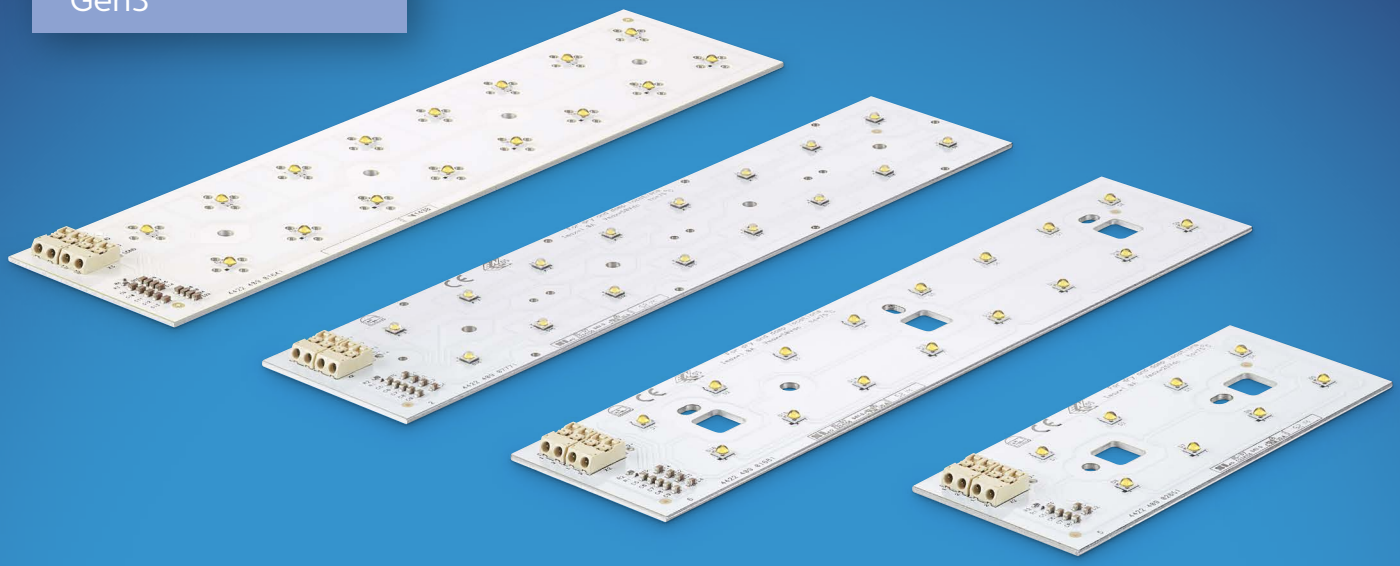
PHILIPS

Fortimo

LED system

FastFlex
LED module
Gen3



Design-in Guide

Flexible
system approach

February 2015

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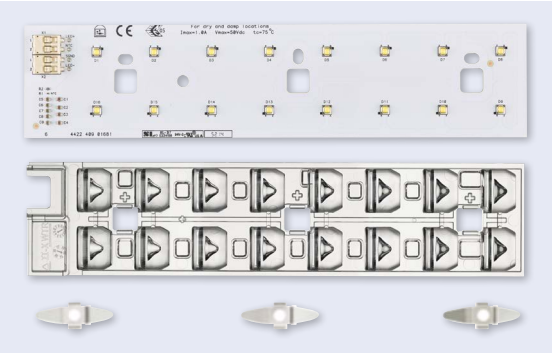


Thank you for choosing the Philips Fortimo FastFlex LED module Gen3. In this guide you will find all the information required to design this module into a luminaire as well as valuable hints and tips.

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
- Familysheets
- 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/fastflex for all commercial and technical downloads
- 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

To operate a system you will need one or more FastFlex LED modules, they consist of different parts that are sold separately.

Each Fortimo FastFlex 2x8 and 2x4 (standard) LED module consists of:

- FastFlex LED board Gen3
- FastFlex module clips
- and FastFlex lens Gen2 or FastFlex Mounting Gen2

To create a LED system you can use one of the release

- Compatible LED driver. (Please refer to the respective product datasheet for the full list of compatible LED drivers.)
- Example of a Philips Fortimo FastFlex LED module 2x8 and 2x4 Gen3 (standard) system in picture on the left.

Important usage notes

- Minimum drive current = 100 mA. If dimmed below 100 mA, Philips does not guarantee the specified product performance
- Maximum drive current = 1,000 mA. This limit must be observed in all cases, including CLO
- Please refer to the respective product datasheet for the reference T_{case} and for the maximum T_{case} values. T_{case} must not exceed the provided figure at the given drive current.
- ΔT ($T_{ambient}$ -T_{case}) must not exceed 50 °C, regardless of drive current
- Failure to comply with usage conditions will void product warranty
- Optical efficiency of the complete FastFlex LED module Gen3 (2x8 or 2x4), pre-assembled with the FastFlex lens Gen3 (any type) is specified as 96 % ±1 %.

Each Fortimo FastFlex LED module 2x8 (DA or DS) consists of:
- FastFlex LED board 2x8 Gen3 (DA or DS)
- Third party lens of your preference

To create a LED system you can use one of the release
- Compatible LED driver. (Please refer to the respective product datasheet for the full list of compatible LED drivers.)

Note: Third party or OEM proprietary lens are not included.

Applications

The Philips FastFlex LED module has been developed primarily for outdoor and industry lighting applications but can also be used indoor (providing the applicable IEC regulations are observed and all design-in requirements are met).

The FastFlex LED module Gen3 with Xitanium driver can be used in:
- Class I and Class II IEC isolation systems

Product Range

The Philips Fortimo FastFlex LED Gen3 boards described in this guide are available in different CCT and CRI versions. The boards together with a wide range of standard, as well as third party lenses enable the creation of outdoor and industrial LED lighting systems for every type of application.

