



Dual-Beam Focus Optical System (FOCOS™) for Cree XLamp™ XR-E LEDs FXGR-N1-XR79-0R & FXGR-W1-XR79-0R

- **Patented Fraen Technology**
U.S. Patent #8,118,451
- **Produces Narrow and Wide Beam Patterns**
- **Compact size**
- **High efficiency Designed for use with Cree XLamp XR79¹ LEDs**
(Please contact Fraen for suitability of this reflector pair with other LEDs)

Fraen's **FOCOS** (FOCUS Optical System) dual beam system consists of two reflectors that work together to deliver both a narrow spot and a wide flood from a single lighting fixture.

The secret behind the **FOCOS** system is its two reflector, two position design. When the outer reflector is extended away from the LED source, the system delivers a tightly focused beam with excellent throw and maximum projection of light.

For tasks requiring smooth, wide beam lighting, simply move the outer reflector to the retracted position, allowing the inner **FOCOS** reflector to deliver a pleasing and uniform area flood.

Typical **FOCOS** applications are ones requiring dual beam patterns, such as:

- Flashlights
- Bicycle lights
- Mining lights and head lights
- Any application requiring quick changes between flood and spot patterns



(1) XLamp and XR-E, are trademarks of Cree, Inc. For technical specification on Cree XLamp LEDs, please refer to the Cree website www.cree.com/products/ledlamps.asp.

FRAEN Corporation OMG	FRAEN Corporation Srl
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
Website: FraenOMG.com

For ordering information, please contact:

NAFTA Countries	ARROW Telephone: 1-888-9LIGHT1 email: lightingsolutions@arrow.com
European Countries	Please contact Fraen S.r.l. for distributor's information Email: info@fraen.com



Optical Characteristics – On-axis Intensity¹, Beam Angle², Field Angle³

Narrow Beam (spot with spill)	
Beam Angle (50% peak)	4 degrees
Field Angle (10%-peak)	8 degrees
Peak intensity, center of spot	29 candela/lumen
Perceived cut-off, full-angle	~45 degrees
Intensity at 15 degrees from center	2.5 candela/lumen



Wide Beam (flood)	
Beam Angle (50% peak)	36 degrees
Field Angle (10%-peak)	75 degrees
Peak intensity, center of beam	1.3 candela/lumen
Perceived cut-off, full-angle	~70 degrees
Intensity at 30 degrees from center	0.6 candela/lumen



1. To calculate the on-axis intensity (cd), multiply the on-axis value, above, of the reflector (cd/lm) by the total flux (lm) of the Cree XLamp LED used. See “Illumination Calculations” below. Luminous intensity depends on the flux binning and tolerances of the LEDs. Please refer to the Cree XLamp datasheets 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

Illumination Calculations

To calculate intensity (cd): Find the central spot “on-axis intensity” value in the table above, then multiply this value by the luminous flux (lm) from your LED (refer to the Cree XLamp datasheet for nominal lumen values.) For a more accurate calculation, refer to the intensity “ranking” (binning) tables on the datasheet for the specific LED.



Example calculations:

If the Fraen FXGR Narrow is used on a Cree XR-E Cool White driven at 350 mA, a typical luminous flux of the LED is 80 lumens.

The calculation is: (29 cd/lm) x (80 lumens) = 2320 candela on-axis intensity.

One candela at 1-meter distance produces 1 Lux. This means the peak illuminance at 1 meter will be 2320 lux. The illuminance decreases as a function of the distance squared, so at 2 meters the peak illuminance will be $2320 / (2^2) = 580$ lux. At 3 meters distance, the peak illuminance will be $2320 / (3^2) = 258$ lux.

The beam angle specified in the table above is 4 degrees FWHM (full angular width measured where the beam intensity equals half the on-axis maximum intensity.) This means at ± 2 degrees off-axis (half of 4 degrees), the intensity should be half of 2320 candela, or 1160 candela.

