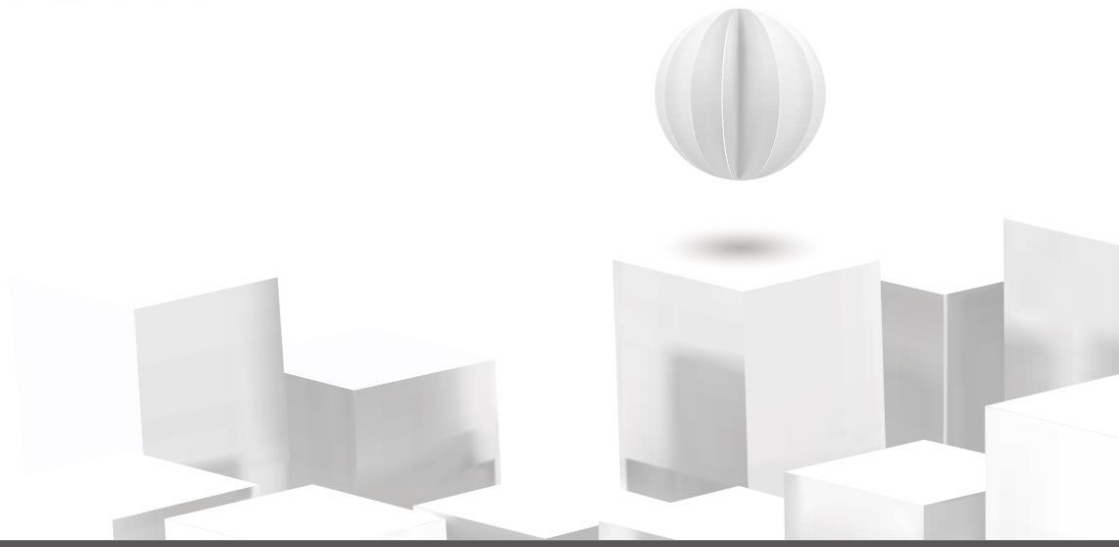

WE MAKE IT
VISIBLE
Fresnel Lens | Motion Sensor | Optical Film
Optical Design | Lens for LED, Solar
First Surface Mirror
www.fresnelfactory.com
www.fresnelfactory.co.kr
Fresnel Factory

HISTORY

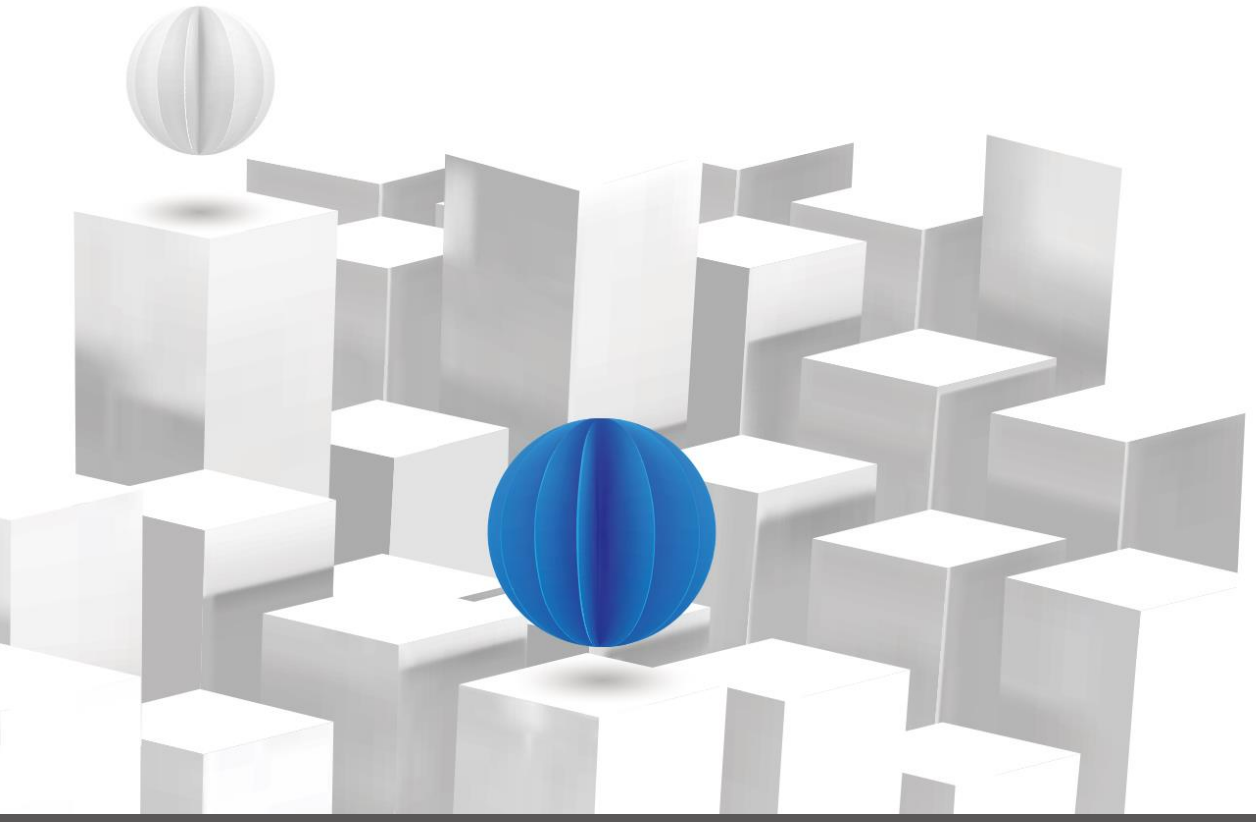


2002 ~ 2010

2002~ 2003		Introduced various media as new concept and the first D.I.Y. projector Patented new type projector lamp using Metal-Halide lamp
2004	07	Introduced CEO KIM Myungloong at Arirang TV
	09	Developed Sayview, the first D.I.Y. concept projector and introduced Naeil newspaper
	10	Recruited over 4million members of Diypro. net Listed D.I.Y projector contents in the the Korean best display channel
2005	01	Introduced Korean magazine DVD 2.0 and PCBee
	06	Imported Front Surface Mirror from OCLI Inc. Developed and patented Wall-mounted projector
2006	04	Participated development of projector "Amazing" from GreenOpt
	10	Transferred Do It Yourself Projector technology to OMAX Inc
2007	10	10 Participated development of projector "Viewcell" from GreenOpt
2008	01	Moved manufacturing facility to aboard
	08	Introduced KBS(Korean Broadcasting System) News program
2010	01	Supplied Front surface mirror for the World first 4th generation Media Facade
	02	Donated more than USD 12,000 for education of low-income children

2011 ~ 2014

2011	05	Participated National R&D: Development of Fresnel lens for high power LED
	06	Opened English website: www. FresnelFactory.com
2012	02	Developed Glass-free 3D Fresnel lens for LG Display
	06	Developed lens cab for security sensor
	09	Participated National R&D of improvement on Concentrate Photovoltaic
2013	02	Participated National R&D of Glass-free 3D integral photography
		Registered the establishment of incorporation of DiYPRO Co., Ltd.
	06	Accredited Venture Certification from KOVA
	09	Accredited Corporate R&D center from KOITA
	12	Approved manufacture of Suwon-si
2014	01	Awarded R&D research achievement from Gyeonggi governor
	03	Design and manufactured 150W Spot type LED broad casting lighting
	07	Mass-produced motion detector for Moving walk
	08	Developed Quad element motion-detector module
	09	Assigned by government as the company to carry out development of products linked with overseas projects



2014 ~ 2017

2014	10	Signed contract with global network solution leader, LEVITON, USA
2015	02	Developed optical component and device for 50 inches glassless 3D display.
	04	Developed lens for motion detecting sensor of Smart Home
	10	Designed and produced Optical Floating Hologrm system. 08 Start supply of PIR lens and sensor for SmartThings Motion Sensor.
	09	Accredited Corporate R&D center from KOITA
	12	Approved manufacture of Suwon-si
2016	01	Designed and produced lens core for Concentrating Photovoltaics(CPV)
	03	Developed optical element for Optical Hologram
	04	Developed Flat Type PIR Fresnel Lens that enables Pet Immune
	06	Developed Simulator for Optical Hologram System
	07	Appointed as the incubating company for next generation 5G Glassles 3D Hologram
	10	Supplied PIR lens to Global no. 2 EMS enterprise on ODM base.
2017	03	Innobiz Certificate Acquisiton
	06	R&D Center Registration
	07	FresnelFactory Inc. Established US branch

2017 ~ 2024

2017	11	Awarded commendation for vitalize small and medium business startups prize awarded by Minister of Small and Medium Venture Business
	12	Appointed as the ICT promising enterprise (K-Global 300). prize awarded by the Ministry of Science and ICT(MSIT)
2018	01	Participate in CES2018
	10	Selection of promising small and medium- sized enterprises in Gyeonggi-do
	11	Head office relocation: 504, Yeongtong-ro 323beon-gil 38, Suwon-si, Gyeonggi-do, 16676 South Korea
	12	Selected as a family-friendly company- Ministry of Gender Equality and Family
		Selected as a business that is friendly to Gyeonggi family
2019	04	Change of corporate name : Fresnelfactory Korea Inc.
	05	Participate in VIVA Technology 2019
	09	Certificate acquisition ISO9001, ISO14001
2020	02	Participate in SPIE PHOTONICS WEST 2020
2022	08	Established a production plant (Injection system, Fully automated post-processing 6axis robot arm etc)
2023	12	Awarded $1 Million Export Excellence Award on 60th Trade Day Anniversary
2024	12	Awarded $3 Million Export Excellence Award on 61st Trade Day Anniversary

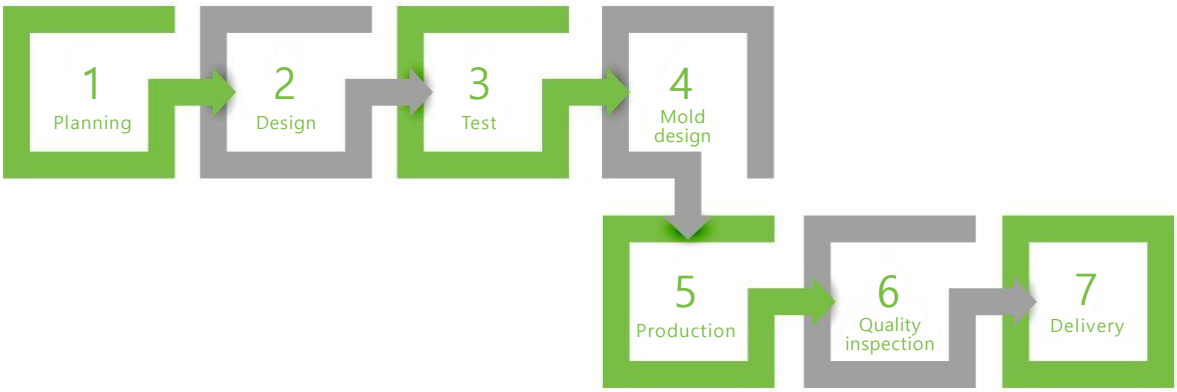
COMPANY

Fresnelfactory Korea Inc. is Fresnel Lens specialized company.
Our moto is "We Make it visible"
Currently our Fresnel technology for producing is 5 different methods, such as Hot-press, Injection, Casting, Roll-to-Roll and Hot-embossing.
Each method has different advantage in terms of precision, mass-production, faster R&D time and price.
Our business model is not only supply optical components, but also optical design and mold design for different aspect of companies in global.
We have not only skillful design and tooling of Fresnel lens, but also handsful experience in VR, AR, Integral photonics, CPV, LED lights and Daylights.
We have 11 patents related with Fresnel lens and its application.
We are conducting research and development and producing in both the USA and the Korea republic.

SERVICE

Step of One Stop Service

Fresnelfactory Korea Inc. provides One-Stop Service for your needs for optics.
If you concern about time and budget, we can provide you Fast-track to find out best solution from our existing products.



1. Planning : To find out the needs of customer and set-up constraints
2. Design : Optical design and simulation-based on details and constrains
3. Test: To check the assumption from the design stage and find out best solution from existing products
4. Mold design: Hot press or injection mold
5. Production
6. Quality inspection
7. Delivery

Parts supply(Standard Product)

We also supply various lenses from our shelf.
More than 300variations - We have various fresnel lenses that test proof of concept in a small budget and short time.
Circular Fresnel, Cylindrical, Lenticular, MLA, PIR, FIR, NIR and so on

- PIR LENS CAP(Pyroelectronics, motion sensor)
- NIR AND FIR(Lenses with special materials for Far-Infrared and Near-Infrared)
- MLA LENTICULAR(Sheet and film type Micro Lens Array and 65-inch Lenticular)
- CPV AND LARGE(Photovoltaic SOG and PMMA lens array and Large Fresnel)
- CIRCLE FRESNEL(Various focus length and shape of Fresnel lenses, common purpose)
- CYLINDERICAL(Linear Fresnel with PMMA. FL from 12 to 300mm)
- LED LIGHT(Shape beam angle and condense Luminus)
- FLAT WIDE ANGLE MIRROR(Front Surface Mirror and Flat-wide angle mirror for ATM)
- OPTICAL PRISM(Various design and size of prism lenses)

CAPACITY

Our design and production capacity

The Infrared fresnel lens, be extensively apply in the switch, Annunciator, IR thermo scope, IR formation of a imagine and so on,
can provide different induce angle, distance, size of the fresnel lens for customer.
Nicera and Perkin-elmer sensors can supply
Total production capacity is 200million (150 million PIR lens cab from above)

Tolerance of mold

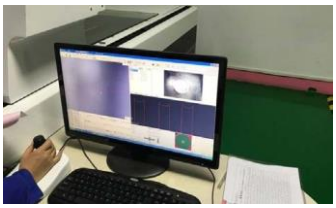
Fresnel lens Mold	
Precision	0.0005mm
Max, Mold size	1600x1200mm
Draft angle	0°
Tip & Valley radius	<0.005mm & 0.01mm

DOE & Micro lens Mold	
Precision	0.001mm~0.002mm
Max, Mold size	1600mm
Draft angle	0°

Design and tooling Machine List

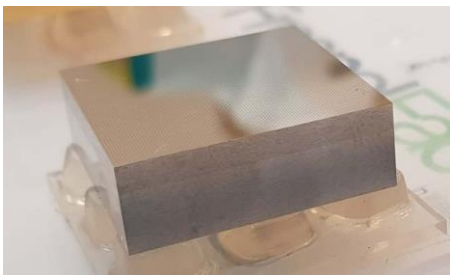
- Ultra Precision CNC Machining Center
- Ultra Precision Diamond turning machine
- Low Speed Wire Cut
- High-precision Grooving Lathe for roll
- Hot press machine
- Roll-to-roll machine
- Injection machine
- Rotary table laminator
- Image measuring instrument
- Automatic Chemiluminescence Analyzer
- Solidworks for mold design
- ZEMAX optical ray-tracing
- Light tools optical ray-tracing

Design and tooling Machine

Mold

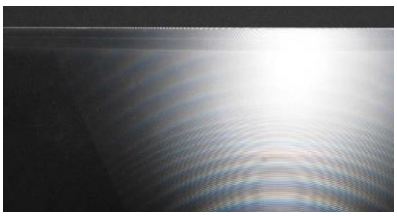




PRODUCT

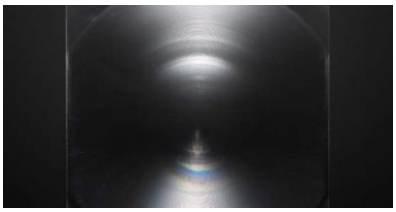
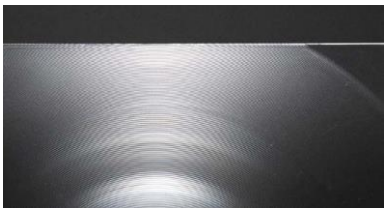
Common Fresnel lens

Common Fresnel lenses such as magnifiers, lighting fixtures, and 3D displays are used in a variety of fields. We can design and manufacture a variety of focus lengths, lengths and shapes of Fresnel lenses according to your needs. For example, Minus focus lens, Circle lens, Cylindrical lens, etc.
The Fresnel magnifying glass is an ultra-thin magnifying glass. Fresnel magnifying made of PMMA, PVC. The minimum thickness of PMMA is between 2 and 5MM, and the minimum thickness of PVC is between 0.45 and 0.90mm.


