LENS SERIES

Machine Vision Lens & Accessory

Myutron Thailand
imRN Asia Co.,Ltd
Email : sale@imrnasia.com Tel: 087-803 1661
Website : www.imrnasia.com

Total Soluiton of Optics for Various Applications

Line-up of Myutron Lens Series

Large FOV

Lenses for photography and surveillance were used for inspection of large objects such as metal, paper, PCB, and others. Due to the improvement of systems, quality of these lenses are not enough for machine vision applications. Myutron lens is designed for very low distortion and high resolution, suitable for machine vision applications.「FV-W Series (P15)」are suitable for line scan, and「HF Series (P44-45)」and「HS Series (P46-47)」are suitable for area scan applications.

Line Scan Lens
・FV-W Series

CCTV Lens for 5 Mega Pixel
・HF Series

Middle FOV

Suitable for inspection of electronic component and fine pitch, wire bonder, and alignment.「TL Series (P28-33)」are suitable for alignment, and「MGTL Series(P18-21)」are suitable for measurement, required for high accuracy.「LSP (P3)」and「SP Series (P4-5)」are compatible with 8K and 12K line scan camera and suitable for high speed and accurate inspection. F mount series,「LS Series (P8-9)」and「FV-L Series (P14)」are also available.

Super High Resolution Lens for Line Scan
・LSP350
・SP Series

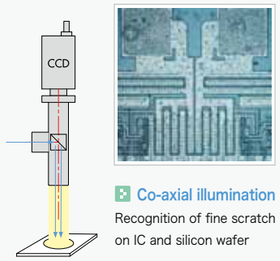
Telecentric Lens
・MGLT Series
・TL Series

Small FOV

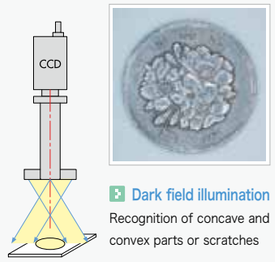
Suitable for inspection of IC, silicon wafer, and color filter.「HMZ Series (P38-39)」are suitable for inspection of different size of objects. High magnification of telecentric lens with co-axial,「MGTL High Magnification Series (P20-21)」are suitable for inspection of reflective objects, required for higher resolution.

Macro Zoom Lens
・HMZ Series

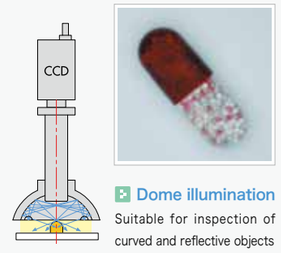
Shooting examples of various illuminations



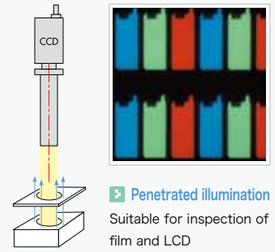
Co-axial illumination
Recognition of fine scratch on IC and silicon wafer



Dark field illumination
Recognition of concave and convex parts or scratches



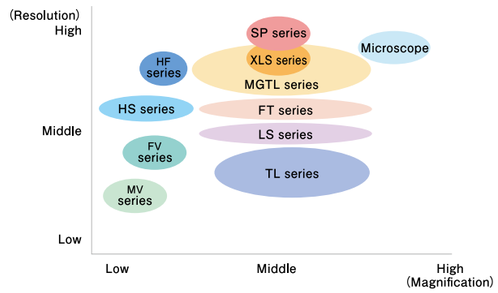
Dome illumination
Suitable for inspection of curved and reflective objects



Penetrated illumination
Suitable for inspection of film and LCD

LED lighting
Various types of LEDs are available.

