

**PHILIPS**

LED Modules

Design-in Guide

Fortimo Outdoor  
LED Module  
FastFlex Gen 3



# Flexible system approach

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# Introduction to this guide



Figure 1. Philips Fortimo FastFlex 2x8 and 2x4 gen 3 (standard) LED modules.

Thank you for choosing the Philips Fortimo outdoor LED module FastFlex gen 3. 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 or support

On our website at [www.philips.com/oemna](http://www.philips.com/oemna), you will not only find information about this module but also:

- Design-in guides
- Datasheets
- Family sheets
- Optical files
- CAD files
- Certificates of all these Philips Fortimo LED products

If you require any further information or support please consult your local Philips sales representative.

## Basics

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

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

- FastFlex gen 3 LED board
- FastFlex module clips
- and FastFlex gen 2 lens or FastFlex gen 2 mounting

### To create a LED system you can use one of the released:

- Compatible LED drivers. (Please refer to the respective product datasheet for the full list of compatible LED drivers.) You can also use the Philips Easy Design-in Tool on <https://www.na.easydesignintool.philips.com/select-module/7>
- Example of a Philips Fortimo FastFlex 2x8 and 2x4 gen 3 (standard) system is shown in Figure 4.



Figure 2. Philips Fortimo FastFlex 2x8, 2x4 and 2x2 gen 3 DA LED modules.



Figure 3. Philips Fortimo FastFlex 2x8 gen 3 DS LED module.



Figure 4. Philips Fortimo FastFlex standard system.

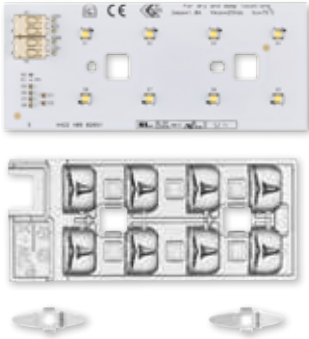


Figure 5. Philips Fortimo FastFlex 2x4 gen 3 LED module.



Figure 6. Xi095C275V054BSS1.

#### Each Fortimo FastFlex 2x8 (DA or DS) LED module consists of:

- FastFlex 2x8 gen 3 (DA or DS) LED board,
- FastFlex 2x4 gen 3 (DA) LED board or
- FastFlex 2x2 gen 3 (DA) LED board
- A third-party lens

#### To create a LED system you can use one of the released:

- Compatible LED drivers. (Please refer to the respective product datasheet for the full list of compatible LED drivers.) You can also use the Philips Easy Design-in Tool on <https://www.na.easydesignintool.philips.com/select-module/7>

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

### Applications

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

#### The Fortimo FastFlex gen 3 with Philips Advance Xitanium LED driver can be used in:

- Class 2 and Non-Class 2 isolation systems

### Product range

The Philips Fortimo FastFlex gen 3 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 Fortimo FastFlex gen 3 modules can be divided in three main groups designed to offer a suitable solution to each type of OEM:

- Fortimo FastFlex gen 3 (referred in this document as "standard") LED module
- Fortimo FastFlex gen 3 DA LED module
- Fortimo FastFlex gen 3 DS LED module

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 Fortimo FastFlex gen 3 DA and DS were designed to operate together with third-party lenses, enabling an endless number of possible configurations and 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/modulesna](http://www.philips.com/modulesna).



#### **Important usage notes**

- Minimum drive current = 100 mA. If dimmed below 100 mA, Philips does not guarantee the specified product performance.
- Maximum drive current = 1,050 mA. This limit must be observed in all cases, including CLO.
- Please refer to the respective product datasheet for the reference T<sub>case</sub> and for the maximum T<sub>case</sub> values. T<sub>case</sub> must not exceed the provided figure at the given drive current.
- $\Delta T (T_{\text{ambient}} - T_{\text{case}})$  must not exceed 50°C, regardless of drive current.
- Failure to comply with usage conditions will void product warranty.
- Optical efficiency of the complete Fortimo FastFlex (2x8 or 2x4) gen 3 LED module, pre-assembled with the FastFlex gen 3 (any type) lens is specified as 96 % ±1%.

