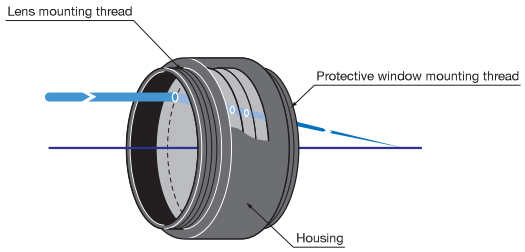
YAG laser focusing lenses are air spaced triplets or doublets for YAG wavelengths. The elements are made of crown glass of lower dispersion and flint glass of higher dispersion. These lenses are optimized for spherical aberration and coma. With its spot size designed to be smaller than or equal to the diffraction limited spot size for beams at 1064nm.

- These lenses are chromatically corrected so that any HeNe guided beam or visible video monitor beam will remain focused in the same position as the YAG beam. All elements are coated with a laser-resistant narrowband multi-layer anti-reflection for YAG: 1064nm and HeNe: 633nm.
- We offer optical protective windows to prevent damage to the lens by absorbing high levels of energy from inadvertent back reflection of the incident beam. These protective windows can be easily installed to the focusing side of the lens.

Specifications

Material	Crown Glass – (Air spaced) – Flint Glass
Material of frame	Aluminum Finishing: Black anodized
Design wavelength	1064nm, 632.8nm
Coating	Narrow band multi-layer anti-reflection coatig for 1064nm and 633nm
Acceptance angle	±1°
Laser Damage Threshold	1J/cm^2 (Laser pulse width 10ns, repetition frequency 20Hz)

Schematic



Guide

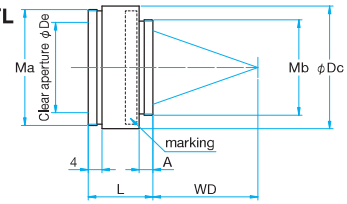
- Please contact our Sales Division for customized products. (Customized on size etc.)
- Please check the "wavelength characteristic of the focal length data" on the Web for the focal lengths of each wavelength.
  WEB Reference Catalog Code W3079

Attention

- Since the focal length and working distance of the lens is calculated at 1064nm, it will change at other wavelengths due to the refractive index of the material shift.
- The F number of a lens is calculated by f (effective focal length) / De (effective clear aperture). The value represents "Brightness of the lens". The lower the value, the brighter the lens is.
- Be sure to wear laser safety goggles when checking optical path and adjusting optical axis.

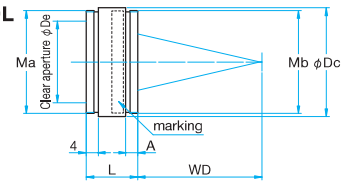
Outline Drawing (in mm)

NYTL



●Tolerance
Diameter Dc±0.1
Length L ±0.2
Focal length ±2%

NYDL



Specifications

Part Number	Maximum lens diameter φD [mm]	Focal length f [mm]	Diameter φDc [mm]	Clear aperture φDe [mm]	Length L [mm]	Lens mounting thread Ma	Protective window thread Mb	Thread length A [mm]	Numerical aperture (NA)	Working distance (WD) [mm]
NYTL-25-20PY1	φ25	20.0	φ32	φ20	22	M29 P0.75	M22 P0.75	6.0	0.50	9.0
NYTL-30-30PY1	φ30	30.0	φ36	φ27	22	M34 P0.75	M28 P0.75	6.5	0.45	19.1
NYTL-30-40PY1	φ30	40.0	φ36	φ26.5	19	M34 P0.75	M28 P0.75	4.0	0.33	30.9
NYTL-30-50PY1	φ30	50.0	φ36	φ25.5	19	M34 P0.75	M28 P0.75	3.5	0.25	41.4
NYDL-30-60PY1	φ30	59.9	φ36	φ27	17	M34 P0.75	M34 P0.75	4.0	0.23	41.1
NYDL-30-80PY1	φ30	79.9	φ36	φ27	15	M34 P0.75	M34 P0.75	4.0	0.17	67.6
NYDL-30-100PY1	φ30	100.1	φ36	φ27	14	M34 P0.75	M34 P0.75	4.0	0.14	88.4
NYDL-30-150PY1	φ30	149.3	φ36	φ27	12	M34 P0.75	M34 P0.75	4.0	0.09	140.0

Compatible Optic Mounts

LHF-M29-25, LHF-M34-30

Focusing Lenses for Fiber Lasers | HFTLSQ/HFDLSQ

RoHS Catalog Code W3080

High performance multi-element focusing lens. They are suitable for focusing and collimating solid state lasers like Yb fiber laser, YAG laser and YVO_4 laser.