FL140-130(Common Fresnel lens) Technical information

Model No.	Size H x L (mm)	Focal Length (mm)	Groove Pitch(mm)	Thickness(mm)	Material
FL140-130	Ø130	140	0.3	2	Poly visible

FLM140-180(Minus focus lens) Technical information

Model No.	Size H x L (mm)	Focal Length (mm)	Groove Pitch(mm)	Thickness(mm)	Material
FLM140-180	Ø180	-140	0.3	2	Poly visible

MFL90-70(Cheap card Fresnel lens) Technical information

Model No.	Size H x L (mm)	Magnification
MFL90-70	70×70	2
Thickness(mm)		Material
0.4		Poly PVC

TMOS lens

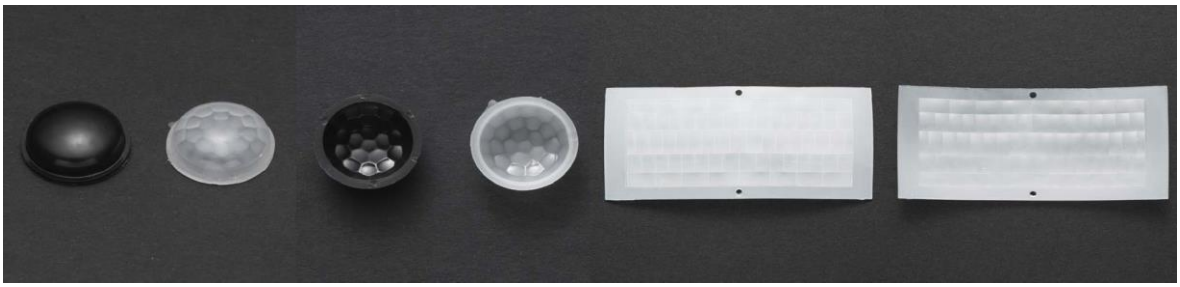
The partnership between Fresnel Factory and ST Microelectronics was officially registered in June 2023, and now Fresnel Factory will act as ST's optical solution partner.

Fresnel Factory and ST jointly release four types of optical lens modules for TMOS sensors. This lens module is an optical solution used in ST's TMOS sensor and will help improve the functionality and performance of sensor. The TMOS sensor is a sensor used with ST's semiconductor technology, and the performance of the sensor can be optimized through the additional function of the lens module.

It is hoped that these products, released through the collaboration between Fresnel Factory and ST, will provide innovative technology and performance in the semiconductor industry. This cooperation is expected to lead to new developments in the field of optical solutions.

TMOS lens

PIR sensor stands for Passive Infrared sensor and it is also called as Pyroelectric Sensor. PIR let the user know whether there is a movement or not by sensing the infrared light from human body relative to the background, it is being used as a motion detector sensor.



| PD06-12005(PIR) |

| PF21-12015P (PIR) |

PD06-12005(PIR) Technical information

Model No.	Lens diameter(mm)	Focal Length (mm)	Detectable distance(m)	Detectable angle	Marerial
PD06-12005	Ø16	6	5	120	Poly FIR200

PF21-12015P(PIR) Technical information

Model No.	Lens diameter(mm)	Focal Length (mm)	Detectable distance(m)	Detectable angle	Marerial
PF21-12015P	76×36	21	15	120	Poly FIR200

IR Series Fresnel Lens

The infrared lens features

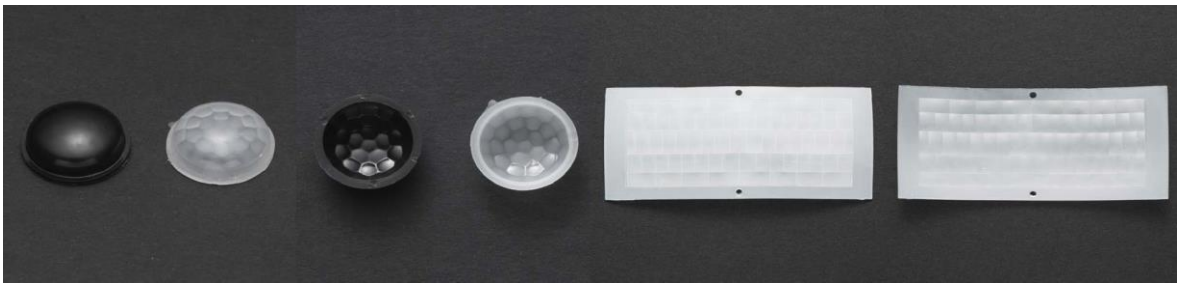
The IR fresnel lens, be extensively apply in the clay influence the switch, Annunciator, IR thermo scope, IR formation of a imagine and so on, can provide different induce angle, distance, size of the fresnel lens for customer.

Without Fresnel lens, the sensor only can detect less than 1m distance and narrower space with lens.
To work with Pyroelectronic detector and thermopile, Fresnel lens that collects infrared rays as a sensor is required.

Fresnel Factory manufactures Fresnel lenses for passive infrared absolute temperature sensors.
Material is important to have a wide FOV and excellent Far infrared transmittance. Therefore, Fresnel Factory is using Poly FIR200 and Poly FIR25, which have a wide FOV and excel FIR transmittance

PIR Fresnel lens

PIR sensor stands for Passive Infrared sensor and it is also called as Pyroelectric Sensor. PIR let the user know whether there is a movement or not by sensing the infrared light from human body relative to the background, it is being used as a motion detector sensor.



| PD06-12005(PIR) |

| PF21-12015P (PIR) |

PD06-12005(PIR) Technical information

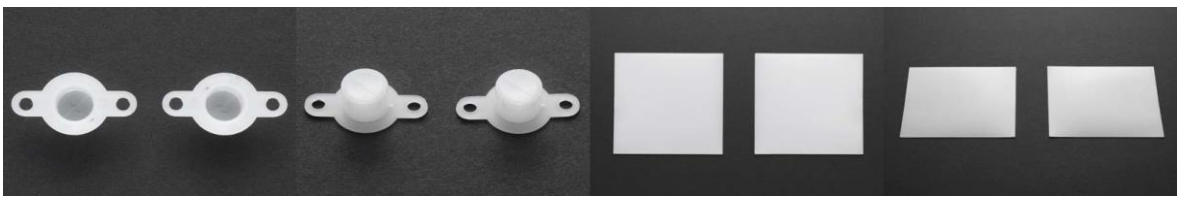
Model No.	Lens diameter(mm)	Focal Length (mm)	Detectable distance(m)	Detectable angle	Marerial
PD06-12005	Ø16	6	5	120	Poly FIR200

PF21-12015P(PIR) Technical information

Model No.	Lens diameter(mm)	Focal Length (mm)	Detectable distance(m)	Detectable angle	Marerial
PF21-12015P	76×36	21	15	120	Poly FIR200

FIR Fresnel lens

FIR sensor infrared light from the subject and identifies energy content and absolute temperature. Therefore, it is frequently used under high temperature where ordinary plastics can't endure.



| FIR05-04(FIR) |

| FIR00-95(FIR) |

PRODUCT

IR Series Fresnel Lens

FIR05-04(FIR) Technical information

Model No.	Size H x L (mm)	Focal Length (mm)	Thickness(mm)	Material
FIR05-04	Ø8.2	5	0.6	Poly FIR25

FIR00-95(FIR) Technical information

Model No.	Size H x L (mm)	Focal Length (mm)	Thickness(mm)	Material
FIR00-95	95x95	0	0.5	Poly FIR25

NIR Fresnel lens

The NIR uses wavelength range of 850nm~950mn, so compared to PIR and FIR which use8~13um wavelength range, it has different quality material and production method for Fresnel lens.

| NF05-16863B(NIR) |

| NF26-10(NIR) |

NF05-1683B(NIR) Technical information

Model No.	Size H x L (mm)	Focal Length (mm)	Thickness(mm)	Material
NF05-1683B	16.8x6.3	3~9	1.95	Poly NIR212

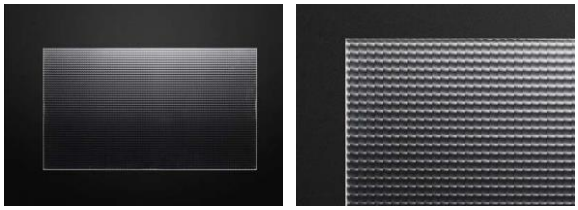
NF26-10(NIR) Technical information

Model No.	Size H x L (mm)	Focal Length (mm)	Thickness(mm)	Material
NF26-10	10	26	1.5	Poly NIR212

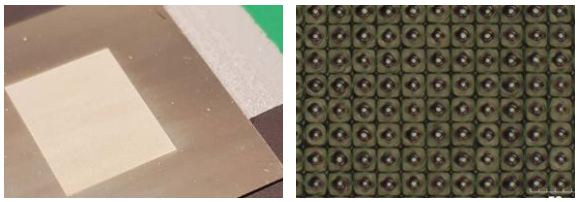
Fresnelfactory possesses appropriate materials that suits both wavelength range and temperature mentioned above.

MLA, Lenticular Fresnel lens

Lenticular and MLA(Micro lens array) is essentially required optics that generates 3-D image. Volume matric is a special feature in glassless 3D image.
It's a different imaging method than AR (Argument Reality) and VR (Virtual Reality) that we see often now.
The Lenticular realizes three dimensional effect on the left and right, and MLA is able to realize the effect on upper, lower, right, and left.
Through the experience of prototyping or mass production, we can design various types of optical quality, side illumination, and thickness of optics, which are the core of stereoscopic images, and we also have developed a film-type as well



| Micro Array Fresnel lens |



| Micro Array Fresnel lens Mold |

FM08-684(MLA) Technical information

Model No.	Size(mm)	Focal Legth (mm)	lens array ize(mm)	Thickness (mm)	Material
FM08-684	684x385.34	8.028	426x240 lens array	5	Poly visible

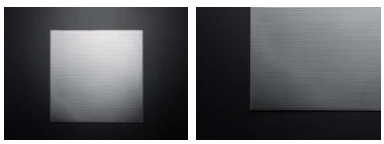
LT051-15(Lenticular) Technical information

Model No.	Size H x L (mm)	Focal Legth (mm)	Groove tch(mm)	Thickness (mm)	Material
LT051-15	800×600	2.069	0.54	1.5	Poly visible

| LT051-15(Lenticular) |

LPV60-400(Prism) Technical information

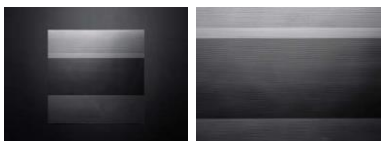
Model No.	Size H x L (mm)	Groove itch(mm)	Angle(°)	Thickness (mm)	Material
LPV60-400	400×400	0.6		1.5	Poly visible



| LPV60-400(Prism) |

LPD83-250(Prism) Technical information

Model No.	Size H x L (mm)	Groove itch(mm)	Angle(°)	Thickness (mm)	Material
LPD83-250	250×250	2.28		0.27	Poly visible

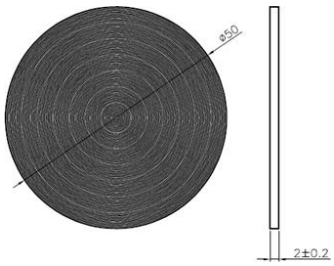


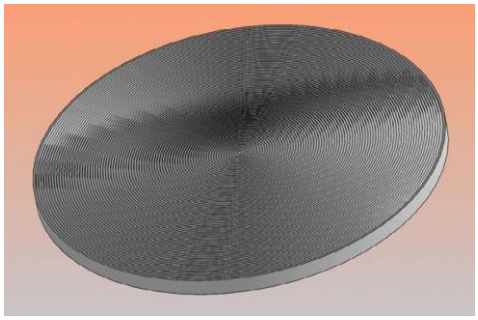
| LPD83-250(Prism) |

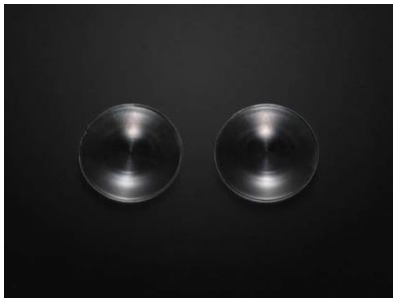
VR, AR FRESNEL LENS

Fresnel lens which is developed for VR devices
This lens was designed and developed to replace the existing glass lens for reduction of weight and volume of VR devices.

VR is an environment similar to reality but not reality through human technology. The created virtual scene stimulates the user's senses to feel and experience a space that is the same as the real feeling. Users can not simply immerse themselves in virtual reality. You can also use real device operation to command them, with a feeling of being on the scene. You can observe things in three dimensions without restriction Simply put, the lens in the real VR helmet is based on different realities and local spaces to create different images. A virtual reality scene is formed in the user brain visual system.







| VR Fresnel lens |

| VR80-50(VR) |

Light transmission rate(VR)

VR80-50(VR) Technical information

Model No.	Size H x L (mm)	Focal Length (mm)	Groove Pitch(mm)	Thickness(mm)	Material
VR80-50	Ø50	80	0.3	2	Poly visible

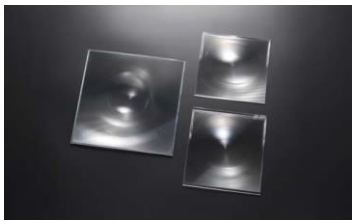
PMMA Condenser Fresnel lens

In the field of solar concentration, the Fresnel lens is one of the important optical components in the concentrating solar system, the solar Fresnel lens concentrator is that the focus of the lens just falls on the solar chip. when the lens face is perpendicular to the sun, the light will be focused on the cell. which will concentrate more energy, thus requiring a smaller cell area and greatly saving costs.

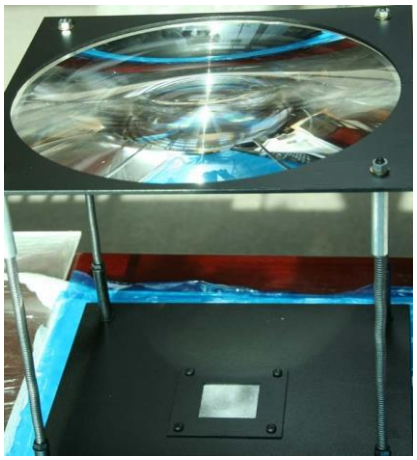
solar arrays uses Fresnel condenser lens with following benefits

- High precision optical components
- High precision thin thread forming process
- High refractive index
- Minimum optical losses
- High-intensity
- High transmittance and anti-aging
- Anti-ultraviolet radiation

PMMA Condenser Fresnel lens

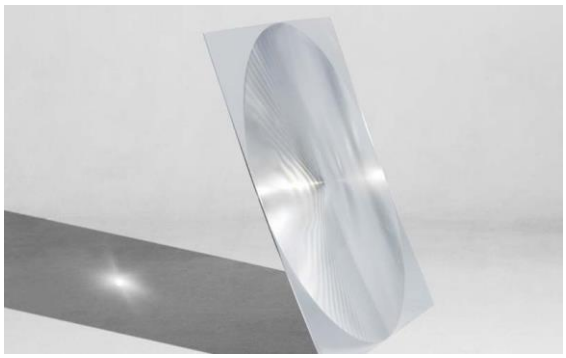


| PMMA Condenser Fresnel lens |



| Installation examples - Solar system |

| Installation examples - Solar Cooking Heater |



CP300-230(PMMA material) Technical information

Model No.	Size H x L (mm)	Focal Length (mm)	Groove Pitch(mm)	Thickness	Material
CP300-230	238x238	300	0.5	5	Poly visible

Silicone-Glass Fresnel lens

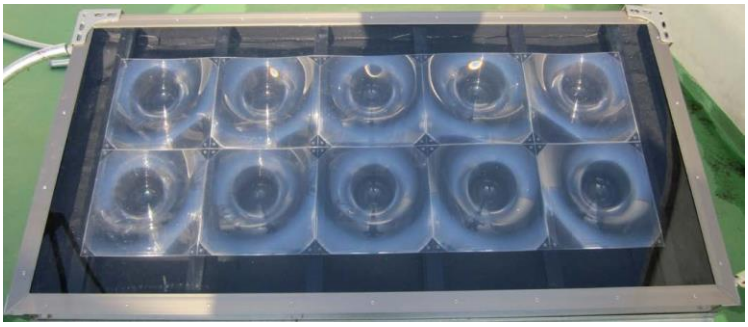
Photovoltaic Glass-silicon on Fresnel condenser lens(SOG) and solar panels generally use the box design approach that we can achieve the best results. Solar arrays using Fresnel condenser lens can achieve long term exposure by high precision optical components, suitable for outdoor air in the work environment. With silicone gel mold attached onto the ultra-white toughened glass surface of Fresnel lens, users will achieve high-precision thin thread forming process, resulting following benefits.

- ensured high refractive index
- minimize optical losses
- high-intensity/transmittance and
- anti-aging/anti-ultraviolet radiation

Comparably, SOG(Silicon on Glass) has several times better climate resistance characteristics than PMMA (Optical Acrylic), as it can take greater heat temperature (180℃ vs. 60℃) without deformation of lens pattern. Based on customer's requirement on solar panel, Fresnelfactory provides various customizations, such as modification on size of lens, incidence angle, distance between lens and solar panels, etc.