Summarized, the range of Philips FastFlex LED Gen3 modules can be divided in 3 main groups designed to offer a suitable solution to each type of OEM:
- Fortimo FastFlex LED module 2x8 /xxx Gen3 (also available in 2x4)
- Fortimo FastFlex LED module 2x8/xxx DA Gen3
- Fortimo FastFlex LED module 2x8/xxx DS Gen3

The Fortimo FastFlex 2x8 and 2x4 (standard lenses) are product designed for OEMs looking for a ‘’one stop shop’’, where board and lens are provided by Philips allowing a short fixture development cycle, while enabling basic optical flexibility with its eight standard light distributions. For OEMs looking to have a unique photometrical performance, the new FastFlex DA and DS Gen3 were designed to operate together with third party lenses, enabling an endless number of possible configurations; allowing the use of standard components yet having a unique photometrical result.

Full characteristics of each module are described in
- the family sheets
- their datasheets

at www.philips.com/technology

Recommendations

The following recommendations should be taken into account when using FastFlex LED modules and Xitanium LED drivers.

Important usage conditions

- Failure to comply with usage conditions will void product warranty

Design-in phase

- It is recommended to use the approved Philips Xitanium LED drivers. For a list of approved drivers please see according datasheet.
- It is mandatory to design the luminaire so it is 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 FastFlex LED modules and Xitanium LED drivers. Luminaire manufacturers are advised to conform to the international standards for luminaire design (IEC 60598 - Luminaires).
- Do not use 3rd party lenses together with the standard FastFlex Gen3 boards.
- Do not use standard FastFlex lenses with the FastFlex Gen3 DA or DS versions.
- Do not combine 2x8 FF board with 2x4 FF lenses.

Design-in and manufacturing phase

- Do not use damaged or defective modules.
- Do not drop the LED module or let any object fall onto it as this may damage the module. 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 while the mains voltage is connected; this includes connecting or disconnecting the FastFlex LED module wires from the driver.
- Hot switching is not allowed.

Controllability

Default controling protocols

The FastFlex Gen3 LED 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

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.

Warning

Although it is technically possible to dim FastFlex Gen3 LED modules down to 100 mA, Philips does not specify product performance for modules operating below this current.

Controlling FastFlex LED module Gen3 with Xitanium LED drivers

It is recommended to operate the Fortimo FastFlex Gen3 in combination with a programmable Xitanium driver. In case the proposed LED system requires the use of a non-programmable driver, the current needs to be set via an external Rset.
Please refer to the data sheet of the chosen driver to determine the Rset to current value.

Controlling FastFlex LED module Gen3 with Xitanium PROG/LITE LED drivers

Xitanium PROG/LITE LED drivers allow the use of several control protocols, including 1-10 V, DALI, Integrated Dynadimmer and CLO. FastFlex LED modules can be used with these drivers. Rset is set via the MultiOne Configurator. These drivers have a default setting of 700 mA output current.

Further details on programming can be found in the Design-in guide for Xitanium PROG/LITE LED Drivers. The Design-in guide can be downloaded via our website at www.philips.com/technology

Which Philips controls can be used?

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

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 the Philips Fortimo FastFlex LED module. Keeping these thermal points in mind will help to ensure the optimal performance and lifetime of the system.

Thermal specifications

The main thermal specification that needs to be taken into account when designing in the FastFlex LED module is the T_{case} temperature. The T_{case} must never exceed $T_{case,max}$ tested in a draft-free lab environment at 25 °C. Please refer to the product datasheet for further details.

Thermal rating of the system

Item	Description	Symbol	Unit	Reference value
Case temperature	Temperature at which the module operates within specifications	T_{case}	°C	75
Delta T	The maximum temperature difference between $T_{ambient}$ and T_{case}	ΔT	°C	50

Operating temperature

Definitions

- **Module temperature:** temperature measured at the specified T_{case} point (at the base) of the module
- **Driver temperature:** temperature measured at the specified T_{case} point on the driver
- **Ambient temperature:** temperature of the air surrounding the luminaire in the test environment or application
- **Ambient temperature in a 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 per day, with at least 8-hour intervals between measurements

Module temperature

To achieve typical product lifetime characteristics, it is crucial to ensure that the product is operating within the specified temperature limits. These limits are determined not only by the product and the application, but also by the luminaire design and ambient environment.

Warning

- Maximum T_{case} should never exceed specified T_{case} max
- Please refer to the specific datasheet for the maximum T_{case} value
- Thermal design should ensure that driver T_{case} < max specified driver T_{case}
- Thermal design must ensure maximum ΔT ($T_{case} - T_{amb}$) ≤50 °C

Thermal de-rating

The FastFlex LED board contains a thermal de-rating system to detect overheating and extreme lifetime degradation of the LEDs when operated outside the maximum permitted environmental conditions. Such conditions can be caused by extreme ambient temperatures or inadequate heat management design. The thermal de-rating is based on temperature detection on the FastFlex LED board. When multiple modules are connected to 1 driver, one module is in the “master” mode and the others are in the “slave” mode. It is strongly recommend that the information is read out from the module with the highest T_{case} in the application.

When the FastFlex LED board is used in combination with Xitanium LED Programmable drivers, the default driver profile will ensure the correct Module Temperature Protection (MTP) settings.

Warning

MTP is only a failsafe in order to protect the module against overheating during peaks in ambient temperature or in the event of a faulty heat sink design. Optimum performance will only be achieved if the Tcase stays below the maximum Tcase at the specified maximum ambient temperature, measured according to the procedure described above.

Thermal measurements

The maximum ambient temperature at which the luminaire will operate constitutes the initial key criterion for defining the correct temperature limit and validating the thermal luminaire design.

If the maximum ambient temperature ($T_{amb,max}$) is 25 °C or lower, the luminaire design needs to ensure that the module temperature does not exceed the maximum T_{case} when tested in a lab environment at 25 °C ambient.

Note: The ambient temperatures given above are average temperatures during the operational period of the module.