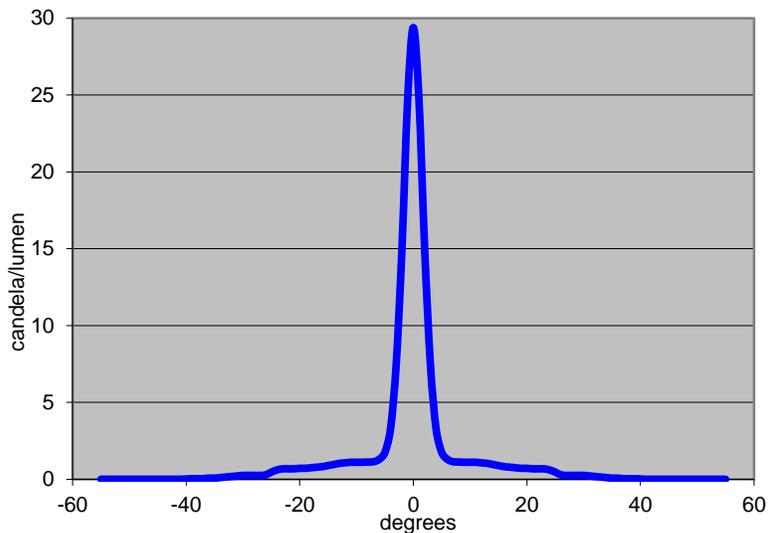


Figure 1: Narrow Beam Profile – cd/lm vs. degrees off-axis

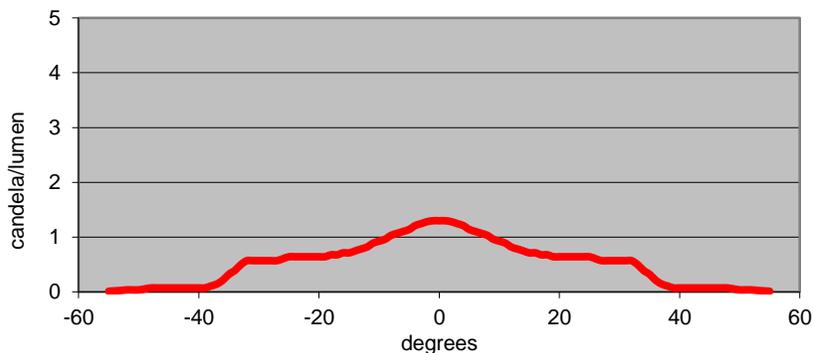


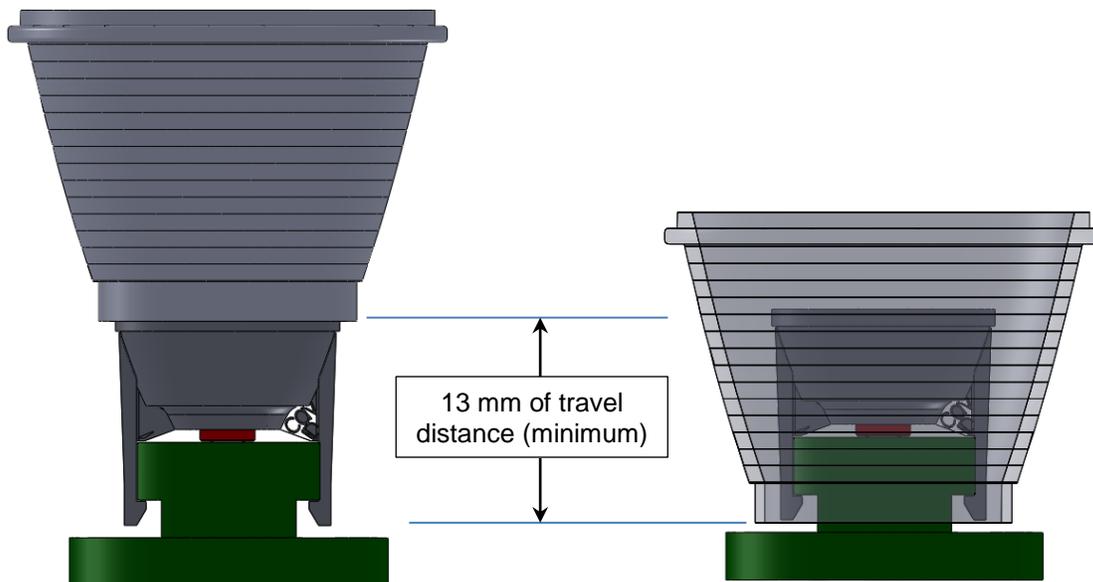
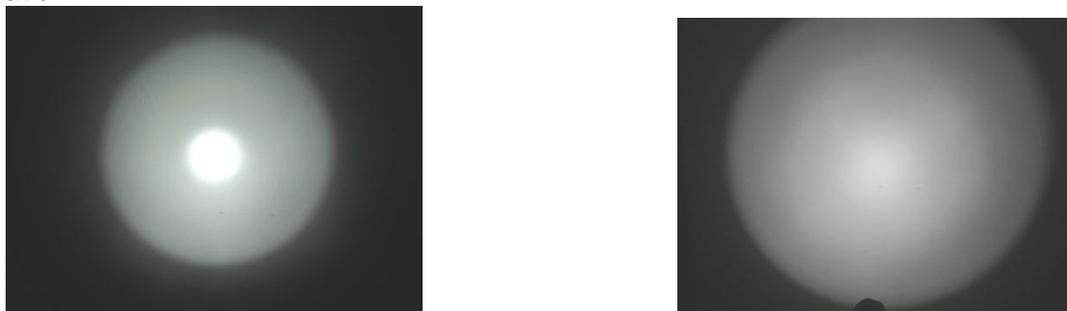
Figure 2: Wide Beam (Flood) Profile – cd/lm vs. degrees off-axis



Mechanical Characteristics

The FXGR Dual-Beam Focusable Reflector System consists of a narrow (FXGR-N1-XR79-0R) and wide (FXGR-W1-XR79-0R) reflector pair. When in the extended position (see figure 1), the two reflectors work in tandem to product a narrow illumination beam with sharp cut-off of the spill beam.

