



## Multi-TIR Nested Lens for COB LEDs FNL-N1-75-R

- Patent Pending multi-TIR innovation
- Low-profile lens for COB LEDs
- Tight beam with minimal spilled light
- Ideal size for PAR20 applications

Fraen Corporation's low-profile, multi-TIR nested lens delivers narrow beam lighting when used with a variety of Chip-On-Board (COB) LEDs. The Patent Pending technology allows the optic height to be reduced significantly (when compared to reflectors with similar optical performance) while delivering a tightly focused beam with reduced spill.

Fraen's low profile nested lens design enables the luminaire designer to have more room for thermal and electrical components, thereby increasing design options.

Typical applications include:

- COB LED lighting application requiring a narrow-beam and/or high center-beam candela
- Architectural Lighting
- Retail Lighting Fixture
- Spot Lights
- Hospitality Lighting Fixtures
- Commercial Lighting Fixtures
- Entertainment Lighting



**FRAEN Corporation OMG**  
80 Newcrossing Road  
Reading MA 01867  
USA

Phone: +1 781.205.5300  
Fax: +1 781.942.2426

**FRAEN Corporation Srl**  
Via delle Querce, 26  
27020 Trivulzio (PV)  
Italy

Phone: +39 0382 1933.1  
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
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 NOTES – 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.*

### CAUTION:













- *Due to the inherently high power of COB LEDs, use proper thermal management of the LED to protect the LED as well as the Fraen plastic parts. Fraen has no liability for direct, indirect or consequential damages resulting from parts being subjected to temperatures outside of the recommended operating range.*

## Scope

---



This datasheet provides information about the FNL-N1-75-R low profile nested lens and the lens holder system and components, and the optical performance when used with a variety of large-source LEDs.

## Optical Characteristics – On-axis Intensity, Beam Angle, Field Angle

LED		Light Emitting Surface (LES) diameter	On-axis Intensity (peak)	Beam Angle (FWHM)	Field Angle (FW10%)
	Vero 13	Ø 13 mm	6.4 cd/lm	16°	34°
	V15	Ø 15 mm	4.6 cd/lm	17°	40°
	Vero 18	Ø 18 mm	3.2 cd/lm	23°	48°
	H6	Ø 6.4 mm	24 cd/lm	8°	16°
	H9	Ø 9.3 mm	13 cd/lm	10°	22°
	H12	Ø 12.4 mm	7.4 cd/lm	14°	29°
	H15	Ø 14.9 mm	5.7 cd/lm	16°	34°
	CLU024	Ø 9.8 mm	11 cd/lm	11°	26°
	CLU026	Ø 9.8 mm	11 cd/lm	10°	26°
	CLU034	Ø 14.5 mm	6.0 cd/lm	16°	36°
	CLU036	Ø 14.5 mm	5.5 cd/lm	16°	38°
	CLU044	Ø 22 mm	2.0 cd/lm	27°	53°
	CLU710	Ø 8.5 mm	13 cd/lm	11°	24°
	CXA1304	Ø 6 mm	26 cd/lm	7°	16°
	CXA1512	Ø 9 mm	14 cd/lm	10°	25°
	CXA1520	Ø 9 mm	13 cd/lm	10°	22°
	CXA1816	Ø 12 mm	7.7 cd/lm	13°	30°
	LUXEON 107	Ø 6.5 mm	20 cd/lm	8°	18°
	LUXEON 109	Ø 6.5 mm	25 cd/lm	8°	16°
	LUXEON 207	Ø 6.5 mm	20 cd/lm	8°	17°
	LUXEON 209	Ø 6.5 mm	20 cd/lm	8°	17°
	LUXEON 1202	Ø 9 mm	11 cd/lm	12°	27°
	LUXEON 1202 Gen3	Ø 9 mm	11 cd/lm	11°	24°

