FC Lens series
for Cree XLamp® 7090 XR and XR-E LEDs

- **High efficiency**
- **4 beams available**
- **Easy assembly**

The FC lens offers low-profile lenses specifically designed for the XLamp® 7090XR and XR-E LEDs [(1)] from Cree.

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

The high collection efficiency reaches 85% of the total flux emitted by the LEDs.

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

The lens holder can be glued to the PCB to provide a secure assembly.

Typical applications are:

- Reading lamps
- Signs
- Architectural Lighting
- Street Lights

Cree® XLamp is a trademark of Cree, Inc. For technical information about these LEDs please refer to the Cree® XLamp datasheet or visit http://www.cree.com/products/xlamp.asp or http://www.cree.com/products/xlamp7090_xre.asp

FRAEN CORPORATION
80 Newcrossing Road
Reading, MA 01867
Phone: 781.205.5300
Fax: 781.942.2426
optics@fraen.com

FRAEN S.r.l.
Via Stelvio, 12
20019 Settimo M. (MI) – Italy
Phone: +39-02-35.456.1
Fax: +39-02-335.456.239
info@fraen.com

Website: www.fraensrl.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

General Characteristics

Lens Material	Optical Grade PMMA
Holder Material	PC, black color
Operating Temperature range	-40deg C / + 80 deg C
Storage Temperature range	-40deg C / + 80 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 solvents such as alcohol, as it will damage the plastic.*

Scope

This datasheet provides information about the new FC series lenses:

- FC-N2-XR79-0R
- FC-M2-XR79-0R
- FC-W2-XR79-0R
- FC-E2-XR79-0R

The N2 and M2 part numbers have replaced the N1 and M1 part numbers:

- FC-N1-XR79-0
- FC-M1-XR79-0

Optical Characteristics – Beam Angle (degrees, Full Angle)

Lens Part Number	Type of lens	Cool White	Warm White	Blue	Green	Red
FC-N2-XR79-0R	Narrow beam	8	8	12	12	12
FC-M2-XR79-0R	Medium beam	21	20	22	22	22
FC-W2-XR79-0R	Wide beam	29	28	28	28	28
FC-E2-XR79-0R	Elliptical beam	8 x 44	8 x 44	13x45	13x45	13x45
FC-N1-XR79-0 (5)	Narrow beam	9	-	9	9	9
FC-M1-XR79-0 (5)	Medium beam	28	-	22	22	26

(1) 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.

Optical Characteristics – On-Axis Intensity (candela/lumen)

Lens Part Number	Type of lens	Cool White	Warm White	Blue	Green	Red
FC-N2-XR79-0R	Narrow beam	27	27	18	18	19
FC-M2-XR79-0R	Medium beam	4.1	4.1	2.9	2.9	3.3
FC-W2-XR79-0R	Wide beam	2.4	2.4	1.9	1.9	2.4
FC-E2-XR79-0R	Elliptical beam	4.8	4.8	3.5	3.5	3.5
FC-N1-XR79-0 (5)	Narrow beam	21	-	15	17	10
FC-M1-XR79-0 (5)	Medium beam	2.7	-	3.3	3.7	1.9

(2) To calculate the on-axis intensity, multiply the on-axis efficiency of the lens (cd/lm) by the total flux of the Cree XLamp 7090® XR and XR-E LED used. See “Illumination Calculations” below. For more detail on flux binning please check the Cree LED datasheet at http://www.cree.com/products/xlamp.asp

(3) Luminous intensity depends on the flux binning and tolerances of the LEDs. Please refer to the Cree XLamp datasheet for more details on flux binning and mechanical tolerances.

(4) Typical illuminance measured in lux per lumen (E) with typical Cree 7090 XR-E LED. To estimate the illuminance in lux, multiply the typical illuminance E by the flux in lumen of the LED used. See “Illumination Calculations” below.

(5) FC-N1-XR79-0 and FC-M1-XR79-0 have been replaced by FC-N2-XR79-0R and FC-M2-XR79-0R.

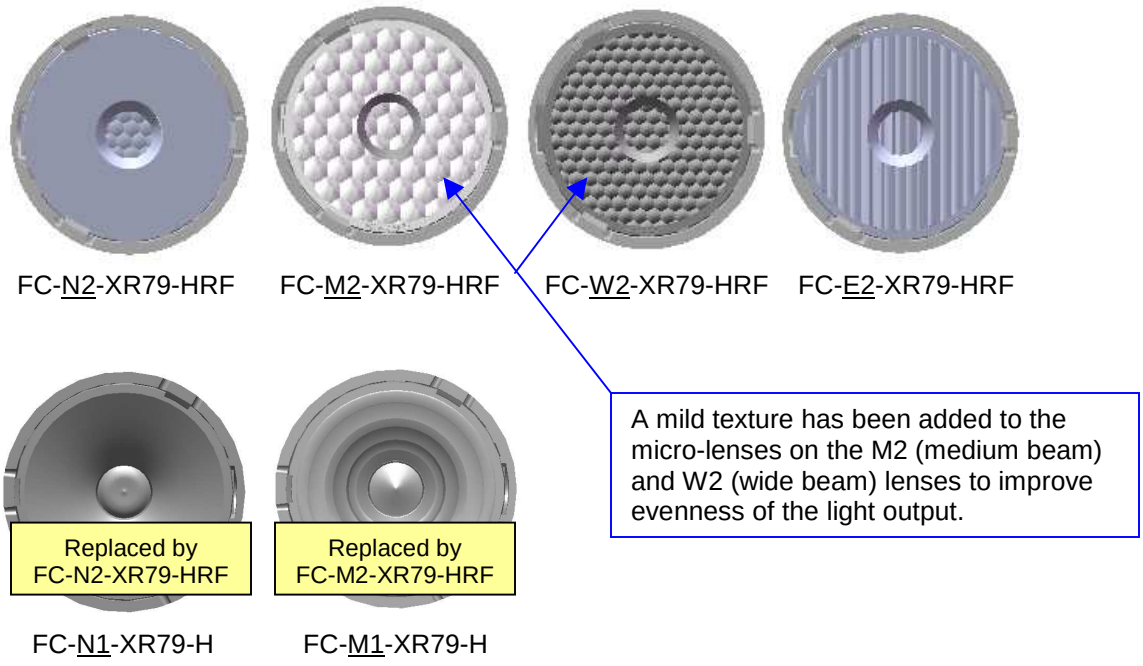
Illumination Calculations

To calculate peak candela: Find the central spot "on-axis intensity" value in the table above, then multiply this value by the lumens output from your LED (refer to the XLamp LED datasheet http://www.cree.com/products/pdf/XLamp7090XR-E.pdf or http://www.cree.com/products/pdf/XLamp7090XR.pdf for nominal lumens values). Or for a more accurate calculation, refer to the intensity binning tables http://www.cree.com/products/xlamp_docs.asp .

Example calculation:
If the Fraen narrow beam lens FC-N2-XR79-0R is used on a cool white Cree XR-E LED at 350 mA, the typical luminous flux of the LED is 80 lumens:
The calculation is: (27 candela/lumen) x (80 lumens) = 2160 candela peak on-axis.
The beam angle specified in the table above is 8 degrees full beam-width measured at half-peak. This means at 4 degrees off-axis (half of 8 degrees), the intensity should be half of 2160 candela, or 1080 candelas.
1 candela at 1-meter distance produces 1 Lux. This means the peak intensity at 1 meter will be 2160 lux. The intensity decreases as a function of the distance squared, so at 2 meters the peak intensity will be 2160 / (2^2) = 540 lux. At 3 meters distance, the peak intensity will be 2160 / (3^2) = 240 lux.

Mechanical Characteristics

Figure 1. Identifying the lenses by their front views



The FC series lenses are available either assembled to a holder or without 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. Correct vertical distance between FC lens and 7090 XR-E LED

NOTE: If the FC lens is used with no lens holder, the user must provide a mechanical method to set the correct distance between the lens and LED. For example, the lens flange can be located in the lamp housing to center the lens to the LED and establish 13.9 mm from the lens flange to the user's PC board. For N2, M2, W2, E2 lenses, the lens touches the LED.

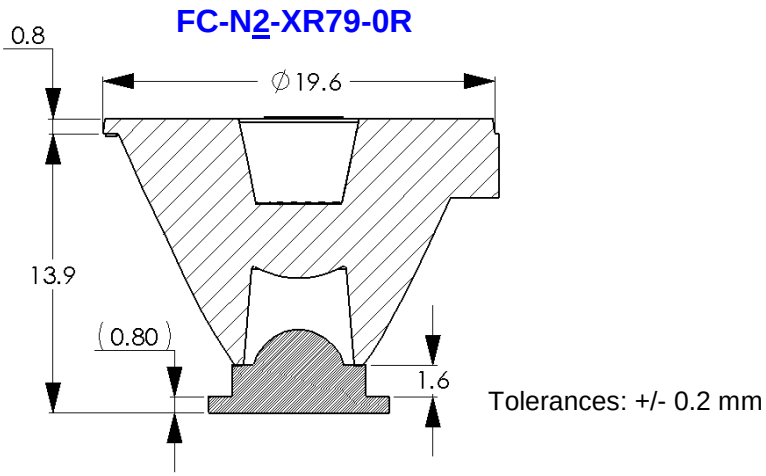
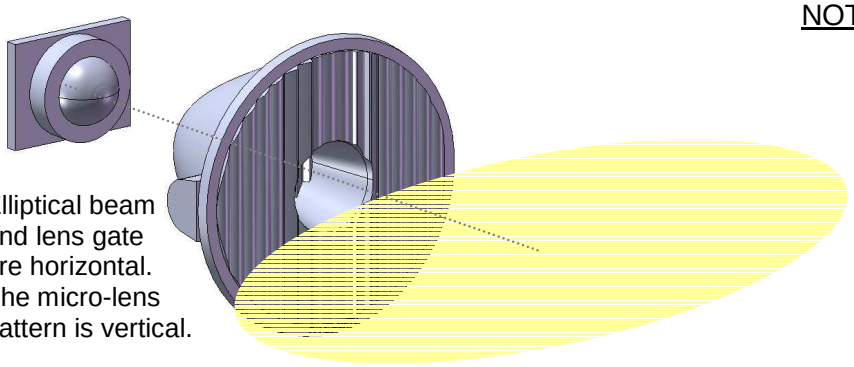


