

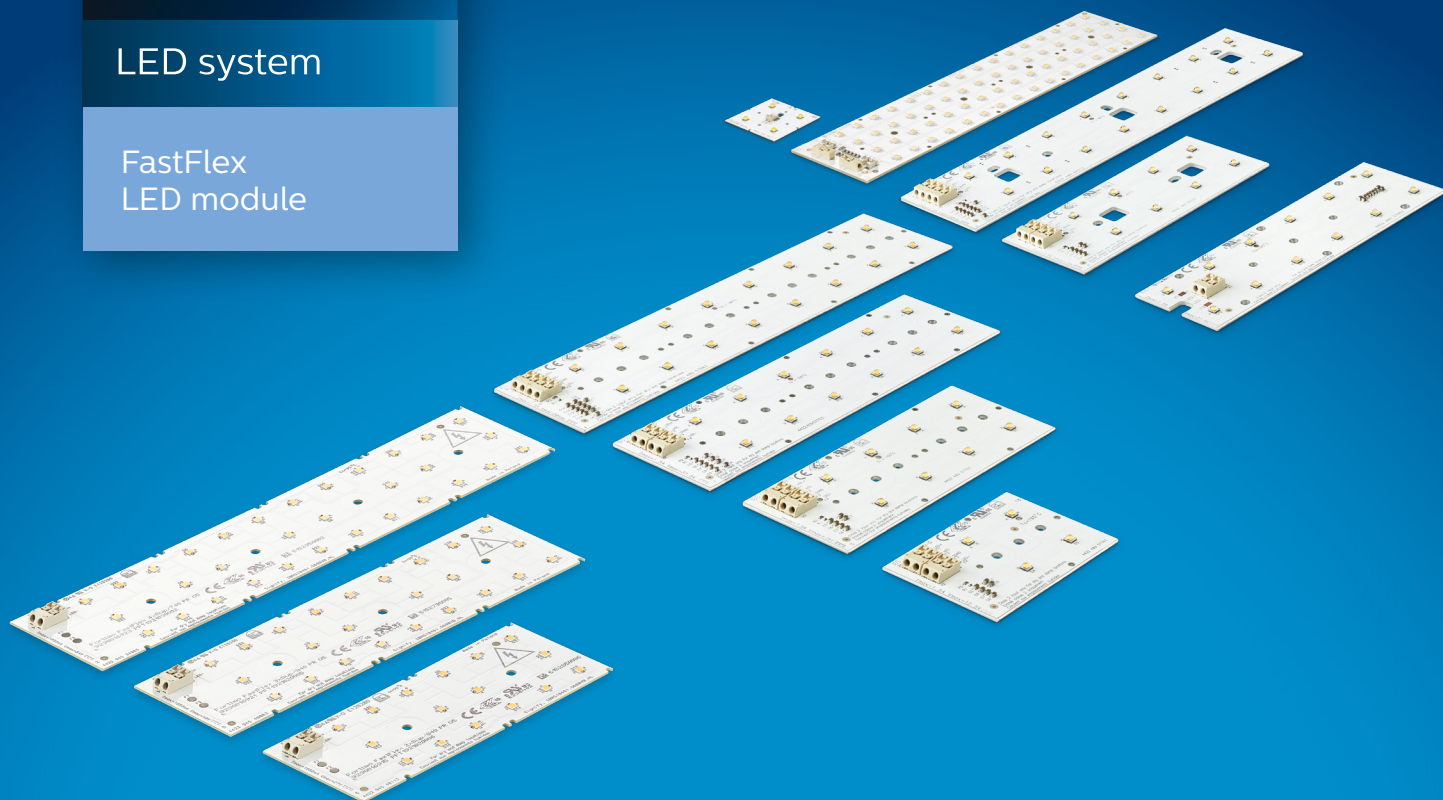
PHILIPS



Fortimo

LED system

FastFlex
LED module



Design-in Guide

Flexible system approach

September 2019

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Introduction to this guide



Philips Fortimo FastFlex LED module 2x8, 2x4 and 2x8 X,(standard)



Philips Fortimo FastFlex LED module 2x8, 2x6, 2x4, 2x2 DA, and 2x6, 2x8 DAX



Philips Fortimo FastFlex LED module 2x6 DP and 2x6 DPX



Philips Fortimo FastFlex LED 4x6 DHE



Philips Fortimo FastFlex LED 2x2 DC



Philips Fortimo FastFlex LED module 2x8up, 3x8up, 4x8up

Thank you for choosing the Philips Fortimo FastFlex LED module . 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.

