



## FL3 Series Tri-lenses for LUXEON™ K2 LEDs

- **High efficiency**
- **Available in 2 different beams**

The FL3 series offers 2 lens assemblies specifically designed for the Lumileds (1) LUXEON® K2 LEDs.

A software-optimized aspheric profile combined with shaped front surfaces and Fresnel profiles provide narrow and medium beam output shapes. The high collection efficiency reaches 85% of the total flux emitted from the LED.

Each of these tri-lenses is only available as assemblies (3 lenses attached to a holder). The lens holder assures the proper relative placement of the lenses on the LEDs. Heat-staking the 3 legs of the holder to the customer's PCB or heat sink provides an excellent optical and mechanical assembly (see Fraen Application Note FAN01-EN, at [www.fraensrl.com](http://www.fraensrl.com) ).

Typical applications are:

- General illumination
- Architectural Lighting
- MR11 size lamps
- Flashlights
- Most applications where a compact light source is required.



- (1) LUXEON® K2 is a trademark of Lumileds Lighting, LLC. For technical specification on LEDs please refer to the LUXEON® K2 datasheet or visit <http://www.luxeon.com/> or <http://www.luxeon.com/products/line.cfm?lineId=18>
- (2) Typical beam divergence may change with different color LEDs.

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## General Characteristics

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Lens Material	Optical Grade PMMA
Holder Material	PC/ABS
Operating Temperature range	-40deg C / + 95 deg C
Storage Temperature range	-40deg C / + 95 deg 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 alcohol, as it will damage the plastic.*



## Optical Characteristics:

Typical Beam Angle (degrees)		Red, Orange, Amber	Green Cyan Blue	Cool White TFFC	Warm White
Lens Part Number	Beam Shape				
FL3-N1-LLK2-H	Narrow	9	13	11	13
FL3-M1-LLK2-H	Medium	19	20	25	23

Typical On-Axis Efficiency (candela/lumen)		Red, Orange, Amber	Green Cyan Blue	Cool White TFFC	Warm White
Lens Part Number	Beam Shape				
FL3-N1-LLK2-H	Narrow	19	12	15	12
FL3-M1-LLK2-H	Medium	5.2	2.7	4.5	3.7

- (3) The typical divergence varies with LED color due to different chip size and chip position tolerance. The typical total divergence is the full angle measured where the luminous intensity is half of the peak value.
- (4) To calculate the on-axis intensity, multiply the on-axis efficiency of the lens (cd/lm) by the total flux of the Luxeon LED used. See "Illumination Calculations" below. For more detail on flux binning please check the Luxeon LED datasheet at <http://www.luxeon.com/>
- (5) Luminous intensity depends on the flux binning and tolerances of the LEDs. Please refer to the Luxeon datasheet for more details on flux binning and mechanical tolerances.
- (6) Typical illuminance measured in lux per lumen (E) with typical Luxeon™ LEDs. To estimate the illuminance in lux, multiply the typical illuminance E by the flux in lumen of the LED used. See "Illumination Calculations" below.



## Illumination Calculations

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To calculate peak candela: Select a lens and LED from the “Typical on-axis efficiency” table above. Find the corresponding “candela/lumen” value. Multiply that value by the lumens output from your LED (refer to the K2 LED datasheet <http://www.luxeon.com/pdfs/DS51.pdf> for nominal lumens values). Multiply this by 3 for a tri-lens result.

Example - Fraen medium beam lens # FL3-M1-LLK2-H on cool white K2 LED # L XK2-PW14-T00:

The table above indicates this lens produces 15 candela/lumen with a cool white K2 LED. The LED datasheet indicates 80 lumens minimum and 85 lumens typical at 1000mA current. Choosing 85 lumens, the calculation is: (15 candela/lumen) x (85 lumens) = 1275 candela peak on-axis. For three 85 lumen LEDs and a tri-lens: 1275 x 3 = 3825 candela peak on-axis.

1 candela at 1-meter distance produces 1 Lux. This means the peak intensity from the tri-lens at 1 meter will be 3825 lux. The intensity decreases as a function of the distance squared, so at 2 meters the peak intensity will be  $3825 / (2^2) = 956$  lux. At 3 meters distance, the peak intensity will be  $3825 / (3^2) = 425$  lux.