Selection chart for magnification and resolution



INDEX

LINE SENSOR LENS	WD and Magnification Chart for Line Scan Lenses	P2
	Super High Resolution of 3.5x Lens for 8K/12K Line Scan Camera	P3
	Super High Resolution Lens for 8K/12K Line Scan Camera	P4-5
	Line Scan Lens for Large Image Circle, ϕ 90mm	P6-7
	Fixed Magnification Lens for F Mount	P8-9
	High Resolution Telecentric Lens for F Mount	P10
	Line Scan Lens for Large Aperture	P11
	High Resolution and Wide Angle Lens for Area and Line Scan Camera	P12-13
	Macro Lens for Area and Line Scan Sensor	P14
	Line Scan Lens for Wide Field of View	P15
TELECENTRIC LENS	Low Magnification Telecentric Lens for 5 Mega Pixel	P16-17
	Telecentric Lens for 5 Mega Pixel	P18-19
	Mega Pixel Telecentric Lens	P20-21
	Vari Focal Telecentric Lens	P22
	10x Telecentric Lens	P23
	WD65 High NA Mega Pixel Telecentric Lens	P24-25
	WD110 High NA Mega Pixel Telecentric Lens	P26-27
	WD40 Built-in type Telecentric Lens Series	P28-29
	WD65 Built-in type Telecentric Lens Series	P30-31
	WD110 Built-in type Telecentric Lens Series	P32-33
	WD220 Built-in type Telecentric Lens Series	P34
	WD240 High Magnification Telecentric Lens for Long WD	P35
	WD300mm Telecentric Lens for Super Long WD	P36
	Description of Telecentric Lens	P37
MACROZOOM LENS	F1.0, 6.0x Macro Zoom Lens	P38-39
	Low Magnification Zoom Lens with Co-axial Illumination	P40
	8.0x Compact Macro Zoom Lens	P41
	F1.0, 6.0x Zoom Lens Ⅱ	P41
CCTV LENS	Area Scan Lens for TFL- Ⅱ Mount	P42-43
	High Resolution Machine Vision Lens for 5 Mega Pixel	P44-45
	2 Mega Pixel CCTV Lens	P46-47
	Mega Pixel Low Distortion CCTV Lens	P48-49
	CCTV Lens	P50-51
ATTACHMENT	Extension Ring	P52-54
	Rear Converter	P55
	Filter	P56
	Prism Adapter	P57
	Optical Component	P58
MATERIAL	Glossary	P59
	Optical Data	P60-61

WD and Magnification Chart for Line Scan Lens

Model No.	Image Circle	∞	0.3x	0.4x	0.5x	0.6x	0.7x	0.8x	0.9x	1x	1.5x	2x	3.5x	Page
LS05	ϕ36				188mm (0.5x)									P8
LS07	ϕ36						151mm (0.7x)							P8
LS10	ϕ36									123mm (1.0x)				P8
LS15	ϕ36										102mm (1.5x)			P8
LSTL10H-F	ϕ44									113mm (1.0x)				P10
LSTL15H-F	ϕ44										109mm (1.5x)			P10
LSTL20H-F	ϕ44											109mm (2.0x)		P10
SP05	ϕ62				276mm (0.5x)									P4
SP07	ϕ62						211mm (0.7x)							P4
SP10	ϕ62									165mm (1.0x)				P4
SP14	ϕ62										112mm (1.4x)			P4
SP20	ϕ62											90mm (2.0x)		P4
LSP350	ϕ62												100mm (3.5x)	P3
XLS03	ϕ90	680mm (0.2x)	477mm (0.3x)	376mm (0.4x)										P6
XLS05	ϕ90			386mm (0.4x)	324mm (0.5x)	274mm (0.625x)								P6
XLS075	ϕ90					279mm (0.625x)	246mm (0.75x)	222mm (0.875x)						P6
XLS10	ϕ90							215mm (0.875x)		197mm (1.0x)	177mm (1.2x)			P6
XLS14	ϕ90									185mm (1.2x)	170mm (1.4x)	154mm (1.7x)		P6
XLS20	ϕ90										157mm (1.7x)	146mm (2.0x)	133mm (2.5x)	P6