# Recommendations

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



## Warnings and cautions

Failure to comply with usage conditions will void product warranty. Failure to follow these warnings and cautions will void the product warranty and may result in serious personal injury (including death) and/or property damage.

## Design-in phase

- It is recommended to use the approved Philips Advance Xitanium LED drivers. For a list of approved drivers please visit the Philips Easy Design-in Tool website: <https://www.na.easydesignintool.philips.com/select-module/7;jsession-id=940A11F3F44FC8E0746C63A3383A2122>.
- It is highly recommended 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 international regulatory agency recommendations: the general recommendations for luminaire design and national safety regulations (CSA, UL, etc.) also apply to selected Fortimo FastFlex LED modules and Philips Advance Xitanium LED drivers. Luminaire manufacturers are advised to conform to the international standards for luminaire design (CSA/UL 1598).
- Do not use third-party lenses together with the standard Fortimo FastFlex gen 3 boards.
- Do not use standard Fortimo FastFlex lenses with the Fortimo FastFlex gen 3 DA or DS versions.
- Do not combine 2x8 FF board with 2x4 FF lenses.

## Design-in and manufacturing phases

- 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 phases of luminaires

- The luminaire should not be serviced while the mains voltage is connected; this includes connecting or disconnecting the Fortimo FastFlex LED module wires from the driver.
- Hot switching is not allowed.

# Controllability

## Default controlling protocols

**The Fortimo FastFlex gen 3 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 Philips Advance Xitanium LED driver system selected. Please visit [www.philips.com/getincontrol](http://www.philips.com/getincontrol) for complete information on the integrated light control options available in the Xitanium product range.



### Please note

Although it is technically possible to dim FastFlex gen 3 LED modules down to 100 mA, Philips does not specify product performance for modules operating below this current.

## Controlling Fortimo FastFlex gen 3 with Philips Advance Xitanium LED drivers

It is recommended to operate the Fortimo FastFlex gen 3 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 datasheet of the chosen driver to determine the Rset to current value.

## Controlling Fortimo FastFlex gen 3 with Philips Advance 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.

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/oemna](http://www.philips.com/oemna).

## Which Philips controls can be used?

Further information about our portfolio of control products is available at [www.philips.com/getincontrol](http://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  $T_{\text{case}}$  temperature. The  $T_{\text{case}}$  must never exceed  $T_{\text{case,max}}$  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	$T_{\text{case}}$	°C	75
Delta T	The maximum temperature difference between $T_{\text{ambient}}$ and $T_{\text{case}}$	T	°C	50

## Operating temperature

### Definitions

- Module temperature: temperature measured at the specified  $T_{\text{case}}$  point (at the base) of the module
- Driver temperature: temperature measured at the specified  $T_{\text{case}}$  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 two measurements per day, with at least eight-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 note

- 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  $T(T_{case} - T_{amb}) \leq 50^{\circ}\text{C}$ .

### Thermal de-rating

The Fortimo 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 Fortimo FastFlex LED board. When multiple modules are connected to one 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 Fortimo 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.



#### Please note

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  $T_{case}$  stays below the maximum  $T_{case}$  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  $25^{\circ}\text{C}$  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  $25^{\circ}\text{C}$  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 Fortimo FastFlex LED board at its critical temperature point. Please refer to figure (Tc point on Fortimo 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 Fortimo 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 Fortimo 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.