Critical temperature point (T_{case})

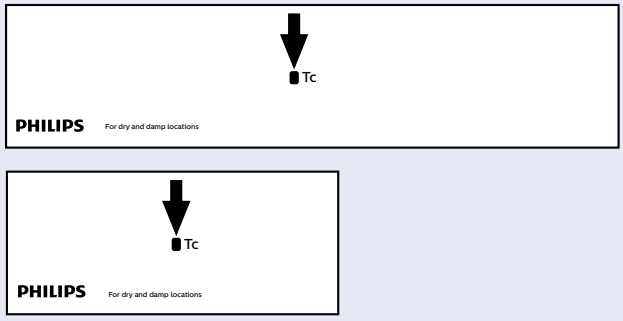
For LEDs, the junction temperature is the critical factor for operation. Since there is a direct relation between the case temperature and the LED junction temperature, it is sufficient to measure the aluminum casing of the FastFlex LED board at its critical temperature point, . Please refer to figure (Tc point on FastFlex LED board). If the case temperature at the T_{case} point exceeds the recommended $T_{case, max}$, this will have an adverse effect on the performance of the LEDs and the FastFlex LED module in terms of light output, lifetime and lumen maintenance.

Measurement of critical temperature point

On the back of the module there is a T_{case} (Tc) point, which should be used for all temperature measurements. The maximum temperature of the module should be measured at a point in the center of the bottom of the LED board. Please refer to figure (Tc point on FastFlex LED board). The temperature must be stable before any reliable data can be obtained (depending on the size and material of the luminaire, this will take between 30 and 180 minutes).

Note

It is important that the T_{case} point is free of thermal interface material when the thermocouple is connected so that temperature measurements can be taken.

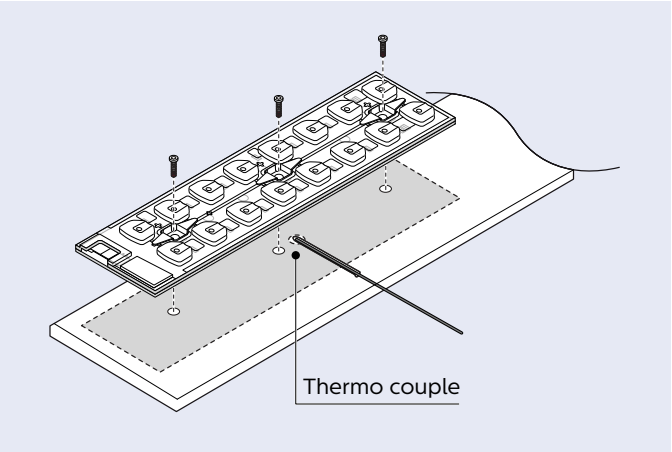


Tc point on FastFlex LED board

It is essential to have a stable connection between the thermocouple and the module. Any shifting of the thermocouple will result in measurement errors and poor measurement repeatability.

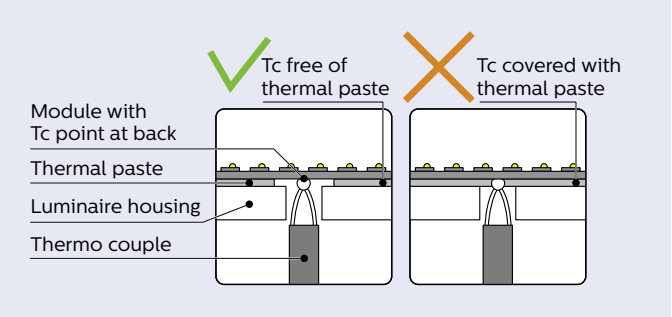
The T_{case} should be measured at its critical temperature point using a thermocouple on the base of the LED board. One of the following methods should be used to measure the temperature.

1. Preferred method: via a groove in the module mounting surface



T_{case} measurement via thermocouple in a groove.
Standard Fortimo FastFlex 2x8 image used for explanation purposes. The method is applicable for all the products of the Fortimo FastFlex portfolio.

2. Via an access point cut through the mounting surface of the module



T_{case} measurement via an access point in the heat sink

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.

Critical module temperature with respect to CLO

The FastFlex LED module can be used with Xitanium Programmable LED drivers with a Constant Light Output (CLO) feature. Over the system lifetime the driver will automatically increase the output current to compensate for lumen depreciation and to keep light levels constant. For the thermal design it is important to ensure that the T_{case} temperature and drive current do not exceed their maximum ratings at end of life.

Note

- Programming CLO increases the thermal load over the lifetime of the module . Thermal management needs to ensure T_{case} at end-of-life does not exceed the maximum T_{case} of the module. (Please refer to the respective product datasheet)
- CLO current at end-of-life drive current must not exceed maximum specified current. (Please refer to the respective product datasheet)

Heat sink design

The FastFlex LED module is primarily designed for metal luminaires in which the luminaire housing may double as the heat sink.

Heat sink material

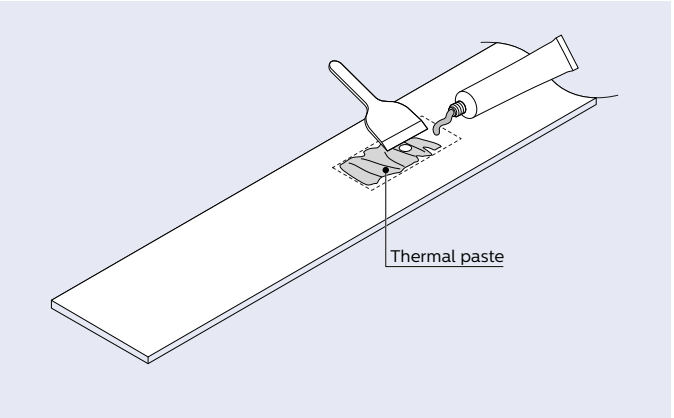
The type of material used has a significant influence on the final result. For example, a comparison of the thermal conductivity (k) of copper with that of corrosion-resistant steel - Thermal conductivity shows that a substantially smaller heat sink can be made with copper. The best material for heat sink is (soft) aluminum. The thickness (H) of the heat sink is also of major importance. If identical heat sinks made from different materials were used, a similar effect would be achieved with 1 mm copper, 2 mm aluminum, 4 mm brass, 8 mm steel and 26 mm corrosion-resistant steel.

Thermal conductivity

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

Thermal radiation and emissivity coefficient

Thermal radiation accounts for 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 more effective heat transfer.