 LUMILEDS	LUXEON 1202s Gen3	Ø 6 mm	20 cd/lm	8°	17°
 LUMILEDS	LUXEON 1203	Ø 9 mm	11 cd/lm	11°	26°
 LUMILEDS	LUXEON 1203 Gen3	Ø 9 mm	11 cd/lm	11°	24°
 LUMILEDS	LUXEON 1205	Ø 13 mm	6.2 cd/lm	15°	33°
 LUMILEDS	LUXEON 1205 Gen2 CrispWhite	Ø 13 mm	6.0 cd/lm	15°	33°
 LUMILEDS	LUXEON 1208 Gen3	Ø 15 mm	4.0 cd/lm	18°	39°
 LUMILEDS	LUXEON 1211	Ø 19 mm	2.9 cd/lm	24°	50°
 LUMILEDS	LUXEON 1211 Gen3	Ø 19 mm	3.0 cd/lm	22°	49°
 LUMILEDS	LUXEON 1211 Gen2 CrispWhite	Ø 19 mm	3.0 cd/lm	21°	51°
 LUMILEDS	LUXEON 1216	Ø 23 mm	2.0 cd/lm	27°	60°
 LUMINUS	CHM-6	Ø 6.3 mm	20 cd/lm	8°	19°
 LUMINUS	CHM-9	Ø 9 mm	12 cd/lm	11°	25°
 LUMINUS	CHM-14	Ø 14 mm	5.7 cd/lm	16°	35°
 NICHIA	NSBLL066A	Ø 9 mm	12 cd/lm	11°	24°
 NICHIA	NSBLL121A	Ø 12 mm	6.9 cd/lm	15°	31°
 NICHIA	NSBLJ216A	Ø 15.3 mm	4.5 cd/lm	19°	38°
 NICHIA	NTCLS024B	Ø 6.7 mm	18 cd/lm	10°	22°
 NICHIA	NFCLL036B	Ø 8.7 mm	14 cd/lm	11°	22°
 NICHIA	NFCLL060B	Ø 11.5mm	7.8 cd/lm	14°	32°
 NICHIA	NFCLJ108B	Ø 14.6 mm	4.9 cd/lm	17°	41°
 OSRAM Opto Semiconductors	Soleriq S 13	Ø 13 mm	6.4 cd/lm	15°	34°
 SAMSUNG	LC013B	Ø 11 mm	7.8 cd/lm	13°	30°
 SAMSUNG	LC026B	Ø 17 mm	2.9 cd/lm	20°	53°
 SAMSUNG	LC040B	Ø 17 mm	2.9 cd/lm	20°	52°
 SEOUL SEMICONDUCTOR	SDW82F1	Ø 14.6 mm	6.0 cd/lm	15°	35°
 SEOUL SEMICONDUCTOR	SDW85F1	Ø 22.6 mm	2.2 cd/lm	26°	75°
 SEOUL SEMICONDUCTOR	SDW86F1	Ø 22.6 mm	2.5 cd/lm	25°	70°



 SEOUL SEMICONDUCTOR	SPW8171	Ø 8.6 mm	15 cd/lm	10°	21°
 SEOUL SEMICONDUCTOR	SPW8371	Ø 14.6 mm	5.5 cd/lm	15°	36°
<b>TRIDONIC</b>	SLE G6 15mm	Ø 13.5 mm	5.5 cd/lm	17°	33°
<b>TRIDONIC</b>	SLE G6 17mm	Ø 15.5 mm	4.6 cd/lm	19°	37°
<b>XICATO®</b>	XTM-09	Ø 9 mm	12 cd/lm	11°	23°
<b>XICATO®</b>	XTM-19	Ø 19 mm	3.5 cd/lm	20°	43°

NOTE 1. The performance values listed above were produced with the bottom of the lens positioned ~3mm from the bottom of the COB LED (top of the heatsink). If using the optional Lens Holder Ring and Base Plate, this distance is controlled at ~3mm by the completed assembly. If using the lens without the optional Lens Holder Ring and Base Plate, this distance can be controlled by the LED lighting fixture, and can be optimized for beam appearance or peak intensity at the user's preference. For XICATO products, the bottom of the lens was in-contact with the top of the plastic LED module (~5.7mm from the bottom of the LED).

NOTE 2: Many other COB LEDs are currently being evaluated and tested, and the performance results will be added to this table periodically. For performance information with specific LEDs not listed above, please contact Fraen <http://www.fraensrl.com/contact.html>

## 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 1050 lumens of flux, the calculations are as follows:

On-axis intensity = (21 cd/lm) x (2000 lumens) = 42000 candela on-axis intensity (one LED).