Figure 3. Elliptical beam orientation

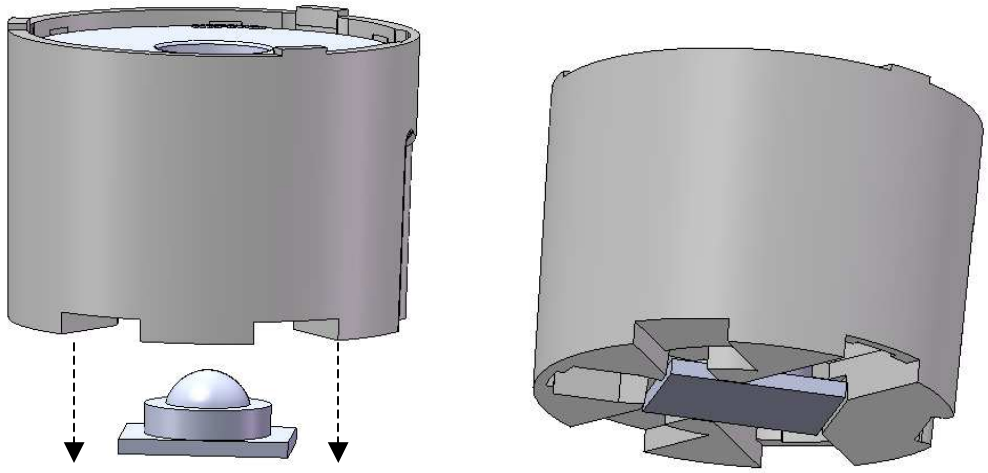


Elliptical beam and lens gate are horizontal. The micro-lens pattern is vertical.

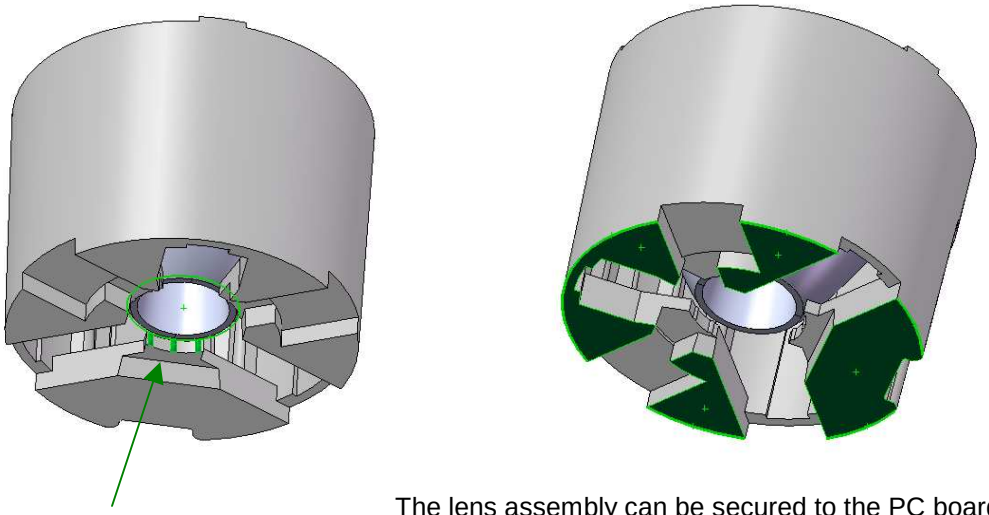
To produce a horizontal elliptical beam, the lens needs to be orientated such that the micro-lenses are positioned vertically. The elliptical beam lens assembly (with holder) will only fit the Cree LED in this orientation (with elliptical beam and rectangular LED substrate aligned). The LED orientation on the PC board should be coordinated with the beam orientation.

NOTE: The elliptical beam lens produces a beam shape that is perpendicular to the microlens pattern on the output face of the lens. The lens holder is designed to align the elliptical pattern with the rectangular shape of the Cree LED substrate. It is important to consider the orientation of the LEDs and the desired elliptical beam orientation when designing the printed circuit board layout.

Figure 4. Installation of lens assembly onto Cree LED



The new FC-N2-XR79-HRF (and M2, W2 and E2) lens assemblies will fit onto the Cree LED at only 2 orientations: 0 degrees and 180 degrees. The bottom of this new –HRF lens holder has a rectangle shape to control lens orientation (important for "E2" elliptical beam lens application). After installation, the bottom of the holder should be at the same datum/plane as the bottom of the Cree LED.



Small crush-ribs inside the round hole will center the lens assembly on the round body of the Cree LED.

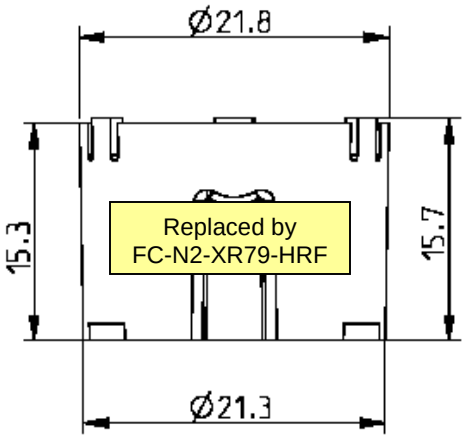
The lens assembly can be secured to the PC board by using glue or silicone RTV. To avoid glue on the lens and LED, apply it along the outside diameter edge, or apply a very thin film on areas shown in green.

CAUTION: Do not use instant glue (containing cyanoacrylates). Always test the glue on a sample assembly and check the results and performance 24 hours later. Some adhesives produce fumes that will damage the surfaces of the plastic lens, lens holder, or LED.

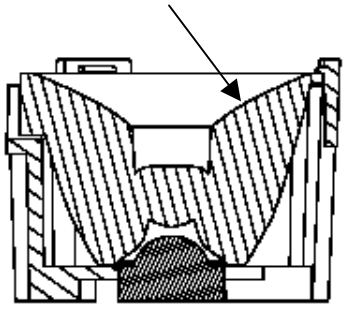
Figure 5. Overall dimensions of FC-_2-XR79-HRF series lens assemblies

The new FC-_2-XR79-HRF assemblies (shown at right) are ~ 0.4 mm larger diameter than the previous FC-_1-XR79-H assemblies shown below.

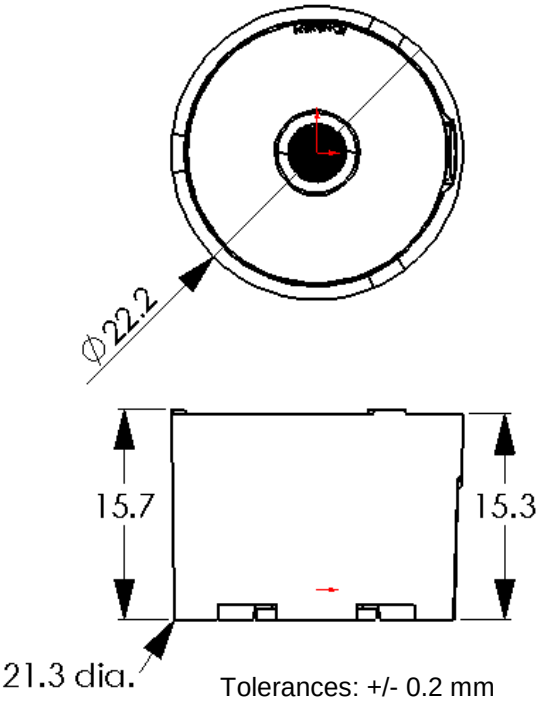
FC-N1-XR79-H



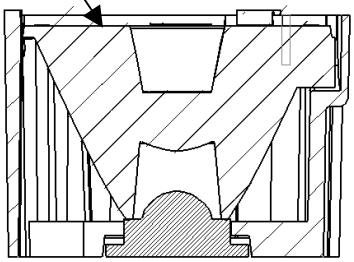
"Curved-top" lens



FC-N2-XR79-HRF



"Flat-top" lens



Ordering part numbers

FC-_2-XR79-__

0R: Lens alone (no holder)
HRF: Lens with black PC holder

Caution: If using lens alone (with no holder), lens alignment and spacing must be set by the user. See Figure 2.

N: Narrow beam
M: Medium beam
W: Wide beam
E: Elliptical beam Caution: The orientation of the elliptical beam lens is controlled by the lens holder and the LED orientation (see Figure 3).

Rev	Date	Author	Description
05	16 October, 2007	C. Jones	Texture added to M2 and W2 lenses to improve homogeneity (evenness) of light output.
04	05 September, 2007	C. Jones	Replaced N1 and M1 with N2, M2, W2, and E2 family. Added figures 2,3, 4, and 5 and illumination calculations.
03	26 March 2007	D. DeGaetano	Added Wide and Elliptical timing of official release
02	4 December 2006	D. DeGaetano	Revised holder mechanical drawing
01	27 November 2006	D. DeGaetano	Official Datasheet
00	10 October 2006	D. DeGaetano	Preliminary Datasheet

FC3 Series Tri-Lens

for Cree XLamp® 7090 XR and XR-E LEDs

- **High efficiency**
- **3 beams available**
- **MR-16 size tri-lens**

The FC3 tri-lens offers MR16 size lenses specifically designed for the XLamp® 7090XR and XR-E LEDs [(1)] from Cree.

A software-optimized aspheric profile enables the generation of three different beam output patterns: narrow, medium, and wide beams.

The high collection efficiency reaches 85% of the total flux emitted by the LEDs.

Lens holders are white or clear polycarbonate, and provide the proper alignment between the LEDs and the lenses, and set the correct distance between the lens and LED.

The lens holder can be heat-staked to the PCB, to provide a secure assembly.