Basics

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

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

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



Important usage notes

- 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.
- In Case of the FastFlex DA,DAX,DP, DHE,PR, and DPX the module T_c should be inline with the max. allowed third party lens operating temperature specified by the lens supplier
- Failure to comply with usage conditions will void product warranty
- Optical efficiency of the FastFlex lens Gen2 (any type) pre-assembled on a FastFlex LED module (2x8 or 2x4), is specified as 96 % ± 1

Each system using a Fortimo FastFlex LED module DA(X), DP(X), DC, DHE, and PR consists of:

- a FastFlex LED board and
- a third party lens
- Compatible LED drivers. (Please refer to the "Easy design-in tool" on www.easydesignintool.philips.com)

Note: Third party or OEM proprietary lenses 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 with Xitanium driver can be used in:

- Class I and Class II IEC isolation systems

Product Range

The Philips Fortimo FastFlex LED 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 modules can be divided in 6 main groups designed to offer a suitable solution to each type of OEM:

- Fortimo FastFlex LED module and LED module X (referred in this document as "Standard")
- Fortimo FastFlex LED module DA, and DAX (referred to in this document as DA)
- Fortimo FastFlex LED module DP, and DPX (referred to in this document as DP)
- Fortimo FastFlex LED module DHE (referred to in this document as DHE)
- Fortimo FastFlex LED module DC (referred to in this document as DC)
- Fortimo FastFlex LED module PR, (referred to in this document as PR)

The Fortimo FastFlex standard lenses are products 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, DC, DHE, PR and DP were designed to operate together with third party lenses, enabling an endless number of possible configurations and in the case of the FastFlex DP IP rating at module level for maximum cost effectiveness and fixture efficacy.

Full characteristics of each module are described in

- their datasheets at www.philips.com/oem

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 approved drivers please refer to the “easy design in tool” on www.easydesignintool.philips.com
- 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 boards.
- Do not use standard FastFlex lenses with the FastFlex DA, DC, DHE or DP versions.
- Do not combine standard 2x8 FF board with standard 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.

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 wiring is not allowed.

Controllability

Default controlling protocols

The FastFlex 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/oem for complete information on the integrated light control options available in the Xitanium product range.



Warning

Philips does not specify product performance for modules operating below 100mA .

Controlling FastFlex LED module with Xitanium LED drivers

It is recommended to operate the Fortimo FastFlex in combination with a programmable Xitanium driver. Please refer to the data sheet of the chosen driver to determine the Rset to current value.

Xitanium PROG/LITE LED drivers allow the use of several control protocols, including 1-10 V, DALI, Integrated Dynadimmer and CLO. Further details on programming with MultOne 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/oem

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 $T_{case,max}$. Please refer to the product datasheet for further details.

Operating temperature

Definitions

- **Module temperature:** temperature measured at the specified T_{case} point 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. Please refer to the performance window in the datasheet.



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 $T_{case} < \text{max specified driver } T_{case}$

Thermal de-rating

The FastFlex LED board contains a thermal de-rating system with the exception of the Fortimo FastFlex DP, DC, PR and DHE 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 recommended 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. For availability of the MTP function on the specific module, please check the datasheet.



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 when operated in the performance window. Do not forget to enable the MTP function in the driver with MultiOne

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.

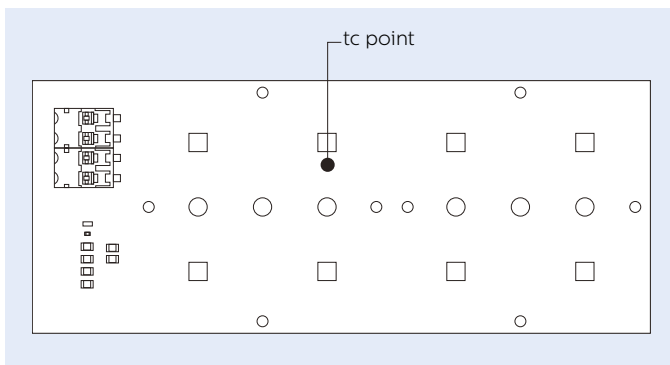
Note: The ambient temperatures given above are average temperatures during the operational period of the module.