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

One candela at 1-meter distance produces 1 lux. In the above example, the LED + lens system produced 42000 candela. If that system is illuminating a surface one meter distant, then the *illuminance* on that surface is 42000 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 42000 lux/(2m)<sup>2</sup> or 10500 lux. Moving the fixture three meters from the surface decreases the illuminance to 42000 lux/(3m)<sup>2</sup> or 4667 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  $7^\circ$  and an on-axis intensity of 42000 cd, then at  $\pm 3.5^\circ$  (half of  $7^\circ$ ) the intensity will drop to half of 42000 or 21000 cd. If the Field Angle for the fixture is  $17^\circ$ , then at  $\pm 8.5^\circ$  (half of  $17^\circ$ ) the intensity should be 10% of 42000 or 4200 cd.

Most lenses have beam angles 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.

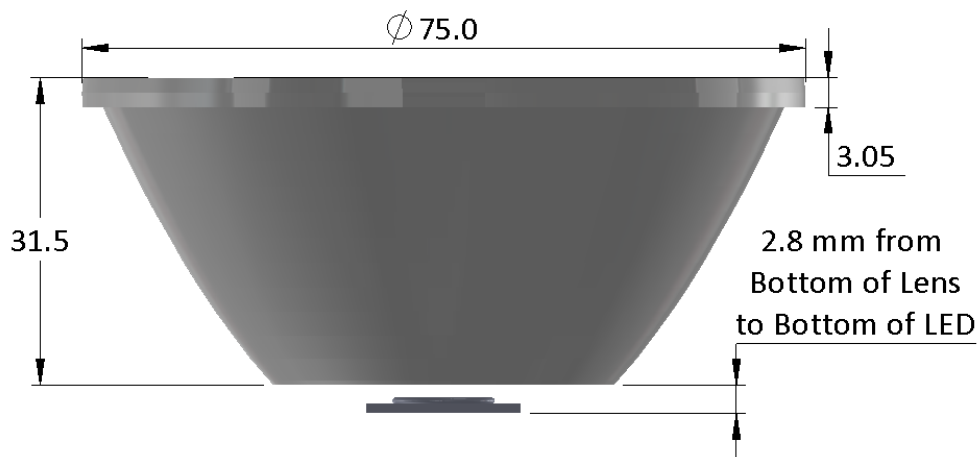
## **Mechanical Characteristics**

---

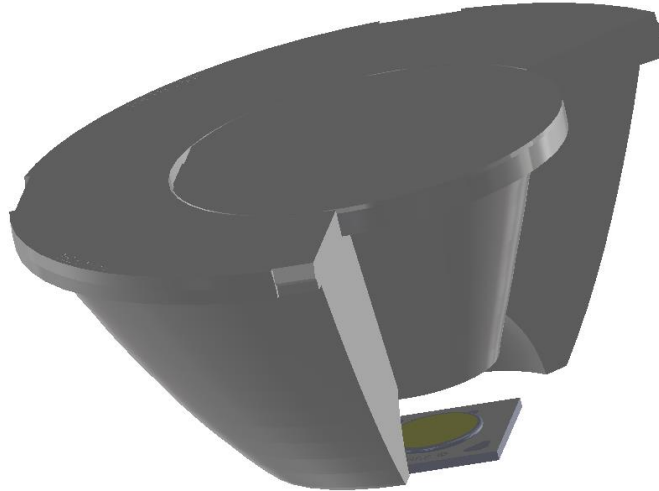
The FNL-N1-75-R nested lens can be purchased with a lens holder, or the user can incorporate into their lamp housing a means for holding the lens. Dimensions of the lens with and without the Fraen lens holder are shown in the figures below.

### FNL-N1-75-R Lens without Lens Holder

If using the lens alone (without the Fraen Lens-Holder System), the lens should be held by its 75 millimeter diameter lens flange. The bottom of the lens should be lens should be approximately  $\sim 2.6$  to  $3.2$  plane of the COB LED, as shown in Figure 1. Adjusting this distance by a few tenths of a millimeter in either direction can produce results that may favor peak intensity in exchange with beam appearance.