Silicone-Glass Condenser Fresnel lens

| Silicone-Glass Condenser Fresnel lens |



| Installation examples Solar water boiler |

| Silicone-Glass Condenser Fresnel lens |

| Installation examples Urban plant factory |

CG1300-1010(Silicone-Glass material) Technical information

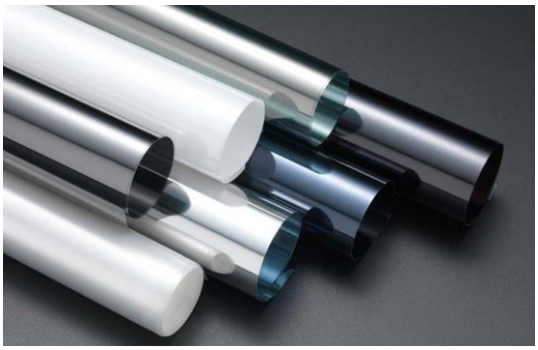
Model No.	Size H x L (mm)	Focal Length (mm)	Groove Pitch(mm)	Thickness	Material
CG1300-1010	1010x1010 (per 244x244mm)	1300		4	Glass+Poly visible

Optical film

Solis™

Solis window film is a sun control optical film brand name of Fresnel Factory Inc.
Solis Daylight film developed on the basis of Fresnel technology held by Fresnel Factory Inc. The film is a kind of neo-concept film, not blocking the sunlight coming into the window, but redirecting the sunlight.
Based on automated production and quality enhancement, we have had our dream, "Low production cost and high-quality stability" realized.
Window tinting films manufactured, based upon technologies of optical lens production, display one step higher coating's quality and quality stability(Low Lot tolerance).

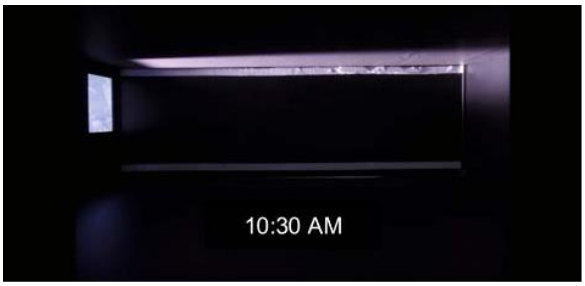
Optical Film

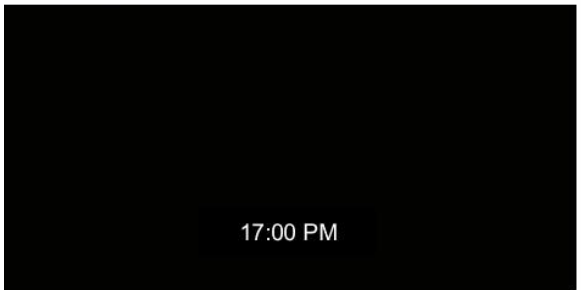


| Optical Film |

| Solis applied example |

Redirected Sunlight of indoor by Solis





Optical film

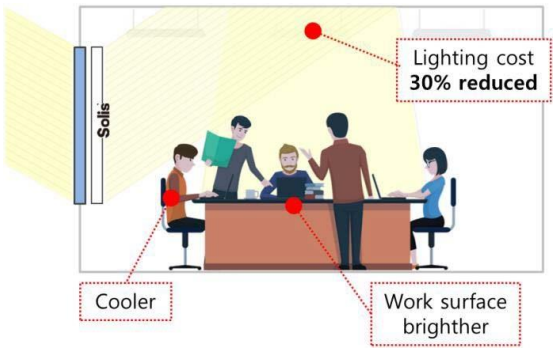
Solis™ Sun Control Window Film
(SL3402, Specialized for Northern Europe)

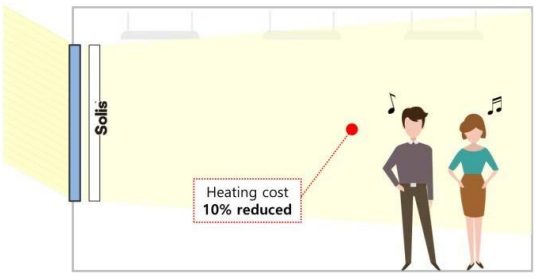
- Up to 20% brighter inside space
- Up to 30% saving of lighting cost
- 250% wider sunny surface
- Non-metalized film with no signal interference
- Up to 90% infrared rejection providing
- 99% of UV-ray blocking, 5 Years warranty

SL3402 Technical information

Model No.	Width(mm)	Length(mm)	Thickness(um)	Material	etc.
SL3402	1050	1000	195um	PET	

Solis is the new way to control natural light.





Solis Natural Light Film can redirect sunlight to the ceiling and deep inside the room. It makes your workspace brighter by 20% than before without any lightings assistance.
So, you can save the lighting cost up to 30% than before.

Flat Wide-angle mirror

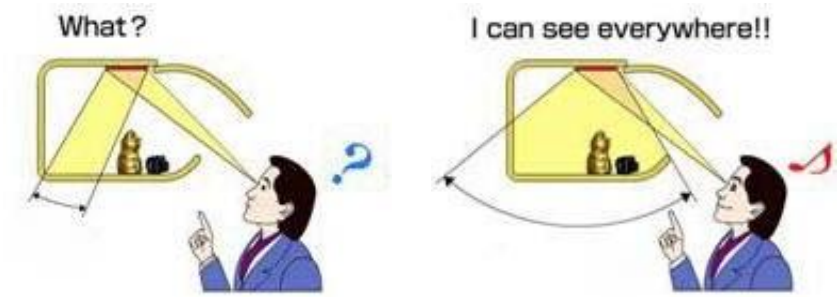
Reflective Fresnel wide-angle mirror can serve following purposes: Banks ATM, bank window for security and other fields. It is designed with light weight, compact size, broad visualization in scope, and high durability to cope with external impacts.

Applications

- Extending throwing distance of Beam Projector
- Rear projection system
- D.I.Y. projector
- Photo mirror
- Digital copiers
- Scanners
- Automotive digital dashes

Reversing The Wide-Angle Mirror

- Enhanced aluminum coating
- Superior durability for long product life
- High reflector (HR) coating produces reflectivity of 94% or 97%
- Protective tape on coated surface (tape type and tack strength options)

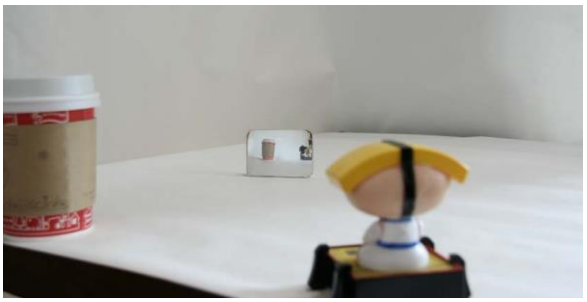


Wide angle Mirror

RP390-283

Flat Wide-angle mirror

Installation examples

Installation examples ATM mirror

RP390-283(Reflecting Wide-Angle Lens) Technical information

Model No.	Size H x L (mm)	Focal Length (mm)	Groove Pitch(mm)	Thickness	Material.
RP390-283	283x283	390	0.4	2	Poly visible

8200QT(Reversing The Wide-Angle Mirror) Technical information

Model No.	Size H x L (mm)	Focal Length (mm)	Groove Pitch(mm)	Thickness	Material.
8200QT	96x42	350	0.3	2	Poly visible

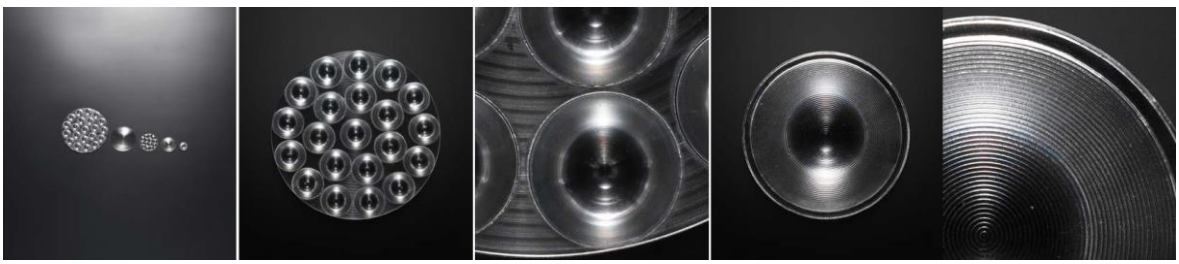
LED Fresnel lens

Fresnelfactory has a lot of optical solution for LED lighting like High-Bay, stage lighting, down lights, lenses for package etc. Fresnel lens a lighter and thin than convex(concave) lens.
So, you can use fresnel lens to make lighter and smaller led light fixture devices.

The Principles of Fresnelfactory's LED lampshade are as follows

01	02	03
With large reflection angle of the LED point lamp-house, the emanative ray spreads the heat and compares severity, making use of the Fresnel lens to gather the light function. The rays will be gathered by using valid scope therefore increase light effect and maximize brightness result.	The Fresnel lens is differentiated from traditional LED lamp, in terms of the design of focal length and distance, which establishes the effective emergent light angle.	Compared to traditional products, the super thin structure of Fresnel lens enables improved light transmissibility. In addition, it could be applied for various purposes with its small and condensed product design. We can design and manufacture according to your needs

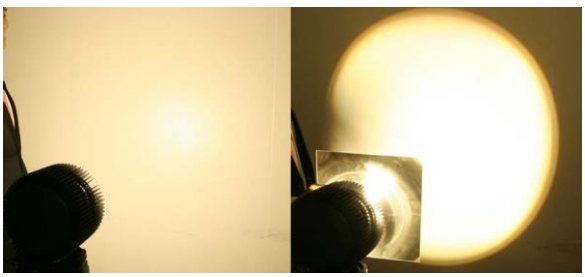
LED Light Fresnel lens



LS35-05 Technical information

Model No.	Size H x L (mm)	Focal Length(mm)	Groove Pitch(mm)	Material
LS35-05	Ø52	35	0.5	Poly visible

| Interior LED light with LS35-05 |



| Condense light to apply LED Fresnel lens |

STANDARD PRODUCT LIST

Common Fresnel Lens

- Common Fresnel Lens

No.	Model No.	Size H x L (mm)	Focal Length (mm)	Groove Pitch(mm)	Thickness(mm)	Material
1	FL06-12	Ø12	6	0.4	2	Poly visible
2	FL12-24	Ø24	12	0.3	2	Poly visible
3	FL16-30	Ø30	16	0.5	2	Poly visible
4	FL28-45	Ø45	28	0.3	2	Poly visible
5	FL35-115	115x140	35	0.3	2	Poly visible
6	FL40-100	Ø100	40	0.3	2	Poly visible
7	FL50-100	Ø100	50	0.3	2	Poly visible
8	FL55-120	Ø120	55	0.3	2	Poly visible
9	FL63-90	Ø90	63	0.3	2	Poly visible
10	FL63-110	Ø110	63	0.3	2	Poly visible
11	FL70-100	Ø100	70	0.3	2	Poly visible
12	FL74-210	Ø210	74	0.3	2	Poly visible
13	FL80-160	Ø160	83	0.5	2	Poly visible
14	FL90-114	114x80	90	0.3	2	Poly visible
15	FL90-150	Ø150	90	0.5	2	Poly visible
16	FL100-180	Ø180	100	0.3	2	Poly visible
17	FL100-200	200x170	100	0.3	2	Poly visible
18	FL100-230	230x230	100	0.5	2	Poly visible
19	FL120-200	Ø200	120	0.3	2	Poly visible
20	FL120-210	Ø210	120	0.5	2	Poly visible
21	FL130-140	140x100	130	0.3	2	Poly visible
22	FL135-120	120x100	135	0.3	2	Poly visible
23	FL135-230	Ø230	135	0.5	2	Poly visible
24	FL140-130	Ø130	140	0.3	2	Poly visible
25	FL140-150	Ø150	140	0.3	2	Poly visible
26	FL140-250	Ø250	140	0.5	2	Poly visible
27	FL148-120	120x90	148	0.3	2	Poly visible
28	FL156-240	Ø240	156	0.3	2	Poly visible
29	FL160-130	Ø130	160	0.3	2	Poly visible
30	FL170-220	Ø220	170	0.3	2	Poly visible
31	FL170-240	240x180	170	0.3	2	Poly visible
32	FL170-140	140x100	170	0.3	2	Poly visible
33	FL185-230	Ø230	185	0.3	2	Poly visible
34	FL185-240	Ø240	185	0.5	2	Poly visible
35	FL200-100	Ø100	200	0.1	2	Poly visible
36	FL200-285	Ø285	200	0.5	2	Poly visible
37	FL210-160	Ø160	210	0.3	2	Poly visible
38	FL210-230	230x230	210	0.5	2	Poly visible
39	FL220-220	220x170	220	0.5	2	Poly visible
40	FL220-300	Ø300	220	0.3	2	Poly visible
41	FL235-300	Ø300	235	0.5	2	Poly visible
42	FL250-240	Ø240	250	0.5	2	Poly visible
43	FL260-160	Ø160	260	0.3	2	Poly visible
44	FL310-230	230x170	310	0.3	2	Poly visible
45	FL326-180	Ø180	326	0.3	2	Poly visible
46	FL330-395	395x395	330	0.5	2	Poly visible
47	FL370-230	Ø230	370	0.5	2	Poly visible
48	FL400-300	Ø300	400	0.3	2	Poly visible
49	FL457-260	260x210	457	0.2	2	Poly visible
50	FL500-510	510x300	500	0.125	2	Poly visible
51	FL510-375	375x260	510	0.5	2	Poly visible
52	FL600-300	300x300	600	0.5	2	Poly visible
53	FL600-320	Ø320	600	0.5	2	Poly visible
54	FL630-431	431x401	630	0.5	2	Poly visible
55	FL700-780	780x780	700	0.2	2	Poly visible
56	FL900-300	Ø300	900	0.3	2	Poly visible
57	FL1000-256	Ø256	1000	0.5	2	Poly visible
58	FL2000-300	Ø300	2000	0.3	2	Poly visible

STANDARD PRODUCT LIST

Common Fresnel Lens

- Minus Focus Fresnel Lens

No.	Model No.	Size H x L (mm)	Focal Length (mm)	Groove Pitch(mm)	Thickness(mm)	Material
1	FLM300-240	240x240	-300	0.5	2	Poly visible
2	FLM220-300	300x300	-220	0.5	2	Poly visible
3	FLM170-180	Ø180	-170	0.3	2	Poly visible
4	FLM330-300	300x300	-330	0.5	2	Poly visible
5	FLM140-180	Ø180	-140	0.3	2	Poly visible
6	FLM05-150	150x100	-5	0.5	2	Poly visible

Cylindrical Fresnel lens

- Linear Fresnel Lens

No.	Model No.	Size H x L (mm)	Focal Length (mm)	Groove Pitch(mm)	Thickness(mm)	Material
1	FLL12-30	30x800	12	0.3	2	Poly visible
2	FLL15-40	40x800	15	0.5	2	Poly visible
3	FLL18-50	50x800	18	0.5	2	Poly visible
4	FLL25-65	65x800	25	0.5	2	Poly visible
5	FLL30-80	80x800	30	0.5	2	Poly visible
6	FLL40-110	110x800	40	0.5	2	Poly visible
7	FLL50-30	30x800	50	0.5	2	Poly visible
8	FLL60-150	150x800	60	0.5	2	Poly visible
9	FLL70-200	200x800	70	0.5	2	Poly visible
10	FLL80-200	200x800	80	0.5	2	Poly visible
11	FLL90-200	200x800	90	0.5	2	Poly visible
12	FLL100-200	200x800	100	0.5	2	Poly visible
13	FLL150-50	50x800	150	0.5	2	Poly visible

MLA,Lendticular Fresnel lens

- Array Fresnel Lens

No.	Model No.	Size H x L (mm)	Focal Length (mm)	lens array size(mm)	Thickness(mm)	Material
1	FM08-684	684x385.34	8.028	426x240 lens array	5	Poly visible
2	FM29-679	679.77x380.97	29.88	91x51 lens array	5	Poly visible
3	LS200MK	482x298		11.6x10.8	5	Poly visible
4	FML32-3030	30x30	0.0321	0.023	0.3	
5	FML15-1008	10.68x8.28		0.012x0.012	0.3	

- Lenticular Fresnel lens

No.	Model No.	Size H x L (mm)	Focal Length (mm)	Groove Pitch(mm)	Thickness(mm)	Material
1	LT051-15	800x600	2.069	0.54	1.5	Poly visible
2	LT147-186	1452x832		1.47	1.86	Poly visible
3	LT127-039	1500x---		1.27	0.39	
4	LT127-034	1500x---		1.27	0.34	
5	LT635-027	1500x---		0.635	0.27	

- VR Fresnel lens

No.	Model No.	Size H x L (mm)	Focal Length (mm)	Groove Pitch(mm)	Thickness(mm)	Material
1	VR80-50	Ø50	80	0.3	2	Poly visible
2	VR90-70	70x70	90	0.3	2	Poly visible