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

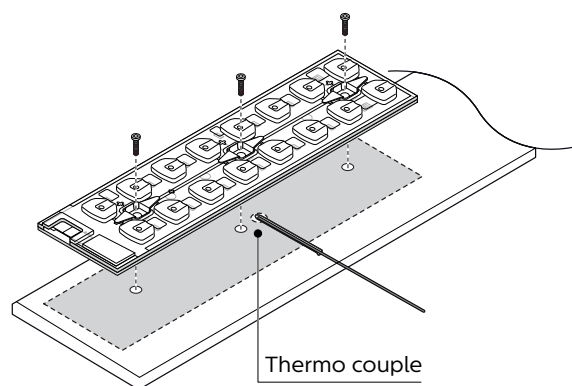


Figure 8.  $T_{case}$  measurement via thermocouple in a groove. Standard Fortimo FastFlex 2x8 image used for explanation purposes. The method is applicable for all the products of the Fortimo FastFlex portfolio.

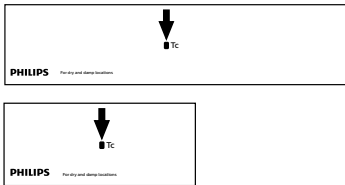


Figure 7. Tc point on Fortimo FastFlex LED board.

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

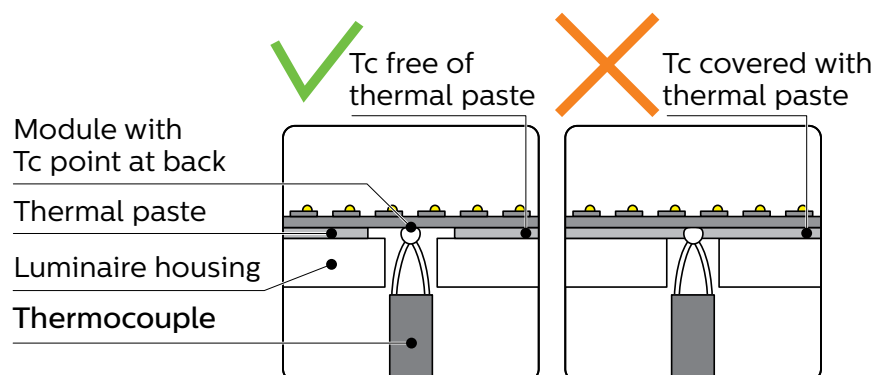


Figure 9.  $T_{case}$  measurement via an access point in the heat sink.

### 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 Fortimo FastFlex LED module can be used with Philips Advance 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 Philips 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, note 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.

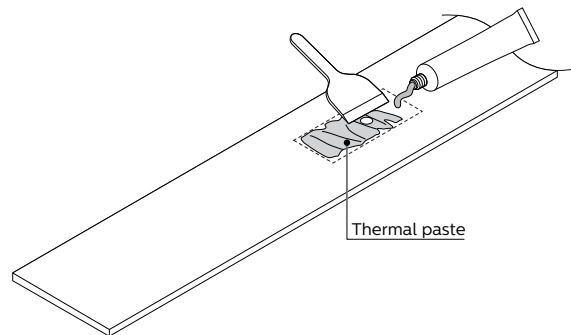


Figure 10. Interface between module and mounting plate filed with thermal paste.

### 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.



### Please note

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 Fortimo 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 Tcase 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 toward the ambient air.

## Philips Advance 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 Tcase point, shown on the driver label.

### Critical driver temperature point with respect to CLO

When the Fortimo FastFlex LED module is used with Philips Advance 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.



#### Please note

Not all drivers have the NTC feature, please check on the website at [www.philips.com/leddrivers](http://www.philips.com/leddrivers).

# Philips Fortimo FastFlex LED module assembly

## Fortimo FastFlex 2x8 gen 3 LED module assembly

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

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



Figure 11. 3X Fortimo FastFlex module clips.



Figure 12. 3X Fortimo FastFlex module clips.



Figure 13. Fortimo FastFlex (2X8) gen 3 LED board.

The Fortimo FastFlex gen 2 lens 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 Fortimo FastFlex gen 2 lensless mounting 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 heat sink.

**The assembly of the complete standard Fortimo FastFlex gen 3 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.

## Fortimo FastFlex 2x4 gen 3 LED module assembly

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



Figure 14. 2X Fortimo FastFlex module clips.