**Figure 1: FNL nested lens showing proper mounting height above the Light Emitting Surface (LES) of the COB LED. Dimensions in millimeters.**



**Figure 2: FNL nested lens position over the Light Emitting Surface (LES) of the COB LED.**

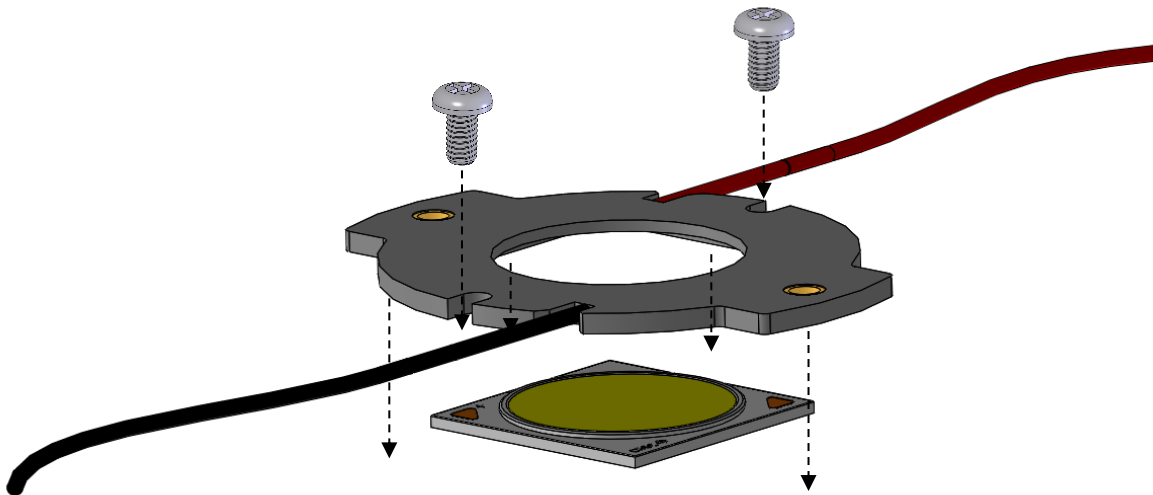
FNL-N1-75-R Lens with the Fraen Lens Holder System

If using the FNL-N1-75-R Lens with the Fraen Lens-Holder System, the Lens + Lens-Holder Ring Assembly (assembly part number: FNL-N1-75-HB) can be twist-locked to