Model No.	Image Circle	∞	0.05x	0.1x	0.15x	0.2x	0.25x	0.3x	0.35x	0.4x	0.45x	0.5x	Page
LSF2528	ϕ45	1,000mm (0.025x)			142mm (0.15x)								P12
LSF3528	ϕ45	1,413mm (0.025x)			223mm (0.15x)								P12
LSF5028	ϕ45	2064mm (0.025x)						163mm (0.3x)					P12
FV3526L	ϕ36			507mm (0.07x)		178mm (0.2x)							P14
FV5026W	ϕ45	2,063mm (0.025x)				297mm (0.18x)							P15
FV5026L	ϕ45			521mm (0.1x)		246mm (0.22x)							P14
HB5014	ϕ45	2,058mm (0.025x)				266mm (0.2x)							P11
FV8528W	ϕ62	3,423mm (0.025x)				463mm (0.2x)							P15
FV8528L	ϕ62					445mm (0.2x)				250mm (0.4x)			P14

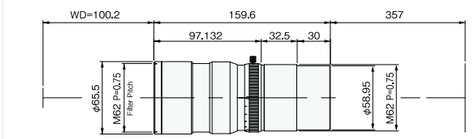
LSP350

Super High Resolution of 3.5x Lens for 8K/12K Line Scan Camera

Suitable for the inspection in high accuracy such as LCD, TFT, and wafer

- Compatible with 8K and 12K line scan camera
- Maximum compatible sensor is 62mm.
- Long working distance, WD100mm
- Reduce relative illumination and excellent uniformity
- Very low distortion
- Excellent brightness, suitable for high speed applications
- Custom mount is available

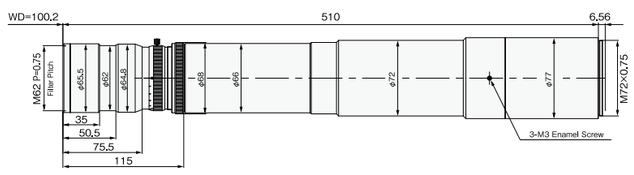
LSP350



Magnification	3.5×	OI	616mm
F No.	11	Maximum Compatible CCD	ϕ62mm
WD	100mm		

※Indicated specifications are design values.

Dimension of LSP350 + Dalsa HS Mount



* Please ask for customized mount.

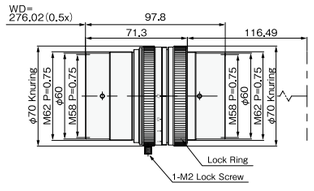
SP Series

Super High Resolution Lens for 8K/12K Line Scan Camera

Suitable for high speed and high-end applications

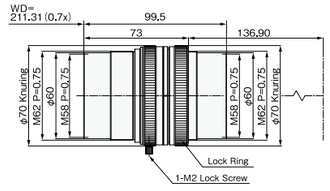
- Compatible with 8K and 12K and 16K, ϕ 62mm sensor
- Magnification can be changed by reversing a lens
- Reduce relative illumination and excellent uniformity
- Very low distortion
- Excellent brightness, ∞ F No. 2.7
- Customized mount is available

SP05



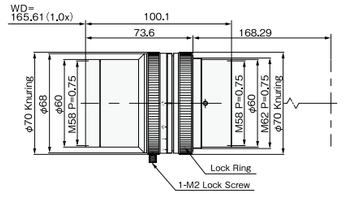
Magnification	0.5×	OI	463mm
F No.	4.3	Maximum Compatible CCD	ϕ 62mm
WD	276mm		

SP07



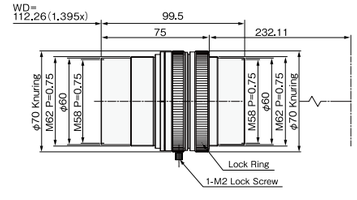
Magnification	0.7×	OI	421mm
F No.	5	Maximum Compatible CCD	ϕ 62mm
WD	211mm		

SP10



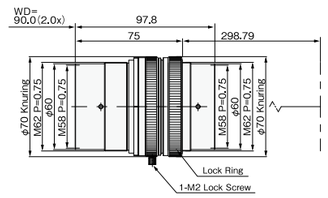
Magnification	1.0×	OI	407mm
F No.	5.8	Maximum Compatible CCD	ϕ 62mm
WD	165mm		