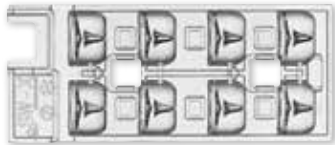


Figure 15. Fortimo FastFlex (2X4) lens.



Figure 16. Fortimo FastFlex (2X4) gen 3 LED board.



Figure 17. Lensless component. Can be used for both LED board types.



## Mounting hole pattern

The pattern of the holes (in the luminaire) must be checked and inspected before assembly begins. The drawing supplied describes the hole pattern for each module and also the distance between individual modules. For 2x2 modules, a screen can be used to align.

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

Fortimo FastFlex gen 3 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.

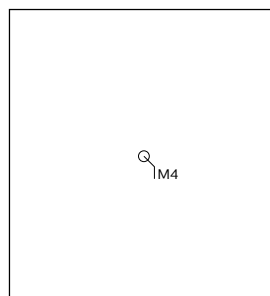


Figure 18. Mounting hole pattern for Fortimo FastFlex 2x2 DA.

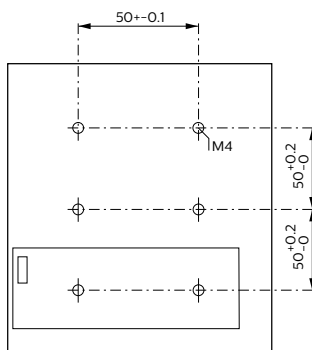


Figure 19. Mounting hole pattern for Fortimo FastFlex 2x4 standard.

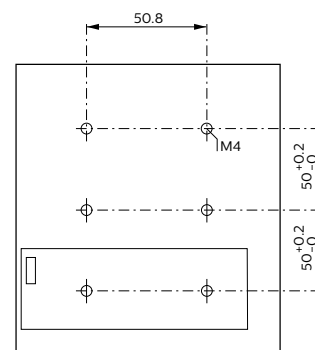


Figure 20. Mounting hole pattern for Fortimo FastFlex 2x4 DA.

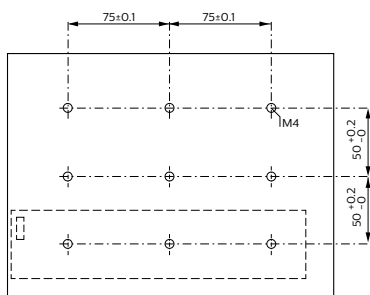


Figure 21. Mounting hole pattern for standard Fortimo FastFlex 2x8.

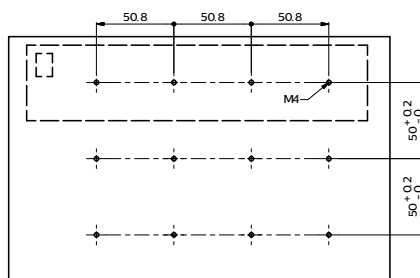


Figure 22. Mounting hole pattern for Fortimo FastFlex 2x8 DA.

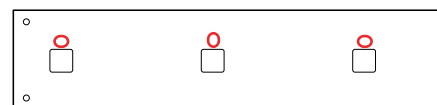


Figure 23. Slots for the lens grippers on the back of Fortimo FastFlex gen 3 LED board.

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

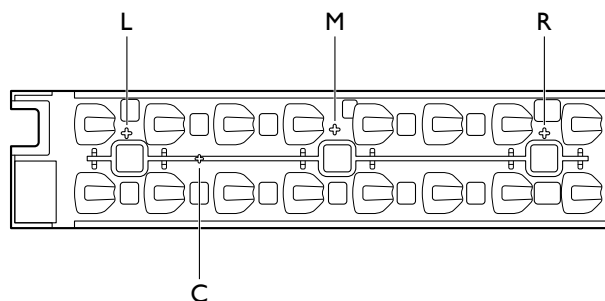


Figure 24. Lens grippers on the Fortimo FastFlex lens.