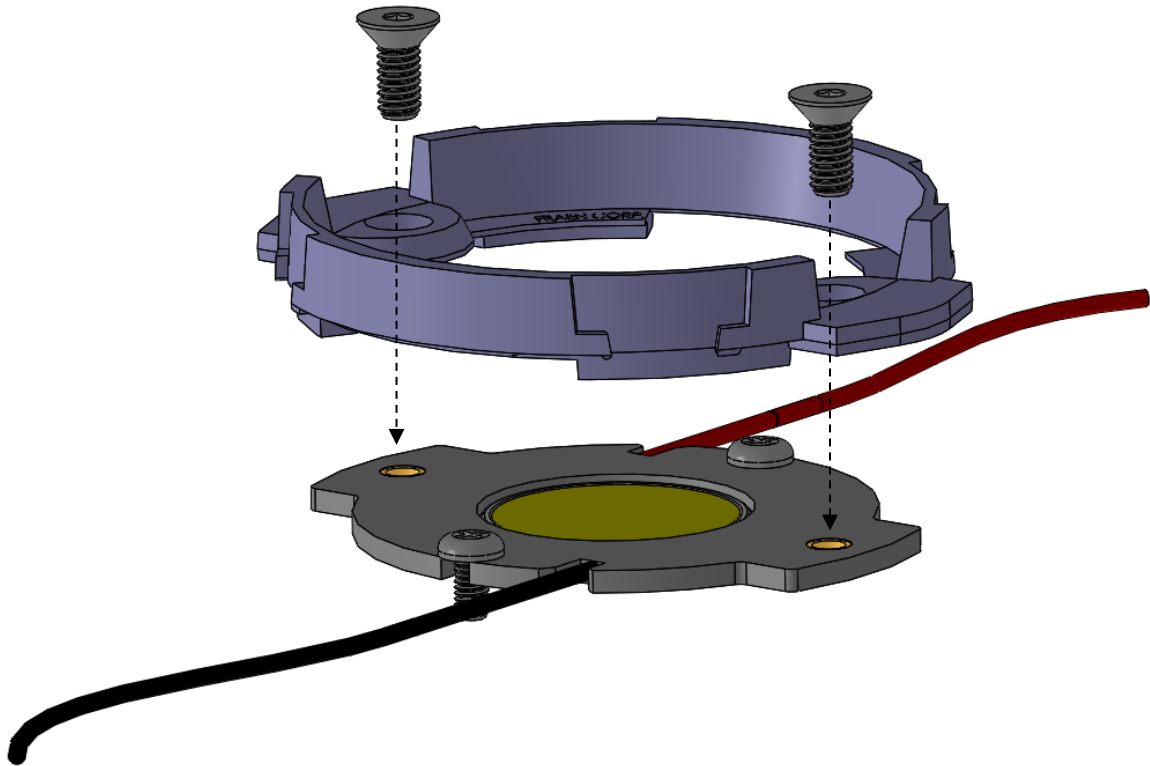
**BENDER**

the mounting Base-Plate. The Base Plate is designed to fit Bender+Wirth **+WIRTH** “4xx Typ F1” electrical connectors. The assembly method is shown in Figure 3A-F below.

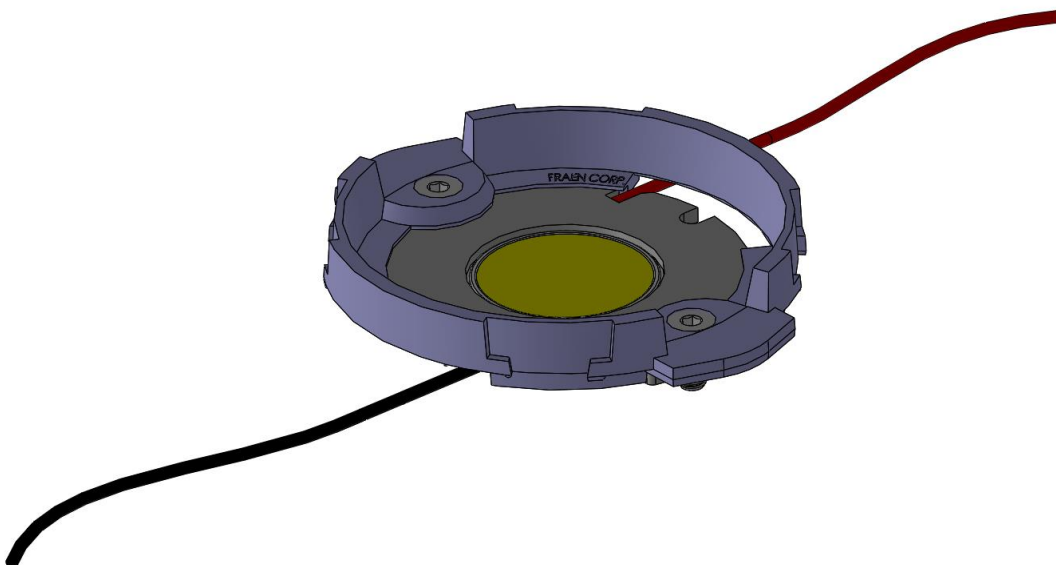
The COB LED is held to the user’s heatsink by the Bender+Wirth connector, and the Bender+Wirth connector is held against the COB LED by the Fraen Base Plate as shown in Figures 3A, 3B, and 3C).



**Figure 3A: COB LED with Bender+Wirth “4xx Typ F1” connector. The connector can be secured (optional) with 2 screws in the 2 u-slots.**