Interface between module and mounting plate filed with thermal paste

Thermal emissivity coefficients of common materials

Material	Finish	Emissivity coefficient
Aluminum	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 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.

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 heat sink.

Important points for luminaire design

- Ensure good thermal contact between the module/driver and the coldest part of the luminaire.
- Ensure a well-defined electrical contact between the module and the luminaire and/or heat sink surface. A coated surface may cause intermittent electrical contact, potentially impairing driver performance.
- Place the module(s) and driver at a distance from each other to obtain a more homogeneous temperature distribution in the luminaire.
- When mounting FastFlex LED 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 and thicker material will improve the heat flow through the luminaire housing, resulting in a lower T_{case} of the module.
- Use anodized, painted surfaces rather than blank surfaces in order to increase the transfer of heat via thermal radiation.
- 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.

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 thermal and electrical contact between the driver and the luminaire as this enables the heat to dissipate efficiently and allows the driver to deliver optimal electrical performance. The driver temperature can be measured with a thermocouple at the T_{case} point, shown on the driver label.

Critical driver temperature point with respect to CLO

When the FastFlex LED module is used with Xitanium Programmable LED drivers, CLO will increase the output current. As a result, the driver losses will increase accordingly, which in turn will lead to a higher driver T_{case} temperature. For the thermal design it is therefore important to ensure that the T_{case} temperature of the driver is within specification for its T_{case} max at end of life.

Please refer to individual product datasheets for T_{case} max information.

NTC and thermal design

This feature helps to protect the LEDs when they are operated in a hot ambient environment. The thermal design of an LED module/LED board should be such that the critical temperature (Tc) is not reached under normal application conditions.
The purpose of the NTC is to assure the lifetime of the LED module/LED board in the event that external thermal influences result in the critical temperature being exceeded.

Warning

Not all drivers have the NTC feature, please check on the website at www.philips.com/xitanium

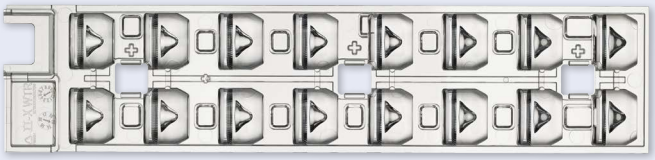
FastFlex LED module assembly

FastFlex LED module assembly 2x8 Gen3

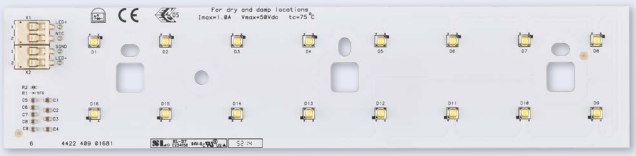
The Fortimo FastFlex standard LED boards (2x4 and 2x8), the FastFlex lens and the FastFlex module clips are shipped separately. The following section provides module assembly instructions.

Each complete standard FastFlex 2x8 Gen3 LED module consists of three (3) components. Every module assembly requires 3 module clips.

3X FastFlex module clips



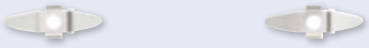
FastFlex lens (2X8)



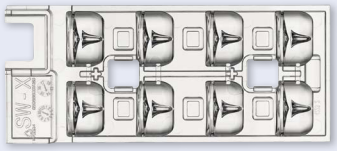
FastFlex Gen3 LED board (2X8)

FastFlex LED module assembly 2x4 Gen3

Each complete FastFlex LED module consists of three (3) components. Every module assembly requires 2 module clips. The concept of assembly is similar with the description of the standard FastFlex 2x8 Gen3 module.



2X FastFlex module clips



FastFlex lens (2X4)

FastFlex Gen3 LED board (2X4)

Lensless component
Can be used for both LED board types

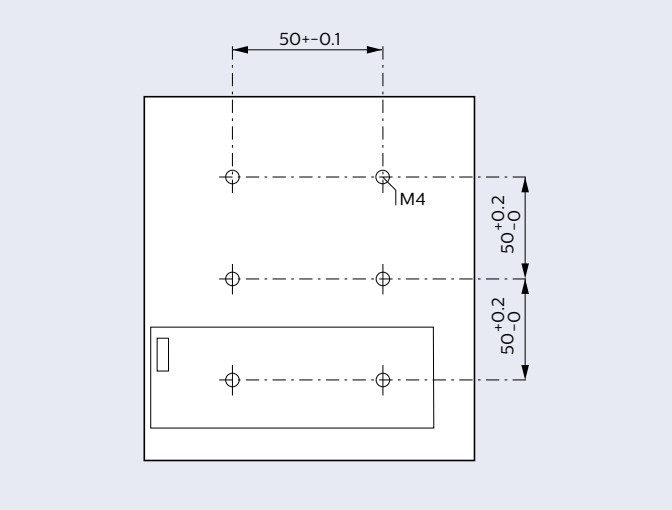
FastFlex lens Gen2 covers the LED board and produces a specific light distribution, depending on the type. The lens plate ID, e.g. IV-X, is marked next to the connector cover.
If no lens is needed, the FastFlex lensless mouting Gen2 is used on the LED board together with the correct quantity of clips. This to guarantee the correct fixation and thermal contact with the given heatsink.

The assembly of the complete standard FastFlex Gen3 module is divided into two phases:

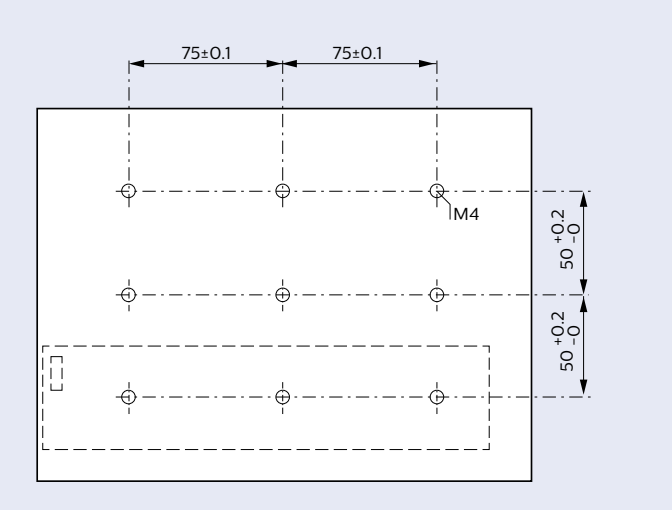
- Pre-assembly and final assembly.
- During the pre-assembly phase the lens plate gets a first fixation on the LED board; during the final assembly the module with lens is fixed inside the luminaire.