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 two different directions.

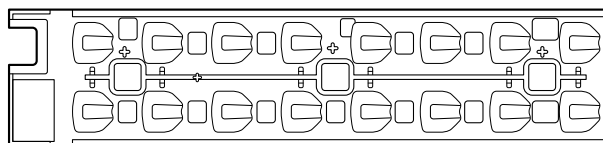


Figure 25. Pre-assembled Fortimo FastFlex LED module.

## Manual pre-assembly

To manually pre-assemble the Fortimo FastFlex LED board and the Fortimo 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 Fortimo FastFlex board by inserting the three (3) pins on the bottom side of the lens in the three slotted holes of the LED board.

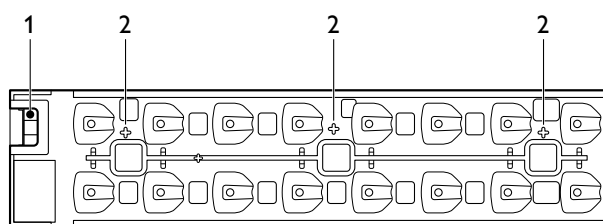


Figure 26. Steps 1 and 2 of manual pre-assembly procedure.

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.

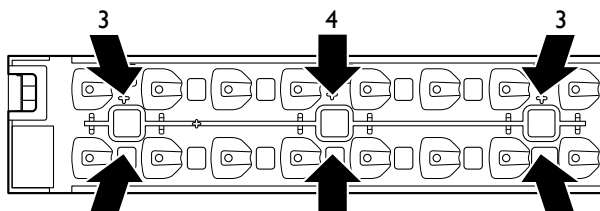


Figure 27. Step 3 of manual pre-assembly procedure.

### Pre-assembly with a tool

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

1. To force the three pins of the lens plate into the slots of the Fortimo 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)  $\pi$ -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).

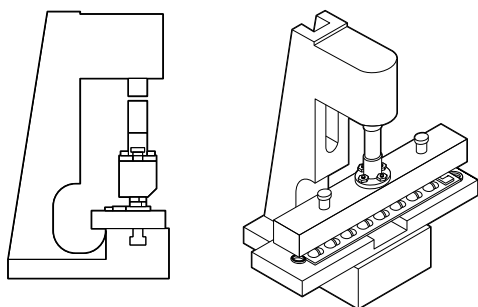


Figure 28. Pre-assembly tool.

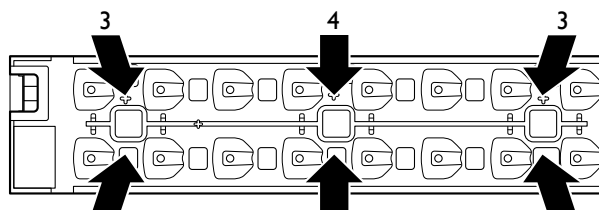


Figure 29. Step 3 of manual pre-assembly procedure.

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 Fortimo 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.



Figure 30. Fortimo FastFlex module clips.

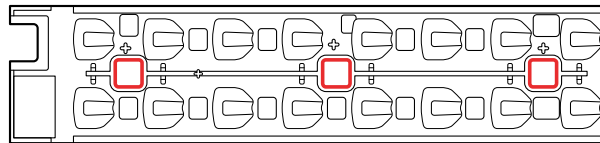


Figure 31. Slots for module clips indicated on pre-assembled Fortimo FastFlex LED module.

**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 toward the left and right x board direction (see arrows in next figure).

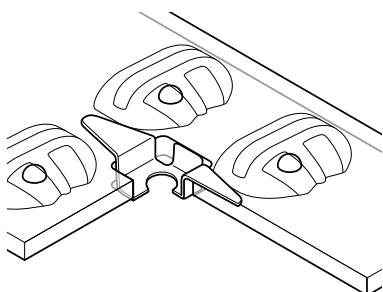


Figure 32. Fortimo FastFlex module clip mounted in a lens plate.