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 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 $T_{case, life}$, 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 top of the module there is a T_{case} (T_c) 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 top of the LED board. Please refer to figure product datasheet. 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).



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.

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

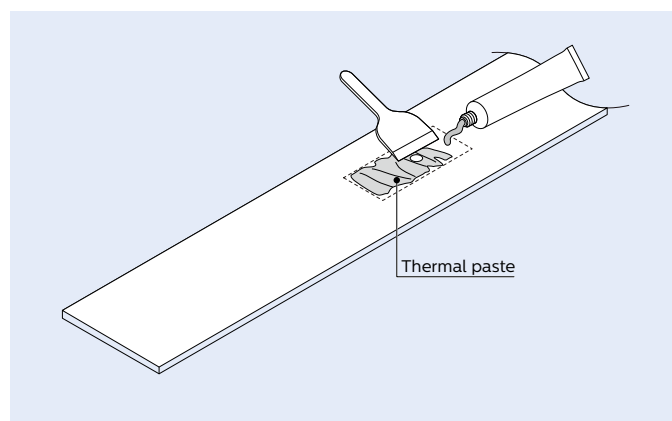
The type of material used has a significant influence on the final result. For example, a comparison of the thermal conductivity (k) of copper with that of corrosion-resistant steel - Thermal conductivity shows that a substantially smaller heat sink can be made with copper. The best material for heat 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 filled 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 is 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. We recommend the use of thermal grease for MC-PCB. For CEM 3 PCB's it may not be needed.

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.
- When lenses are applied please ensure the Lens material can withstand the temperatures in the luminaire

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 (T_c) 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. Not all modules have an NTC. For modules without the NTC, the DTL function of the driver can be used to "protect" the module. For more information on the DTL function please refer to the Design in guide of the Philips LED Xtreme drivers



Warning

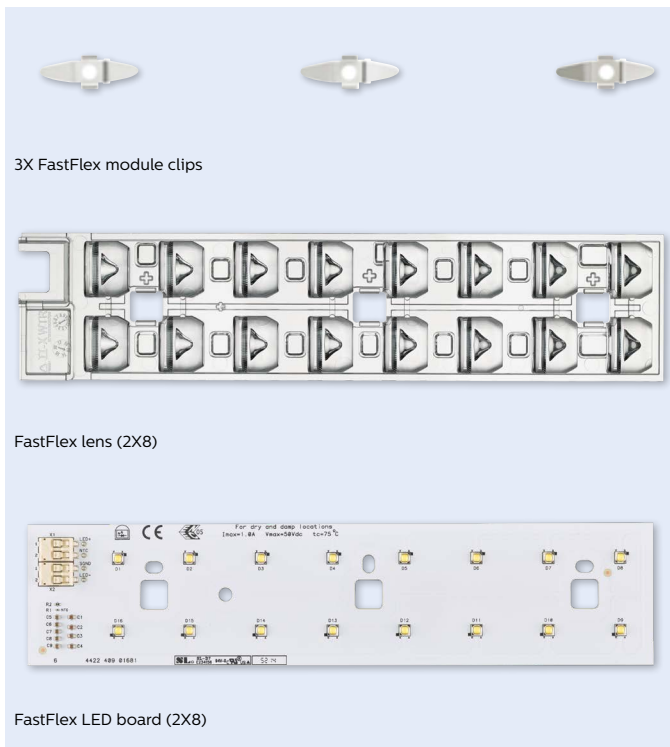
Not all drivers have the NTC and or DTL feature, please check on the website at www.philips.com/oem