Mounting hole pattern

The pattern of the holes (in the luminaire) must be checked and inspected before assembly commences. The drawing supplied describes the hole pattern for each module and also the distance between individual modules.



Mounting hole pattern for FastFlex 2x4



Mounting hole pattern for FastFlex 2x8

It is important to guide the cable between the different modules so it is out of the light path in order to prevent light losses. Do not allow cables to become tangled, keep them short and guided.

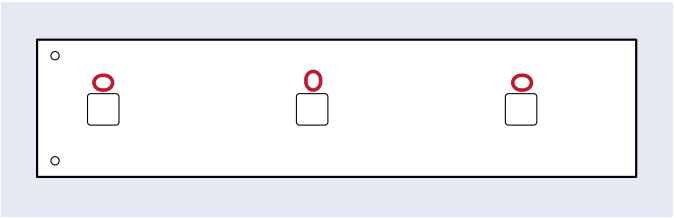
Note

- It is advisable to wear gloves during the installation of the lenses in order to prevent any dirt affecting the lenses.
- A dust-free environment is recommended.

Lens pre-assembly

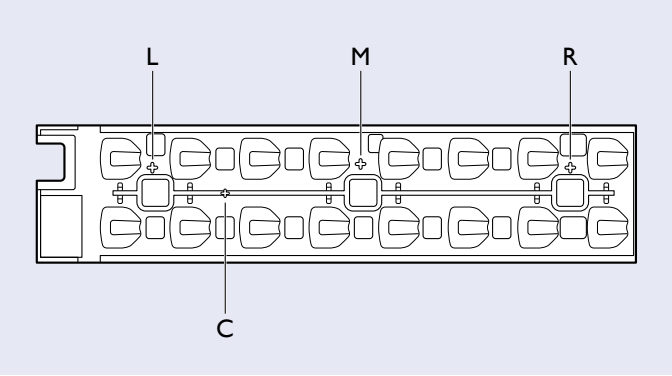
FastFlex Gen3 LED modules can be pre-assembled for fast factory manufacturing. The LED board may be covered with the lens in preparation for final assembly.

Three (3) mounting holes are used for pre-assembly of the lens plate on the LED board.



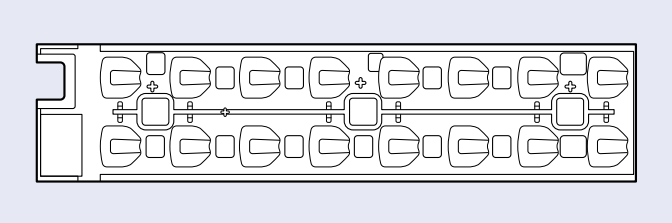
Slots for the lens grippers on the back of FastFlex Gen3 LED board

Each FastFlex lens has lens grippers, a patented feature that (1) ensures the correct alignment of the lens plate with the FastFlex LED board and (2) enables the pre-assembly of the module.



Lens grippers on the FastFlex lens

The lens grippers ensure alignment of the lens plate with the LED Board and enable pre-assembly. There are three (3) grippers on the base of the lens plate: one middle pin (M) and two outer pins (L, R). The pins align the lens plate in 2 different directions.

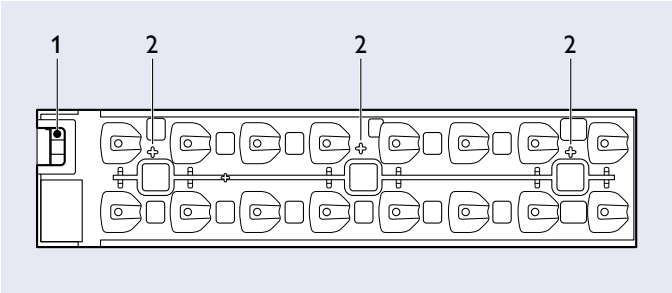


Pre-assembled FastFlex LED module

Manual pre-assembly

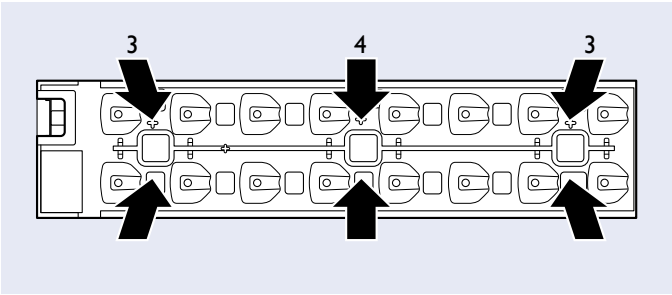
To manually pre-assemble the FastFlex LED board and the FastFlex lens:

1. Mount the lens plate on the board. Use the connector position to properly orient the lens. Each LED on the board should fall under each lens on the lens plate.
2. Align the lens plate with the FastFlex board by inserting the three (3) pins on the bottom side of the lens in the three slotted holes of the LED board.



Steps 1 & 2 of manual pre-assembly procedure

3. To insert the pins into the slotted holes, apply pressure evenly with your fingers on the left and right side along the length of the lens plate for each pin. Start with the grippers on the edges (3) and finish with the central gripper (4). Press until the pins are squeezed into the aluminum holes. The squeeze function will hold the lens plate and the LED board together until final assembly.