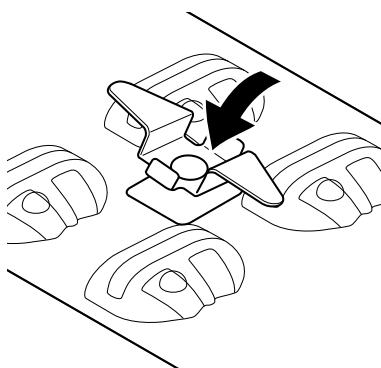


Figure 33. Step 1 of final assembly.

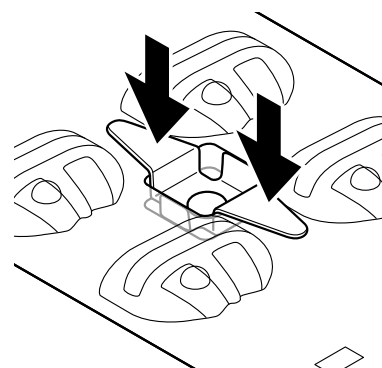


Figure 34. Step 1 of final assembly.

2. Insert a screw into each wing hole to fix the preassembled 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 or equivalent with an M4 spring-lock washer or equivalent for screws with cylindrical heads. Maximum permitted screw-head diameter is 8 mm.

**Remark:** The concept of assembly the standard Fortimo FastFlex 2x4 gen 3 is similar with the description of the standard FastFlex 2x4 gen 3 module assembly.

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

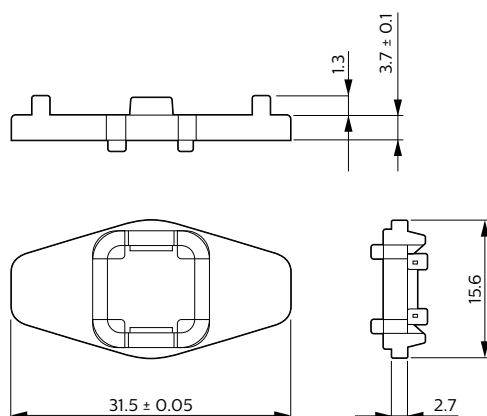


Figure 35. Fortimo FastFlex module clip dimensions.

# Installation instructions



## **Warning: Risk of electrocution**

The Fortimo 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 Fortimo 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 Fortimo 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/oemna](http://www.philips.com/oemna).

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 (2x8, 2x4 or 2x2) gen 3 DS boards, 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 2x8/XXX gen 3 DS LED board 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 2x8/XXX gen 3 DS LED board can be installed after the fixation of the module on the heat sink has been performed.

## **Fixation of the module**

Before fixing the Fortimo 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  $\leq 0.2$  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.

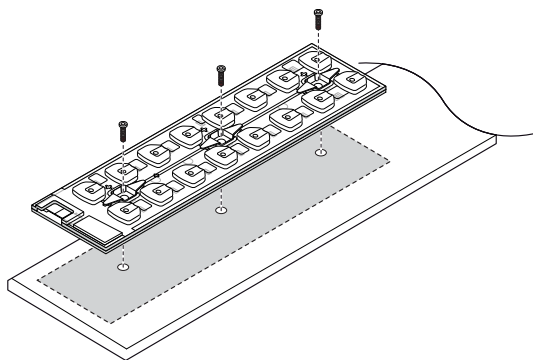


Figure 36. Fixation of the Fortimo FastFlex LED module.

### Fixation of the complete module inside the luminaire

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

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

Some of the Fortimo FastFlex lenses provide asymmetrical beams. These lenses can be identified by name, as -X will follow the lens number in the name, e.g., Fortimo 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.