FastFlex LED module assembly

FastFlex LED module assembly 2x8

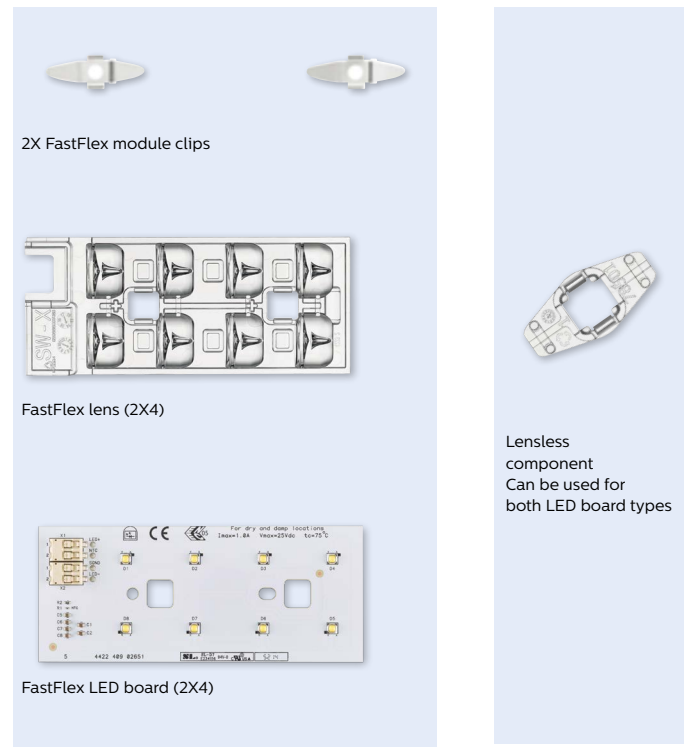
The Fortimo FastFlex standard LED boards (2x4 and 2x8), the FastFlex lens and the FastFlex module clips are shipped separately. The following section provides module assembly instructions.

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



FastFlex LED module assembly 2x4

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 module.

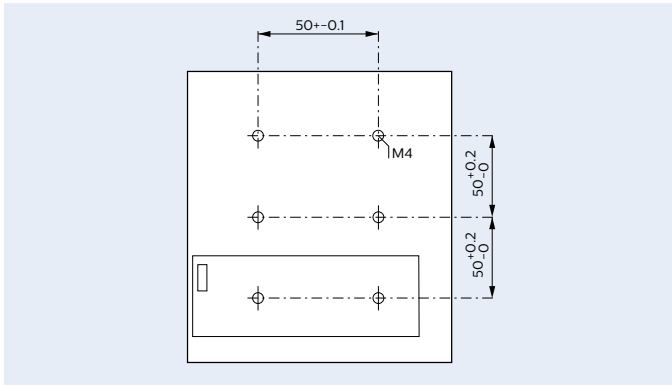


FastFlex lens Gen2 covers the LED board and produces a specific light distribution, depending on the type. The lens plate ID, e.g. IV-X, is marked next to the connector cover.

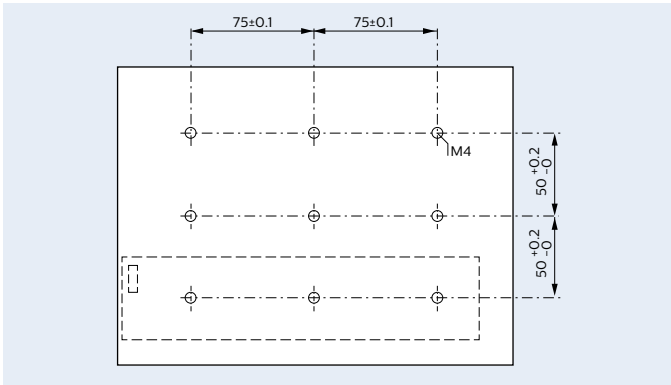
If no lens is needed, the FastFlex lensless mounting Gen2 is used on the LED board together with the correct quantity of clips. This to guarantee the correct fixation and thermal contact with the given heatsink.

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

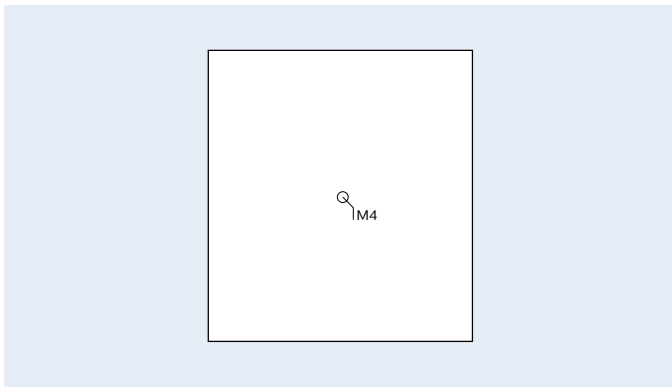
- Pre-assembly and final assembly.
- During the pre-assembly phase the lens plate gets a first fixation on the LED board; during the final assembly the module with lens is fixed inside the luminaire.