- Prism Fresnel lens

No.	Model No.	Size H x L (mm)	Groove Pitch(mm)	Angle(°)	Thickness(mm)	Material
1	LPV60-400	400x400	0.6		1.5	Poly visible
2	LPV60-300	300x300	0.6		1.86	Poly visible
3	LPD105-300	300x300	400/38.4		0.39	Poly visible
4	LPD67-226	226x150	0...8/0.201		0.34	Poly visible
5	LPD83-250	250x250	2.28		0.27	Poly visible
6	LPV9050F				0.27	Poly visible

STANDARD PRODUCT LIST

CPV and Large Fresnel lens

- Large Fresnel Lens

No.	Model No.	Size H x L (mm)	Focal Length (mm)	Groove Pitch(mm)	Thickness(mm)	Material
1	CP1300-1100	1100x1100	1300	0.5	5	Poly visible
2	LF890-813	812.8x812.8	890	0.5	5	Poly visible
3	LF1000-1100	1100x1100	1000	0.5	5	Poly visible
4	LF700-780	780x780	700	0.2	5	Poly visible

- Condenser Fresnel Lens(PMMA material)

No.	Model No.	Size H x L (mm)	Focal Length (mm)	Groove Pitch(mm)	Thickness(mm)	Material
1	CP300-230	238x238	300	0.5	5	Poly visible
2	CP330-280	280x280	330	0.5	5	Poly visible
3	CP220-280	280x280	220	0.5	5	Poly visible
4	CP250-270	270x250	250	1	5	Poly visible
5	CP182-235	235x235	182	0.5	5	Poly visible
6	CP350-300	310x310	350	1	5	Poly visible
7	CP350-330C	340x340	350	1	5	Poly visible
8	CP265-25249	268x249	265	1	5	Poly visible
9	CP265-250	Ø240	265	0.5	5	Poly visible
10	CP406-260	Ø250	406	0.5	5	Poly visible
11	CP450-230	Ø200	450	0.5	5	Poly visible

- Condenser Fresnel Lens(Silicone-Glass materials)

No.	Model No.	Size H x L (mm)	Focal Length (mm)	Groove Pitch(mm)	Thickness(mm)	Material
1	CG1300-1010	"1010x1010 (per 244x244mm)"	1300		4	Glass+Poly visible
2	CG93.5-830	"830x630 (per 50x50mm)"	93.5		4	Glass+Poly visible

Flat wide angle mirror

- Reflecting Wide-Angle Lens

No.	Model No.	Size H x L (mm)	Focal Length (mm)	Groove Pitch(mm)	Thickness(mm)	Material
1	RN350-40	60x40	350	0.3	2	Poly visible
2	RN350-44	44x29	350	0.35	2	Poly visible
3	RN280-38	117.8x37.8	280	0.3	2	Poly visible
4	RN350-54	54x35	350	0.35	2	Poly visible
5	RN350-53	84.5x53.6	350	0.3	2	Poly visible
6	RN350-30	64.5x29.5	350	0.35	2	Poly visible
7	RN350-47	74x47	350	0.3	2	Poly visible
8	RN350-B47	74x47 , Ø30	350	0.35	2	Poly visible
9	RT350-49	65.3x49.5	350	0.3	2	Poly visible
10	RT350-R49	65.3x49.5	350	0.3	2	Poly visible
11	RP390-283	283x283	390	0.4	2	Poly visible
12	RN145-298	298x298	145	0.5	2	Poly visible
13	RP375-292	292x292	375	0.4	2	Poly visible
14	RN145-280	280x280	145	0.4	2	Poly visible

- Reversing The Wide-Angle Mirror

No.	Model No.	Size H x L (mm)	Focal Length (mm)	Groove Pitch(mm)	Thickness(mm)	Material
1	PR350-199	252x199	350	0.3	2	Poly visible
2	8200QT	96x42	350	0.3	2	Poly visible
3	8200QT-half	96x32	350	0.3	2	Poly visible
4	PR150-45	150x45	750		2	Poly visible
5	PR200-45	200x45	750		2	Poly visible

STANDARD PRODUCT LIST

LED Light

No.	Model No.	Size H x L (mm)	Focal Length (mm)	Groove Pitch(mm)	etc.	Material
1	LS18-03	Ø38	18	0.3		Poly visible
2	LM20-01B	Ø162	20	0.1	Ø30, 21 array	Poly visible
3	LM20-01M	Ø162	20	0.1	Ø30, 11 array	Poly visible
4	LM20-01S	Ø162	20	0.1	Ø30, 7 array	Poly visible
5	LM20-01V	Ø210	20	0.1	"Ø42, 7 array Ø35, 6 array Ø45, 6 array"	Poly visible
6	LS21-03	Ø38	21	0.3		Poly visible
7	LM24-026	Ø62	24	0.26		Poly visible
8	LM24-03	152.3x152.3	24	0.3	Ø52, 6 array	Poly visible
9	LS2605-02	Ø44.8	26.5	0.2		Poly visible
10	LS2705-05	Ø51	27.5	0.5		Poly visible
11	LS35-05	Ø52	35	0.5		Poly visible
12	LS35-05D	Ø80	35	0.5		Poly visible
13	LM35-05	44x42	35	0.5		Poly visible
14	LM35-05B	100.5x51.5	35	0.5	Ø50, 2 array	Poly visible
15	LS52-04	26.5x19.5	52	0.4		Poly visible
16	LM6704-025		67.4/134.8	0.25		Poly visible
17	LM83-025	Ø268.5	83/125	0.25		Poly visible
18	LS90-125	(64+125)x90	90	0.5		Poly visible
19	LS90-155	(58+155)x100	90	0.5		Poly visible
20	LS120-75	75.5x75.5	120	0.3		Poly visible
21	LS120-138	138x120	120	0.3		Poly visible
22	LS120-170	Ø170	120	0.3		Poly visible
23	LS120-200	Ø200	120	0.3		Poly visible
24	LS130-147	Ø147	130	0.3		Poly visible
25	LS135-88	Ø88	135	0.3		Poly visible
26	LS135-155	(59+155)x100	135	0.3		Poly visible
27	LS140-88	(22+88)x72	140	0.5		Poly visible
28	LS140-198	Ø198	140	0.5		Poly visible
29	LS140-165	Ø165	140	0.3		Poly visible
30	LS140-200	Ø200	140	0.3		Poly visible
31	LS150-035	Ø298	150	0.35		Poly visible
32	LS150-035S	84.2x57	150	0.35		Poly visible
33	LS170-198	Ø198	170	0.3		Poly visible
34	LS185-198	Ø198	185	0.3		Poly visible
35	LS185-200	Ø200	185	0.3		Poly visible
36	LM185-155	155x85	185	0.3	85x77.5 , 2 array	Poly visible
37	LS200-205	Ø205	200	0.5		Poly visible
38	LS200-115	115x115 , Ø150	200	0.3		Poly visible
39	LS200-260	Ø260	200	0.5		Poly visible
40	LS210-196	Ø196	210	0.5		Poly visible
41	LS210-252	252x137	210	0.5		Poly visible
42	LS220-196	Ø196	220	0.3		Poly visible
43	LS220-197	Ø197.5	220	0.3		Poly visible
44	LS230-150	Ø150	230	0.5		Poly visible
45	LS230-180	Ø180	230	0.5		Poly visible
46	LS235-205	Ø205	235	0.5		Poly visible
47	LS235-250	Ø250	235	0.5		Poly visible
48	LS235-260	Ø260	235	0.5		Poly visible
49	LS240-180	Ø180	240	0.5		Poly visible
50	LS326-250	Ø250	326	0.5		Poly visible
51	LS406-240	Ø240	406	0.5		Poly visible
52	LS600-310	Ø310	600	0.5		Poly visible
53	LM12-266	Ø266	12		Ø12,288 array	Poly visible

STANDARD PRODUCT LIST

PIR Lens Cab

No.	Model No.	Lens diameter(mm)	Focal Length (mm)	Detectable distance(m)	Detectable angle	Material
1	PD55-14006	Ø13.6	5.5	6	140	Poly FIR200
2	PD60-12008	Ø12.7	6	8	120	Poly FIR200
3	PD105-10010S	23.4x23.4	10.5	10	100	Poly FIR200
4	PF08-10B	Ø12	8	10	30	Poly FIR200
5	PF20-10WS	Ø20	20	10	120	Poly FIR200
6	PF28-10W	Ø20	28	10	60	Poly FIR200
7	PF36-10W	Ø20	36	10	60	Poly FIR200
8	PF20-10W	Ø22.3	20	10	60	Poly FIR200
9	PD15-14006	Ø28	15	6	140	Poly FIR200
10	PD15-36007	Ø49	15	7	360	Poly FIR200
11	PD105-10010	Ø23.4	10.5	10	100	Poly FIR200
12	PF30-12012C	43.2x19.7	30	12	120	Poly FIR200
13	PF30-12012S	46x20	30	12	120	Poly FIR200
14	PF20-06015	Ø35	20	15	60	Poly FIR200
15	PF297-79810	58x45	29.7	10	79.8	Poly FIR200
16	PF30-12012P	59.5x39	30	12	120	Poly FIR200
17	PF30-12012	59.5x39	30	12	120	Poly FIR200
18	PF31-12012	52x60	31	12	120	Poly FIR200
19	PD06-12005	Ø16	6	5	120	Poly FIR200
20	PF03-3025	Ø17	19	16	30	Poly FIR200
21	PD75-12005		7.5	5	120	Poly FIR200
22	PD75-12005A	Ø21.71	7.5	5	120	Poly FIR200
23	PD75-12005B	Ø19.77	7.5	5	120	Poly FIR200
24	PD75-12005C	Ø19	7.5	5	120	Poly FIR200
25	PD06-12002B	Ø13.34	6	2	120	Poly FIR200
26	PD12-12010	24x24	12	10	120	Poly FIR200
27	PF20-10	Ø22	20	10	60	Poly FIR200
28	PD15-36010P	Ø41.5	15	10	360	Poly FIR200
29	PD15-36010	Ø43	15	10	360	Poly FIR200
30	PD05-12005	Ø11.8	5	5	120	Poly FIR200
31	PD09-12008	Ø17.8	9	8	120	Poly FIR200
32	PF28	Ø19.05	28.7	10	60	Poly FIR200
33	PD116-12010	Ø23.3	11.65	10	120	Poly FIR200
34	PF305-9012	60.7x42.4	30.5	12	90	Poly FIR200
35	PF23-11012	56.7x35.7	23	12	110	Poly FIR200
36	PF305-8324	61x42.7	30.5	24	83	Poly FIR200
37	PF22-10010	57x36	22	10	100	Poly FIR200
38	PF20-8907	39x25	20	7	89	Poly FIR200
39	PD30-0000		30			Poly FIR200
40	PD175-36005	Ø45	17.5	5	360	Poly FIR200
41	PD15-36005A	Ø44.5	15	5	360	Poly FIR200
42	PD105-10005	Ø22.7	10.5	5	100	Poly FIR200
43	PD12-11612	Ø23.5	12	12	116	Poly FIR200
44	PD50-12008	Ø100	50	8	120	Poly FIR200
45	PD15-12010	Ø35.7	15	10	120	Poly FIR200
46	PF297-79810R	56.8x44.6	29.7	10	79.8	Poly FIR200
47	PD105-10010F	23.3x23.3	10.5	10	100	Poly FIR200
48	PF25-12012	92.3x40	25	12	120	Poly FIR200
49	PF25-9010	53.5x34	25	10	90	Poly FIR200
50	PD06-12008	Ø14	6	8	120	Poly FIR200
51	PF16-12012	62x25	16	12	120	Poly FIR200
52	PD05-9005	Ø17	5	5	90	Poly FIR200
53	PF23-6020	39x25	23	20	60	Poly FIR200
54	PD11-12010	Ø23	11	10	120	Poly FIR200
55	PD15-36005B	Ø44.5	15	5	360	Poly FIR200
56	PD96-8010	Ø12.5	9.6	10	80	Poly FIR200
57	PF20-3027		20	27	30	Poly FIR200
58	PD23-6020	35x25	23	20	60	Poly FIR200
59	PF21-12015P	76x36	21	15	120	Poly FIR200

STANDARD PRODUCT LIST

PIR Lens Cab

No.	Model No.	Lens diameter(mm)	Focal Length (mm)	Detectable distance(m)	Detectable angle	Material
60	PD25-10007	34.9x20	25	7	100	Poly FIR200
61	PD12-11607	Ø23.9	12	7	116	Poly FIR200
62	PD115-12010	Ø26	11.5	10	120	Poly FIR200
63	PD06-6005	Ø11.5	6	5	60	Poly FIR200
64	PD076-9005	Ø20.7	7.6	5	90	Poly FIR200
65	PD03-12005	Ø9.5	3	5	120	Poly FIR200
66	PD04-6005	Ø10.1	8	3	60	Poly FIR200
67	PD04-7004	18.7x18.7	4	5	70	Poly FIR200
68	PD08-6003B	26x10	8	3	60	Poly FIR200
69	FD08-10005	23x23	8	5	100	Poly FIR200
70	FD08-110AP	30.8x17.9	8	12	110	Poly FIR200
71	PD09-12008_wall mount	Ø17.8	9	8	120	Poly FIR200
72	PD50-12008	Ø100	50	8	120	Poly FIR200
73	PD_1	64.8x59.7				Poly FIR200
74	PD30-36010	Ø76.58	30	10	360	Poly FIR200
75	PD115-12010_HAT	Ø26	11.5	10	120	Poly FIR200
76	PF63-10	Ø10	63	2	26	Poly FIR200

- Sensor

No.	Model No.	Size H x L (mm)	Element size	Field of View(°)	Pins	etc.
1	BS412	Ø9.1	2x1, 2 elements	65	3	
2	RE200GE	Ø9.2	3x1, 2 elements	X: 138; Y: 125	3	
3	SBG446-671	Ø9.2	1.0x1.0, 4elements	132	3	
4	LHI878	Ø9.2	2x1, 2 elements	95	3	

Cheap card Fresnel lens

No.	Model No.	Size H x L (mm)	Magnification	Thickness(mm)	Material	etc.
1	MFL90-70	70x70	2	0.4	Poly PVC	
2	MFL13-95	80x51	2	0.4	Poly PVC	
3	MFL90-70	95x135	2	0.4	Poly PVC	
4	MFL900-80	Ø80	2	0.4	Poly PVC	

NIR,FIR Fresnel lens

No.	Model No.	Size H x L (mm)	Focal Length (mm)	Transmittance rate	Thickness(mm)	Material
1	FIR05-01	Ø8.2	5		0.6	Poly FIR25
2	FIR00-02	Ø10.2	0	41.96%	0.6	Poly FIR25
3	FIR00-03	Ø10.2	0	32.70%	0.6	Poly FIR25
4	FIR05-04	Ø8.2	5		0.6	Poly FIR25
5	FIR00-95	95x95	0		0.5	Poly FIR25
6	NF26-25	Ø25	26		1.5	Poly NIR212
7	NF26-10	Ø10	26		1.5	Poly NIR212

Optical Film

- Solis film

No.	Model No.	Width(mm)	Length(mm)	Thickness(um)	Material	etc.
1	SL5034	1050	1000	195um	PET	
2	SL3402	1050	1000	195um	PET	
3	SL4060	1050	1000	195um	PET	
4	SL4660	1050	1000	195um	PET	