- Engineered and designed to reduce the effects of thermal expansion.
- Corrected for spherical aberration and coma at 1064nm. Diffraction limited for F number ≧2 (NA≧0.25)
- AR coating optimized from 1040 – 1150nm with transmission at 633nm for pointed lasers

Specifications

Material	Synthetic fused silica
Material of frame	Aluminum Finishing: Black anodized
Design wavelength	1064nm
Coating	Broadband multil-ayer anti-reflection coating
Transmittance	>98.5% (1060 – 1080nm) >97% (1040 – 1150nm) >53% (600 – 700nm)
Laser Damage Threshold	7J/cm^2 (Laser pulse width 10ns, repetition frequency 20Hz)

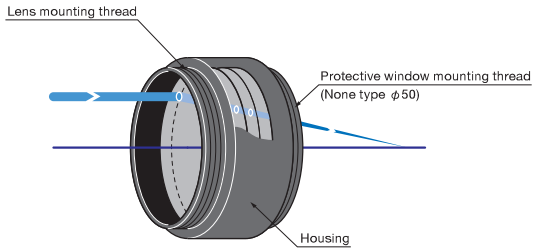
Guide

▶Please contact our Sales Division for customized products. (Customized on size etc.)

Attention

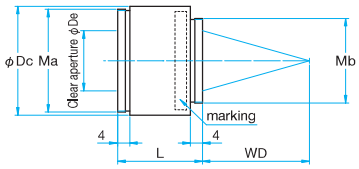
▶Be sure to wear laser safety goggles when checking optical path and adjusting optical axis.
▶Protective window as an option is not Anti-reflection coated.
▶Incident a beam from the side with the screw.

Schematic



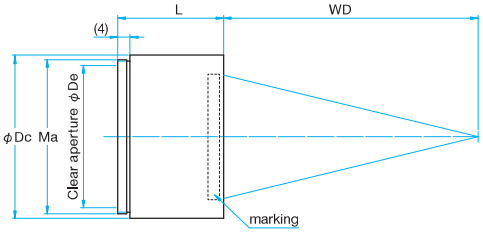
Outline Drawing (in mm)

HFTLSQ-15/HFTLSQ-20/HFTLSQ-30/HFDLSQ-30

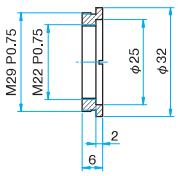


●Tolerance
Diameter Dc±0.1
Length L ±0.2
Focal length ±2%

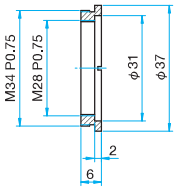
HFTLSQ-50/HFDLSQ-50



Drawing of adapter for HFTLSQ-15-20PF1



Drawing of adapter for HFTLSQ-20-30PF1



Specifications

Part Number	Focal length f [mm]	Diameter ϕDc [mm]	Clear aperture ϕDe [mm]	Length L [mm]	Lens mounting thread Ma	Protective window thread Mb	Numerical aperture (NA)	Working distance (WD) [mm]	Acceptance angle [°]
HFTLSQ-15-20PF1	20.0	ϕ24	ϕ12	16	M22 P0.75	M22 P0.75	0.30	13.7	±1.8
HFTLSQ-20-30PF1	30.3	ϕ30	ϕ17	21	M28 P0.75	M28 P0.75	0.28	22.0	±1.2
HFTLSQ-30-40PF1	40.0	ϕ36	ϕ27	31	M34 P0.75	M28 P0.75	0.34	24.9	±1
HFTLSQ-30-50PF1	50.0	ϕ36	ϕ27	28	M34 P0.75	M28 P0.75	0.27	35.4	±1
HFTLSQ-30-60PF1	60.1	ϕ36	ϕ27	23	M34 P0.75	M34 P0.75	0.22	51.4	±1
HFTLSQ-30-80PF1	80.0	ϕ36	ϕ27	23	M34 P0.75	M34 P0.75	0.17	71.7	±1
HFTLSQ-30-100PF1	100.0	ϕ36	ϕ27	23	M34 P0.75	M34 P0.75	0.14	92.7	±1
HFDLSQ-30-150PF1	150.0	ϕ36	ϕ27	18	M34 P0.75	M34 P0.75	0.09	131.0	±1
HFTLSQ-50-100PF1	99.9	ϕ54	ϕ47	35	M50.9 P0.75	—	0.24	84.2	±1
HFDLSQ-50-200PF1	199.6	ϕ54	ϕ47	23	M50.9 P0.75	—	0.12	185.7	±1
HFDLSQ-50-300PF1	300.0	ϕ54	ϕ47	23	M50.9 P0.75	—	0.08	286.2	±1