SP14



Magnification	1.4×	OI	419mm
F No.	6.8	Maximum Compatible CCD	ϕ 86mm
WD	112mm		

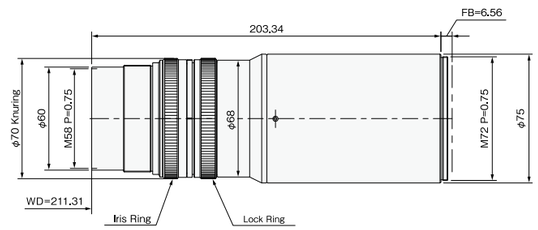
SP20



Magnification	2.0×	OI	463mm
F No.	8.6	Maximum Compatible CCD	ϕ 100mm
WD	90mm		

* Indicated specifications are design values.

Dimension of SP07 + Dalsa HS Mount



* Please ask for customized mount.

XLS Series

Line Scan Lens for Large Image Circle, ϕ 90mm

Compatible with large image circle, up to ϕ90mm sensor

- Suitable for large sensor such as「10μ x 7300 bit 」,「5.2μ x 12000 bit」,「5μ x 16384bit」, etc...
- Suitable for large area sensor of high resolution such as 12 Mega, 16 Mega, and 29 Mega
- Reduce color aberration, suitable for 3 line sensor
- Excellent uniformity of brightness and resolution
- Possible to adjust ±0.05x from the original magnification by using the optional mount
- Customized mount is available
- 「SP Series (Page 4)」is suitable if brightness is essential for the application

How to request if magnification is other than standard.

Ex.) 0.67x for Dalsa P3-12K

XLS075(067)-H

Model No. of a lens
Required magnification
Model No. of mount

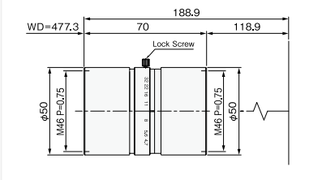
* If a lens is not used at the standard magnification, adjustable range is not ±0.05x.
* Please select one of XLS series which magnification is the closest from required magnification.

Model No. of Mount

Model	Compatible Camera	Screw Pitch	Back Focal Distance
XLS□□□-F	F Mount Camera	F Mount	46.5mm
XLS□□□-Q	NED：3 Line Camera NUCLi7300	M84.5 (P=0.5)	41mm
XLS□□□-N	NED：CLISBee 8k	M72 (P=0.75)	31.8mm
XLS□□□-M	DALSA：Piranha 2 8k ／ TAKEX：TL-16000CL	M72 (P=0.75)	19.55mm
XLS□□□-D	DALSA：Piranha 4 8k　Piranha HS 3 16k	M72 (P=0.75)	12mm
XLS□□□-H	DALSA：Piranha 3 12k　Piranha HS 8k 12k　Piranha ES 8k	M72 (P=0.75)	6.56mm
XLS□□□-E	e2V: ELIIXA + 16K Pixels	M95 x 1	9.4mm

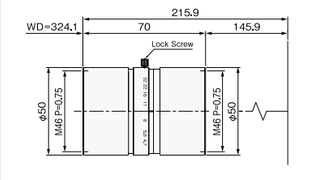
* ±0.05x can be adjusted from the standard magnification by using the mount mentioned above.
* Please ask for customized mount.

XLS03



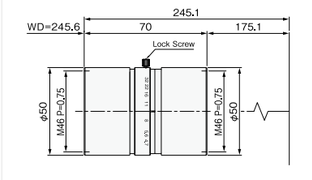
Magnification	0.3×
∞F No.	4.7
F No.	6.0
WD	477mm
OI	666mm
Maximum Compatible CCD	ϕ90mm

XLS05



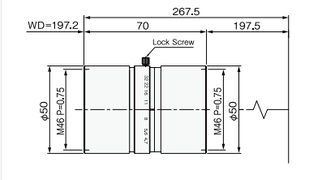
Magnification	0.5×
∞F No.	4.7
F No.	7.0
WD	324mm
OI	540mm
Maximum Compatible CCD	ϕ90mm