Typical applications are:

- MR-16 LED lamps
- Architectural lighting
- General illumination
- Street lights

Cree® XLamp is a trademark of Cree, Inc. For technical information about these LEDs please refer to the Cree® XLamp datasheet or visit http://www.cree.com/products/xlamp.asp or http://www.cree.com/products/xlamp7090_xre.asp

FRAEN CORPORATION
80 Newcrossing Road
Reading, MA 01867
Phone: 781.205.5300
Fax: 781.942.2426
optics@fraen.com

FRAEN S.r.l.
Via Stelvio, 12
20019 Settimo M. (MI) – Italy
Phone: +39-02-35.456.1
Fax: +39-02-335.456.239
info@fraen.com

Website: www.fraensrl.com

For pricing and availability, please contact our Certified Distribution Network. Distribution contact information is available on our website:
http://www.fraensrl.com/contact.html

General Characteristics

Lens Material	Optical Grade PMMA
Holder Material	PC, black color
Operating Temperature range	-40deg C / + 80 deg C
Storage Temperature range	-40deg C / + 80 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 solvents such as alcohol, as it will damage the plastic.*

Scope

This datasheet provides information about the three FC3 series tri-lenses beam angles and two different lens-holder colors:

With white PC holder:

- FC3-N2-XR79-H
- FC3-M2-XR79-H
- FC3-W2-XR79-H (coming soon)

With clear PC holder:

- FC3-N2-XR79-HT
- FC3-M2-XR79-HT
- FC3-W2-XR79-HT (coming soon)

Optical Characteristics – Beam Angle (degrees, full angle)

Lens Part Number	Output Beam	Cool White ○	Warm White ○	Blue ●	Green ●	Red ●
FC3-N2-XR79-H	Narrow	5.5	*	6.5	7.0	5.0
FC3-M2-XR79-H	Medium	24	*	25	26	24
FC3-W2-XR79-H	Wide	Wide Beam version coming soon.				

* Not yet measured

(1) 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.

Optical Characteristics – On-Axis Intensity (candela/lumen)

Lens Part Number	Output Beam	Cool White ○	Warm White ○	Blue ●	Green ●	Red ●
FC3-N2-XR79-H	Narrow	48	*	24	30	37
FC3-M2-XR79-H	Medium	4.4	*	3.6	3.8	4.1
FC3-W2-XR79-H	Wide	Wide Beam version coming soon.				

* Not yet measured

(2) To calculate the on-axis intensity, multiply the on-axis efficiency of the lens (candela/lumen) by the total flux of the Cree XLamp 7090® XR color or XR-E white LED used. See “Illumination Calculations” below. For more detail on flux binning please check the Cree LED datasheet at http://www.cree.com/products/xlamp.asp

(3) Luminous intensity depends on the flux binning and tolerances of the LEDs. Please refer to the Cree XLamp datasheet for more details on flux binning and mechanical tolerances.

(4) Typical illuminance measured in lux per lumen with typical Cree 7090 XR-E LED. To estimate the illuminance in lux, multiply the typical illuminance by the flux in lumen of the LED used. See “Illumination Calculations” below.

Please see the next page for illumination calculations.

Illumination Calculations

To calculate peak candela: Find the central spot "on-axis intensity" value in the table above, then multiply this value by the lumens output from your LED (refer to the Cree LED datasheet http://www.cree.com/products/pdf/XLamp7090XR-E.pdf or http://www.cree.com/products/pdf/XLamp7090XR.pdf for nominal lumens values). Or for a more accurate calculation, refer to the intensity binning tables http://www.cree.com/products/xlamp_docs.asp .

Example calculations:
If the Fraen narrow beam tri-lens FC3-N2-XR79-H is used on 3 cool white Cree XR-E LEDs at 350 mA, the typical luminous flux of the LED is 80 lumens:
The calculation is: (48 candela/lumen) x (80 lumens) = 3840 candela peak on-axis. For three 80 lumen LEDs and a tri-lens: 3840 x 3 = 11520 candela peak on-axis.
1 candela at 1-meter distance produces 1 Lux. This means the peak intensity from this tri-lens at 1 meter will be 11520 lux. The intensity decreases as a function of the distance squared, so at 2 meters the peak intensity will be 11520 / (2^2) = 2880 lux. At 3 meters distance, the peak intensity will be 11520 / (3^2) = 1280 lux.

The beam angle specified in the table above is 5.5 degrees full beam-width measured at half-peak. This means at 2.7 degrees off-axis (half of 5.5 degrees), the intensity should be half of 11520 candela, or 5760 candelas.

Mechanical Characteristics

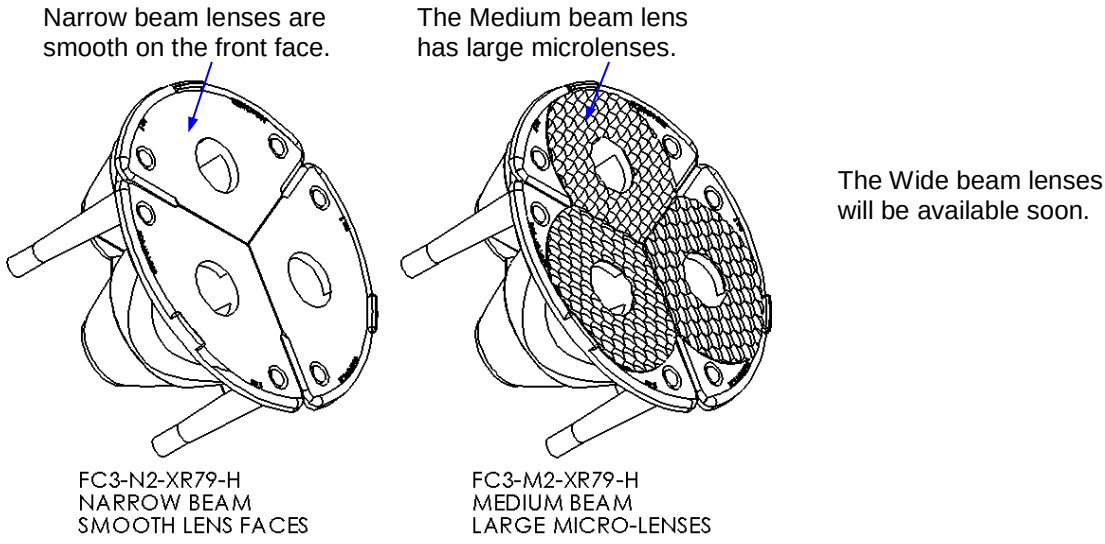
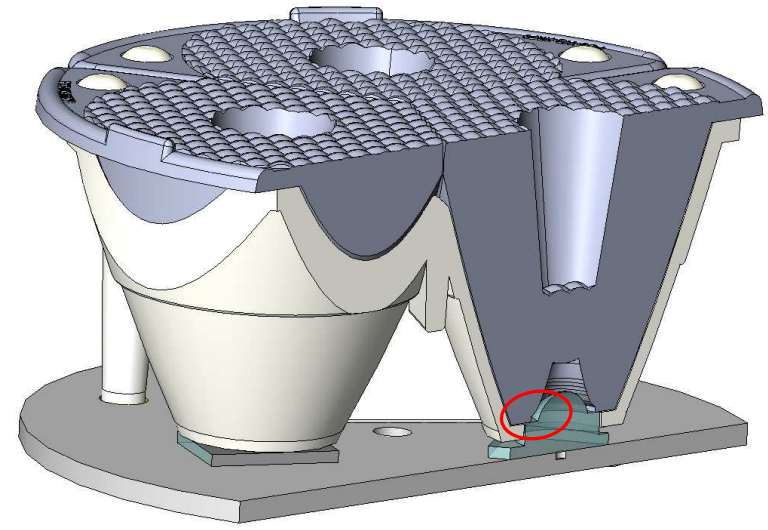


Figure 1: The tri-lens assemblies can be identified by the front face surfaces of the lenses. The FC3 series tri-lenses are available only assembled to a holder. The holder provides the correct alignment of the lenses to the LEDs.



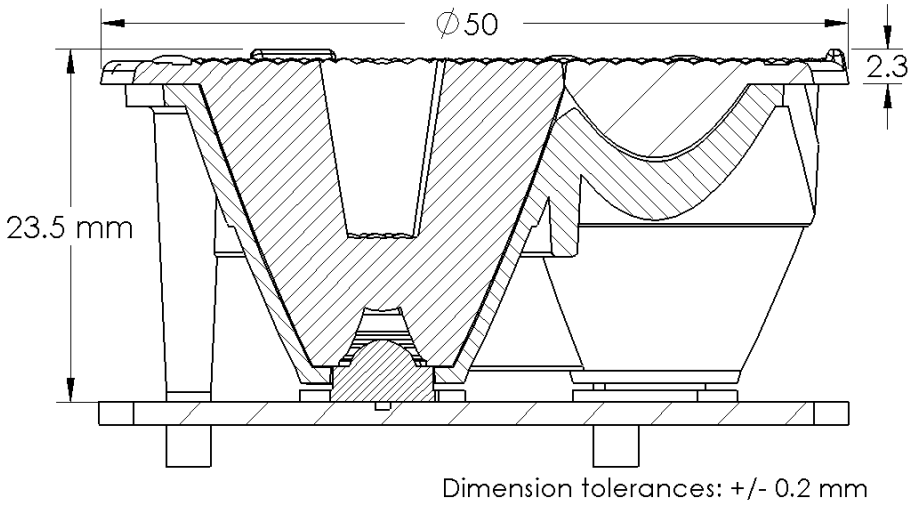


Figure 2: X-section view shows the lens touches the Cree XR/XR-E LED, and the holder aligns the lens to the LED. The dimension “23.5 mm” represents the distance from the top of the lens holder to the bottom of the Cree LEDs.

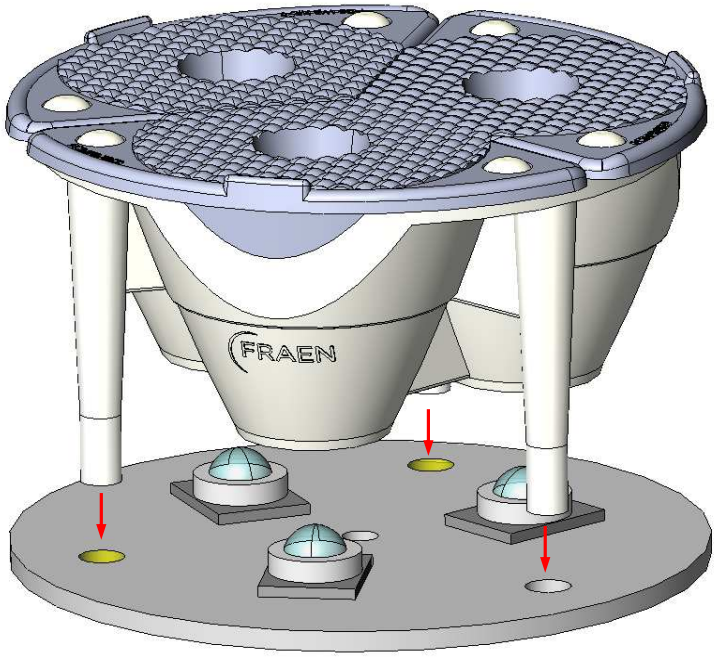


Figure 3: The 3 legs on the tri-lens require clearance holes in the circuit board. The holder has a ring feature around each lens, to align the holder to the LEDs.