STANDARD PRODUCT LIST

Optical Film

- ITO film

No.	Model No.	Width(mm)	Length(mm)	Square(㎡)	Thickness(um)	Resistance
1	Oike KA500PS1-175	510	90	45.9	175	450
2	Oike KA500PS1-175	510	85	43.35	175	450
3	Oike KA500PS1-175	510	17	8.67	175	450
4	Oike KA500PS1-175	510	85	43.35	175	450
5	Oike KA500PS1-175	510	80	40.8	175	450
6	Oike KA500PS1-175	510	75	38.25	175	450
7	Oike KA500PS1-175	510	85	43.35	175	450
8	Oike KA500PS1-175	510	34	17.34	175	450
9	Oike KA500PS1-188	510	80	40.8	188	450
10	Oike KA500PS1-188	510	35	17.85	188	450
11	Oike KA500PS1-188	510	80	40.8	188	450
12	ITO_AG-240	395	110	43.45	240	ITO coated
13	ITO_AG-240	395	110	43.45	240	ITO coated
14	ITO_AG-240	395	111	43.845	240	ITO coated
15	ITO_AG-240	395	1100	39.5	240	ITO coated
16	ITO_AG-240	395	99	39.105	240	ITO coated
17	ITO_AG-240	395	110	43.45	240	ITO coated
18	ITO_AG-240	395	100	39.5	240	ITO coated
19	ITO_AG-240	395	105	41.475	240	ITO coated
20	ITO_AG-240	395	101	39.895	240	ITO coated
21	ITO_AG-240	395	100	39.5	240	ITO coated
22	ITO_AG-240	395	100	39.5	240	ITO coated
23	ITO_AG-240	395	105	41.475	240	ITO coated
24	ITO_AG-240	395	100	39.5	240	ITO coated
25	ITO_AG-240	395	100	39.5	240	ITO coated
26	ITO_AG-240	395	111	43.845	240	ITO coated
27	ITO_AG-240	395	100	39.5	240	ITO coated
28	ITO_AG-240	395	100	39.5	240	ITO coated
29	ITO_AG-240	395	100	39.5	240	ITO coated
30	ITO_AG-240	395	110	43.45	240	ITO coated
31	ITO_AG-240	395	100	39.5	240	ITO coated
32	ITO_AG-240	395	105	41.475	240	ITO coated
33	ITO_clear-240	395	120	47.4	240	ITO coated
34	ITO_clear-240	395	120.5	47.5975	240	ITO coated
35	ITO_clear-240	395	121.5	47.5975	240	ITO coated
36	ITO_clear-240	395	120	47.4	240	ITO coated
37	ITO_clear-240	395	120	47.4	240	ITO coated
38	ITO_clear-240	395	120	47.4	240	ITO coated
39	ITO_clear-240	395	120	47.4	240	ITO coated
40	ITO_clear-240	395	120	47.4	240	ITO coated
41	JW TUJ-0300-AG	380	110	41.8	188	300
42	JW TUJ-0300-AG	380	110	41.8	188	300
43	JW TUJ-0300-AG	380	98	37.24	188	300
44	JW TUJ-0300-AG	380	97	36.86	188	300
45	JW TUJ-0300-AG	380	112	42.56	188	300
46	JW TUJ-0300-AG	380	98.5	37.43	188	300
47	JW TUJ-0300-AG	380	98	37.24	188	300
48	JW TUJ-0300-AG	380	97	36.86	188	300
49	JW TUJ-0300-AG	380	100	38	188	300
50	JW TUJ-0300-AG	380	111.5	42.37	188	300
51	JW TUJ-0300-AG	380	115	43.7	188	300
52	JW TUJ-0300-AG	380	98.5	37.43	188	300
53	JW TUJ-0300-AG	380	111	42.18	188	300
54	JW TUJ-0300-AG	380	97.5	37.05	188	300
55	JW TUJ-0300-AG	380	97	36.86	188	300
56	JW TUJ-0300-AG	380	97	36.86	188	300
57	JW TUJ-0300-AG	380	100	38	188	300
58	JW TUJ-0400-AC	450	97	43.65	188	400
59	JW TUJ-0400-AC	450	98.5	44.325	188	400
60	JW TUJ-0400-AC	450	35	15.75	188	400
61	188-AGAC NAC-400-10	500	52	26	188	ITO coated
62	188-AGAC NAC-400-10	500	89	44.5	188	ITO coated
63	188-AGAC NAC-400-10	500	85	42.5	188	ITO coated
64	Nitto Denko G400L-TFMP	500	70	35	180	400
65	Nitto Denko G401L-TFMP	500	77	38.5	180	400
66	Nitto Denko G402L-TFMP	500	142	71	180	400

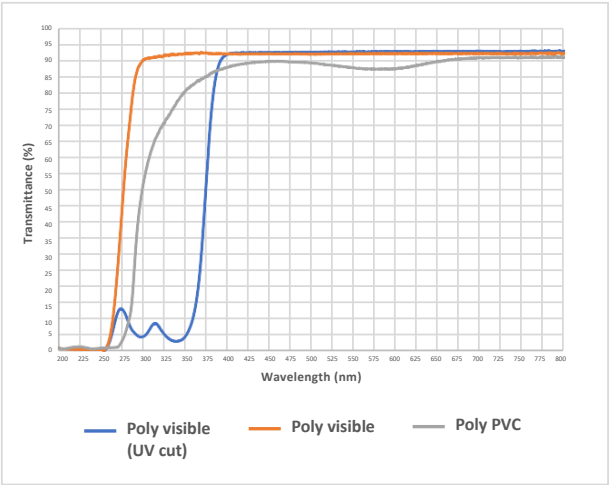
Optical Poly Materials of Fresnelfactory

This document describes the optical characteristics of Polymers of Fresnel Factory, such as the transmittance by wavelength band, tensile strength and etc. To choose a right material and production methods are essential to achieve proper optical property. If you need assistance please feel free to contact, ashton@fresnelfactory.com. Fresnel Factory Inc.
also support design for optics and tooling as your requirements.
The table below summarizes the characteristics of the materials mentioned in this document.
The table does not include PMMA used for casting, PET flim+UV resin used for roll-to-roll, and PMMA film used for hot-embossing.
Also Fresnel Factory has all the general optical materials in addition to the materials mentioned above.

Material Name	Main Wavelength	Main Wavelength Transmittance	Tensile Strength	*Impact Strength	*Hardness (Rockwell Scale)	*HDT (0.46Mpa)	Properties
Poly visible (UV cut)	Visible	92.65%	66Mpa	16J/m	90(M Scale)	82℃	UV cut
Poly visible		92.06%	-	-	-	-	UV transmission
Poly PVC		89.16%	-	-	-	-	Thin, Flexible
Poly NIR212	Near Infrared	91.46%	62Mpa	694J/m	70(M Scale)	137℃	High strength High HDT
Poly FIR 200	Far Infrared (8~13um)	42.81%	24.5Mpa	30.15J/m	-	73℃	High Transmittance
Poly FIR 25		19.24%	26Mpa	70J/m	75 (R Scale)	93℃	High HDT

Optical Poly Materials of Fresnelfactory

Material for visible(400~750nm) light



Fresnel Factory has 3 different material for visible light.
Two PMMA based material, which is Poly visible(UV cut) and Poly visible, and one PVC based, which is Poly PVC. Poly visible(UV cut) is also used for Near Infrared depend on purpose.

Reference

*HDT(Heat Deflection Temperature) : It exhibits heat resistance at a specific temperature when the sample has displacement of 2.5mm under a specific load.
*Hardness : Abrasion resistance
*Izod Impact strength : Impact resistance

Poly visible(UV cut) and Poly visible

(F=2mm to F=2,000mm circle Fresnel lense)

-Transmittance (%)

Material name	Poly visible(UV cut)	Poly visible
UVB(280~315nm)	6.3%	84.05%
UVA(315~400nm)	31.04%	92.65%
Visible(400~750nm)	92.65%	92.06%

FresnelFactory has Poly visible (UV cut) and Poly visible. Poly visible series is mainly produced by using hot-press(precise heat compression mold) using a pre-formed sheet with a thickness from 1mm to 5mm. This materials are using for Circle Fresnel, cylindrical Fresnel, LED lights, CPV and Large, some of MLA and Lenticular, and wide angle mirror.

- Properties

Max Tensile strength	Impact strengh	Hardness	HDT(0.45Map)	Melt Flow rate(230/3.8kg)
66Mpa	16J/m	Rockwell M sale 90	82℃	14g/10min

PMMA has the best visible light transmittance and weather resistance among resins. It has excellent hardness, abrasion resistance and heat resistance. Specific gravity is more than half lighter than glass and strength is similar to inorganic glass. In fact, PMMA has excellent strength and weather resistance, so it is used for aquariums that need to withstand high water pressure and taillights for automobiles exposed to weathering.

Since the melt flow rate is not good at 14g/10min (based on 230/3.8kg), high-pressure injection is required and the sprue runner and gate must be enlarged.
Therefore, Fresnel Factory is producing PMMA lenses by hot pressing most likely. Fresnel Factory provides custom-sized PMMA lenses by precision laser cutting.

Optical Poly Materials of Fresnelfactory

◆ Poly PVC

| Credit card magnifier |

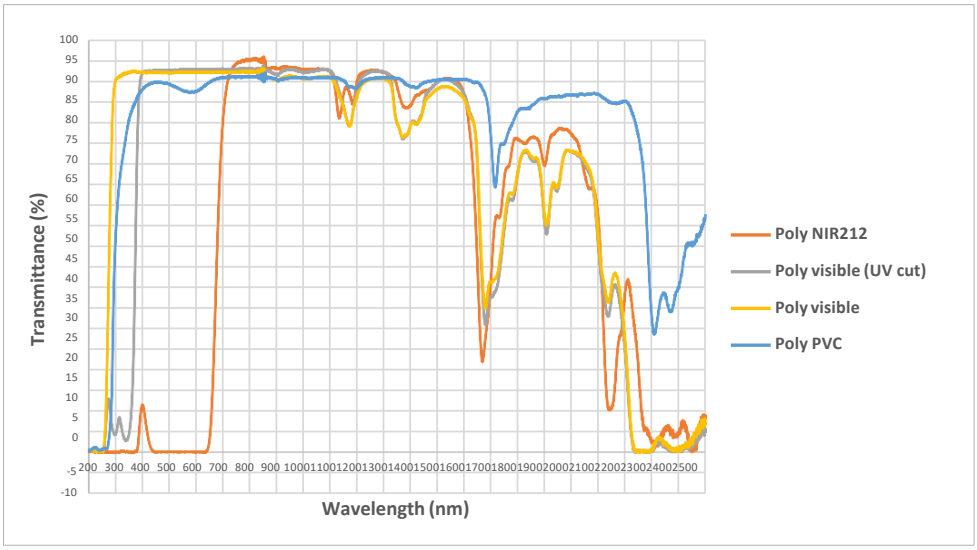
From the nature of PVC, it has excellent processability and can be produced with a thickness thinner than PMMA, normally Poly PVC is 0.4mm. Stiffness can be adjusted according to the amount of plasticizer. Poly PVC is low material cost and good productivity. It is mainly used for mass production of inexpensive consumable lenses, such as credit card magnifiers, which have low optical point quality. Sharpness of each prism is also low compared to PMMA.

- Transmittance (%)

Material name	UVB(280~315nm)	UVA(315~400nm)	Visible(400~750nm)
Poly PVC	40.23%	80.06%	89.16%

The visible wavelength transmittance of Poly PVC is 89.16% at 0.4mm thickness.

◈ Material for NIR(Near Infrared) wavelength



(Graph2 Transmittance of NIR(near infrared) material)

Optical Poly Materials of Fresnelfactory

◆ Poly NIR212

(Fresnel Factory NIR lenses)

-Transmittance (%)

Material name	Poly NIR212
UV and Visible(280~750nm)	6.96%
NIR(750~1,400nm)	91.46%

Poly NIR212 shows very excellent transmittance in the NIR (750~1400nm) and blocks most of the UV and visible Wavelength. It blocks 93.07% of UV and visible wavelength and shows an average transmittance of 91.46% in the main wavelength of Near Infrared.
Poly NIR212 not only has high transmittance of NIR, but also acts as a band pass filter of visible wavelength to prevent malfunction of the photo diode. Poly NIR212 is produced and supplied by custom-made, and mainly produced by injection method.

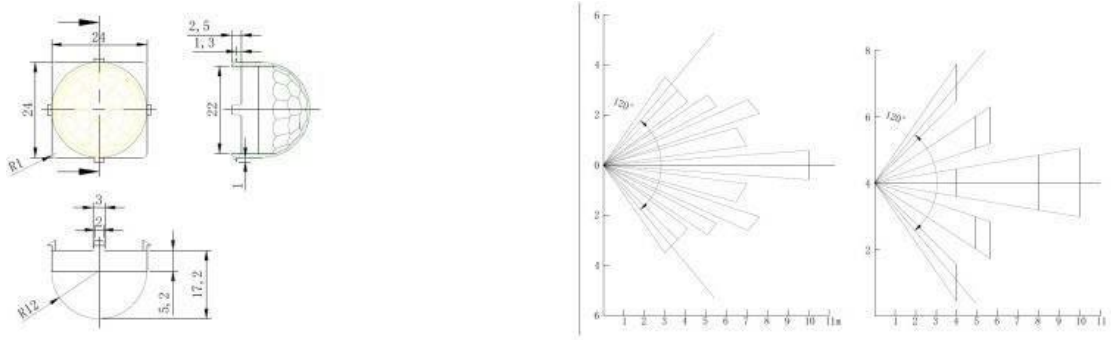
- Properties

Max tensile strength	*Impact strength	*Hardness	*HDT(0.45Map)	Melt Flow rate(230/3.8kg)
62Mpa	694J/m	Rockwell M sale 70	137℃	20g/10min

Poly NIR212 has excellent tensile strength, impact strength, hardness and HDT. Fresnel Factory uses Poly NIR212 for NIR sensing devices exposed to high temperatures and vibrations in the vehicle during summer.

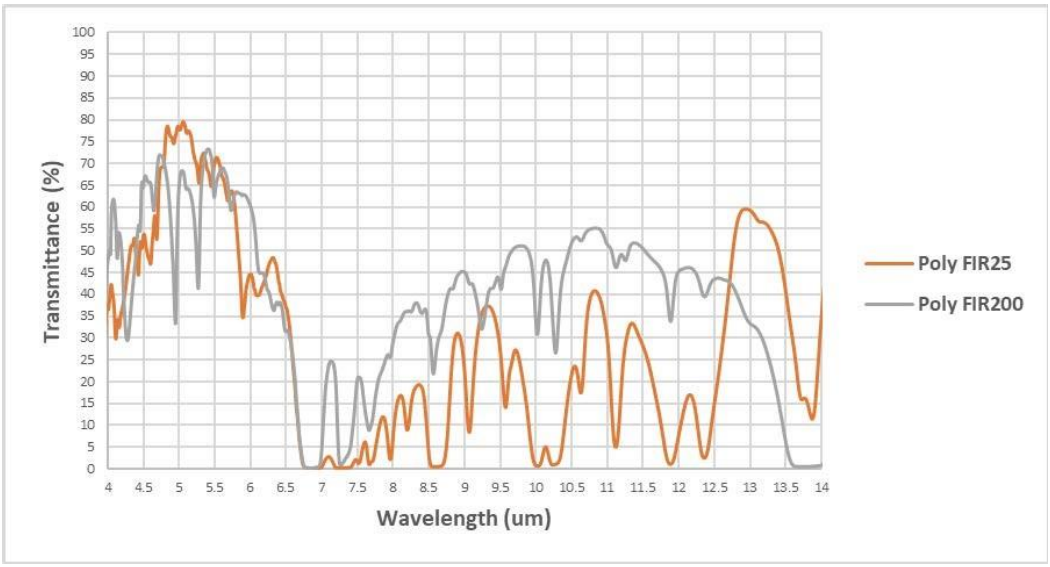
Material for PIR/FIR(8~13um) wavelength

The thermopile and passive infrared sensor that is using for motion sensor detects the wavelength of 8~13um.
Without Fresnel lens, the sensor only can detect less than 1m distance and narrower space with lens. To work with Pyroelectronic detector and thermopile, Fresnel lens that collects infrared rays as a sensor is required. Fresnel Factory manufactures Fresnel lenses for passive infrared and absolute temperature sensors.



<Dimension and FOV(Dome Type Fresnel Lens FOV)>

Optical Poly Materials of Fresnelfactory



(Graph3 Transmittance of PIR, FIR(Far infrared) material)

Material is important to have a wide FOV and excellent Far Infrared transmittance. Therefore, Fresnel Factory is using Poly FIR200 and Poly FIR25, which have a wide FOV and excellent FIR transmittance.

◆ Poly FIR 200

(Fresnel Factory's PIR lens)

-Transmittance (%)

Material name	Poly FIR200
8~12um	42.81% at 0.65T

PIR(Passive Infrared) sensor detects infrared rays in the 8~12um wavelength emitted from body temperature. Fresnel Factory's Poly FIR200 has an excellent transmittance of 42.81% on average from 8~12um wavelength when 0.65T.

Optical Poly Materials of Fresnelfactory

- Properties

Max tensile strength	Impact strength	HDT(0.45Map)	Melt Flow Rate
24.5Mpa	30.15J/m	73℃	20g/min

The price is low since the productivity is high because the melt flow rate is excellent and the time required for injection is short. Despite having the above properties, it is not suitable for use in environments exposed to high temperatures, impacts, and scratches due to its low hardness, impact strength, and HDT compared to Poly FIR25.

◆ Poly FIR 25

(Fresnel Factory's temperature sensor)

-Transmittance (%)

Material name	Poly FIR25
8~12um	19.24% at 0.50T

The FIR (Far-Infrared) sensor detects temperature by measuring infrared emitted from an object and is used in thermal imaging cameras. The transmittance of Poly FIR25 in the 8~13um wavelength is 19.24% on average, which is lower than that of Poly FIR200. However, Poly FIR25 has better Hardness and high resistance of temperature.

- Properties

Max tensile strength	*Impact strength	*Hardness	*HDT(0.45Map)	Meltflow Rate
26Mpa	70J/m	Rockwell M scale 70	130℃	2.5g/min

Poly FIR25 has higher tensile strength, impact strength, and HDT than Poly FIR200. Due to the above properties, Poly FIR25 is used for temperature sensing sensors exposed to high temperatures despite low transmittance.

Reference

*HDT(Heat Deflection Temperature) : It exhibits heat resistance at a specific temperature when the sample has displacement of 2.5mm under a specific load.