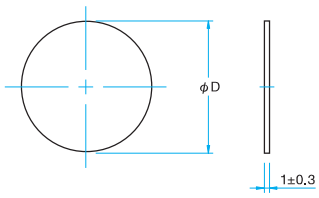
PG / PGH

- Protective windows can be attached to the focusing lens to minimize damage from laser fabrication. The protective window comes in 3 different sizes.
  Protective Window Holders (PGH)
  - Visible Spectrum Achromats
  - YAG Laser Focusing Lenses

Guide & Attention

- Since protective windows are uncoated, surface reflections will reduce transmittance to 90%.
- Anti-reflection coating for specific wavelength are available to improve trasmittance, please contact our Sales Division for assistance.
- Replace protective window if it is damaged or there is poor transmittance performance.

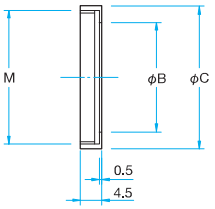
Protective Windows (Package of ten pieces)



Both sides: Uncoated

Part Number	ϕD [mm]	Protective window retainer
PG-21	ϕ21	PGH-24
PG-27	ϕ27	PGH-30
PG-33	ϕ33	PGH-36

Protective Window Holders (Retainer only)



Material: Aluminum
Finish: Black anodized

Part Number	M [mm]	ϕB [mm]	ϕC [mm]	Protective window diameter [mm]
PGH-24	M22 P0.75	ϕ18	ϕ24	ϕ21
PGH-30	M28 P0.75	ϕ23	ϕ30	ϕ27
PGH-36	M34 P0.75	ϕ29	ϕ36	ϕ33

LHF

Please select a fixed lens holder and a protective window that matches the profile of the focusing lens. (use the matrix table on the right)

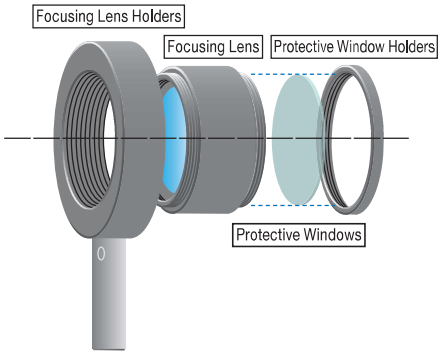
- There are two types of fixed holder for the focusing lens.

WEB Reference Catalog Code W4023

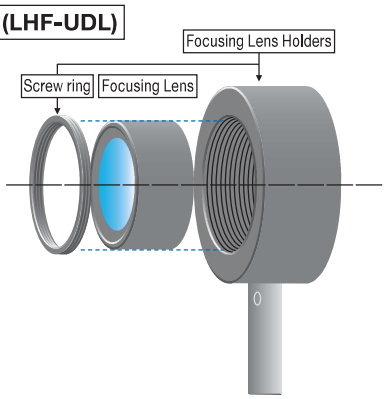
Thread Mount Type (LHF-M)
- Visible Spectrum Achromats
- YAG Laser Focusing Lenses
- Focusing Lenses for Fiber Laser
- Excimer Laser Focusing Lenses (some models)

Lens Tube Type (LHF-UDL)
- Ultraviolet Achromats

Thread Mount Type (LHF-M)



Lens Tube Type (LHF-UDL)