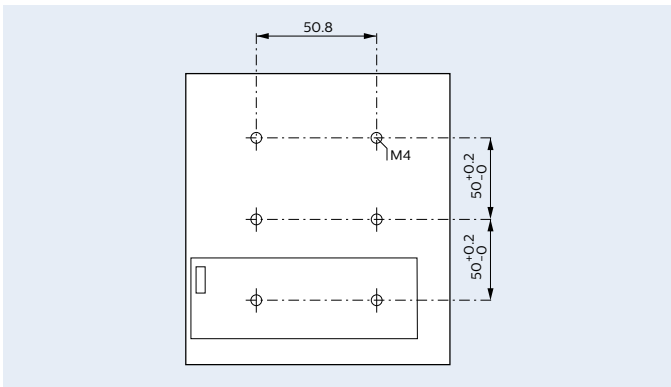
Mounting hole pattern for FastFlex Standard 2x4



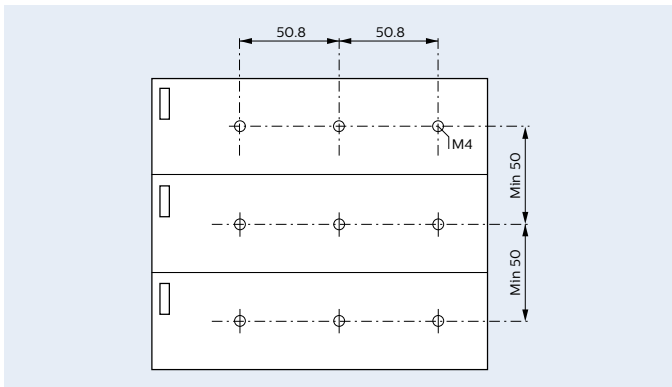
Mounting hole pattern for Standard FastFlex (X) 2x8



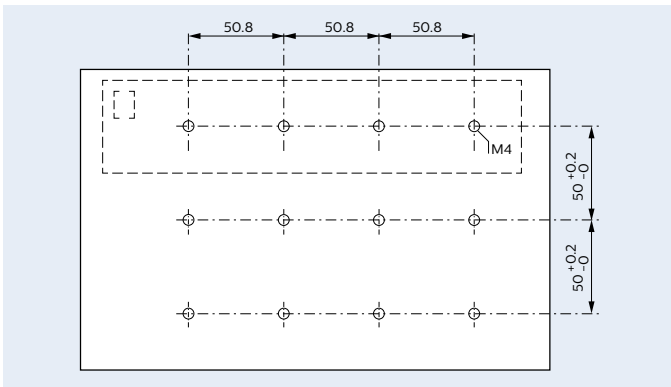
Mounting hole pattern for FastFlex DA (X) 2x2



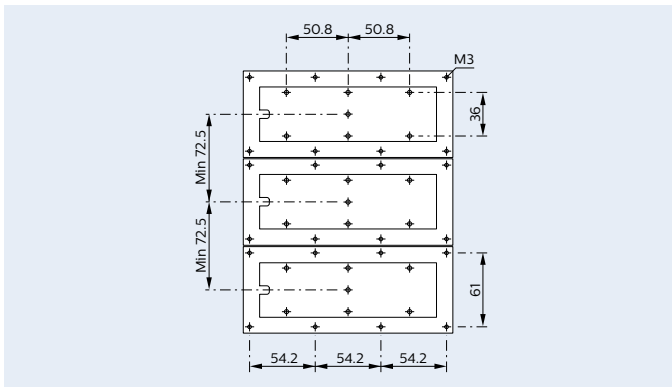
Mounting hole pattern for FastFlex DA(X) 2x4, and PR 2x8up



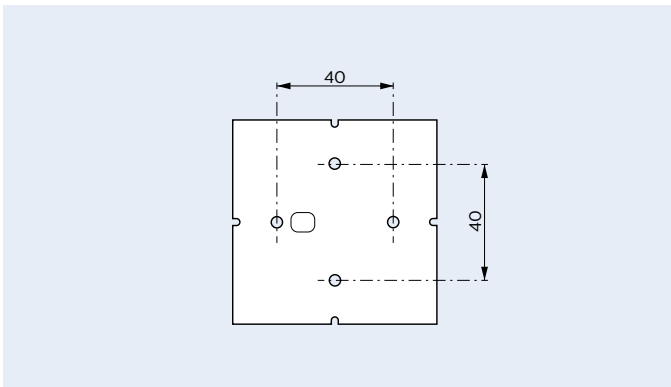
Mounting hole pattern for FastFlex DA(X) 2x6, PR 3x8up



Mounting hole pattern for FastFlex DA(X) 2x8, PR 4x8up and FastFlex DHE 4x16



Mounting hole pattern for FastFlex DP(X) 2x6



Mounting hole pattern for FastFlex DC 2x2

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. For 2x2 DA modules, a screen can be used to align the module with respect to the fixture.