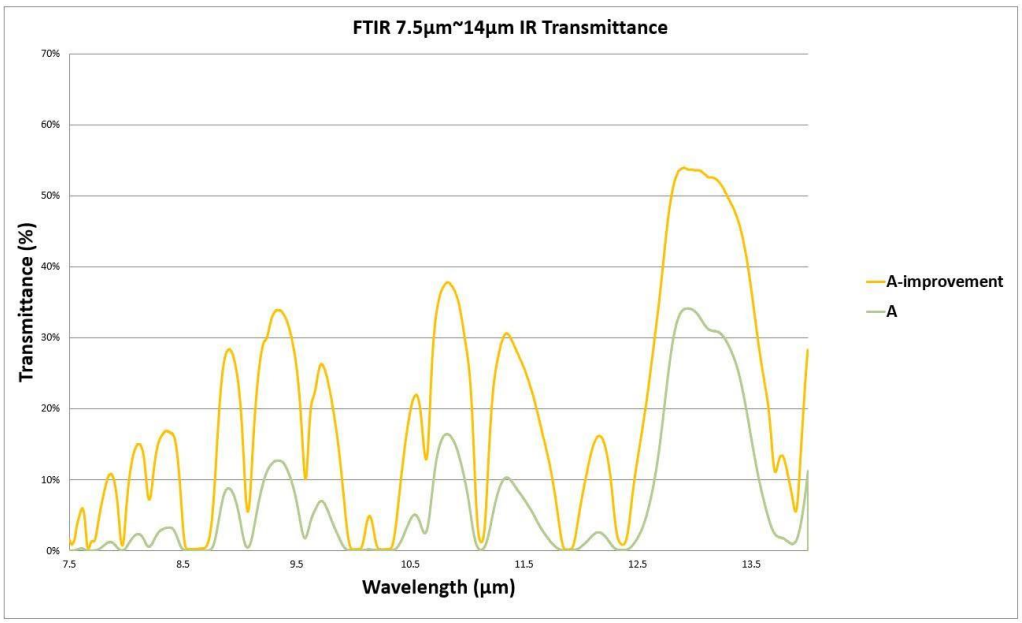
*Hardness : Abrasion resistance

*Izod Impact strength : Impact resistance

Optical Poly Materials of Fresnelfactory

Transmittance enhance process of Fresnelfactory

Fresnel Factory Inc. has excellence skill in mold design, tooling and production for optics. With this skills, we are manufacturing lenses to higher quality. Therefore, even with the same poly material, Fresnel Factory produces better transmittance. The graph below is an example of an achievement for improving transmittance.



<(Poly FIR25) Comparison graph before and after the transmittance improvement process>

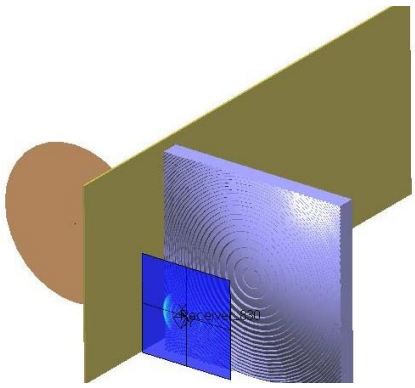
Poly FIR25 was originally a material having a low transmittance of about 10%, but the transmittance increased by more than 10% through a process of improving the transmittance of Fresnel Factory. Fresnel Factory is a professional optical company that undergoes an injection process that align with optical properties of each material.

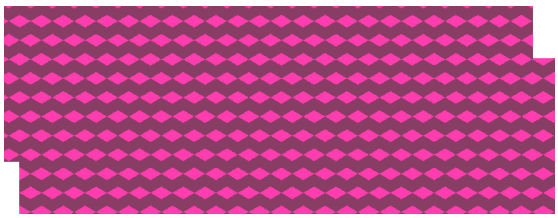
Application

Design of Security Optical System with Fresnel lens and Reflectors

Recently, more and more people are asking about security optics. Usually, security optics use invisible infrared rays. It is constructed by transmitting infrared light to receive light coming back from an object. There was also an inquiry about the development of a security optics system in FresnelFactory, So we proceeded with the design of an infrared optical system using Fresnel lenses and reflectors.
The following is about the design of an infrared optical system for security conducted by FresnelFactory. FresnelFactory has modeled NIR lasers, reflectors, and receiver Fresnel lenses through its optical design program.

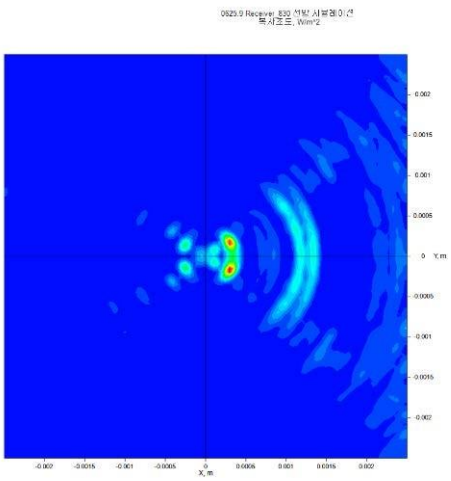
◆ Optical system and Reflector



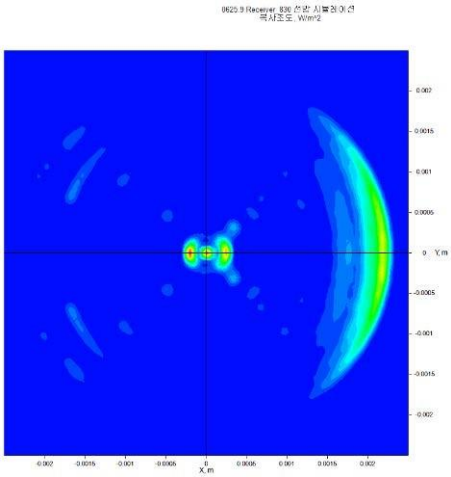


The security optical system must have as much light as possible on the receptor sensor to increase detection sensitivity. Therefore, we designed it in the form of a reflector, reflecting it with a reflector, and collecting as much light as possible with a Fresnel lens.
The picture below shows a comparison of the distribution of light that reaches the sensor before(left) optimizing and the distribution of light that reaches the sensor after(right) optimizing.

◆ Fresnel lens pre-optimization



◆ Fresnel lens after optimization



If you look at the results of the optical simulation, the results of fresnel lens pre-optimization(left) show a lot of light spread out of the sensor. After optimization, light was collected into the sensor, and the total amount of light that reached the sensor was about twice the increase.

Application

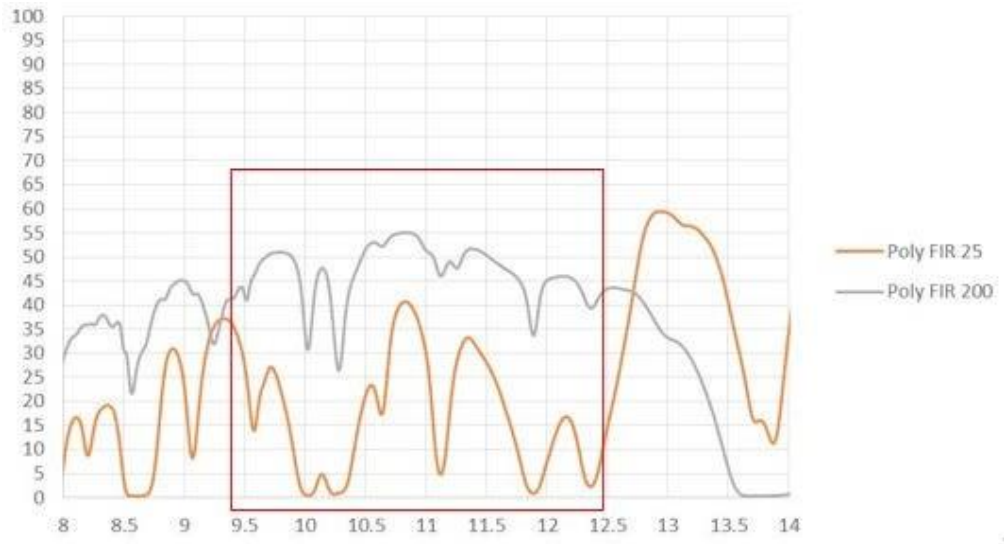
Development and Supply of Covers and Lens for Infrared Bolometer Arrays (Grid-EYE) Sensor

Recently, more and more questions have been raised about the cover and lens for Infrared bolometer arrays (Gird-EYE) sensors that detect human body movements.

In general, lenses that act as covers or covers should be used to prevent Infrared bolometer arrays (Grid-EYE) sensors from extruding due to the risk of breakage.

However, the existing material has a low transmittance, so its usability is very poor.

Therefore, Fresnel Factory Korea has developed lenses for Infrared bolometer array (Grid-EYE) sensors.
The development lens increases sensor detection distance and sensitivity, and not only has a higher transmittance rate compared to the commonly used material made of Fresnel Factory Korea's development material, but also serves as a sensor protection cover.



< Existing Materials vs Fresnel Factory Development Materials, Transfusion Rate Data Comparison >

- Lens for Grid-EYE Sensor

Along with increased transmittance, multiple types of lenses can be developed and applied immediately to the desired environment.

Fresnel Factory Korea is a professional optical company that develops and supplies lenses in the desired area accurately and quickly based on material data.

Market of Far Infrared Lenses

What are Far Infrared lenses

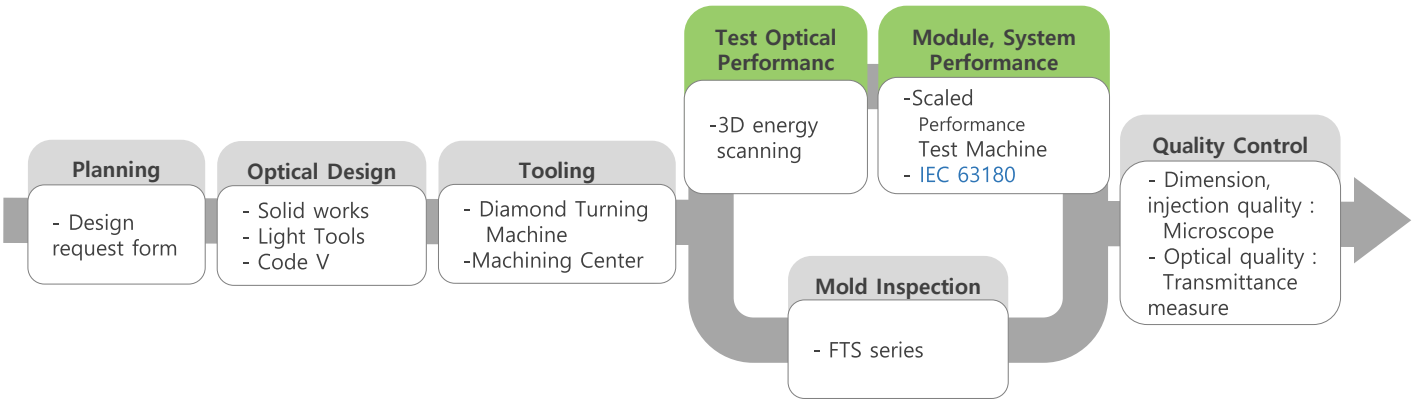
- Far Infrared for sensors is typically from 8um to 13um.
- The sensors are PIR, Thermopile, Thermopile array, Thermal imager, and TMOS.
- The performance of all the FIR sensors is hugely dependent on lenses in terms of detection distance, Field of View, and detection direction.
- The lens material is very limited, because of the characteristics of the wavelength. The lens material also affect the performance of sensor device. Fresnel Factory Inc. is the one of companies that has own FIR material.

Market size and Players

- FIR lens market size is relatively small than other optical lens ones.
- Only three companies in the world use over 10 million lenses for a single product. Fresnel Factory Inc. has and had among them.
- There are only a few players in the world that specialize in FIR lenses from design to mass production.
- Entering barrier to this market is high, because of the required know-how about sensors, optical design, tooling mold, material, and plastic mass production.
- Fresnel Factory Inc. is a company that not only has the skills above but also application planning.

OPTICAL DESIGN with simulation

Development process of Fresnel Factory



Design request from customer

Project	-Name of product or project		Customer	Company	
				Name	
				E-mail	
				Telephone	
No.			data	Note / Mesurement	
1	FIELD OF VIEW	TOP VIEW		Degree	
		SIDE VIEW		Degree	
2	Detection distance	TOP VIEW		meter or ft.	
		SIDE VIEW		meter or ft.	
3	WorkingconditionWorkingcondition	Indoo	☐		
		Outdoor	☐		
		Tempurature			
4	Usage	Lighting	☐		
		Smarthome	☐		
		Security	☐		
		PET IMMUNE	☐		
5	Sensor type	DUAL elements	☐		
		QUAD elements	☐		
6	Installed height			meter or ft.	
7	Tilting angle			Degree	
8	Lens Color	White	☐		
		Balck	☐		
		Other			
Do you have a drawing of lens?			☐		
9	Shape of lens	Dome	☐		
		Sheet	☐		
10	Overall size			mm or inch	
11	Distance between sensor and lens			mm or inch	

Key specifications

- PIR Sensor Specification
- Detection distance
- Detection Angle (Vertical/Horizontal), or Detection Area
- Material
- Desired Shape of Fresnel lens with fixture (preferred 3D CAD files such as STEP, IGES, SAT)
- Installation Height/ Tilt Range

Optional specifications

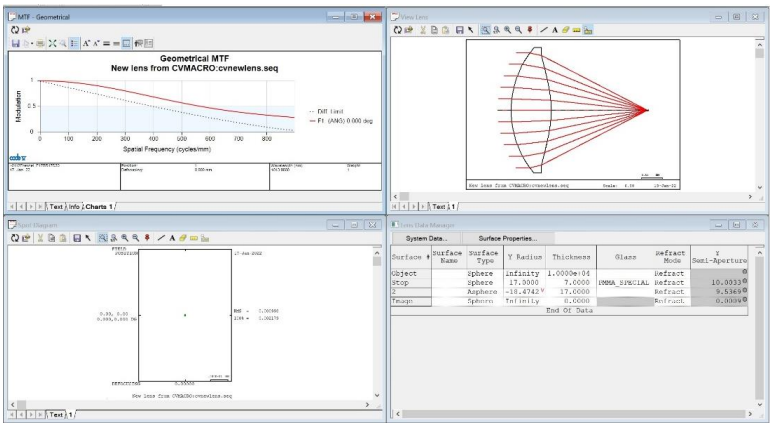
- Wavelength Range
- Number of Detection Zones
- Fresnel lens Thickness
- Fresnel lens Tip radius
- Fresnel lens Groove Depth
- Fresnel lens Groove Width
- Fresnel lens Draft Angle

Design request form for PIR Fresnel lens

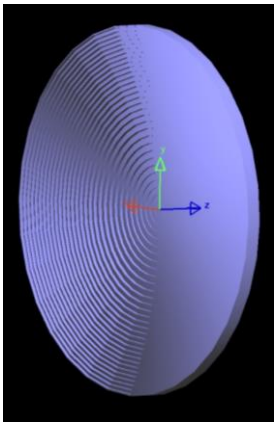
Project	-Name of product or project		Customer	Company	
				Name	
				E-mail	
				Telephone	
No.			data	Note / Mesurement	
1	FIELD OF VIEW	TOP VIEW		Degree	
		SIDE VIEW		Degree	
2	Detection distance	TOP VIEW		meter or ft.	
		SIDE VIEW		meter or ft.	
3	WorkingconditionWorngcondition	Indoo	☐		
		Outdoor	☐		
		Tempurature			
4	Usage	Lighting	☐		
		Smarthome	☐		
		Security	☐		
		PET IMMUNE	☐		
5	Sensor type	DUAL elements	☐		
		QUAD elements	☐		
6	Installed height			meter or ft.	
7	Tilting angle			Degree	
8	Lens Color	White	☐		
		Balck	☐		
		Other			
Do you have a drawing of lens?			☐		
9	Shape of lens	Dome	☐		
		Sheet	☐		
10	Overall size			mm or inch	
11	Distance between sensor and lens			mm or inch	

OPTICAL DESIGN with simulation

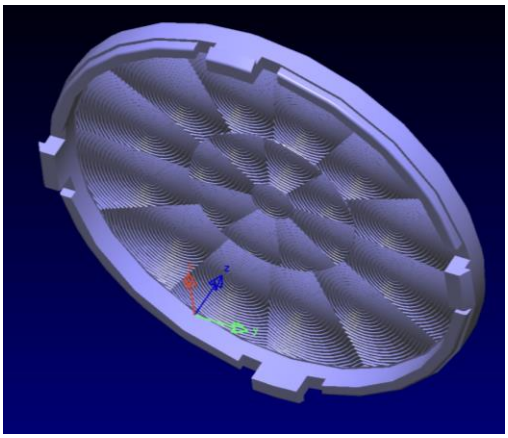
Optical Optimization and conversion



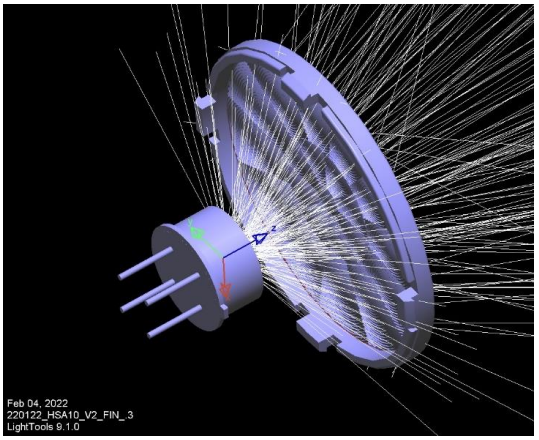
Aspheric lens optimization



Conversion to Fresnel lens.