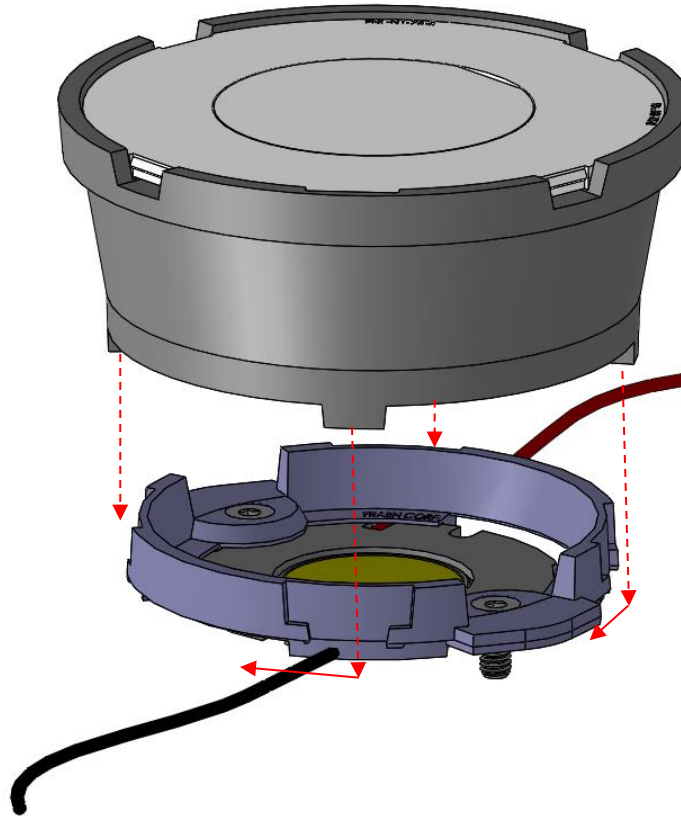


**Figure 3B: Fraen Base Plate with screws, to hold Bender+Wirth connector to heat-sink.**

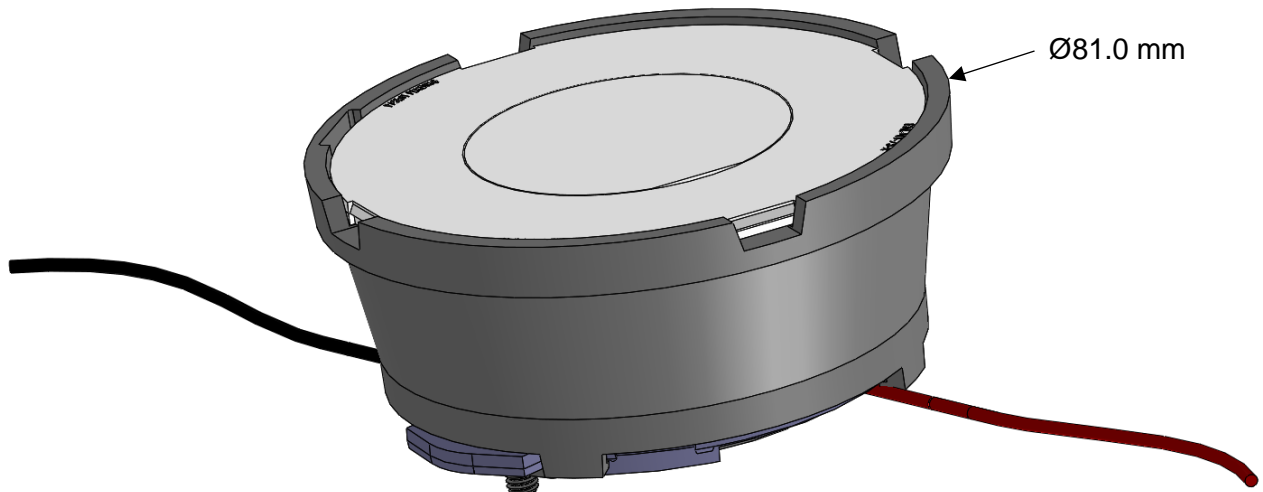




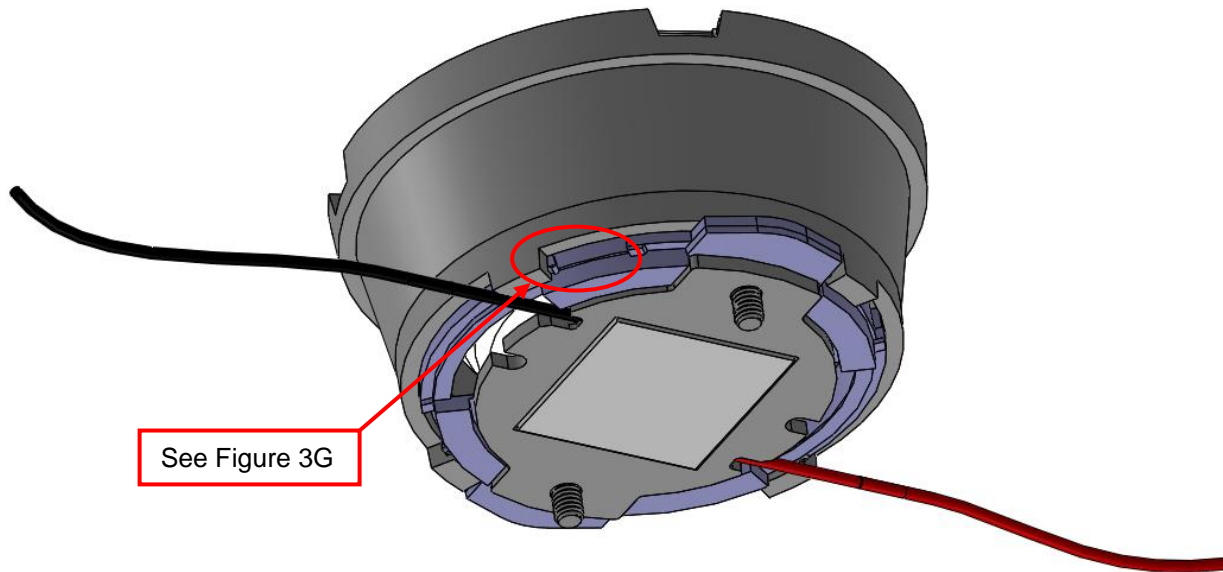
**Figure 3C: Fraen Base Plate secured with screws, to hold Bender+Wirth connector to heat-sink.**