When the large reflector is in the retracted position, the FXGR delivers a smooth, wide beam illumination.



FXGR in Narrow Spot position with large reflector fully extended

FXGR in Wide Flood position with large reflector fully retracted

Extending or retracting the large reflector by 13 mm changes the illumination pattern from narrow spot to wide flood. The heat-sink/pedestal (in green) and the LED (in red) are shown for illustration purposes only and are not provided by Fraen Corporation.

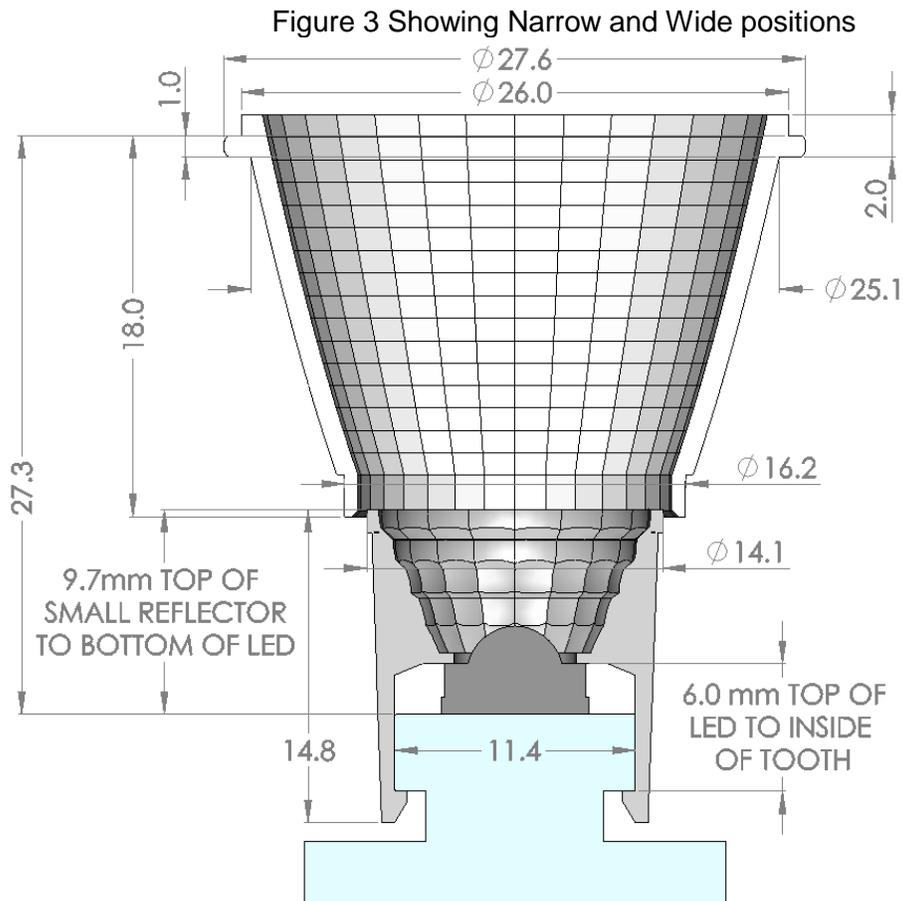


Figure 4 – Mechanical dimensions of the FXGR Dual-Beam Focusable Reflector System

Changing the illumination pattern from a narrow to a wide beam requires that the large reflector be moved relative to the LED. The large reflector is designed with a mounting flange, allowing the designer to properly align, secure and move the reflector in their assembly.

The smaller reflector is designed for a snap fit onto the customer's heat sink or PCB. The dimensions of your heat sink will be determined by the LED used. Maximum reflector performance is realized when the top of the LED package is coincident with the bottom of the small reflector, as shown in figure 2.

To permit full retraction of the large reflector, the LED must be mounted on a heat-sink/pedestal feature (figure 1 in blue). Proper design of your heat sink to accommodate the full retraction of the large reflector and the snap fit of the small reflector is an important design consideration.



Ordering Part Numbers

FXGR-N1-XR79-0R **(Large, narrow spot reflector)**
FXGR-W1-XR79-0R **(Small, wide flood reflector)**

These parts must be ordered as reflector pairs to achieve dual beam performance. While the reflectors may be used individually, their performance in this configuration has not been fully evaluated.

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