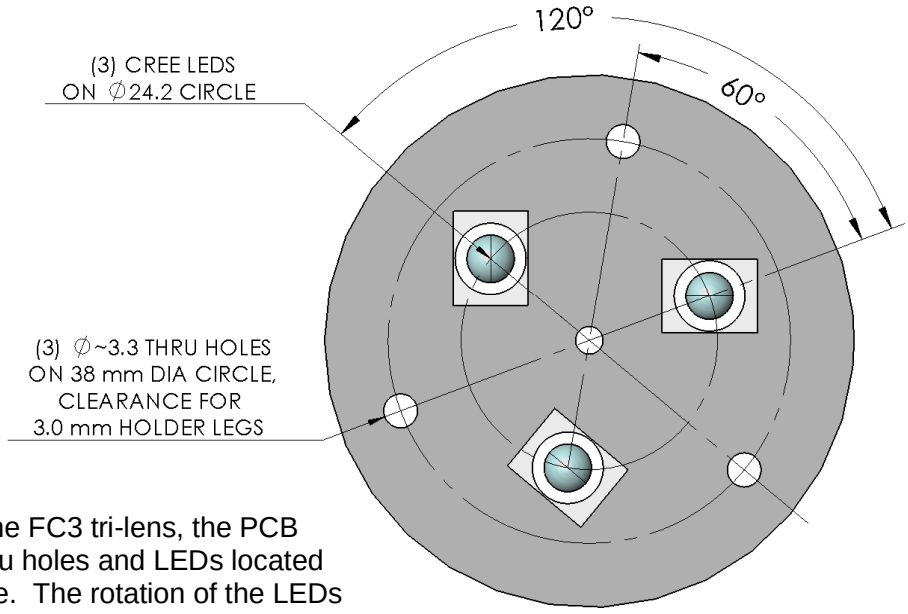
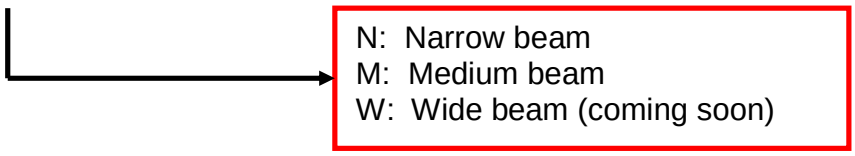


Figure 4: For best fit to the FC3 tri-lens, the PCB should have thru holes and LEDs located as shown above. The rotation of the LEDs is not controlled or affected by the tri-lens holder, and can be decided by the user.

Ordering part numbers

FC3-_ 2-XR79-H



Rev	Date	Author	Description
00	18-November-2008	C. Jones	Initial Release

FCG Lens Series
for Cree XLamp® 7090 XR and XR-E LEDs

- **Narrow peak**
- **High efficiency**
- **4 beams available**

The FCG lens offers lenses specifically designed for the XLamp® 7090XR and XR-E LEDs [(1)] from Cree.

A software-optimized aspheric profile enables the generation of different beam output patterns: narrow, medium, and elliptical patterns.

The high collection efficiency reaches 85% of the total flux emitted by the LEDs.

Typical applications are:

- Portable Lighting
- Reading Lamps
- Signs
- Architectural Lighting
- Street Lights

Cree® XLamp is a trademark of Cree, Inc. For technical information about these LEDs please refer to the Cree® XLamp datasheet or visit http://www.cree.com/products/xlamp.asp or http://www.cree.com/products/xlamp7090_xre.asp

FRAEN CORPORATION
80 Newcrossing Road
Reading, MA 01867
Phone: 781.205.5300
Fax: 781.942.2426
optics@fraen.com

FRAEN S.r.l.
Via Stelvio, 12
20019 Settimo M. (MI) – Italy
Phone: +39-02-35.456.1
Fax: +39-02-335.456.239
info@fraen.com

Website: www.fraensrl.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

General Characteristics

Lens Material	Optical Grade PMMA
Holder Material	PC, black color
Operating Temperature range	-40deg C / + 80 deg C
Storage Temperature range	-40deg C / + 80 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 solvents such as alcohol, as it will damage the plastic.*

Scope

This datasheet provides information about the new FCG lens series.

Lens alone:

- FCG-N1-XR79-0R
- FCG-M1-XR79-0R
- FCG-E1-XR79-0R

Lens and holder:

- FCG-N1-XR79-H
- FCG-M1-XR79-H
- FCG-E1-XR79-H

Optical Characteristics – Beam Angle (degrees, Full Angle)

Lens Part Number	Type of lens	Cool White	Warm White	Blue	Green	Red
FCG-N1-XR79-H	Narrow beam	6	*	8	8	6
FCG-M1-XR79-H	Medium beam	21	*	21	21	21
FCG-E1-XR79-H	Elliptical beam	7 x 43	*	9 x 46	9 x 45	8 x 41

(1) 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.

Optical Characteristics – On-Axis Intensity (candela/lumen)

Lens Part Number	Type of lens	Cool White	Warm White	Blue	Green	Red
FCG-N1-XR79-H	Narrow beam	48	*	23	36	39
FCG-M1-XR79-H	Medium beam	4.5	*	2.8	3.6	3.7
FCG-E1-XR79-H	Elliptical beam	5.8	*	4.0	6.0	7.0

(2) To calculate the on-axis intensity, multiply the on-axis efficiency of the lens (cd/lm) by the total flux of the Cree XLamp 7090® XR and XR-E LED used. See “Illumination Calculations” below. For more detail on flux binning please check the Cree LED datasheet at http://www.cree.com/products/xlamp.asp

(3) Luminous intensity depends on the flux binning and tolerances of the LEDs. Please refer to the Cree XLamp datasheet for more details on flux binning and mechanical tolerances.

(4) Typical illuminance measured in lux per lumen (E) with typical Cree 7090 XR-E LED. To estimate the illuminance in lux, multiply the typical illuminance E by the flux in lumen of the LED used. See “Illumination Calculations” below.

* Configuration not yet measured.

Illumination Calculations

To calculate peak candela: Find the central spot "on-axis intensity" value in the table above, then multiply this value by the lumens output from your LED (refer to the XLamp LED datasheet http://www.cree.com/products/pdf/XLamp7090XR-E.pdf or http://www.cree.com/products/pdf/XLamp7090XR.pdf for nominal lumens values). Or for a more accurate calculation, refer to the intensity binning tables http://www.cree.com/products/xlamp_docs.asp .

Example calculation:
If the Fraen narrow beam lens FCG-N1-XR79-0R is used on a cool white Cree XR-E LED at 350 mA, the typical luminous flux of the LED is 80 lumens:
The calculation is: (48 candela/lumen) x (80 lumens) = 3840 candela peak on-axis.
The beam angle specified in the table above is 6 degrees full beam-width measured at half-peak. This means at 3 degrees off-axis (half of 6 degrees), the intensity should be half of 3840 candela, or 1920 candelas.
1 candela at 1-meter distance produces 1 Lux. This means the peak intensity at 1 meter will be 3840 lux. The intensity decreases as a function of the distance squared, so at 2 meters the peak intensity will be 3840 / (2^2) = 960 lux. At 3 meters distance, the peak intensity will be 3840 / (3^2) = 427 lux.

Mechanical Characteristics

Figure 1. Identifying the lenses by their front views

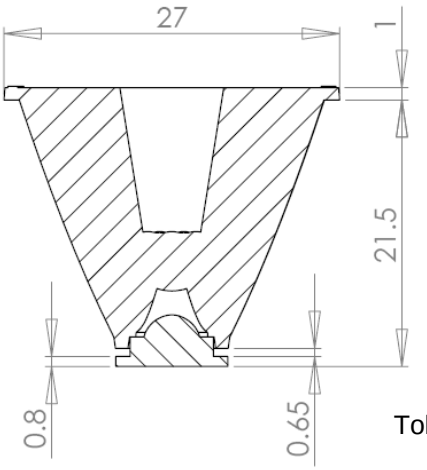
FCG-N1-XR79-H FCG-M1-XR79- H FCG-E1-XR79- H

Continued on next page…

Figure 2. Correct vertical distance between FCG lens and 7090 XR-E LED

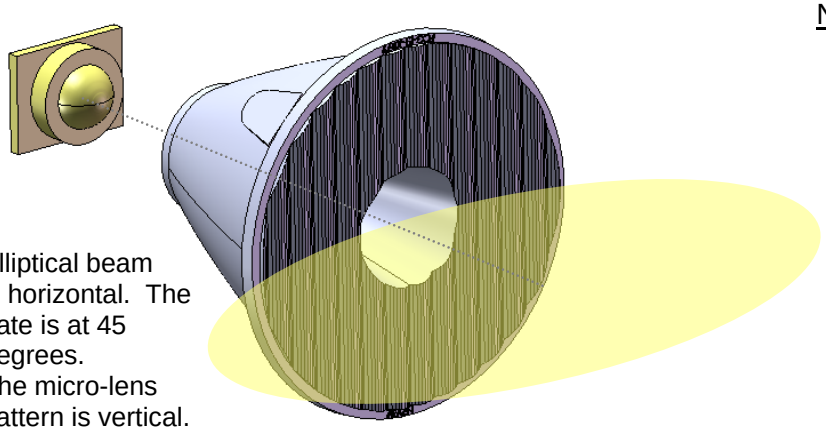
NOTE: The lens is correctly positioned vertically as shown in the figure below. The lens provides mechanical reference to the LED.