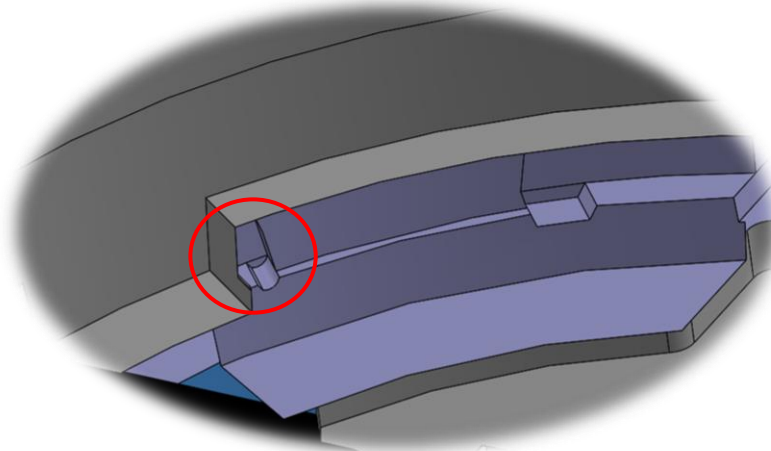
**Figure 3D: Fraen FNL-N1-75-HB Lens and Holder Ring Assembly, twist-locks onto the Base Plate.**



**Figure 3E: Fraen FNL-N1-75-HB Lens and Holder Ring Assembly, twist-locked onto the Base Plate.**



**Figure 3F: Fraen FNL-N1-75-HB Lens and Holder Ring Assembly, twist-locked onto the Base Plate, showing retaining feature. The total height from bottom of the Bender+Wirth electrical connector to the top of the Fraen lens holder ring is ~35.2mm.**

