



## FNP Lens Series for Philips Lumileds Rebel and Rebel ES LEDs

- High efficiency design
- Five beams patterns available
- Available as a lens alone for maximum design flexibility or in a holder for easy assembly

The FNP lens offers low profile lenses specifically designed for the Lumileds Rebel LEDs from Philips Corporation.

A software-optimized aspheric profile enables the generation of several different beam output patterns: narrow, narrow spot, medium, elliptical, and wide beams<sup>2</sup>.

The design of the FNP series insures that almost all of the light emitted by the LED is captured and usefully directed, resulting in a lens with maximum performance and efficiency.

Lens holders are available in black polycarbonate to provide the proper alignment between the LEDs and the lenses; and to set the correct distance between the lens and LED.

The lens holder can be glued and/or screwed to the PCB to provide a secure assembly.

Typical applications are:

- Reading lamps
- Architectural Lighting
- Entertainment Lighting
- Interior Lighting



**PHILIPS**  
**LUMILEDS**

- (1) LUXEON® Rebel and Rebel ES are trademarks of Philips Lumileds. For technical specification on LEDs please refer to the LUXEON® Rebel and Rebel ES datasheet or visit [www.luxeon.com](http://www.luxeon.com)
- (2) Typical beam divergence may change with different color LEDs.

<b>FRAEN Corporation OMG</b>	<b>FRAEN Corporation Srl</b>
80 Newcrossing Road	Via delle Querce, 22
Reading MA 01867	27020 Trivolzio (PV)
USA	Italy
Phone: +1 781.205.5300	Phone: +39 0382 1933.1
Fax: +1 781.942.2426	Fax: +39 0382 1933.239

Inquiries: [optics@fraen.com](mailto:optics@fraen.com)  
Website: [FraenOMG.com](http://FraenOMG.com)

*For ordering or sales information in your region, please contact one of our offices listed above or visit [www.FraenOMG.com/Contact](http://www.FraenOMG.com/Contact).*



## General Characteristics

---

### Materials

Lens Material	Optical Grade PMMA
Holder Material	Polycarbonate: Black, White, Transparent
Operating Temperature range	-40° C / + 80° C
Storage Temperature range	-40° C / + 80°C

Average transmittance in visible spectrum (400 – 700nm) >90%, as measured using 3mm thick Optical Grade PMMA.

*Please note that flow lines and weld lines on the external surfaces of the lenses are acceptable if the optical performance of the lens is within the specification described in the section “OPTICAL CHARACTERISTICS”*

### IMPORTANT NOTE – Lenses handling and cleaning:

- Handling: Always use gloves to handle lenses and/or handle the lenses only by the flange. Never touch the outside surfaces of the lenses with fingers; finger oils and contamination will absorb or refract light.
- Cleaning: Clean lenses only if necessary. Use only soap and water to clean the surfaces and lenses. Never expose the lenses to solvents such as alcohol, as it will damage the plastic.

## Scope

---

This datasheet provides information about the FNP series lens assemblies for the Philips Lumileds LUXEON Rebel LED.

FNP series lens assemblies (lenses in holders)

	<b>Black Holder</b>	<b>White Holder</b>	<b>Transparent Holder</b>
<b>Narrow Beam</b>	FNP-N1-PEB	FNP-N1-PEW	FNP-N1-PET
<b>Narrow Spot</b>	FNP-N2-PEB	FNP-N2-PEW	FNP-N2-PET
<b>Medium Beam</b>	FNP-M1-PEB	FNP-M1-PEW	FNP-M1-PET
<b>Wide Beam</b>	FNP-W1-PEB	FNP-W1-PEW	FNP-W1-PET
<b>Elliptical Beam</b>	FNP-E1-PEB	FNP-E1-PEW	FNP-E1-PET



## Optical Characteristics – On-axis Intensity<sup>1</sup>, Beam Angle<sup>2</sup>, Field Angle<sup>3</sup>

LED	Beam Shape	On-axis Intensity (peak)	Beam Angle (FWHM)	Field Angle (FW10%)
Rebel ES Cool White	Narrow	7.2 cd/lm	15°	30°
Rebel ES Cool White	Narrow Spot	11.3 cd/lm	13.5°	25°
Rebel ES Cool White	Medium	3.9 cd/lm	21°	40°
Rebel ES Cool White	Wide	1.5 cd/lm	39°	57°
Rebel ES Cool White	Elliptical	3.5 cd/lm	13° x 42°	28° x 64°

- (1) To calculate the on-axis intensity (cd), multiply the on-axis value of the lens (cd/lm) by the total flux (lm) of the LED used. See “Illumination Calculations” below. Luminous intensity depends on the flux binning and tolerances of the LEDs. Please refer to the LED datasheet for more details on flux binning.
- (2) FWHM is the full angle where the beam intensity is half the on-axis peak intensity
- (3) Field angle is the full angle where the beam intensity is 10% of the on-axis peak intensity

Performance values typical. Actual values may vary with LED color and binning.

## Example Calculations

To calculate intensity (cd): Find the central spot on-axis intensity (cd/lm) for the lens and then multiply this value by the luminous flux (lm) of the LED. Refer to the LED’s datasheet for typical flux values; drive current versus flux ratios; color temperature and binning characteristics.

### Example intensity calculations:

If a Fraen lens with an on-axis intensity of 21 candela per lumen (cd/lm) is used with an LED that produces 105 lumens of flux, the calculations are as follows:

On-axis intensity = (21 cd/lm) x (105 lumens) = 2205 candela on-axis intensity (one LED).

