mains)

This is in combination with a basic isolated driver

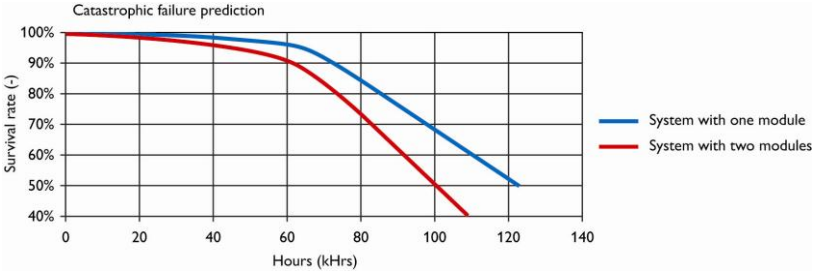
UL Class	Classification
1	Basic insulation between L2 and heat spreader Test voltage 1000+2U_{work} Both poles isolated in luminaire
2	Functional insulation between L2 and heat spreader Test voltage 500 Both poles isolated in luminaire

Sustainability

The Fortimo High Brightness Module and Xitanium driver are compliant with RoHS and REACH requirements.

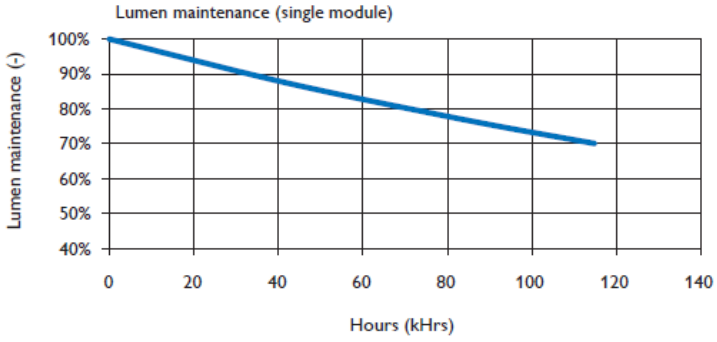
Lifetime performance of the Philips Fortimo High Brightness system

The lifetime of the Fortimo High Brightness system is specified for a system composed of one driver and two modules connected in series. The average lifetime is 50,000 hours, with 10% failure. The expected lumen maintenance for High Brightness Modules is up to 85% at 50,000 hours. The graphs below show the extrapolated data for the lifetime modules used to predict the catastrophic failure rate and lumen maintenance. These models have been validated by means of reliability tests at product level. The catastrophic failure model predicts the survival rate of a single module operated within temperature specifications. It is important that the modules and driver are operated in accordance with the currents and temperatures specified in this guide.



Catastrophic failure of module

N.B.: the lifetime statement presented here is based on extrapolated data and on the lifetime prediction model, at a specified case temperature of 70 °C. The real-life performance of products can vary. No rights can be derived from the information given here.



Lumen maintenance model

Cautions relating to use during storage, transportation and operation

If this product is stored for a long time (more than one week), it should be stored in a dark place. Do not expose it to sunlight.
The temperature should be maintained at between -40 ~ +85 °C, and RH 5-85%.

During transportation and storage for a short time

The temperature should be maintained below 100 °C at normal humidity.

During operation

Philips shall not be held responsible for any damage to the user arising from an accident or any other cause during operation of the system if the absolute maximum ratings are exceeded.

System disposal

We recommend that the Fortimo LED HBM 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.

Appendix; specification

Specification of the Fortimo LED High Brightness Module

All product performances are specified at a T_{case} = 70 °C (+/- 1 °C)

	Unit	Accuracy	Fortimo LED HBM 4000 45W/740	Fortimo LED HBM 4000 40W/641	Fortimo LED HBM 4000 35W/757
Flux	lm	+/- 400lm	4000	4000	4000
Power	W	+/- 10%	45	40	35
Thermal load	W	+/- 10%	31	28	23
CCT	K		4000	4100	5700
Performance	lm/W	+/- 10%	90	105	115
Color rendering	-		>70	>65	>70
Typical color rendering	-	+/- 2	77	68	72
Color consistency	-		<7	<7	<7
Max. case temperature	C		75	75	75
Max. temp. difference on/off	C		45	45	45
Lifetime @ Tc 70 <10% failures	hr		50,000	50,000	50,000
Lumen depreciation	-		B50L70	B50L70	B50L70
Light-emitting window	mm		60x15	60x15	60x15
Connector pins	-		7	7	7
Current setting	-		Rset1, Rset2	Rset1, Rset2	Rset1, Rset2
Approbation	-		CE, ENEC, UL, CSA	CE, ENEC, UL, CSA	CE, ENEC, UL, CSA

	Unit	Accuracy	Fortimo LED HBM 6000 68W/740	Fortimo LED HBM 6000 59W/641	Fortimo LED HBM 6000 52W/757
Flux	lm	+/- 600lm	6000	6000	6000
Power	W	+/- 10%	68	59	52
Thermal load	W	+/- 10%	49	41	35
CCT	K		4000	4100	5700
Performance	lm/W	+/- 10%	90	105	115
Color rendering	-		>70	>65	>70
Typical color rendering	-	+/- 2	77	68	72
Color consistency	-		<7	<7	<7
Max. case temperature	C		75	75	75
Max. temp. difference on/off	C		45	45	45
Lifetime @ Tc 70 <10% failures	hr		50,000	50,000	50,000
Lumen depreciation	-		B50L70	B50L70	B50L70
Light-emitting window	mm		60x15	60x15	60x15
Connector pins	-		7	7	7
Current setting	-		Rset1, Rset2	Rset1, Rset2	Rset1, Rset2
Approbation	-		CE, ENEC, UL, CSA	CE, ENEC, UL, CSA	CE, ENEC, UL, CSA

Specification of the Xitanium drivers

	Unit	Xitanium 150W .35-7A Prog GL sXt	Xitanium 75W .35-7A Prog GL sXt
Input voltage	V	120 / 200 / 240 / 277	120 / 200 / 240 / 277
Input current	A	1.4 / 0.85 / 0.7 / 0.6	0.7 / 0.45 / 0.35 / 0.3
Input frequency	Hz	50/60	50/60
Max. output power	W	165	85
Max. output current	A	0.7	0.7
Inrush current	A/50%-µs	130/140	130/140
THD @ max. load	%	20	20
Power factor @ max. load	-	>0.95	>0.95
Max. case temperature	C	80	80
Lifetime @ Tc □0 <10% failures	hr	100,000	100,000
Surge protection	KV	3	3
IP rating	-	IP66	IP66

06/2011

www.philips.com/fortimo
www.philips.com/oem