List of adaptive lens holder and protective window

Part Number	Protective window	Protective window retainer	Compatible Optic Mounts
Visible Spectrum Achromats			
ATL-30-40PY2	PG-33	PGH-36	LHF-M34-30
ATL-30-50PY2			
ATL-30-60PY2			
NADL-30-80PY2			
NADL-30-100PY2			
NADL-30-150PY2			
NADL-30-200PY2			
YAG Laser Focusing Lenses			
NYTL-25-20PY1	PG-21	PGH-24	LHF-M29-25
NYTL-30-30PY1	PG-27	PGH-30	LHF-M34-30
NYTL-30-40PY1			
NYTL-30-50PY1			
NYDL-30-60PY1	PG-33	PGH-36	
NYDL-30-80PY1			
NYDL-30-100PY1			
NYDL-30-150PY1			
Focusing Lenses for Fiber Laser			
HFTLSQ-15-20PF1	(PG-21)	PGH-24	exclusive adapter + LHF-M29-25
HFTLSQ-20-30PF1			exclusive adapter + LHF-M34-30
HFTLSQ-30-40PF1	(PG-27)	PGH-30	LHF-M34-30
HFTLSQ-30-50PF1			
HFTLSQ-30-60PF1			
HFTLSQ-30-80PF1	(PG-33)	PGH-36	
HFTLSQ-30-100PF1			
HFDLSQ-30-150PF1			
HFTLSQ-50-100PF1			LHF-M50.9-50
HFDLSQ-50-200PF1			
HFDLSQ-50-300PF1			
Excimer Laser Focusing Lenses			
ETL-30-40P	(PG-33)	PGH-36	LHF-M34-30
ETL-30-50P			
ETL-30-60P			
ETL-30-80P			
NEDL-30-100P			
NEDL-30-150P			
NEDL-30-200P			
EDL-50-100P			LHF-M50.9-50
EDL-50-150P			
EDL-50-200P			
EDL-50-250P			
EDL-50-300P			
Ultraviolet Achromats			
UDL-30-50P			LHF-UDL-30
UDL-30-80P			
UDL-30-100P			
NUDL-30-150P			
NUDL-30-200P			
UDL-40-80P			LHF-UDL-40
NUDL-40-100P			
NUDL-40-150P			
NUDL-40-200P			
NUDL-40-250P			
UDL-50-100P			LHF-UDL-50
NUDL-50-150P			
NUDL-50-200P			
NUDL-50-250P			
NUDL-50-300P			

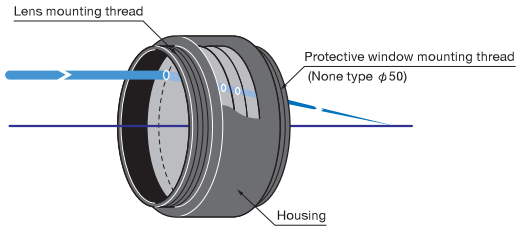
As for the protective windows enclosed in parentheses, glass material needs to be changed to synthetic fused silica as custom-made item.

Excimer Laser Focusing Lenses | ETL/EDL/NEDL RoHS Catalog Code W3082

These lenses are manufactured with a synthetic fused silica material and it has a high transmittance value in the ultra-violet wavelength of 180 – 400nm. They have excellent performance and are ideal for focusing and imaging applications. There is no adhesive or heat absorption material used to produce these lenses, as a result they show high resistance to the ultraviolet light.

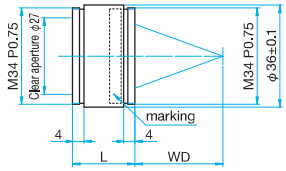
- They are made of 2 or 3 spherical lenses and they offer correction on spherical and comatic aberration.
- Standard focal lengths for Excimer laser with 248nm, 266nm and 355nm.
- NA 0.1 or below (ETL model NA 0.25) can be focused to the diffraction limit.

Schematic

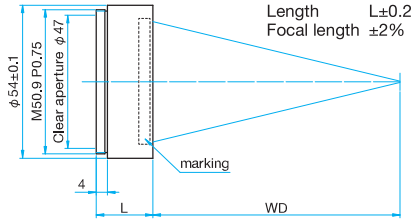


Outline Drawing (in mm)

ETL-30/NEDL-30



EDL-50



Specifications

Material	Synthetic fused silica for Excimer Laser
Material of frame	Aluminum Finishing: Black anodized
Design wavelength	248nm
Coating	Uncoated
Acceptance angle	±1°

Guide

- Products that are not listed in the table or in the catalog such as high pulse lasers or different wavelengths are available upon request, please contact our Sales Division.
- Protective Windows is sold separately. Reference B183
- For detail on focal length of each wavelength, please see our web site. WEB Reference Catalog Code W3082