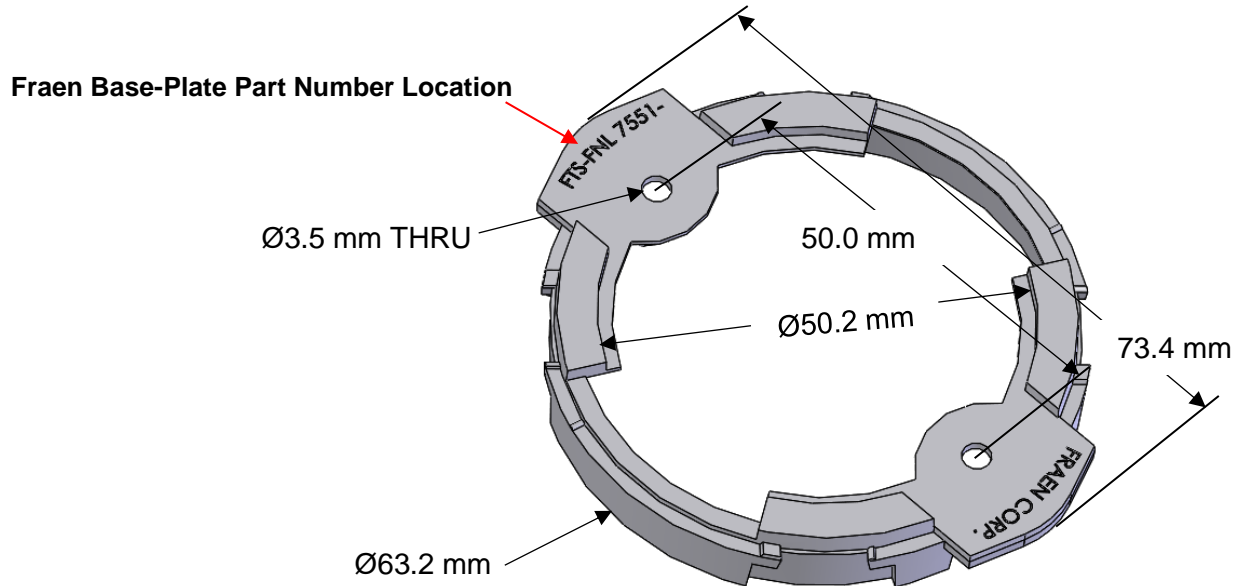


**Figure 3G: Detail view of twist-lock retaining feature.**

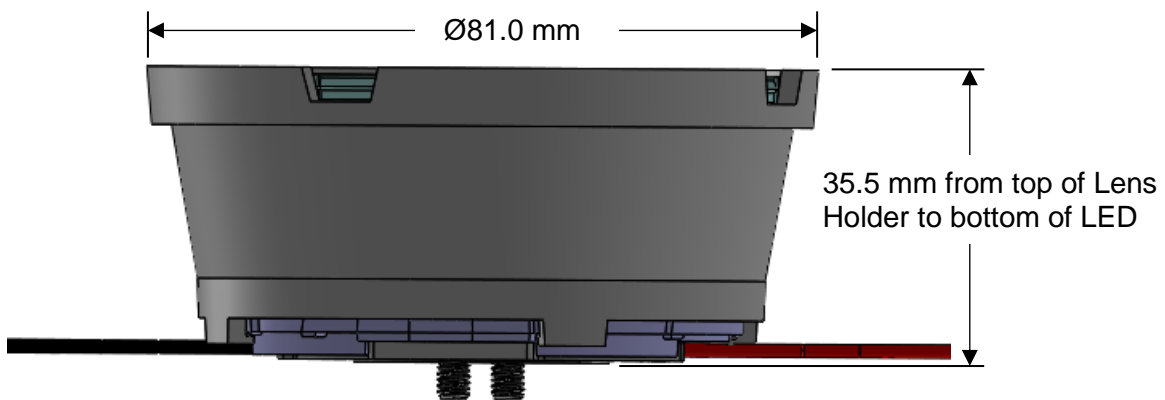
Fraen Base-Plates and Associated Bender+Wirth Connectors

If using the FNL-N1-75-HB Lens + Holder Ring Assembly with a Fraen Base Plate and Bender+Wirth connector, please refer to Figure 4 below as well as the subsequent “Ordering Part Numbers” section.

To find the correct Bender+Wirth 4xx Typ F1 connector, please reference their catalog: <http://bender-wirth.com/katalog/katalog.php?lan=1&cat=196&subCat=45>



**Figure 4: The Fraen Universal Base Plate (part number “FTS-FNL7551-”) has a 50.2 mm inner diameter to fit all Bender+Wirth “Typ F1” connectors.**



**Figure 5: Dimensions of completed assembly, with 1.0mm-thick COB substrate.**



## Ordering Part Numbers

---

Part Number	Description
<b>FNL-N1-75-R</b>	<b>Fraen Nested Lens</b> , Narrow Beam, 75mm Outer Diameter, Round. This part is the lens alone (without a holder, as shown in Figure 1).
<b>FNL-N1-75-HB</b>	<b>FNL-N1-75-R Lens heat-staked to a Lens Holder Ring</b> (as shown in Figure 3D) The last character "B" indicates the color of the polycarbonate Holder Ring: "B"=black. To order a different color, substitute the "B" with "W" (white) or "T" (transparent clear). NOTE: This assembly requires the "Base Plate" (part number FTS-FNL7551-B" sold separately.
<b>FTS-FNL7551-B</b>	<b>Base Plate</b> with 50mm diameter cut-out to fit 50mm diameter round Bender+Wirth "4xx Typ F1" connectors. The last character "B" indicates the color of the polycarbonate Holder Ring: "B"=black. To order a different color, substitute the "B" with "W" (white) or "T" (transparent clear).

If assistance is needed, please contact Fraen [www.FraenOMG.com/Contact](http://www.FraenOMG.com/Contact).

© Copyright 2015 Fraen Corp. All rights reserved.