FCG-N1-XR79-0R



Tolerances: +/- 0.2 mm

Figure 3. Elliptical beam orientation

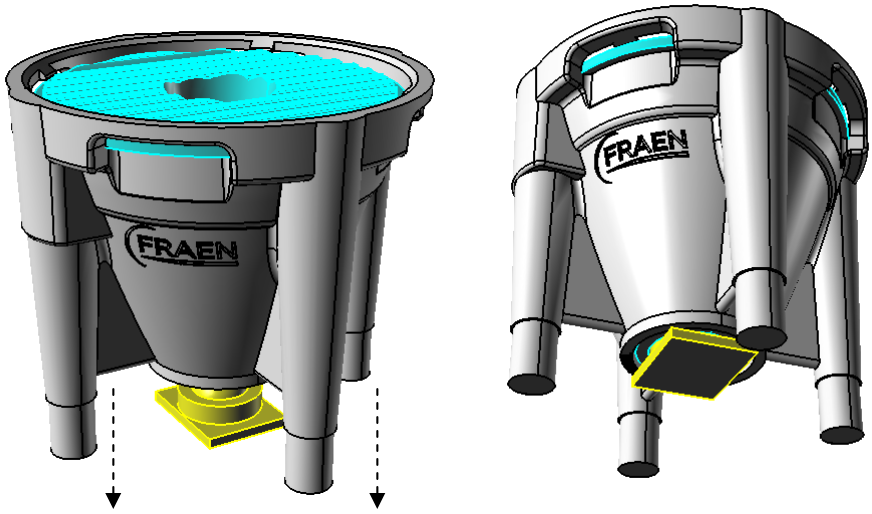


Elliptical beam is horizontal. The gate is at 45 degrees. The micro-lens pattern is vertical.

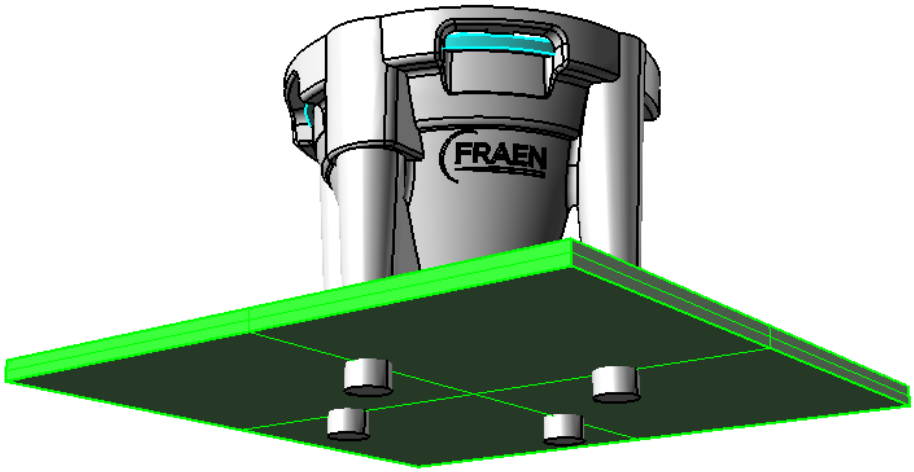
NOTE: The elliptical beam lens produces a beam shape that is perpendicular to the microlens pattern on the output face of the lens. It is important to consider the orientation of the LEDs and the desired elliptical beam orientation when designing the printed circuit board layout.

To produce a horizontal elliptical beam, the lens needs to be orientated such that the micro-lenses are positioned vertically. The LED orientation on the PC board should be coordinated with the beam orientation.

Figure 4. Installation of lens assembly onto Cree LED



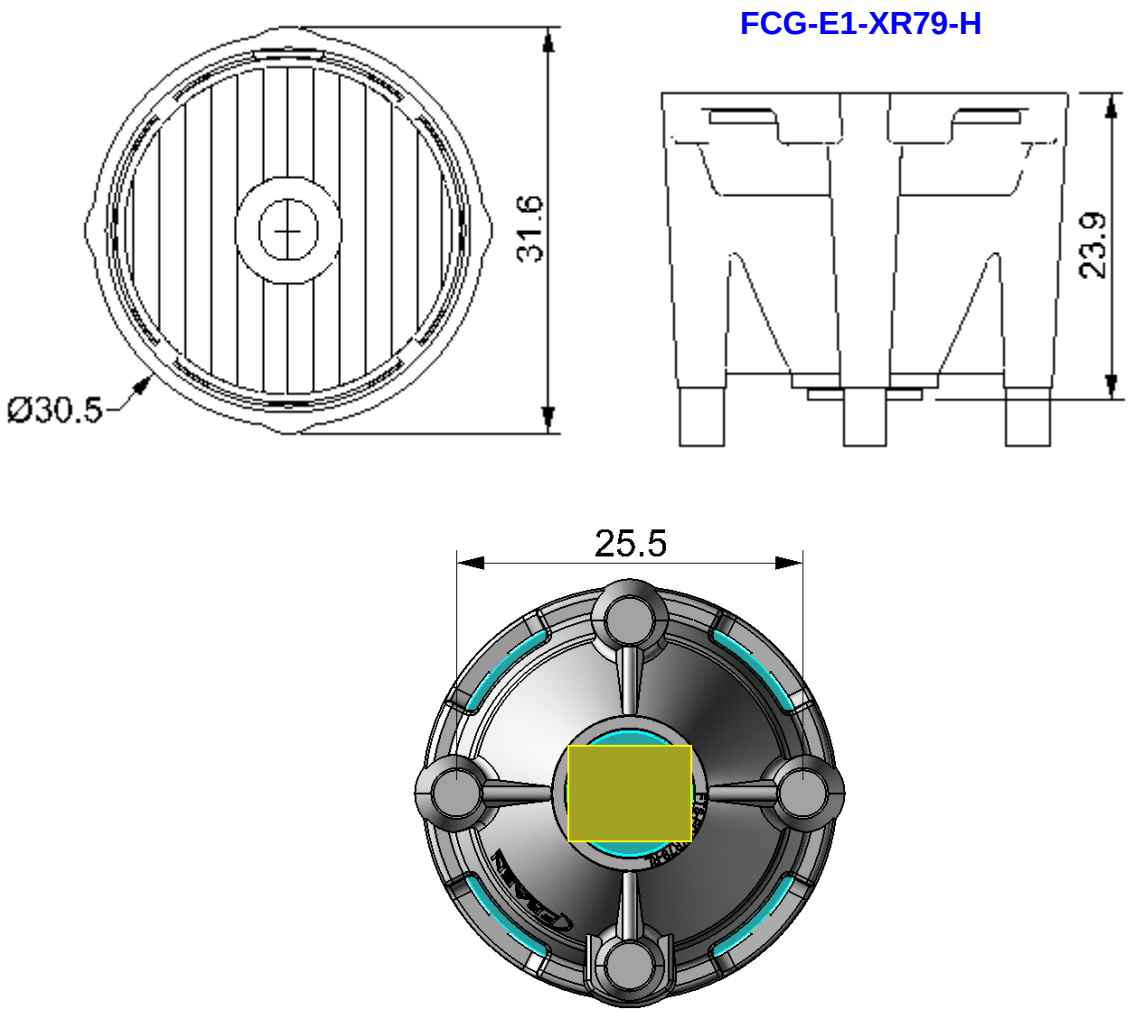
The new FCG-E1-XR79-HRL (and N1, M1 and W1) lens assemblies will fit onto the Cree LED as shown above. After installation, the legs on the holder will protrude through the PCB as shown below. The legs can be heat-staked or glued in place.



The lens assembly can be secured to the PC board by using glue or silicone RTV. To avoid glue on the lens and LED, apply it only on the legs of the lens holder.

CAUTION: Do not use instant glue (containing cyanoacrylates). Always test the glue on a sample assembly and check the results and performance 24 hours later. Some adhesives produce fumes that will damage the surfaces of the plastic lens, lens holder, or LED.

Figure 5. Overall dimensions of FCG- 1-XR79-H series lens assemblies



Ordering part numbers

FCG-_1-XR79-__

0R: Lens alone (no holder)
H: Lens with white PC holder

Caution: If using lens alone (with no holder), lens alignment and spacing must be set by the user. See Figure 2.

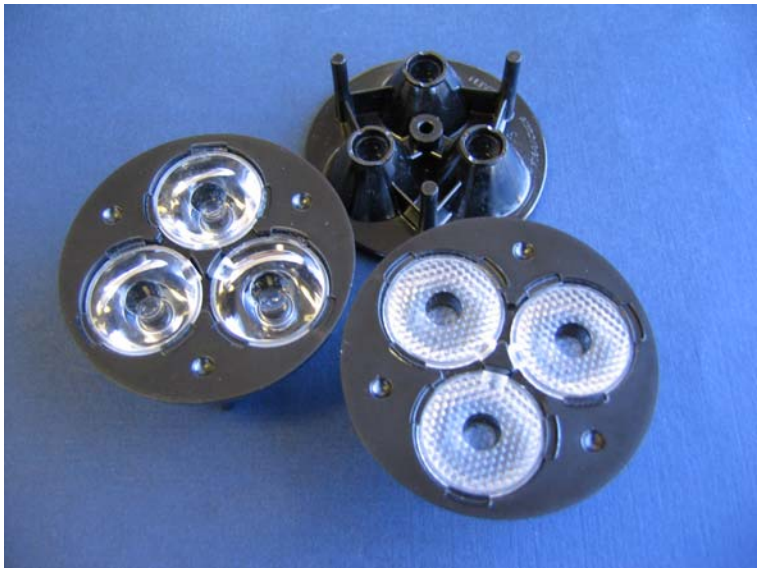
N: Narrow beam
M: Medium beam
E: Elliptical beam

Caution: The orientation of the elliptical beam lens is controlled by the lens holder and the LED orientation (see Figure 3).

Rev	Date	Author	Description
02	23 September 2008	C. Jones	Improved optical design, W1 option removed, -H option added.
01	20 February 2008	C. Jones	Initial Release

FCT3 Series Tri-Lens
for Cree XLamp® 7090 XR and XR-E LEDs

- **High efficiency**
- **3 beams available**
- **MR-16 size tri-lens**



The FCT3 tri-lens offers low-profile lenses specifically designed for the XLamp® 7090XR and XR-E LEDs [(1)] from Cree.

A software-optimized aspheric profile enables the generation of three different beam output patterns: narrow, medium, and wide beams.

The high collection efficiency reaches 85% of the total flux emitted by the LEDs.

Lens holders are black polycarbonate, and provide the proper alignment between the LEDs and the lenses, and set the correct distance between the lens and LED.

The lens holder can either be heat-staked or mounted with screw to the PCB, to provide a secure assembly.