Attention

- These focusing lenses are made for use to image an object located in an infinitive distance or using a point of source as a parallel light.
- The correct direction to input a parallel light is the side with barrel lettering. If the direction is wrong, the spherical aberration will be increased and the image unfocused.
- If Focusing lens is used with the designed wavelength the spherical aberration and transmission will be poor.
- Usage with high power laser or near a high temperature light source, the high heat build-up in the lens may alter the focal length. To avoid this, heat prevention is required.
- To reduce the focus spot size, ensure that the input beam diameter ($1/e^2$) is reduced to half of the effective diameter of the focus lens.
- These focusing lenses are not chromatic lenses; they are not optically corrected.
- The lenses have 4% of reflectivity per surface; therefore about 20% of loss is expected in transmission.

Specifications

Part Number	Focal length f [mm]	Length L [mm]	Numerical aperture (NA)	Working distance (WD) [mm]
ETL-30-40P	39.6	22	0.34	31.1
ETL-30-50P	49.8	22	0.27	41.6
ETL-30-60P	59.7	22	0.23	52.4
ETL-30-80P	79.8	22	0.17	73.2
NEDL-30-100P	99.9	12	0.14	94.6
NEDL-30-150P	149.3	12	0.09	144.6
NEDL-30-200P	199.3	12	0.07	194.7
EDL-50-100P	100.4	20	0.24	87.1
EDL-50-150P	149.6	20	0.16	137.9
EDL-50-200P	199.1	20	0.12	187.8
EDL-50-250P	249.0	20	0.09	238.0
EDL-50-300P	298.6	20	0.08	288.0

Compatible Optic Mounts

LHF-M34-30, LHF-M50.9-50

fθ Lenses | fθ

RoHS

F-Theta Lenses are used for laser marking, bar code reader, laser micromachining and other laser applications.

- F-Theta lenses convert a rotational movement of a galvanometer mirror into a linear motion on the focal plane by using distortion effects.
- Telecentric type is also available that can be irradiated vertically to the focusing plane.
- Also available for fundamental YAG laser (1064nm), harmonic lasers (266nm, 355nm, 532nm).

Guide

- Transmittance value is a representative value only and is not guaranteed. If you have any questions, please feel free to contact our Sales Division.
- We accept orders to suit customized requirements.
- We also fabricate laser scanning systems which combine the galvanometer mirror and fθ lens as a unit.

Attention

- We do not recommend using fθ lens in an imaging system because it is designed for a scanning type optical system.
- Please position the incident pupil of the fθ lens beam into the scanning system (galvanometer mirror). If the incident pupil is not in position of the beam scanning system, the optimum focusing spot cannot be achieved because of increased aberration.

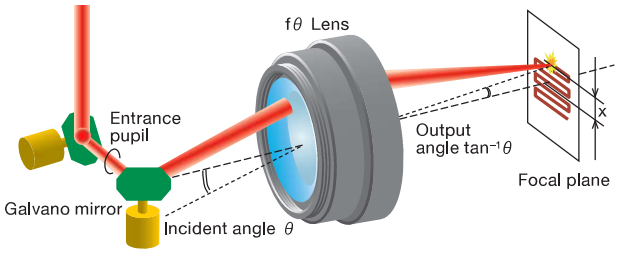
fθ Lenses dimension table

Part Number	A (mm)	B (mm)	C (mm)	D (mm)	E (mm)	F (mm)	φG (mm)	φH (mm)	I	φJ (mm)	K (mm)
fθ-100-266T	60	57.8	43	5	6	6	φ97	φ82g6	M80 P1	φ69	74.8
fθ-150-266T	80	73.3	65	3	6	6	φ122	φ102g6	M100 P1	φ89	88.3
fθ-100-355T	60	56.3	42	6	6	6	φ97	φ82g6	M80 P1	φ69	74.3
fθ-100-355THG	80	109.6	59	9	6	6	φ112	φ102g6	M100 P1	φ84	130.6
fθ-150-355T	80	72.3	64	4	6	6	φ122	φ102g6	M100 P1	φ89	88.3
fθ-100-532T	60	51.5	50	—	6	4	φ92	φ82g6	M80 P1	—	61.5
fθ-300-1064	39	35.9	27.3	3.7	8	—	φ91	—	M80 P1	φ76	47.6
fθ-100-1064T	60	49.5	47.5	—	6.5	6	φ92	φ82g6	M80 P1	—	62