Step 3 of manual pre-assembly procedure

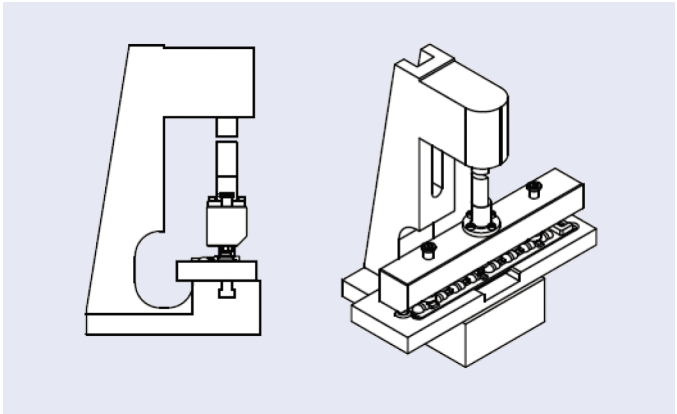
The module has been assembled correctly when there is no visible gap between the lens and the LED board along the entire circumference.
If pressing with the fingers requires too much force, a hand-held tool can be used.

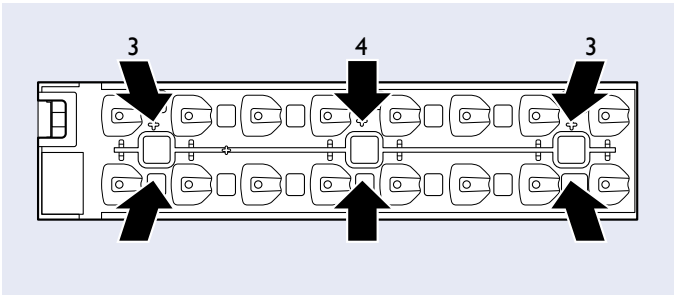
Pre-assembly with a tool

It is possible to develop a customized tool to mechanically pre-assemble the FastFlex LED module. The tool has two main functions:

1. To force the three pins of the lens plate into the slots of the FastFlex LED board simultaneously.
2. To evenly distribute the push force delivered by a force tool along the width and the length of the LED board.

The lens plate must be aligned on the LED board following steps 1 and 2 of the manual pre-assembly process as described above.
Included figure provides an example of a tool developed for mechanical pre-assembly. The tool consists of an orthogonal plate (A) screwed on three (3) ϖ-shaped legs (B). The middle and the outer legs are oriented along the width of the board above the middle and the outer pins of the lens plate respectively. The open area on each leg is needed to avoid pushing the plastic protrusions from the lens's central square slots. The metal structure is connected to a force meter (C).





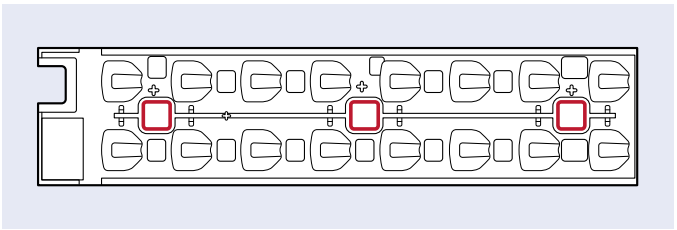
Step 3 of manual pre-assembly procedure

The suggested force is 150 N for each lens gripper.
The gripper must be constructed of a material that will not damage the lenses.

Final assembly

The FastFlex clip is used for the final assembly in the luminaire. The metal wings introduce a defined force that will hold the LED board pressed onto the luminaire for heat transfer.

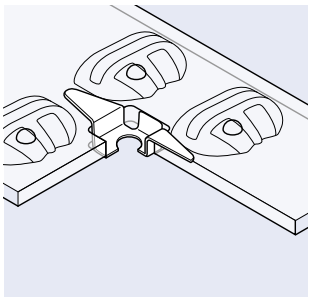
FastFlex module clips



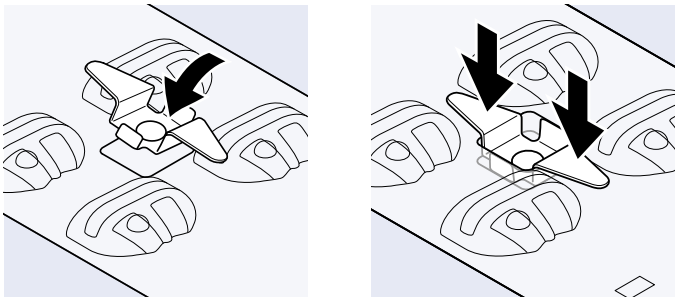
Slots for module clips indicated on pre-assembled FastFlex LED module

To complete the installation of the pre-assembled LED board module on the mounting surface:

1. Tilt the module clip and place it in the mounting slot. Position the metal wings as illustrated, and click one side of the three (3) metal wings in the three (3) central square slots. Once the wings have been clicked into the slots they can move freely towards the left and right x board direction (see arrows in next figure).



FastFlex module clip mounted in a lens plate



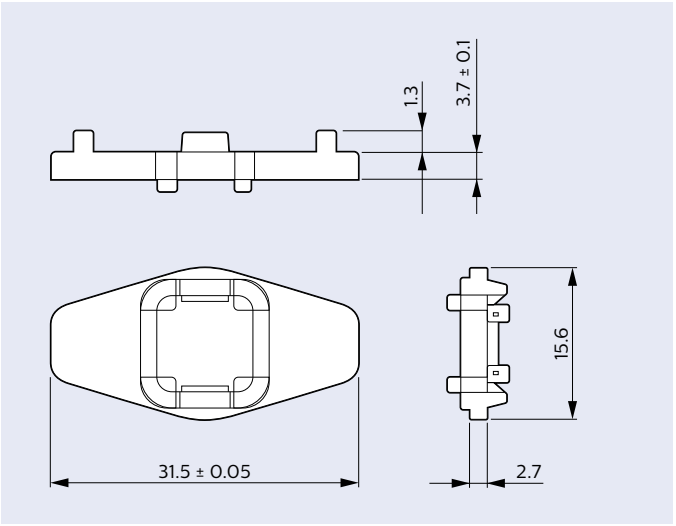
Step 1 of final assembly

2. Insert a screw into each wing hole to fix the pre-assembled module onto the mounting surface. Screw the module onto the fixture until the bottom side of the lens plate touches the LED board.

To fix the module in place we recommend using an M4 hexagonal socket-head cap screw with an M4 spring-lock washer for screws with cylindrical heads. Maximum permitted screw-head diameter is 8 mm.