The beam angle specified in the “Typical total beam divergence” table above indicates 11 degrees full beam-width measured at half-peak. This means at 5-1/2 degrees off-axis (half of 11 degrees), the intensity should be half of 3825 candela, or 1912 candela.

## Mechanical Characteristics

The FL3 tri-lenses have been designed specifically for the Luxeon Lambertian K2 LEDs. The lens holder provides mounting legs for heat staking the lens assembly to a printed circuit board or heat sink. The holder also helps to center the lenses to the LEDs.

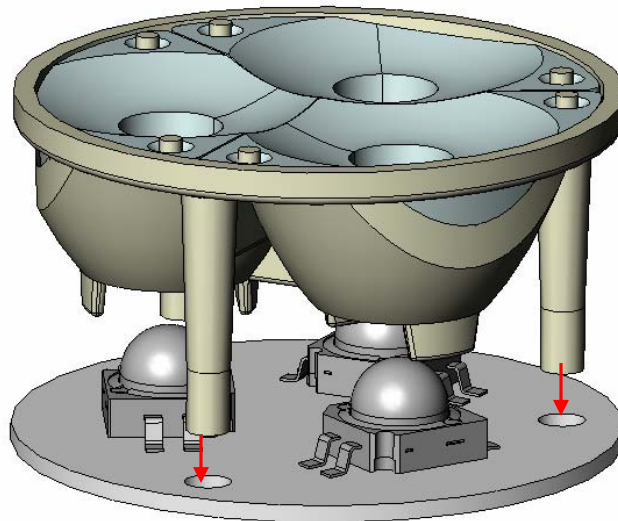


Figure 1: The FL3 series tri-lens can be assembled to a PCB+LED by inserting the holder's legs thru holes in the PCB. The holder's legs can be glued or heat-staked to the PCB.

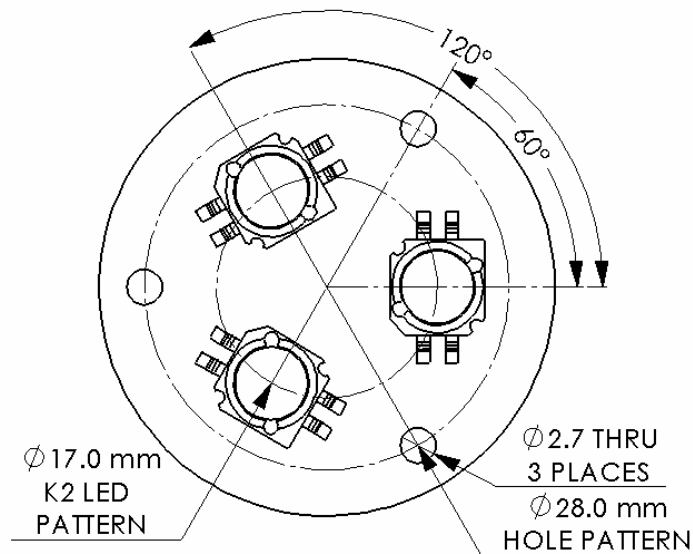


Figure 2: For best fit to the FL3 tri-lens, the PCB should have thru holes and LEDs located as shown above.