If 12 LEDs are used in a fixture, then the on-axis intensity = 12 LEDs x 2205 candela/LED  
= 26460 cd (on-axis – 12 LEDs)

### An explanation of illuminance and the effect of distance

One candela at 1-meter distance produces 1 lux. In the above example, the 12 LED fixture produced 26460 candela. If that fixture is illuminating a surface one meter distant, then the *illuminance* on that surface is 26460 lux.

Illuminance decreases with the square of the distance. If you move the fixture so that it is two meters from the surface, then the illuminance falls to 26460 lux/ (2m)<sup>2</sup> or 6615 lux. Moving the fixture three meters from the surface decreases the illuminance to 26460 lux/(3m)<sup>2</sup> or 2940 lux.



## Beam and Field Angles

Beam and Field Angles are methods of describing the light distribution of a lens. The Beam Angle is expressed as a FWHM value (Full angular Width of the beam where it reaches Half the Maximum intensity). The Field Angle is a similar concept, sometimes expressed as FW10%, and represents the Full Width angle where the beam reaches 10% of maximum intensity.

If the lenses in our example fixture, above, have a Beam Angle of  $10^\circ$  and an on-axis intensity of 26460 cd, then at  $\pm 5^\circ$  (half of  $10^\circ$ ) the intensity will drop to half of 26460 or 13230 cd. If the Field Angle for the fixture is  $19^\circ$ , then at  $\pm 9.5^\circ$  (half of  $19^\circ$ ) the intensity should be 10% of 26460 or 2646 cd.

Most lenses have Beam and Field Angles that are rotationally symmetrical about the center axis of the lens. Lenses with an elliptical beam profile or optics with specifically shaped beam profiles are the exception.

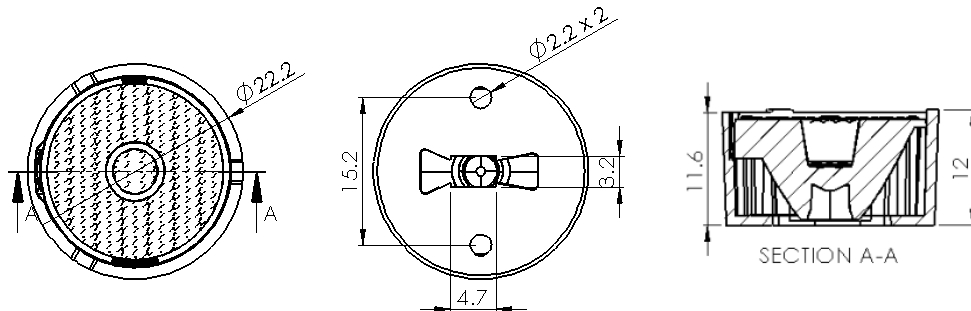
Intensity, illuminance, Beam and Field Angle are all important factors to be considered in a fixture design. Some applications may require specific ratios between the Beam and Field Angle values.

## Mechanical Characteristics



**Figure 1. Identifying the assemblies by their front views**

**NOTE:** The FNP series lenses are available only as an assembly (lens in a holder.) The holder provides the correct alignment (concentricity, height, and orientation) of the lens to the LED. Orientation control is important for the elliptical beam lens.



**Figure 2: Top, bottom and section assembly views with dimensions (millimeters)**



The FNP-E1 elliptical assembly produces a beam shape whose long axis is perpendicular to the micro-lens ribs on the output face of the lens. This is an important consideration when designing your printed circuit board, LED alignment and fixture layout.

Mechanical CAD files are available. Please contact [Applications@fraen.com](mailto:Applications@fraen.com).

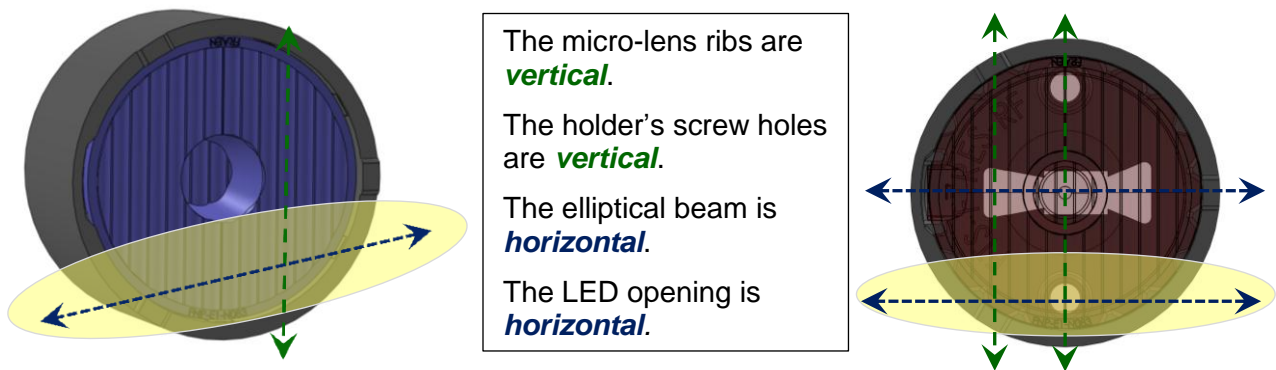


Figure 3: Relationship between mechanical features and the resulting elliptical beam