Remark: The concept of assembly the standard FastFlex 2x4 Gen3 is similar with the description of the standard FastFlex 2x4 Gen3 module assembly.

Remark: The assembly guidelines for the FastFlex lensless mounting Gen2, are the same as described in previous FastFlex lenses 2x8 / 2x4 Gen2.



Installation instructions

Warning

The FastFlex LED module/s should always be replaced by an OEM-qualified 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 FastFlex LED module 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 FastFlex LED 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 Philips Technology website at www.philips.com/oem.

In a system with multiple modules, it is recommended that the modules are mounted with a distance of between 0 mm and 10 mm maximum between each module to ensure correct optical performance.

In the case of the Fortimo FastFlex LED board 2x8/XXX DA Gen3 , the third party array lenses (OEM or complementary partner made) must be installed on the module by means of four M3 screws.
Please refer to your lens supplier to define the maximum allowed torque to be applied to the screws.

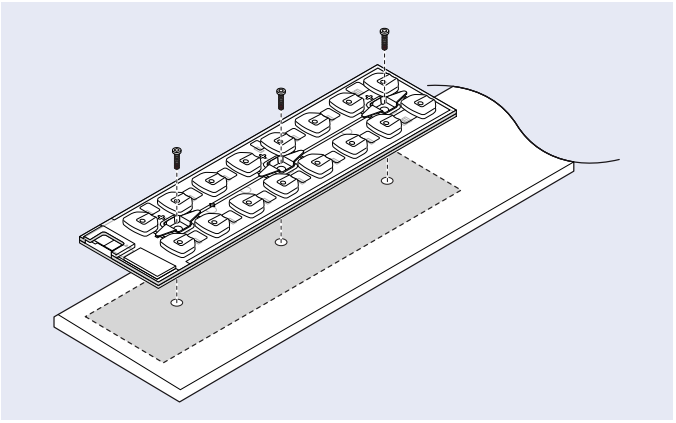
The Fortimo FastFlex LED board 2x8/XXX DS Gen 3 can be fixated on the given surface, by means of four M3 screws plus washers with a maximum diameter of 6.3 mm.

The third party single lenses (OEM or complementary partner made) used in combination with the Fortimo FastFlex LED board 2x8/XXX DS Gen3, can be installed after the fixation of the module on the heatsink has been performed.

Fixation of the module

Before fixing the FastFlex LED module, ensure that the mounting surface is clean and flat, without any protrusions or pits. Also ensure that the electrical connection between the module and the mounting surface is well-defined and not subject to potential intermittent contact due to surface coatings.
To ensure a reliable thermal and mechanical attachment, we recommend that the flatness of the mounting surface should be ≤0.2 mm.

For optimum 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). For more information see the Thermal management section in this guide.



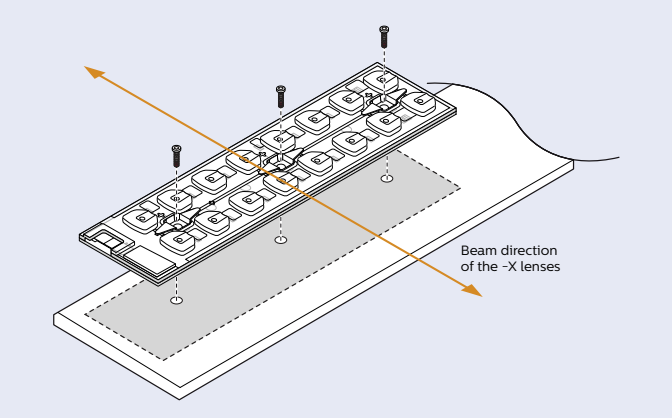
Fixation of the FastFlex LED module

Fixation of the complete module inside the luminaire

When designing FastFlex LED module into a luminaire, the following should be taken into consideration.

FastFlex lens beam orientation (only applicable for standard Fortimo FastFlex 2x8 and 2x4 variants)

Some of the FastFlex lenses provide asymmetrical beams. These lenses can be identified by name, as -X will follow the lens number in the name, e.g. FastFlex lens 2x8/II-**X**. For these lenses, the module position inside the luminaire will directly impact on beam direction.
For all -X lenses, the width of the beam falls across the lens.

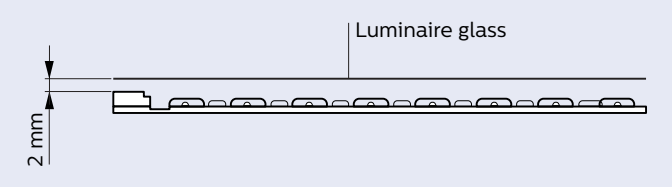


FastFlex lens beam orientation

Luminaire glass

The module should be placed as close as possible to the luminaire front glass in order to reduce optical losses and therefore achieve the best possible LOR.
To minimize reflective glare, we recommend that the luminaire glass is positioned 2 mm above the highest point of the module (the connector).

Note: The height of the lenses used with the Fortimo FastFlex DA and DS Gen3 versions may differ from the standard Fortimo FastFlex Gen3.



Distance between FastFlex LED module and glass in a luminaire

Fixation of the driver

Please refer to the specific Xitanium LED driver product datasheet and design-in guide for individual product dimensions and installation instructions.

Connection between module and driver

The Fortimo FastFlex Gen3 has been designed to be connected via standard wiring to the selected driver. Please refer to the module datasheet for recommended wiring specifications.

Warning

- FastFlex LED module may be operated at any output current between 100 mA and 1000 mA. Operating the module outside the approved output current and temperature range will void the warranty and may damage the LEDs.
- When using the Xitanium PROG/LITE LED drivers the drive current needs to be programed via the MultiOne configurator.
- Take care not to cause damage to the board when inserting solid wires into the poke-in connectors; sharp edges on the wire core can cause scratches in the isolation material of the board, thereby compromising the insulation performance.
- Philips does not recommend the use of stranded wires, due to the risk of loose strands causing short circuit or compromising the isolation.
- Miss wiring can lead to damaged products.