Typical applications are:

- MR-16 LED lamps
- Architectural lighting
- General illumination
- Street lights

Cree® XLamp is a trademark of Cree, Inc. For technical information about these LEDs please refer to the Cree® XLamp datasheet or visit http://www.cree.com/products/xlamp.asp or http://www.cree.com/products/xlamp7090_xre.asp

FRAEN CORPORATION
80 Newcrossing Road
Reading, MA 01867
Phone: 781.205.5300
Fax: 781.942.2426
optics@fraen.com

FRAEN S.r.l.
Via Stelvio, 12
20019 Settimo M. (MI) – Italy
Phone: +39-02-35.456.1
Fax: +39-02-335.456.239
info@fraen.com

Website: www.fraensrl.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

General Characteristics

Lens Material	Optical Grade PMMA
Holder Material	PC, black color
Operating Temperature range	-40deg C / + 80 deg C
Storage Temperature range	-40deg C / + 80 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 solvents such as alcohol, as it will damage the plastic.*

Scope

This datasheet provides information about the three FCT3 series tri-lenses with a screw tower (column) on the holder:

- FCT3-N2-XR79-HRLC
- FCT3-M2-XR79-HRLC
- FCT3-W2-XR79-HRLC

and the three FCT3 series tri-lenses without a screw tower on the holder:

- FCT3-N2-XR79-HRLN
- FCT3-M2-XR79-HRLN
- FCT3-W2-XR79-HRLN

Optical Characteristics – Beam Angle (degrees, full angle)

Lens Part Number	Output Beam	Cool White ○	Warm White ○	Blue ●	Green ●	Red ●
FCT3-N2-XR79-HRLC	Narrow	8	8	12	12	12
FCT3-M2-XR79-HRLC	Medium	21	20	22	22	22
FCT3-W2-XR79-HRLC	Wide	29	28	28	28	28

(1) 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.

Optical Characteristics – On-Axis Intensity (candela/lumen)

Lens Part Number	Output Beam	Cool White ○	Warm White ○	Blue ●	Green ●	Red ●
FCT3-N2-XR79-HRLC	Narrow	27	27	18	18	19
FCT3-M2-XR79-HRLC	Medium	4.1	4.1	2.9	2.9	3.3
FCT3-W2-XR79-HRLC	Wide	2.4	2.4	1.9	1.9	2.4

(2) To calculate the on-axis intensity, multiply the on-axis efficiency of the lens (cd/lm) by the total flux of the Cree XLamp 7090® XR and XR-E LED used. See “Illumination Calculations” below. For more detail on flux binning please check the Cree LED datasheet at http://www.cree.com/products/xlamp.asp

(3) Luminous intensity depends on the flux binning and tolerances of the LEDs. Please refer to the Cree XLamp datasheet for more details on flux binning and mechanical tolerances.

(4) Typical illuminance measured in lux per lumen (E) with typical Cree 7090 XR-E LED. To estimate the illuminance in lux, multiply the typical illuminance E by the flux in lumen of the LED used. See “Illumination Calculations” below.

Please see the next page for illumination calculations.

Illumination Calculations

To calculate peak candela: Find the central spot "on-axis intensity" value in the table above, then multiply this value by the lumens output from your LED (refer to the Cree LED datasheet http://www.cree.com/products/pdf/XLamp7090XR-E.pdf or http://www.cree.com/products/pdf/XLamp7090XR.pdf for nominal lumens values). Or for a more accurate calculation, refer to the intensity binning tables http://www.cree.com/products/xlamp_docs.asp .

Example calculations:
If the Fraen narrow beam tri-lens FCT3-N2-XR79-HRLC is used on 3 cool white Cree XR-E LEDs at 350 mA, the typical luminous flux of the LED is 80 lumens:
The calculation is: (27 candela/lumen) x (80 lumens) = 2160 candela peak on-axis. For three 80 lumen LEDs and a tri-lens: 2160 x 3 = 6480 candela peak on-axis.
1 candela at 1-meter distance produces 1 Lux. This means the peak intensity from this tri-lens at 1 meter will be 6480 lux. The intensity decreases as a function of the distance squared, so at 2 meters the peak intensity will be 6480 / (2^2) = 1620 lux. At 3 meters distance, the peak intensity will be 6480 / (3^2) = 720 lux.

The beam angle specified in the table above is 8 degrees full beam-width measured at half-peak. This means at 4 degrees off-axis (half of 8 degrees), the intensity should be half of 6480 candela, or 3240 candelas.

Mechanical Characteristics

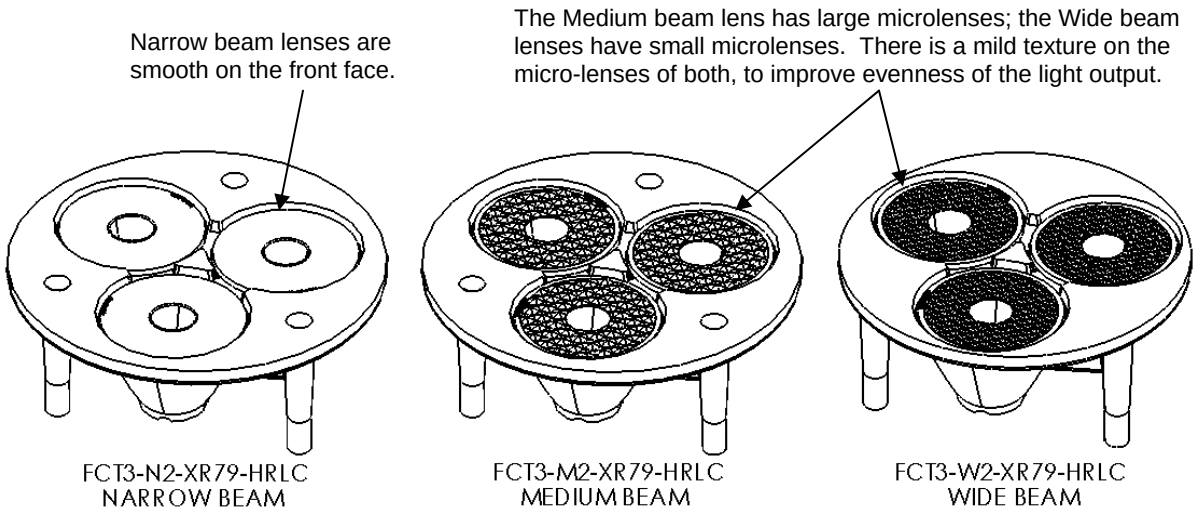
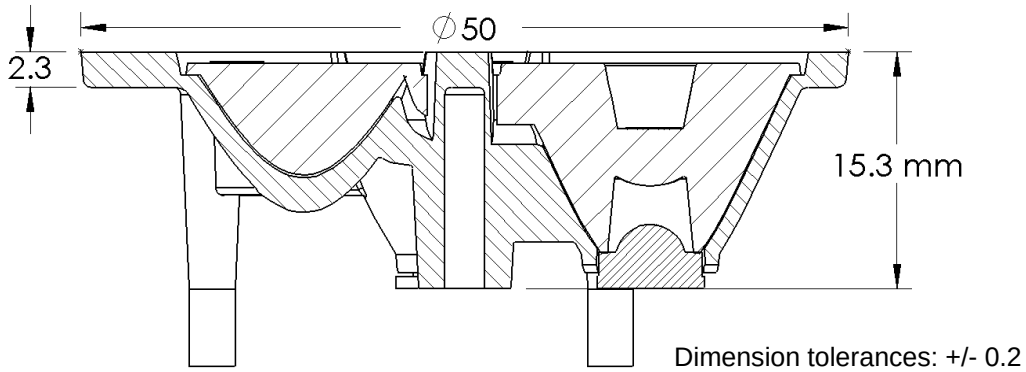


Figure 1: The tri-lens assemblies can be identified by the front face surfaces of the lenses.

The FCT3 series tri-lenses are available only assembled to a holder. The holder provides the correct alignment (concentricity, height, and alignment) of the lens to the LED.



NOTE: The dimension “15.3mm” represents the distance from the top of the lens holder (excluding heat stake marks) to the bottom of the Cree LEDs. For the tri-lens assemblies with part number suffix –HRLC, the screw column is designed to touch the circuit board, and there is a hole 2.6 mm diameter x ~12 mm deep to accept a self-threading screw. The tri-lens assemblies with part number suffix –HRLN have a shortened screw column height (only 11mm) to provide clearance for circuit components or hardware, if a screw mounting is not employed.

Figure 2: X-section view shows the lens touches the Cree XR/XR-E LED, and the holder aligns the lens to the LED.

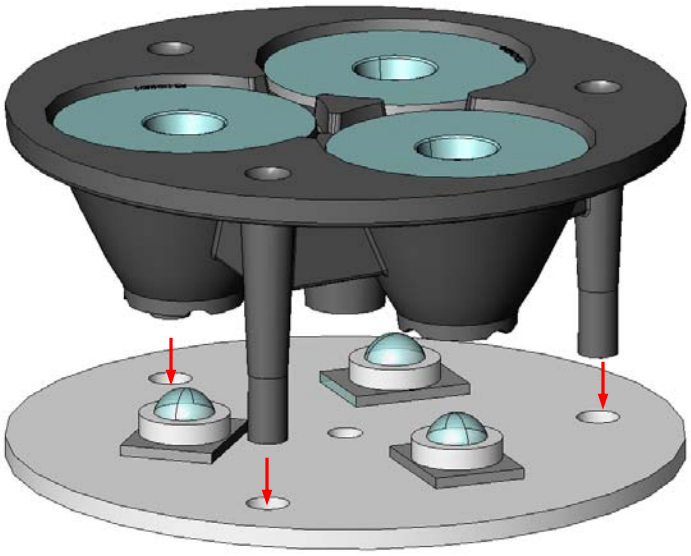


Figure 3: The 3 legs on the tri-lens require clearance holes in the circuit board. The holder has a ring feature around each lens, to align the holder to the LEDs.