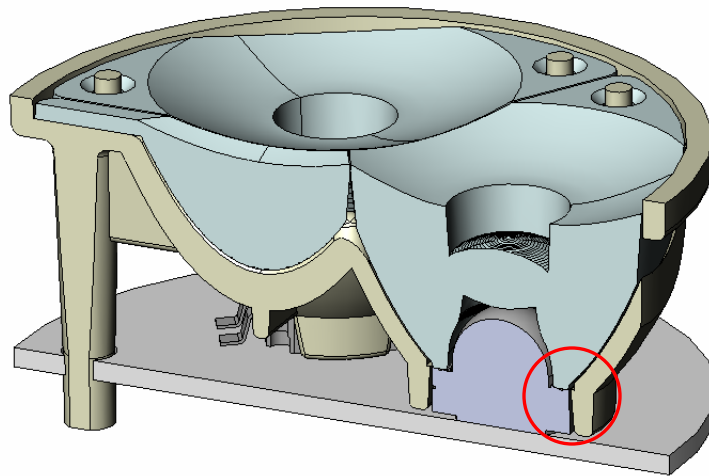
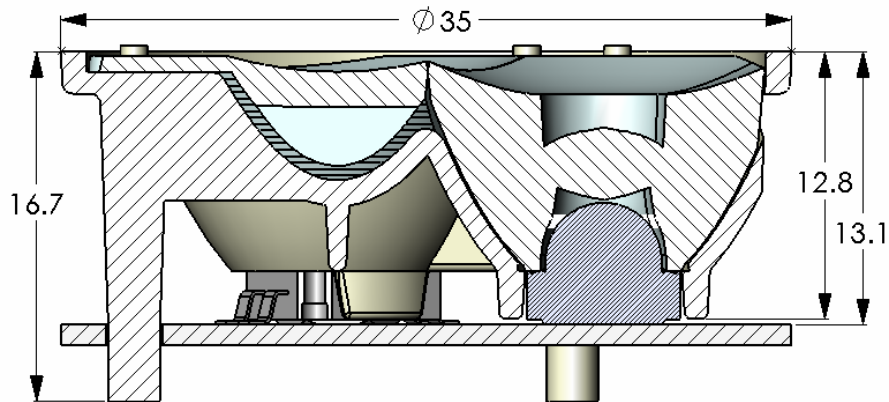


Figure 3: X-Section view shows the bottom of the lens touches the top of the K2 LED package while the tabs protruding from the bottom of the holder reference 2 sides of the K2 LED's square package.



Dimensions tolerance is  $\pm 0.2\text{mm}$

Figure 4: X-Section view shows the lens touches the K2 LED, and the holder aligns the lens to the LED.

**Identifying the lenses by their front surface:**

The outside mechanical dimensions of the lenses (Narrow and Medium beam lenses) are the same, except the front of the lens. The lens can be recognized by their unique front surfaces:

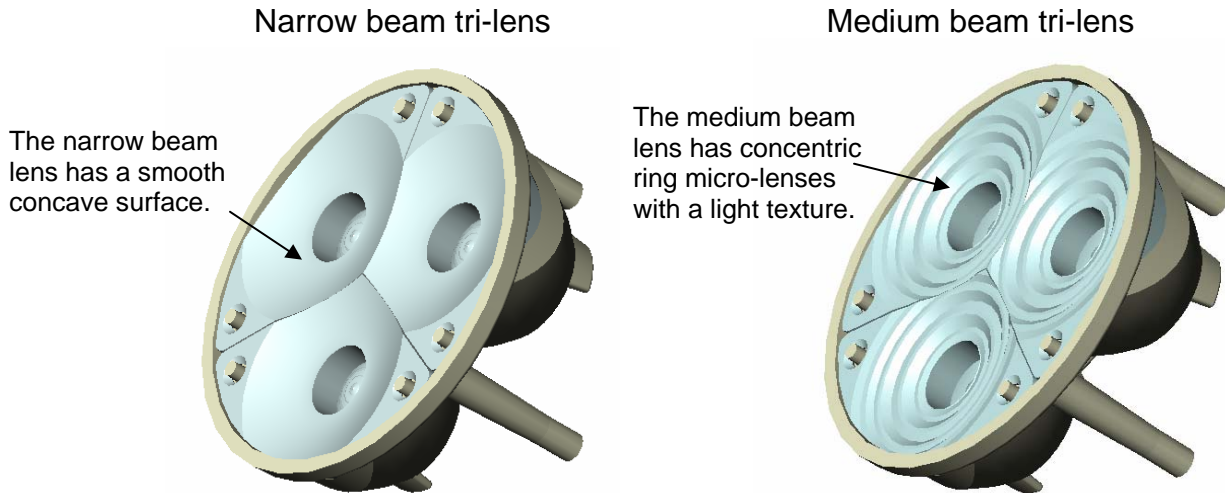


Figure 5: Narrow beam and Medium beam lenses can be distinguished by their front surface shape and appearance.

**Ordering part numbers**

FL3-\_1-LLK2-H

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**Lens Type:**  
**N** = Narrow beam lens  
**M** = Medium beam lens

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Document Revision Record

Rev	Date	Author	Description
00	03 January 2008	C. Jones	Initial Release