fθ Lenses

Part Number	Design wavelength [nm]	Focal length f [mm]	Entrance pupil diameter [mm]	Scanning angle [°]	Scanning Range [mm]	Telecentric	Working distance (WD) [mm]	Transmittance (Angle of Incidence: 0°) [%]
fθ-100-266T	266	100.4	φ12	±15	φ52	○	135.9	93
fθ-150-266T	266	149.9	φ12	±15	φ78	○	205.1	93
fθ-100-355T	355	99.85	φ12	±15	φ52	○	136.1	93
fθ-100-355THG	355	100.1	φ14	±15	φ52	○	60.94	90
fθ-150-355T	355	150.2	φ12	±15	φ78	○	207.2	93
fθ-100-532T	532	100.3	φ12	±15	φ52	○	121.1	90
fθ-300-1064	1064	299.8	φ16	±23	φ240	—	361.6	95
fθ-100-1064T	1064	100.3	φ12	±15	φ52	○	123.1	95

Schematic

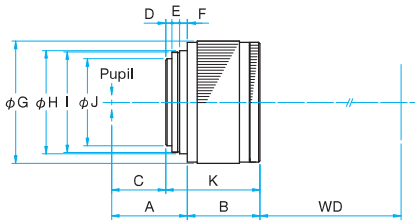


By using the f theta lens, it is possible to be moved a laser light spot in constant speed linear motion on the focal plane by scanning the mirrors such as galvanometer scanner mirrors.
The f theta lens enables this by the effect of distortion.
Mathmatically it is expressed as following;
focal length = "f", ideal image height = "y", the angle of scanned = "θ"
therefore, y = fθ.
In the normal single lens, the ideal image height "y" is represented by "y = f tanθ".
Characteristics of both are the same in a small angle range. However, the difference is greater angle increases.

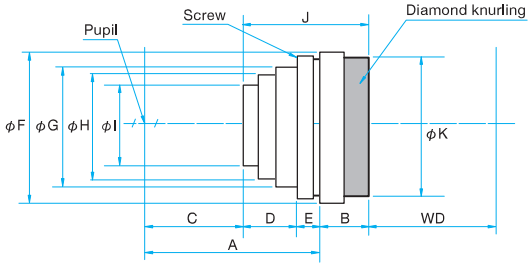
Outline Drawing

(in mm)

fθ Lenses



fθ Lenses for YAG (fθ-L/fθ-B/fθ-270-1064)



fθ Lenses for YAG dimension table

Part Number	A (mm)	B (mm)	C (mm)	D (mm)	E (mm)	ϕF (mm)	ϕG (mm)	ϕH (mm)	ϕI (mm)	J (mm)	ϕK (mm)	Screw
fθ-100-532L	53.3	17.8	22.5	22.8	8	ϕ89	ϕ80	ϕ72	ϕ60	48.6	ϕ83	M85 P1
fθ-100-1064L	53.3	17	20	25.3	8	ϕ87	ϕ80	ϕ69	ϕ57	50.3	ϕ83	M85 P1
fθ-150-1064B	63	19.8	26.8	28	8.2	ϕ87	ϕ80	ϕ74.5	ϕ64	56	ϕ86	M85 P1
fθ-220-1064L	59.8	21.1	32.1	19.7	8	ϕ97	ϕ80	–	ϕ68	48.8	ϕ97	M85 P1
fθ-270-1064	59.7	33.5	26.0	24.7	9	ϕ106	ϕ74	–	ϕ64	67.2	ϕ106	M85 P1

fθ Lenses for YAG

Part Number	Design wavelength [nm]	Focal length f [mm]	Entrance pupil diameter [mm]	Scanning angle [°]	Scanning Range [mm]	Telecentric	Working distance (WD) [mm]	Transmittance [%]
fθ-100-532L	532	100.2	ϕ12	±22.9	ϕ80	–	114.7	>95
fθ-100-1064L	1064	99.93	ϕ12	±22.9	ϕ80	–	109.6	>95
fθ-150-1064B	1064	152.1	ϕ15	±24.0	ϕ127.4	–	168.6	>95
fθ-220-1064L	1064	220.0	ϕ12	±24.0	ϕ184	–	254.2	>95
fθ-270-1064	1064	273.0	ϕ15	±24.13	ϕ230	–	318.9	>95