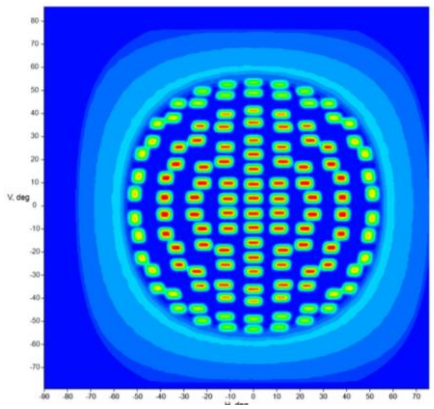


MERGE Array of Fresnel lenses and Fixture

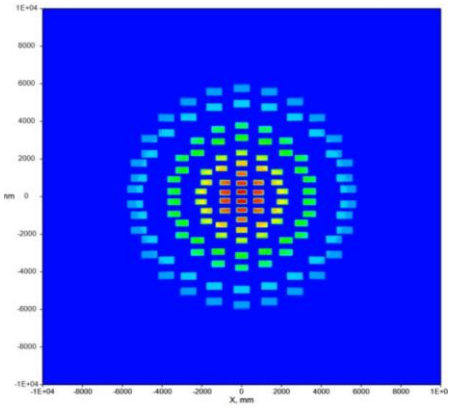


Optical Design finalizing
Ray tracing simulation

Optical Design Simulation Analysis



Fresnel lens Angular distribution

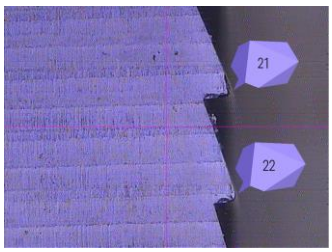


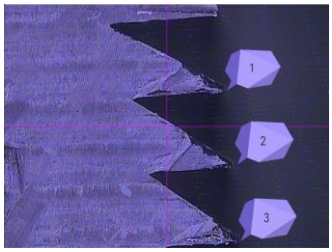
Detection zones simulation on the Floor

MOLD INSPECTION

Mold Inspection Microscope

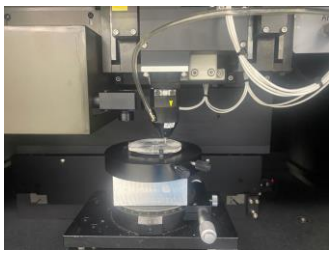
Mold shape measurement using microscope

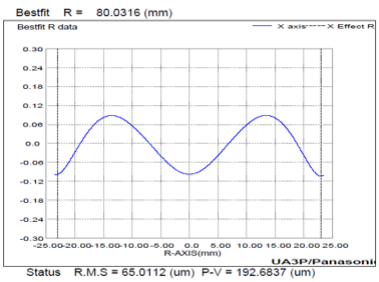




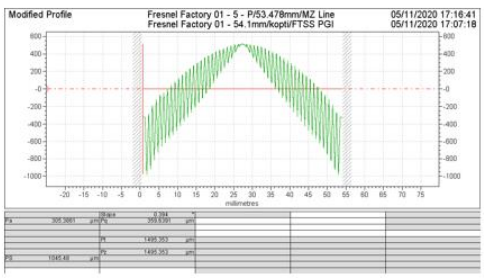
Mold shape measurement raw data

Mold Inspection Talysurf





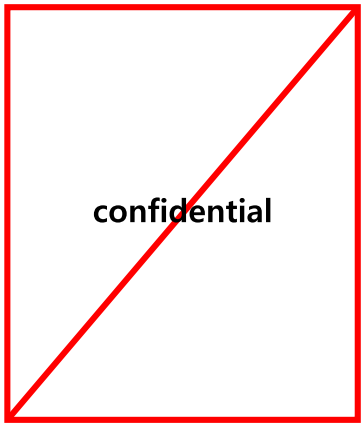
Spheric, Aspheric
(Panasonic, UA3P)



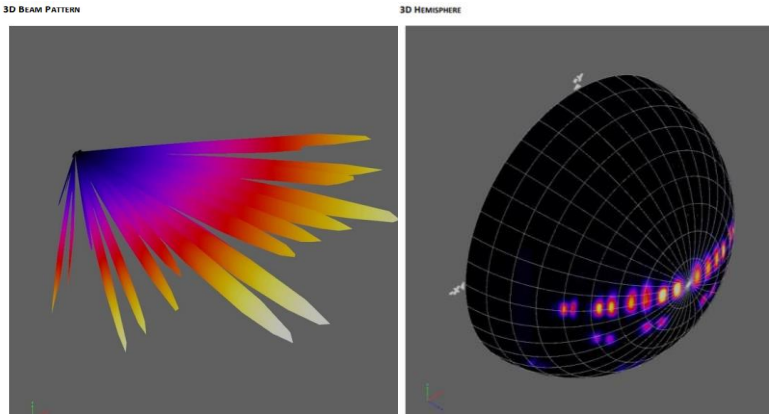
Fresnel pattern
(Taylor Hobson, FTS series 2)

Optical Performance Test with produced sample

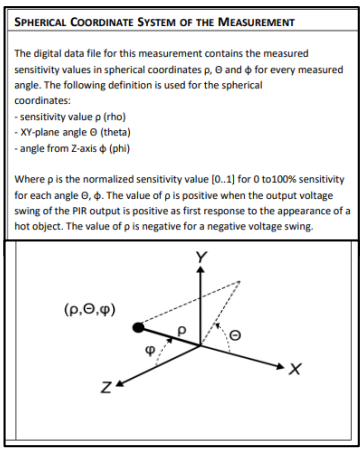
3D scanning to confirm optical design - Testing optical property of each Fresnel zone

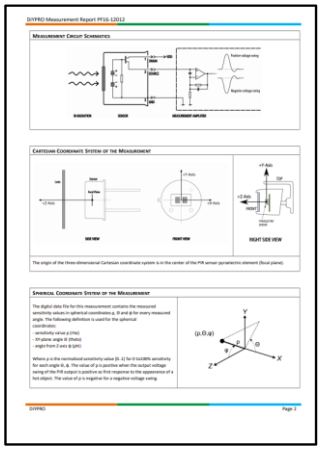


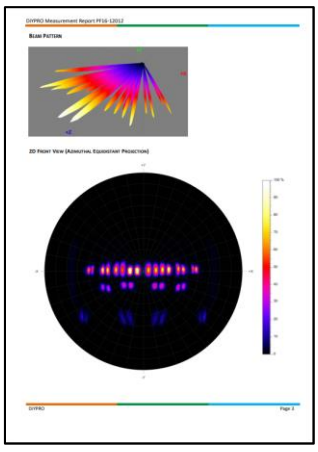
Test with real sample

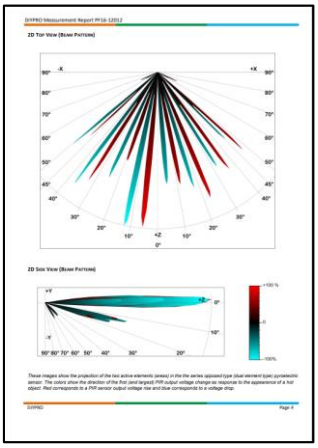


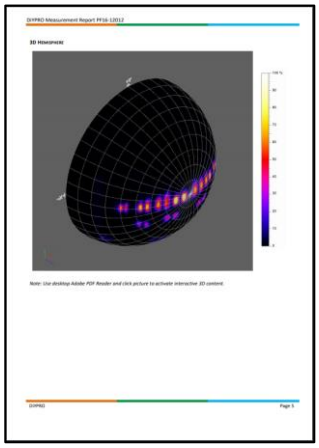
Measurement result

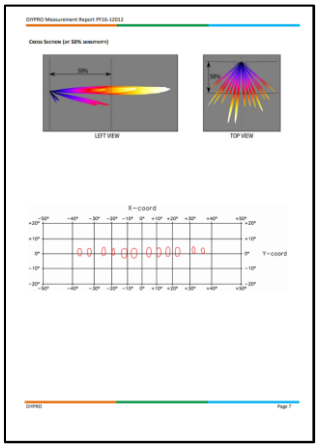












How to test

SPT machine (Scaled Performance Test Machine)

Methods of measurement and declaration of the detection range of detectors – Passive infrared detectors for major and minor motion detection

All tests to be conducted according to IEC 63180

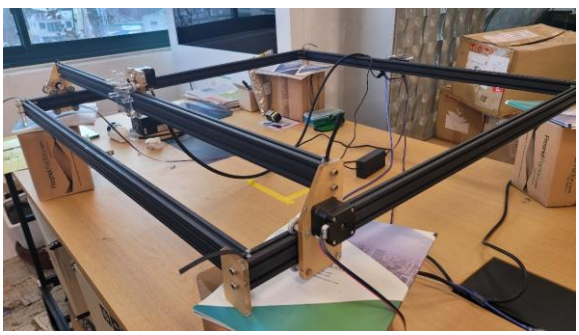
Fresnel Factory Automated Test facility

- Fresnel Factory's 5-axis CNC automated test systems perform motion detector measurement in a full 360°circle for only one measurement cycle.
- Maximum diameter of Detection area is 45 meter (147 ft) (Scale ratio is 1:5)
- Maximum sensor mounting height is 8.5 m or 30 ft. (Scale ratio is 1:5)
- Maximum Speed of Dummy Body is 25km/h (15.5 mph) (Scale ratio is 1:5)
- Scaled test dummy of human body (1:5 Scale ratio) according to IEC 63180 standard

Hardware Specification

Measurable Distance	22.5meter,74ft (for wall mounted), 45meter, 147 ft (for ceiling)
Measurable Field of View	360º
Installation Height	8.5meter, 28ft (Maximum)
Movement Speed	25km/h, 15.5 mph (Maximum)
Angular Resolution	0.1º (Minimum)
Linear Resolution	0.1mm, 0.0039inch
Position accuracy	0.1mm, 0.0039inch
Temp Resolution	0.1℃ (Minimum)
CNC control	5 Axis

Earlier version of SPT machine



SPT machine (Scaled Performance Test Machine)

Specification

- Fresnel Factory's 5-axis CNC automated test systems perform motion detector measurement in a full 360°circle for only one measurement cycle.
- Maximum diameter of Detection area is 45.0 meters, and maximum sensor mounting height is 8.5 meters. (Scale ratio is 1:5)
- Scaled test dummy of human body (1:5 ratio) according to IEC 63180 standard
- Numerical control of temperature (dummy leg, body, head).
- Automated test system can measure tangential, radial, small tangential movement in fully automatic mode according to all requirements of IEC 63180 standard.
- Proven repeatability.
- Customization of measurement condition.

All tests to be conducted according to IEC 63180.

- For Tangential motion, grid cells may be 1m square as defined in the standard.
- For Radial motion, 10° steps shall be used as defined in the standard. Target should start as far away from the detector as test setup allows.
- For Detection boundary, rotation angle -5° to +5° shall be used as defined in the standard. Distance steps of 1m may be used.

Methods of measurement and declaration of the detection range of detectors – Passive infrared detectors for major and minor motion detection

- Published June 2020 by INTERNATIONAL ELECTROTECHNICAL COMMISSION (IEC)
- For the Automated Test for testing different mounting heights of DUT(Device Under Test), the scaled test dummy shall be used.
- Scaled 1:5 test dummy are acceptable with controlled temperature of Dummy head is 14°K above ambient temperature; and body and legs of dummy must be 7 °K above ambient temperature of the test room.
- Major motion detection tests: Tangential motion within the detection area, and Radial motion within detection area. (Detection area is 1mX1m, or 0.2mX0.2m for scaled 1:5 automated test)
- Detection boundary test: Tangential dummy movement 10° from detector.
- Minor motion detection test: "occupancy" or "presence" detection.

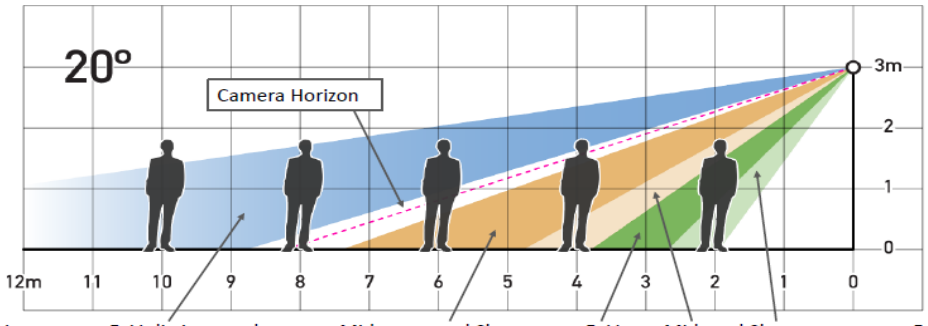
IEC 63180 standard published by
INTERNATIONAL ELECTROTECHNICAL COMMISSION (IEC)

SPT machine (Scaled Performance Test Machine)

Performance test for optical sensor

PIR Motion-Detection Vertical Fields of View (Outdoor Mount, 20° Tilt)

Center Plane (containing camera-facing direction)



Long-range FoVs lie in one plane (just above the camera horizon).

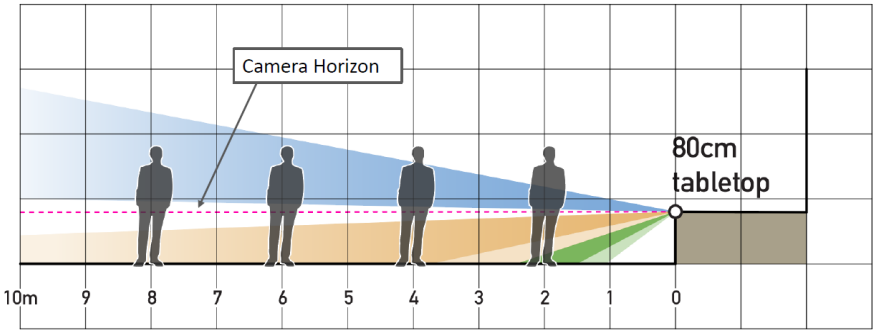
Mid-range and Short-range FoVs lie mostly in lower-facing planes below the camera horizon, except for the outer FoVs, which are cast somewhat lower.

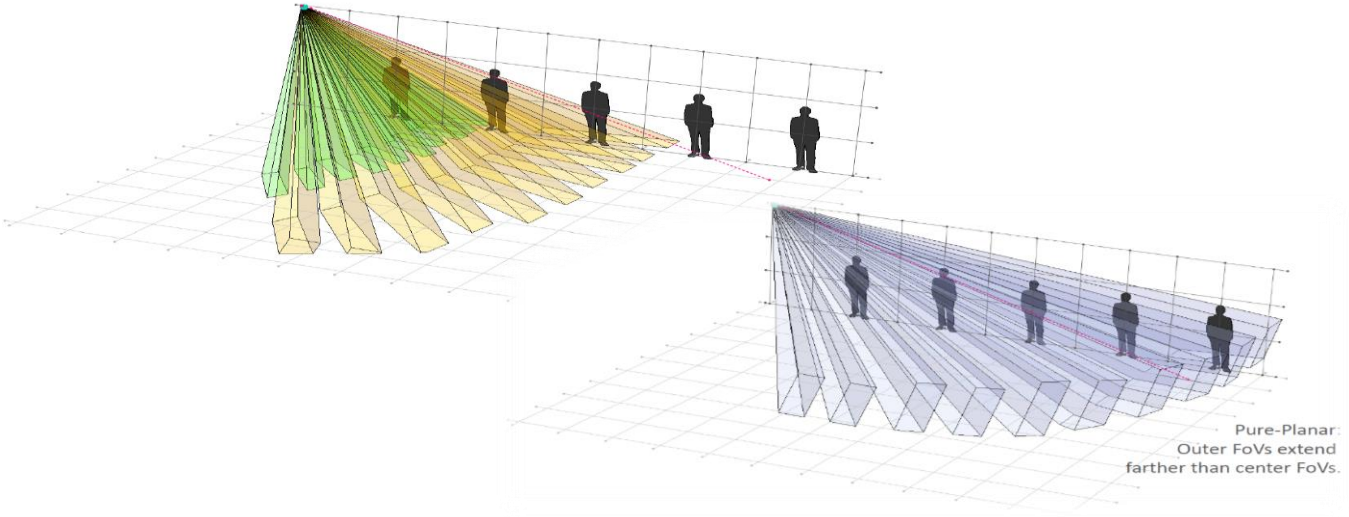
Mid- and Short-range outer FoVs that are somewhat below planar

PIR Motion-Detection Vertical Fields of View (Table-Mount)

Center Plane (containing camera-facing direction)

Planar Long-Range FoV Pattern Must be Employed, to Keep Blue FoV above the Horizon.