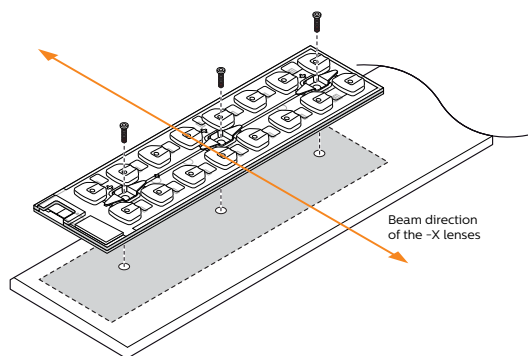


Figure 37. FastFlex lens beam orientation.

## 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 gen 3 DA and DS versions may differ from the standard Fortimo FastFlex gen 3.

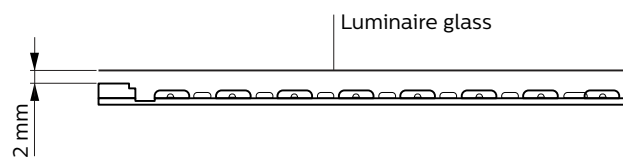


Figure 38. Distance between Fortimo FastFlex LED module and glass in a luminaire.

## Fixation of the driver

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

## Connection between module and driver

The Fortimo FastFlex gen 3 has been designed to be connected via standard wiring to the selected driver. Please refer to the module datasheet for recommended wiring specifications.



### **Warning: Risk of increased LED temperature due to LED failure, which could cause burn injuries or electrocution**

- Fortimo FastFlex LED module may be operated at any output current between 100 mA and 1050 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 programmed 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/oemna](http://www.philips.com/oemna).





#### **Please note**

- If a system consists of multiple Fortimo 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 Fortimo 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.



#### **Please note**

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**

Fortimo FastFlex LED modules are suitable for luminaire isolation Class I and Class II applications in combination with approved Philips Advance Xitanium LED Xtreme drivers. Approved combinations should comply with the latest CSA/UL 1598 luminaire standard requirements (please refer to specific product datasheet).

### **Surge protection in a Fortimo FastFlex LED system**

Fortimo FastFlex gen 3 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 Fortimo FastFlex LED module.

# Quality

## Compliance and approval marks

The Philips Fortimo FastFlex gen 3 LED board is CSA/UL approved and complies with the applicable regulatory agency directives.

To ensure approval of the luminaire, the conditions of acceptance need to be fulfilled. Module-related data can be found in CSA 250-13 and UL8750. All luminaire manufacturers are advised to conform to the international standards of luminaire design (CSA/UL 1598).

## Sustainability

Fotimo FastFlex gen 3 LED modules are compliant with the Restriction of the Use of Certain Hazardous Substances in Electrical and Electronic Equipment (RoHS).

## Limited warranty<sup>1</sup>

The limited warranty on Fortimo FastFlex gen 3 LED module performance only applies if the product is used in combination with approved Philips Advance Xitanium LED drivers. Please refer to the respective product datasheet for full module(s) to driver compatibility chart.

## IP rating, humidity and condensation

Fotimo FastFlex gen 3 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.

Fotimo FastFlex gen 3 LED modules are not suitable for direct exposure to moisture, dust, chemicals, salt, etc.



### Please note

Fotimo FastFlex gen 3 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.

## 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 Fotimo FastFlex gen 3 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 electrostatic 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 has 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 Fortimo FastFlex gen 3 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  $\Omega$ ), 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](http://www.innovationservices.philips.com).

**More information can be found in the Contact details section.**

## Remote system operation

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

## Use of circuit breakers: Philips Advance Xitanium LED drivers

Please consult the design-in guide for Xitanium LED drivers at [www.philips.com/ledddrivers](http://www.philips.com/ledddrivers).

### **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**

Fortimo FastFlex gen 3 modules must be operated within the specifications stated in the product design-in guide. Please contact your local Philips sales representative for additional information.

### **System disposal**

We recommend that the Fortimo FastFlex gen 3 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 all applicable federal, state and local laws and regulations.

# Disclaimer

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