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.

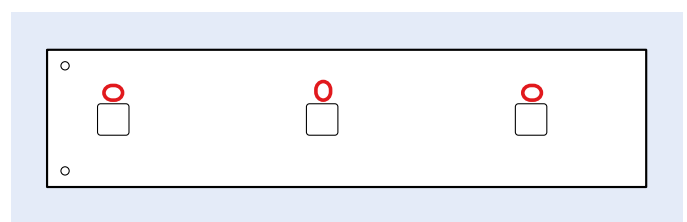
Note

- 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

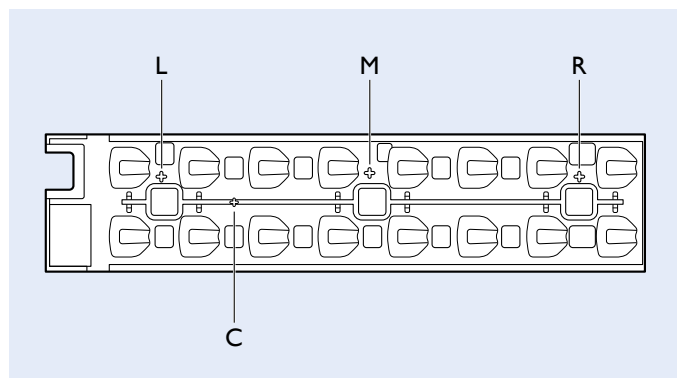
FastFlex LED modules Standard can be pre-assembled for fast factory manufacturing. The LED board may be covered with the lens in preparation for final assembly.

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



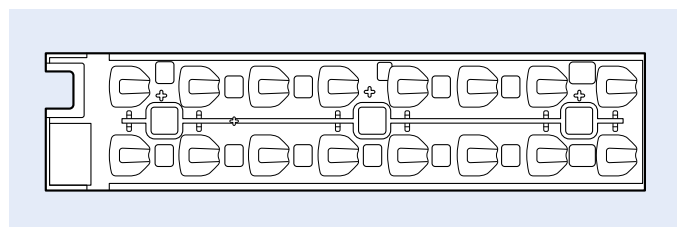
Slots for the lens grippers on the back of FastFlex LED board

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.

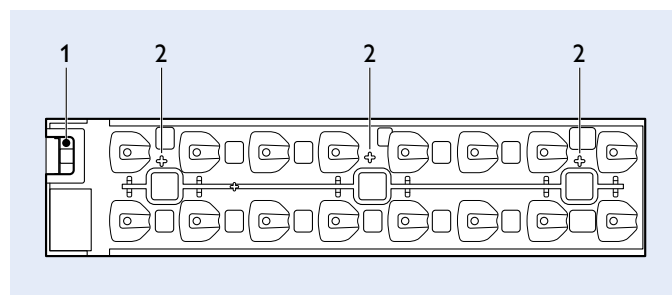


Pre-assembled FastFlex LED module

Manual pre-assembly

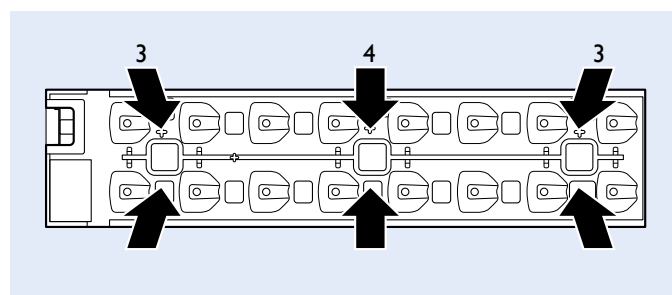
To manually pre-assemble the FastFlex LED board and the FastFlex lens:

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.