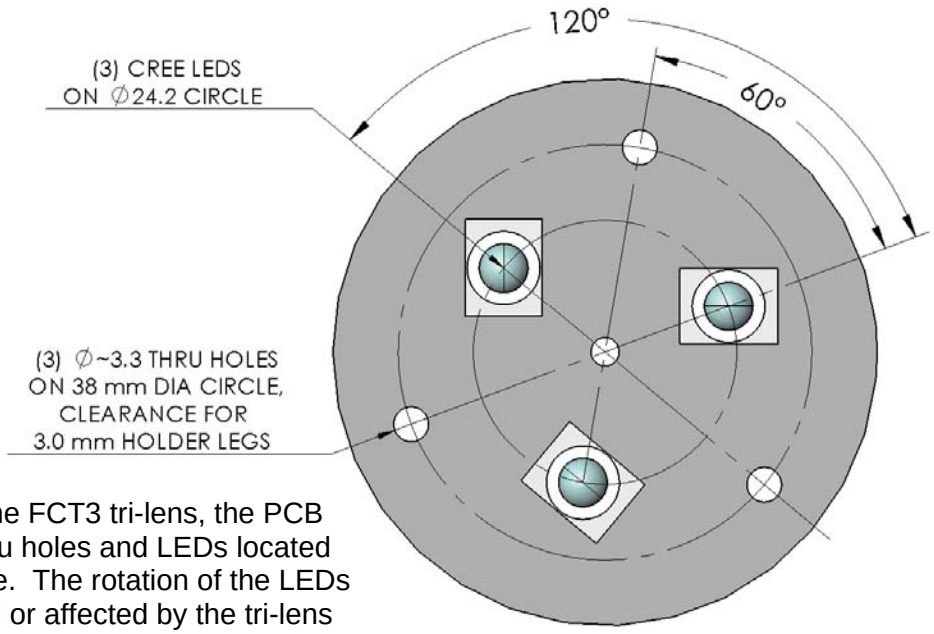


Figure 4: For best fit to the FCT3 tri-lens, the PCB should have thru holes and LEDs located as shown above. The rotation of the LEDs is not controlled or affected by the tri-lens holder, and can be decided by the user.

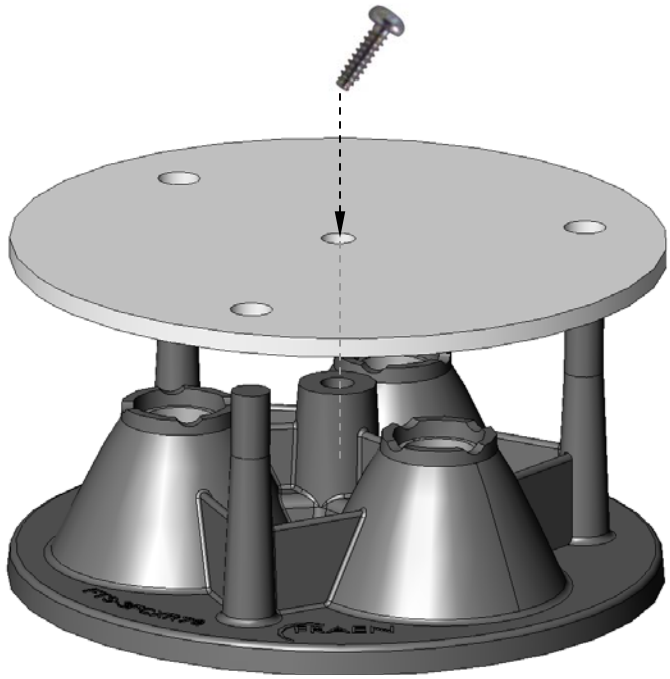
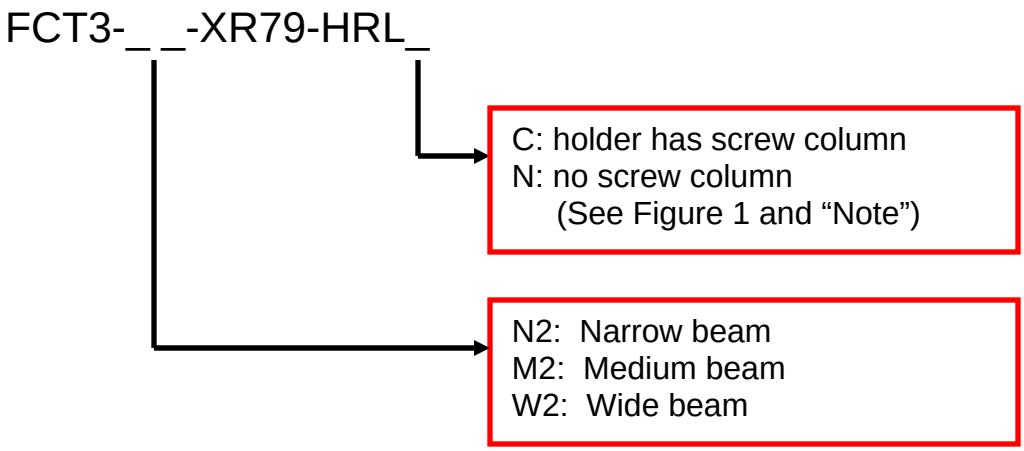


Figure 5: A thread-forming or thread-rolling screw (size: #4-24) can be used to secure the circuit board to the Fraen tri-lens assembly (use tri-lens assemblies with p/n suffix -HRLC). Alternatively, the 3 legs on the holder can be heat staked or glued on the back of the circuit board. For general information about heat staking, see Fraen Application Note: http://www.fraensrl.com/images/FRN_FHSLenses_HeatStake.pdf

Ordering part numbers



Rev	Date	Author	Description
01	18-April-2008	C. Jones	Added Figure 4
00	25-March-2008	C. Jones	Initial Release

FRC-N1-XR79-0R Reflector for Cree XLamp™ XR-E LEDs

- **High efficiency**
- **Compact size**
- **Provides a focused spot *and* spilled/direct light**

The FRC-N1-XR79-0R reflector has been specifically designed for the Cree XLamp XR-E LEDs.

A software-optimized aspheric profile combined with precision facets provides a narrow focused beam with a homogeneous central spot as well as useful peripheral spilled light.

The high collection efficiency reaches 88% of the total flux emitted from the LED.

The reflector fits to the body of the XLamp with a snug press-fit.

Typical applications are:

- Flashlights
- General illumination
- Architectural Lighting
- Most application where a compact light source is required.

Cree® XLamp is a trademark of Cree, Inc. For technical information about these LEDs please refer to the CREE® XLAMP datasheet or visit Cree XLamp LED or Cree XR-E LED

FRAEN CORPORATION
80 Newcrossing Road
Reading, MA 01867
Phone: 781.205.5300
Fax: 781.942.2426
optics@fraen.com

FRAEN S.r.l.
Via Stelvio, 12
20019 Settimo M. (MI) – Italy
Phone: +39-02-35.456.1
Fax: +39-02-335.456.239
info@fraen.com

Website: www.fraensrl.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

General Characteristics

Materials:	Black Polycarbonate with vacuum aluminum coating, protected by clear coat lacquer.
Operating Temperature range:	-40deg C / + 100 deg C
Storage Temperature range:	-40deg C / + 100 deg C

Please note that small defects in the reflective coating, and flow lines and weld lines on the surfaces of the reflectors are acceptable if the optical performance of the reflector is within the specification described in the section "OPTICAL CHARACTERISTS"

IMPORTANT NOTE – Reflector handling and cleaning*:*

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

Optical Characteristics:

Optical Performance **On-axis efficiency (candela/lumen) and beam angle (degrees)**			**Central Spot**		**Spilled Light**	
			On-axis intensity	**Beam angle**	**~ spill intensity**	**Beam angle**
Fraen Reflector Part Number	Reflector Name		Cd/lm	Degrees FWHM	Cd/lm	Degrees FWHM
FRC-N1-XR79-0R	Narrow beam		17	7	0.2	36

(1) 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.

(2) To calculate the on-axis intensity, multiply the on-axis efficiency of the reflector (cd/lm) by the total flux of the Cree LED used. See "Illumination Calculations" below. For more detail on flux binning please check the Cree LED datasheet at Cree XLamp LED
(3) Luminous intensity depends on the flux binning and tolerances of the LEDs. Please refer to the Cree XLamp datasheet for more details on flux binning and mechanical tolerances.
(4) Typical illuminance measured in lux per lumen (E) with typical Cree 7090 XR-E LED. To estimate the illuminance in lux, multiply the typical illuminance E by the flux in lumen of the LED used. See "Illumination Calculations" below.