More information on these drivers you can find in the design in guide on www.philips.com/technology

Warning

- If a system consists of multiple FastFlex modules connected to a single driver, only one module is monitored by the NTC
- A robust thermal design is strongly recommended
- Always use modules of the same type and batch

Module replacement

When multiple modules are connected to one driver, one module is in “master” mode and the rest are in “slave” mode. Always connect/replace all modules with products from the same series (and preferably the same batch) as LED performance is improving all the time.
If modules with different efficacies are connected to the same driver, it may result in a luminous flux difference between modules.

Using a long cable in combination with the FastFlex LED module system

When using AWG24 cables, the connection between module(s) and driver can be extended by up to 10 meters without affecting the power supply to the module. It is not advisable to use the communication wires (NTC- Common) because of possible interference.

In case of questions please request Design-in support via your Philips sales representative.

Warning

When using a long cable between the module and driver, extra care should be taken in the design of EMI, surge and noise suppression. It is also important to ensure the cable is guided out of the optical path.

Luminaire isolation Class I and Class II applications

FastFlex LED modules are suitable for luminaire isolation Class I and Class II applications in combination with approved Philips Xitanium LED Xtreme drivers. Approved combinations (please refer to specific product data sheet) comply with the latest IEC60598 luminaire standard requirements.

Surge protection in a FastFlex LED system

FastFlex LED modules Gen3 have a high level of integrated protection against the adverse effects of external surges and electro-static discharges. For optimum system protection, apply external common-mode and differential-mode surge protection at luminaire level in order to mitigate the harmful effects of surges on the LED driver and the FastFlex LED module.

Quality

Compliance and approval marks
The Philips FastFlex LED board Gen3 is ENEC approved and complies with the applicable EU directives.

To ensure approval of the luminaire, 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 or UL1598).

Sustainability
FastFlex LED modules Gen3 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.

Warranty
The warranty on FastFlex LED module Gen3 performance only applies if the product is used in combination with approved Philips Xitanium LED drivers. Please refer to the respective product datasheet for full module(s) to driver compatibility chart.

IP rating, humidity and condensation
FastFlex Gen3 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.

FastFlex LED modules Gen3 are not suitable for direct exposure to moisture, dust, chemicals, salt, etc.

Warning

FastFlex LED module Gen3 has been developed and released for use in dry and 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
The photobiological safety standard IEC 62471 (Photobiological safety of lamps and lamp systems) gives guidance on the evaluation of 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 from 200 to 3000 nm.

Wavelengths used for photobiological safety measurements

Radiance-based

Blue Light	LB	300 - 700 nm
Retinal Thermal	LR	380 - 1400 nm
Retinal Thermal	LIR	780 - 1400 nm

Irradiance-based

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

Measured results of emission limits for FastFlex LED modules Gen3 using the non-GLS (20cm) method are available on request via your local sales department.

FastFlex Gen3 photobiological measurement results

Item	Symbol	Result: Risk group
Actinic UV	E_s	Exempt
Near-UV	E_{UVA}	Exempt
Retinal Blue Light	L_B	RG1/RG2 threshold distance depending on color temperature and type of lenses
Retinal thermal	L_R	Exempt
Infrared eye	E_{IR}	Exempt

Conclusion regarding photobiological safety
All type of modules (CCT) are measured and information is available on request via your local sales department
Assembly (including optics and front glass) in the luminaire can improve the level of photobiological safety.

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 FastFlex Gen3 was tested with a Xitanium driver in a reference luminaire and no EMC issues were observed.

Electrostatic discharge (ESD)

Introduction to ESD

It is generally recognized that Electro Static Discharge (ESD) can damage electronic components, like LED chips, resulting in early failures. Professional users of electronic components are used to implementing extensive and rigorous measures to prevent ESD damage in their finished products. With the introduction of LED components for lighting, a new breed of users, such as OEMs and installers, are now involved in handling and using electronic LED components in the manufacturing process.

ESD in the production environment

Depending on the immunity level of the LED board, there is a minimum set of measures that have to be implemented when handling LED boards. ESD measures are required in a production environment where handling can exceed the ESD immunity level. Furthermore, products that are susceptible to ESD must be packed and delivered in ESD-safe packaging.
The purpose of an effective ESD-control strategy is to reduce line failures, final inspection failures and field failures.

ESD specifications

Philips designed FastFlex LED module Gen3 products to be robust when exposed to ESD.
The maximum permitted contact discharge level and air discharge level, according to IEC 61000-4-2 (HBM 150 pF + 330 Ω), is 8 kV contact and 15 kV air.

Servicing and installing luminaires

It is highly recommended that installers are instructed not to touch the LED components and to use earthed arm straps to prevent ESD damage during installation and maintenance.

ESD consultancy

Independent ESD consultancy companies can advise and supply adequate tools and protection guidance.
Philips Innovation Services can provide consultancy at www.innovationservices.philips.com

More information can be found in the Contact details section.

Remote system operation

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

Use of circuit breakers: Xitanium LED drivers

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

Note on conditions: storage, transportation & 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

FastFlex Gen3 modules must be operated within the specifications stated in the product leaflet and design-in guide. Please contact your local sales representative for additional information.

System disposal

We recommend that the FastFlex LED module Gen3 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.

Philips will not be liable for unforeseen interactions of the proposed solutions when applied in the fixtures or applications using these fixtures. Philips has not investigated whether the recommendations are or will in the future be in conflict with existing patents or any other intellectual property right. Philips does not warrant that its recommendations are technically or commercially the best options.

Since the tests are only performed on one particular fixture provided by the customer, it will be treated as a prototype. This means that there is no statistical evidence regarding later production quality and performance of the lamp – lamp gear – fixture system.

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.

The OEM expressly agrees that test design-in guides are provided by Philips on an ‘as is’ basis and an ‘as available’ basis at customer’s sole risk and expense.
Philips shall not be liable for any lost profits or lost savings, indirect, incidental, punitive, special, or consequential damages whether or not such damages are based on tort, warranty, contract, or any other legal theory – even if Philips has been advised, or is aware, of the possibility of such damages.

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.

02/2015
Data subject to change.

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