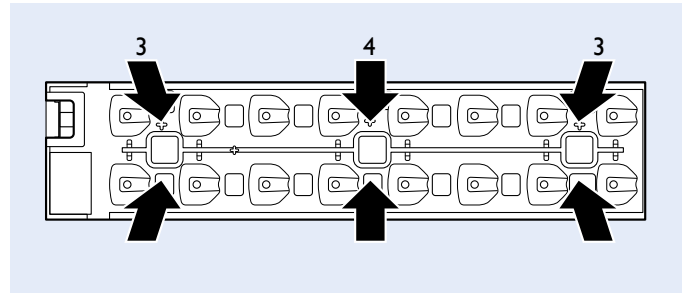
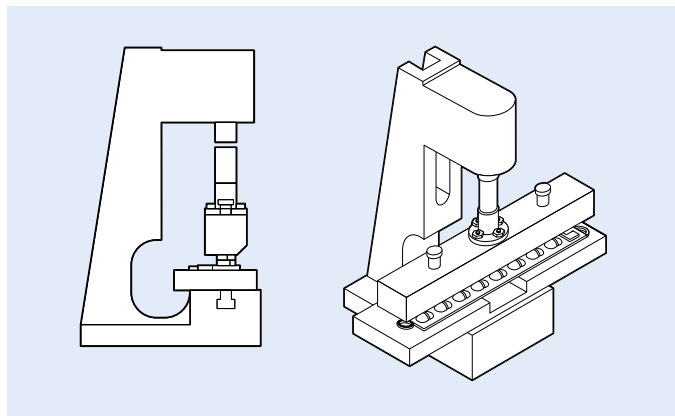
Pre-assembly with a tool

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

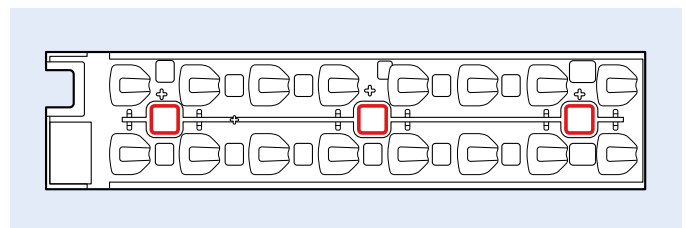
The suggested force is 150 N for each lens gripper. The gripper must be constructed of a material that will not damage the lenses.

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.



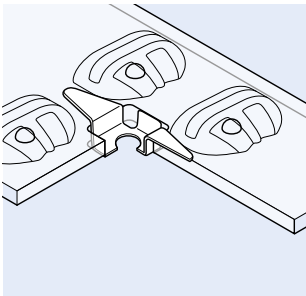
FastFlex module clips



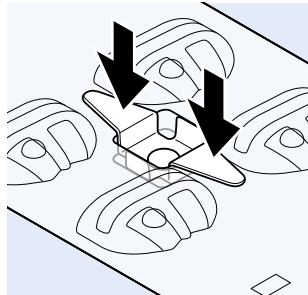
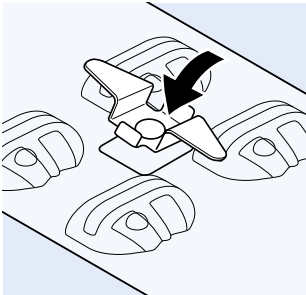
Slots for module clips indicated on pre-assembled FastFlex LED module

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



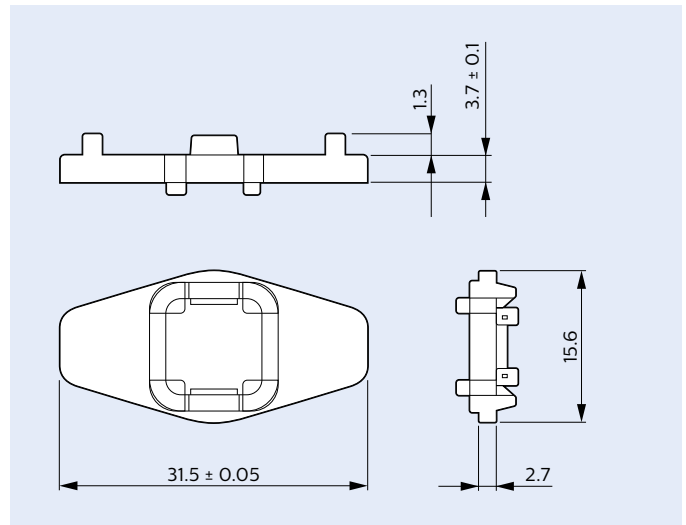
Step 1 of final assembly

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 is similar with the description of the standard FastFlex 2x8 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.