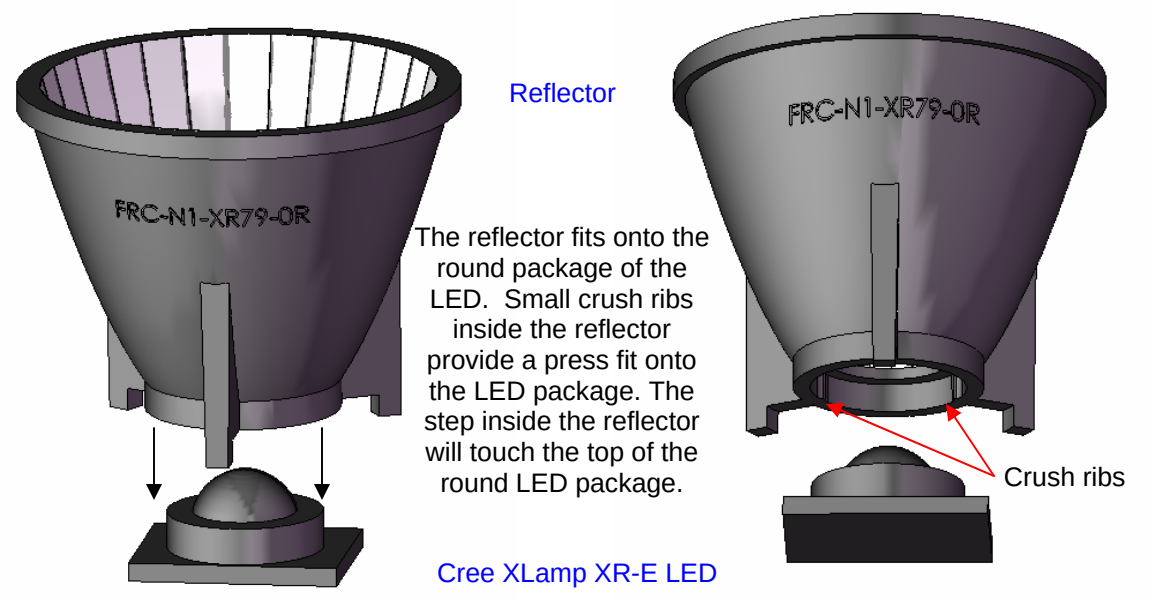
Illumination Calculations

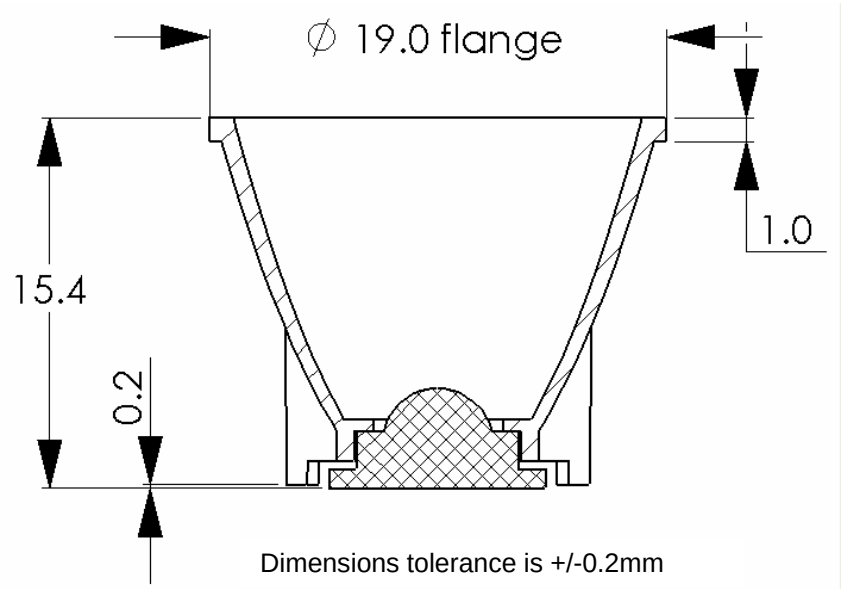
To calculate peak candela: Find the central spot "on-axis intensity" value in the table above. It is 17 candela/lumen". Multiply this value by the lumens output from your LED (refer to the XLamp LED datasheet (Cree XR-E LED datasheet or Cree XR LED datasheet) for nominal lumens values. OR for a more accurate calculation, refer to the intensity binning tables Cree XLamp binning .
Example – If the Fraen narrow beam reflector # FRC-N1-XR79-0R is use on a cool white Cree XR-E LED at 350 mA, the typical luminous flux of the LED is 80 lumens:
The calculation is: (17 candela/lumen) x (80 lumens) = 1360 candela peak on-axis.
The central spot beam angle specified in the table above is 7 degrees full beam-width measured at half-peak. This means at 3.5 degrees off-axis (half of 7 degrees), the intensity should be half of 1360 candela, or 680 candelas.
1 candela at 1-meter distance produces 1 Lux. This means the peak intensity at 1 meter will be 1360 lux. The intensity decreases as a function of the distance squared, so at 2 meters the peak intensity will be 1360 / (2^2) = 340 lux. At 3 meters distance, the peak intensity will be 1360 / (3^2) = 151 lux.

Continued on next page…

Mechanical Characteristics

View and dimensions of reflector on XLAMP LED:





Ordering part numbers

(Only 1 part number is currently available)

FRC-_1-XR79-0R

Beam angle (main spot):

N = Narrow beam

Document Revision Record

Rev	Date	Author	Description
00	30 July 2007	C. Jones	Initial Release.

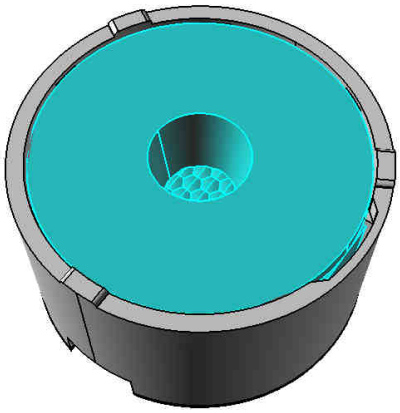
FRAEN CORPORATION
80 Newcrossing Road
Reading MA 01867
Phone: 781.205.5300
Fax: 781.942.2426
optics@fraen.com

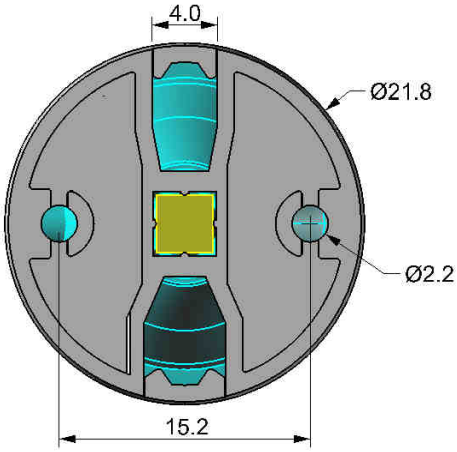
FRAEN Srl
Via Stelvio, 12
20019 Settimo M. (MI) – Italy
Phone: +39-02-335.456.1
Fax: +39-02-335.456.239
info@fraen.com

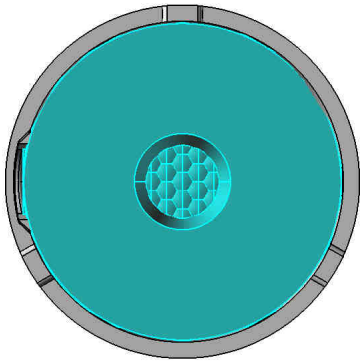
Fraen – Preliminary Datasheet (not for official release)

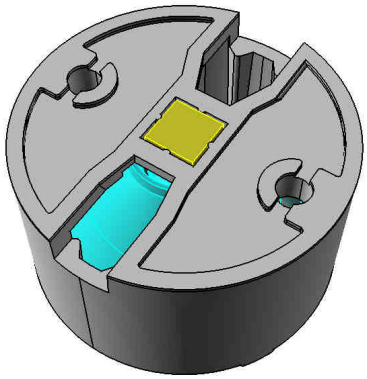
P/N: FCP-_1-XPE1-0R

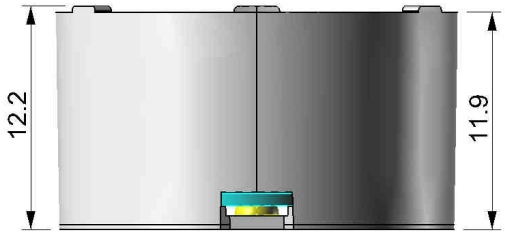
Low Profile Lens Series for Cree XP-E











Units: mm Tolerance: +/- 0.2mm

Part Number Assembly (Lens + Holder)	Part Number Lens alone (no holder)	Solution	On-axis efficiency (cd/lm)	Divergence (degrees)
FCP-N1-XPE1-HRF	FCP-N1-XPE1-0R	Narrow beam	24	10
FCP-M1-XPE1-HRF	FCP-M1-XPE1-0R	Medium beam	4.0	21
FCP-W1-XPE1-HRF	FCP-W1-XPE1-0R	Wide beam	1.9	27
FCP-E1-XPE1-HRF	FCP-E1-XPE1-0R	Elliptical beam	5.0	10x50

** The divergence is measured at the Full Width at Half Maximum (FWHM)*

FRAEN CORPORATION
80 Newcrossing Road
Reading MA 01867
Phone: 781-205-5300
Fax: 781-942-2426
optics@fraen.com

FRAEN Srl
Via Stelvio, 12
20019 Settimo M. (MI) – Italy
Phone: +39-02-335.456.1
Fax: +39-02-335.456.239
info@fraen.com

www.fraensrl.com

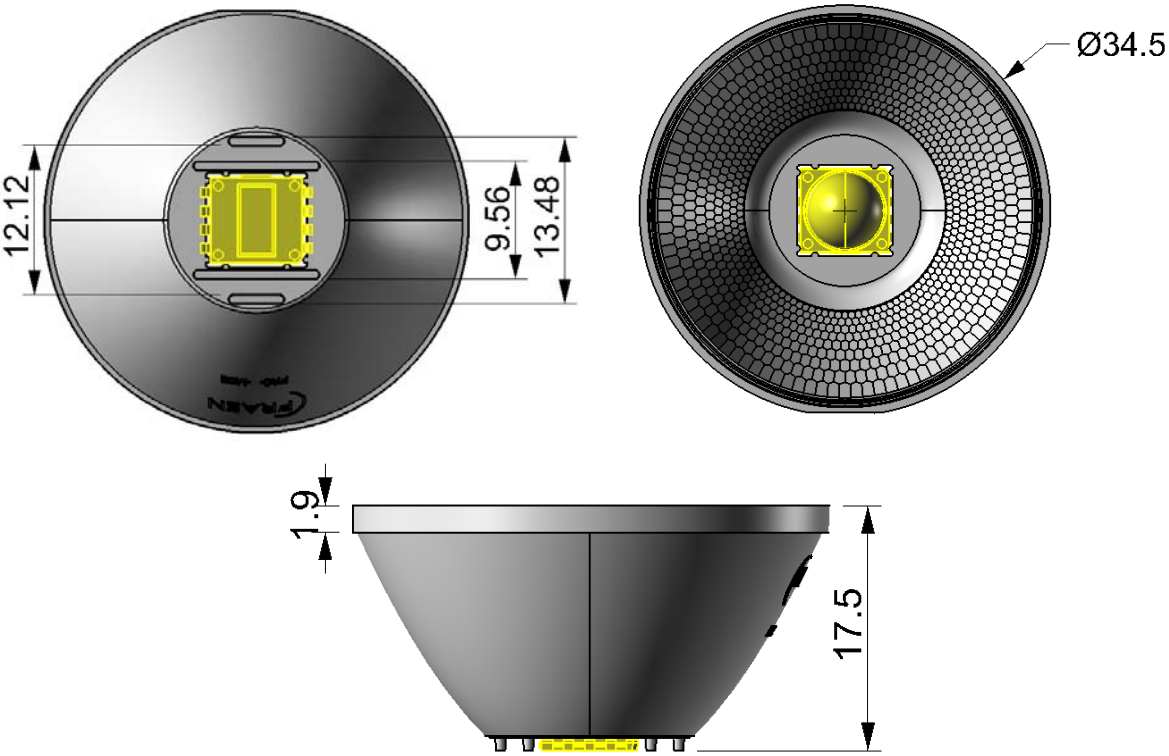
Fraen – Preliminary Datasheet

P/N: FRC-_1-MCE-0R

MR-11 Reflector
for
Cree MC-E

To find a local distributor, check the Fraen website.

Website: www.fraensrl.com



Units: mm
Tolerance: +/- 0.2mm

Optical Solution	On-axis efficiency (cd/lm)	Divergence (degrees)
Narrow (P/N: FRC-N1-MCE-0R)	11.2	13.5
Medium (P/N: FRC-M1-MCE-0R)	2.5	32.0

** The divergence is measured at the Full Width at Half Maximum (FWHM)*