fθ Lenses for CO_2 Lasers | fθ-10600

RoHS Catalog Code W3203

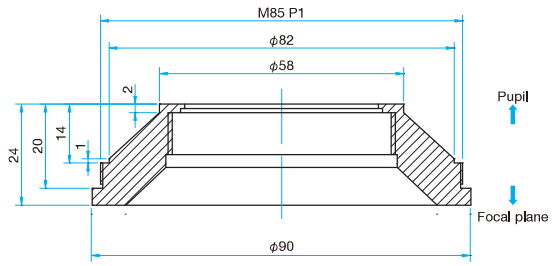
The f theta lens for CO_2 laser is made by a single lens of zinc selenide (ZnSe). These are used in the laser marking systems.

- It is compact and lightweight because it is composed of a single lens.
- The design and use are processed to an optimum shape of various aberrations becomes smaller.
- There are wide variety of the lineup that scan area is 50mm to 300mm.

Specifications

Material	Zinc selenide (ZnSe)
Design wavelength	10.6μm
Entrance pupil diameter	ϕ12mm
Scanning angle	±12.5°
Distance to lens from pupil	25mm
Coating	Dielectric multi-layer coating

Outline Drawing (in mm)



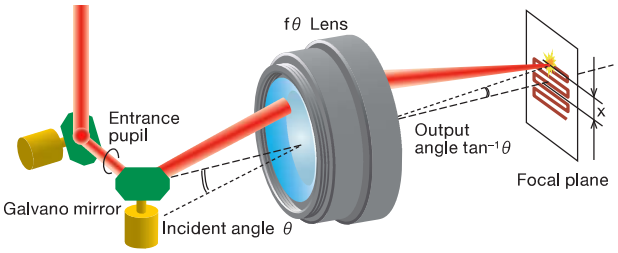
Guide

▶We also offer f theta lens in other than CO_2 laser wavelength of 10.6μm. Reference B186

Attention

▶Hydrogen selenium is harmful when it comes to contact with strong acids! Do not immerse the lens in hydrochloric or sulphuric acid.
▶When light is condensed on the surface of ZnSe, the high power laser beam may produce toxic gases due to the thermal decomposition.
In addition, a large amount of gas and powder occurs when the ZnSe lens is damaged by the laser thermal runaway. In case of the ZnSe lens is damaged by any chance, DO NOT handle the lens with your bare hands. Collect the debris and be careful not to inhale the powder and steam generated.
▶It is not recommended to use the f theta lens for the optical imaging system because it is designed for the scanning system.
▶Please place in accordance with the position of the entrance pupil of the fθ lens beam scanning system (galvanometer mirror).
If the incident pupil is not in position of the beam scanning system, the optimum focusing spot cannot be achieved because the aberration will increase.

Schematic



By using the f theta lens, it is possible to be moved a laser light spot in constant speed linear motion on the focal plane by scanning the mirrors such as galvanometer scanner mirrors.
The f theta lens enables this by the effect of distortion.
Mathmatically it is expressed as following;
focal length = "f", ideal image height = "y", the angle of scanned = "θ"
therefore, y = fθ.
In the normal single lens, the ideal image height "y" is represented by "y = f tanθ".
Characteristics of both are the same in a small angle range. However, the difference is greater angle increases.

Specifications

Part Number	Focal length f [mm]	Scanning Range [mm]	WD [mm]
fθ-75-10600	75	50×50	57.8
fθ-100-10600	100	70×70	85.8
fθ-150-10600	150	110×110	139.0
fθ-200-10600	200	140×140	181.2
fθ-250-10600	250	175×175	232.7
fθ-300-10600	300	210×210	283.6
fθ-340-10600	340	250×250	344.7
fθ-400-10600	400	300×300	414.5

Important: Treatment of ZnSe optics

Important: Treatment of ZnSe optics
ZnSe (Zinc selenide) is Poisonous and Deleterious Substances classified as legal, Depending on the specifications, the certificate of delivery may be required acquisition of Poisonous and Deleterious Substances.
In addition, ZnSe Optics disposal after use is prohibited.
When lenses that are no longer needed, please return them to us.
However, it is only in our products. The above is a case in Japan and please ask your local sales contact about requirements outside Japan.