SPT machine (Scaled Performance Test Machine)

Test report format

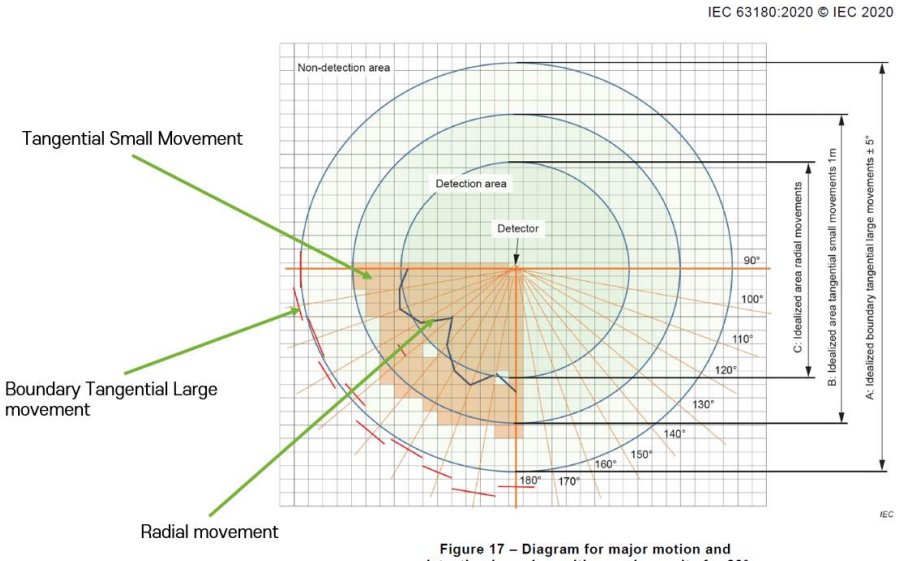
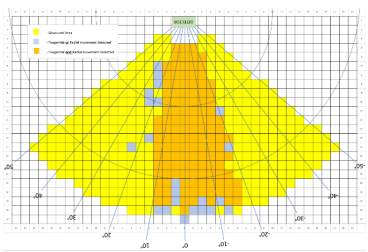
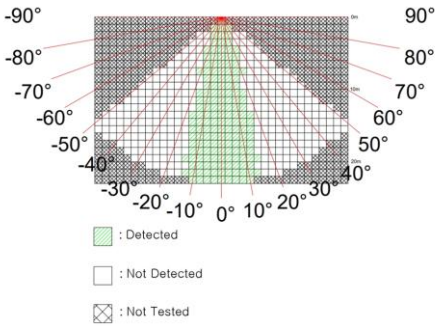


Figure 17 – Diagram for major motion and detection boundary with sample results for 90°

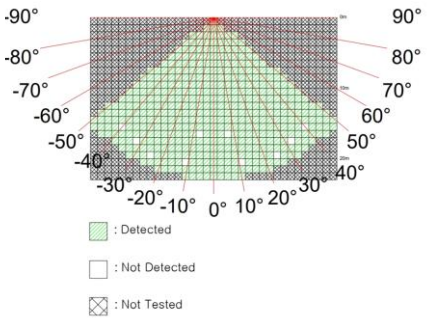
Proven 98.5% Repeatability



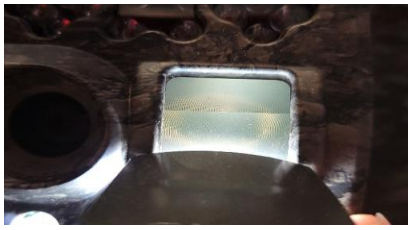
LENS A. Test date 2021-12-27
Ambient Temp = 16° C
Angular FOV = 25°

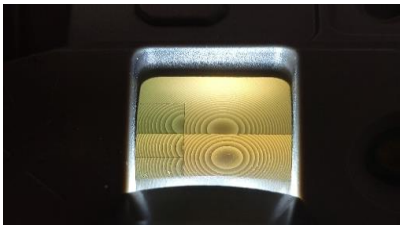


LENS A. Test date 2021-09-17
Ambient Temp 25° C
Angular FOV = 25°



LENS B. Test date 2021-09-17
Ambient Temp 25° C
Angular FOV = 100°

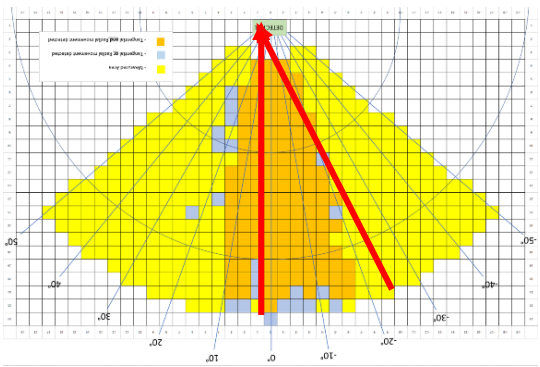


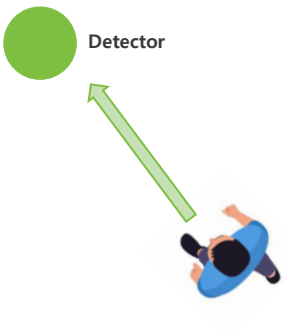


SPT machine (Scaled Performance Test Machine)

Radial Test Movement

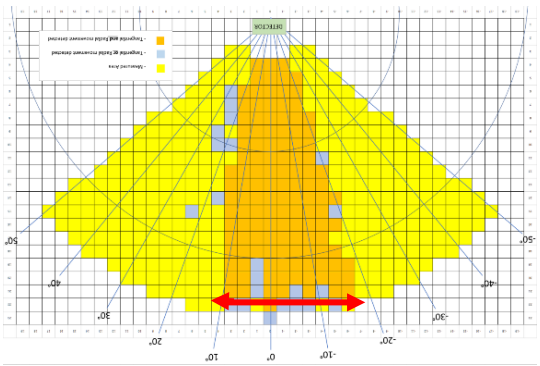
For Radial motion, 10° steps shall be used as defined in the standard. Target should start as far away from the detector as test setup allows.

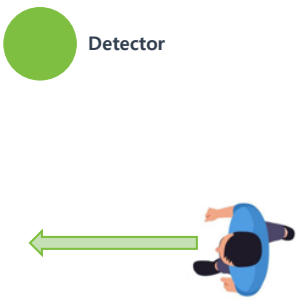




Boundary Test Movement

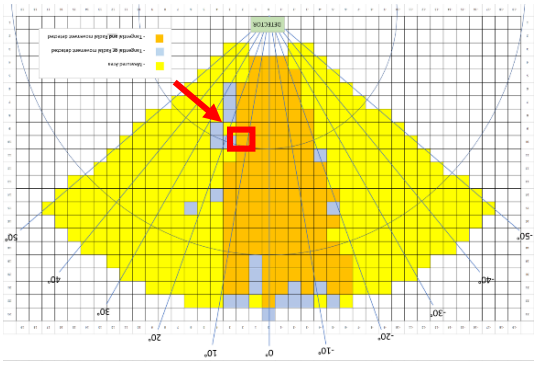
For Detection boundary, rotation angle -5° to +5° shall be used as defined in the standard.
Distance steps of 1m may be used.

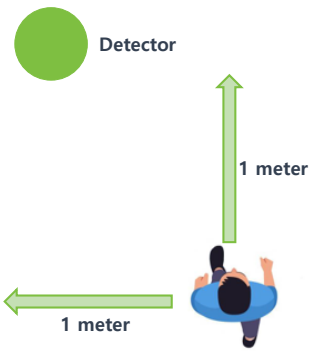




Tangential Small Movement

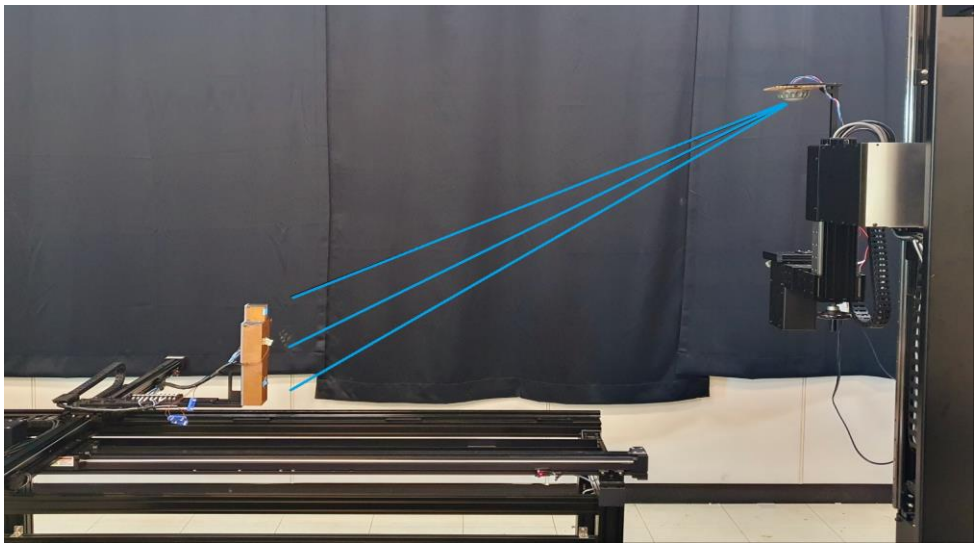
For Tangential motion, grid cells may be 1m square as defined in the standard.

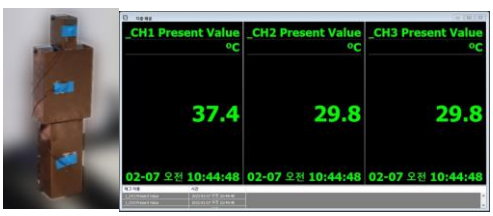




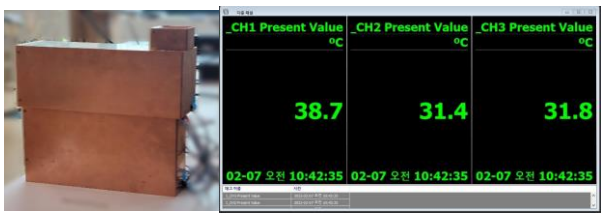
SPT machine (Scaled Performance Test Machine)

Numerical control of temperature (dummy leg, body, head)





Human dummy



Deer dummy

SPT Machine evaluates the suitability of..

Door Bell

Action Cam

Smart Street Lighting

SPT machine (Scaled Performance Test Machine)

Q&A

- **Test target size**
  In your previous email you mention 1:5 scale testing dummy (35cm tall per IEC 63180 Figure 7).
  Is this the only testing dummy available? Is a 1:1 testing dummy (175cm tall per IEC 63180 Figure 5) also available?

  ➔ No, we only have 1:5 scale dummy

- **Facility Shape**
  From this presentation, I understand the testing area is circular with DUT at the center, and no other DUT mounting location is possible. Is this accurate?

  ➔ No, our facility can mount DUT for wall-mounted, table-placed and floor-placed. DUT can installed and test as described in there installation manual.

- **DUT Mounting Height**
  From this presentation, you mention up to 8.5m mounting height. Is this 8.5m "real" mounting height, or is it 8.5m simulated mounting height per IEC 63180 Table 10?
  According to this Table, H/5 scaling factor can be used when using 1:5 scale testing dummy.
  Can your facility accommodate DUT mounted 8m above the ground, or is the mounting 1.6m above the ground based on H/5 scaling factor?

  ➔ As you well understand about IEC63180, all the scales are 1:5. DUT installed 1.6meter instead of 8m

- **Facility Diameter**
  Similar to above, is the 22.5m radius (45m diameter) "real" distance, or is this simulated distance based on use of 1:5 scale testing dummy?

  ➔ Same as above. 1:5 scale testing

- **Testing Dummy Movement Speed**
  Similar to above, is the 25 km/h target speed "real" linear speed, or is this simulated speed based on use of 1:5 scale testing dummy?

  ➔ Scaled speed. You can find scaled speed in IEC63180

- **Speeds for IEC 63180 Motion Profiles**
  Are various speeds possible for the IEC 63180 motion profiles? For example, is it possible to conduct test 7.3.2.2 Radial motion within the detection area at with target moving toward the detector at 1.0 m/s, and then repeat the test again with the target moving at 5.5 m/s? Results for both speeds will be recorded separately. This speed adjustment is most critical for "Radial Motion" test.

  ➔ Yes, our facility can test different speed and results are recorded separately.

IR lens production

CURRENT (2022)

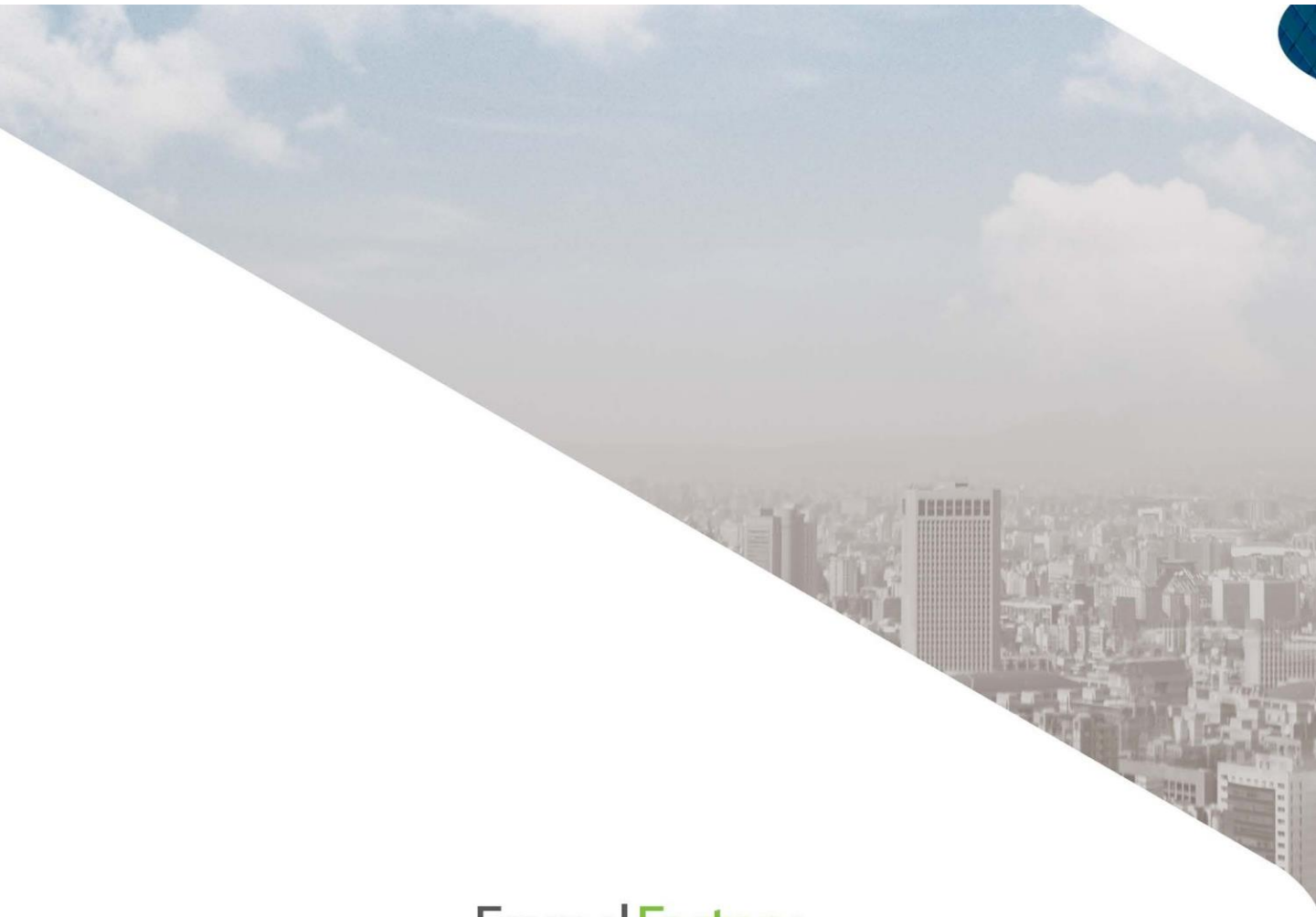
Production Capacity		Fully automated post-processing
OWNED	CONTRACTED MANUFACTURING	OWNED
1.2 million per month	1.5 million per month	1.2 million per month (6axis robot arm etc.)
2.7 million per month		

After Mid of 2023

Production Capacity		Fully automated post-processing
OWNED	CONTRACTED MANUFACTURING	OWNED
2.8 million per month	1.3 million per month	2.5 million per month (6axis robot arm etc.)
4.1 million per month		

Injection machine

Fully automated post-processing



Fresnel Factory

+82 70-7605-0693
+82 70-7605-0020
ashton@fresnelfactory.com