XLS075



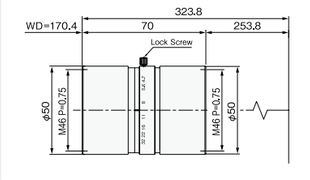
Magnification	0.75×
∞F No.	4.7
F No.	8.1
WD	246mm
OI	491mm
Maximum Compatible CCD	ϕ90mm

XLS10



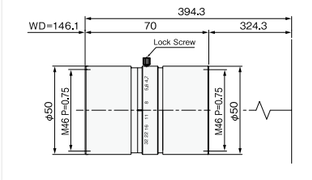
Magnification	1.0×
∞F No.	4.7
F No.	9.0
WD	197mm
OI	465mm
Maximum Compatible CCD	ϕ90mm

XLS14



Magnification	1.4×
∞F No.	4.7
F No.	11.4
WD	170mm
OI	494mm
Maximum Compatible CCD	ϕ90mm

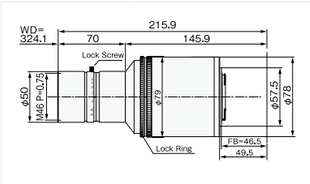
XLS20



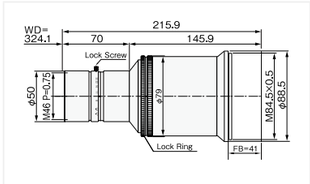
Magnification	2.0×
∞F No.	4.7
F No.	14.5
WD	146mm
OI	540mm
Maximum Compatible CCD	ϕ90mm

Example of a lens with mount (XLS05)

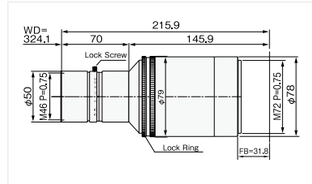
XLS05-F



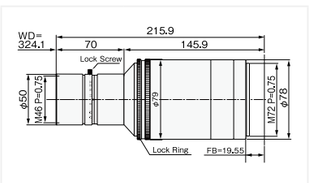
XLS05-Q



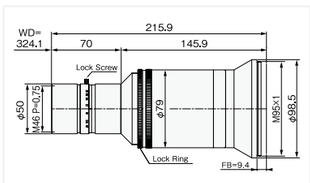
XLS05-N



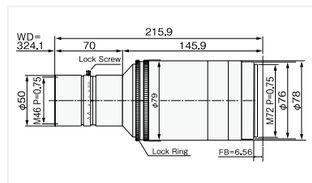
XLS05-M



XLS05-E

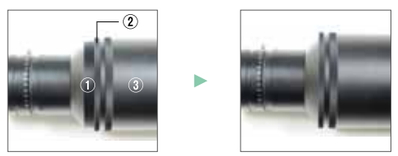


XLS05-H



How to adjust magnification

- Mount tube is composed by three mechanical parts ①, ②, and ③.
- Magnification increases by extending the mount and decreases by shortening.



* Indicated specifications are design values.

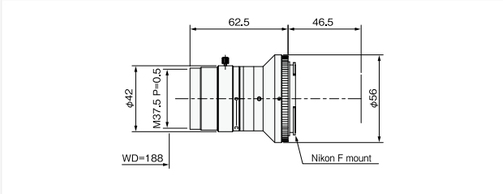
LS Series

Fixed Magnification Lens for F Mount

High Resolution and high contrast
Suitable for LCD, film, and PCB inspection

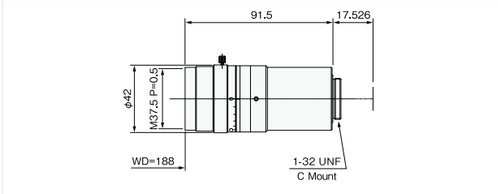
- Excellent uniformity
- High resolution from the center to the edge of image
- Compact design
- High durability
- Optical distortion less than 0.1%
- Suitable for area sensor, over 1 inch
- TFL-Ⅱ mount for 12 Mega camera is available