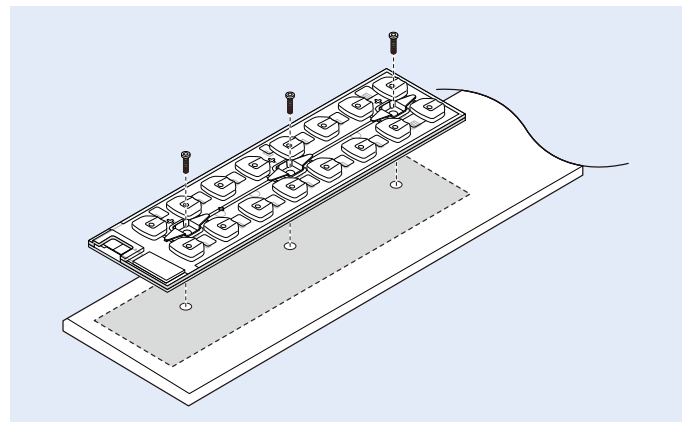
In the case of the Fortimo FastFlex LED DA Gen4 boards (2x8, 2x6, 2x4 or 2x2), and FastFle DHE 4x16, the third party array lenses (OEM or complementary partner made) must be installed on the module by means of M3 screws. Please refer to your lens supplier to define the maximum allowed torque to be applied to the screws.

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.



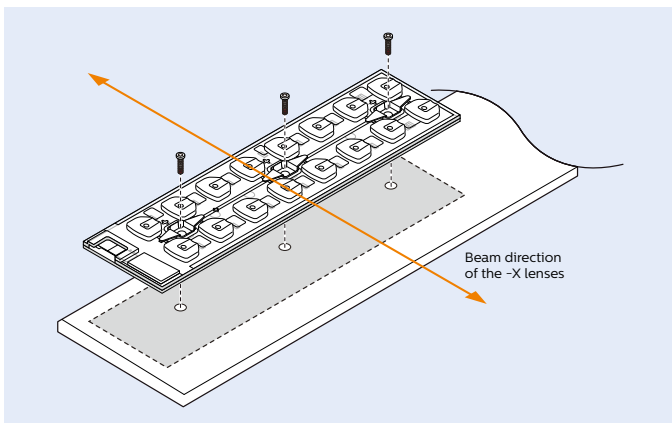
Fixation of the FastFlex LED module

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.

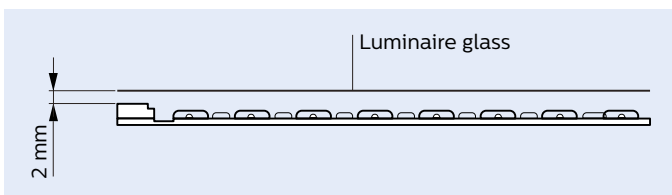


FastFlex lens beam orientation

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 DP versions may differ from the standard Fortimo FastFlex.



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 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 1050 mA., 100 mA and 1500 mA in the case of X version products. 100 mA and 700 mA in the case of DHE version products. 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.
- For the fastFlex DC; take care that the wire is not damaged when inserted through the PCB hole

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

Surge protection in a FastFlex LED system

FastFlex LED modules 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.

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 drivers. Approved combinations (please refer to the Easy design-in tool) comply with the latest IEC60598 luminaire standard requirements.

Quality

Compliance and approval marks

The Philips FastFlex LED board 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).

Complementary partners

Complementary lens partners

LEDIL www.ledil.com

Darkoo Optics www.darkoo.cc

CK Optics www.ckoptics.com

Most lenses are made of PMMA because of best transmission, in case of extreme thermal condition lenses of PC and silicone can be used. These lenses can stand higher temperatures.

Sustainability

FastFlex LED 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.

Warranty

The warranty on FastFlex LED module performance only applies if the product is used in combination with approved Philips Xitanium LED drivers. Please refer to the Easy design-in tool.

IP rating, humidity and condensation

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

In case of the FastFlex DP, DPX, PR and DC the protection against external agents can be achieved by the installation of the module in combination with a third party IP ready lens.



Warning

FastFlex LED module 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 using the non-GLS (20cm) method are available on request via your local sales department.

FastFlex 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 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 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/oem

Note on conditions: storage, transportation & operation

- Store in a dark place
- Do not expose to sunlight
- Maintain temperature between -30 and +60 °C
- Relative humidity (RH) between 5% and 85%

During operation

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

System disposal

We recommend that the FastFlex LED module 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.



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