LS05F (F Mount)



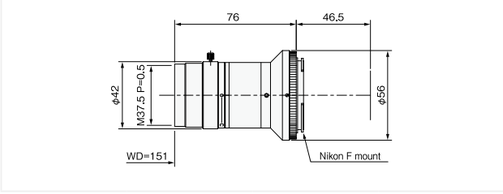
Magnification	0.5×	Resolution	11μ
WD	188mm	Optical distortion	-0.01%
Depth of field	0.94mm	Maximum Compatible CCD	φ36mm
F No.	5.1	Mount	F

LS05C (C Mount)



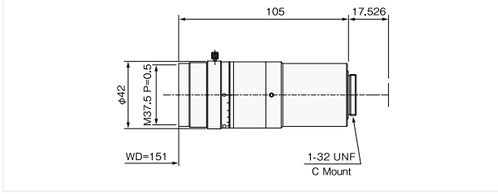
Magnification	0.5×	Resolution	11μ
WD	188mm	Optical distortion	-0.01%
Depth of field	0.94mm	Maximum Compatible CCD	4/3 (φ22.6mm)
F No.	5.1	Mount	C

LS07F (F Mount)



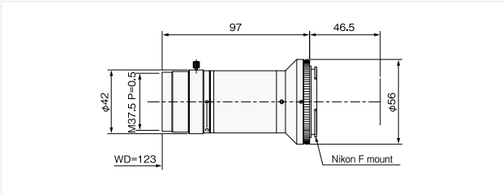
Magnification	0.7×	Resolution	10μ
WD	151mm	Optical distortion	-0.07%
Depth of field	0.54mm	Maximum Compatible CCD	φ36mm
F No.	6	Mount	F

LS07C (C Mount)



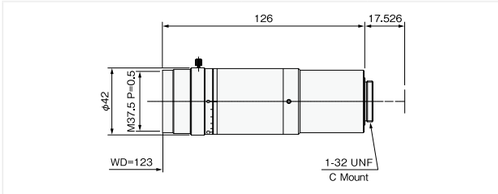
Magnification	0.7×	Resolution	10μ
WD	151mm	Optical distortion	-0.07%
Depth of field	0.54mm	Maximum Compatible CCD	4/3 (φ22.6mm)
F No.	6	Mount	C

LS10F (F Mount)



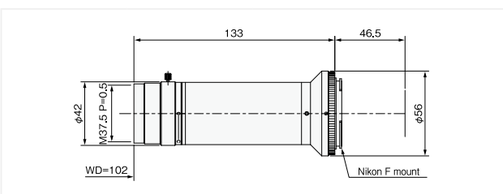
Magnification	1.0×	Resolution	8μ
WD	123mm	Optical distortion	-0.01%
Depth of field	0.31mm	Maximum Compatible CCD	φ36mm
F No.	7.5	Mount	F

LS10C (C Mount)



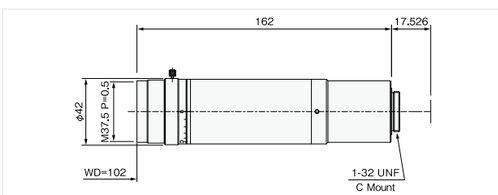
Magnification	1.0×	Resolution	8μ
WD	123mm	Optical distortion	-0.01%
Depth of field	0.31mm	Maximum Compatible CCD	4/3 (φ22.6mm)
F No.	7.5	Mount	C

LS15F (F Mount)



Magnification	1.5×	Resolution	7μ
WD	102mm	Optical distortion	0.26%
Depth of field	0.17mm	Maximum Compatible CCD	φ36mm
F No.	9.9	Mount	F

LS15C (C Mount)



Magnification	1.5×	Resolution	7μ
WD	102mm	Optical distortion	0.26%
Depth of field	0.17mm	Maximum Compatible CCD	4/3 (φ22.6mm)
F No.	9.9	Mount	C

* Indicated specifications are design values. * Resolution is calculated based on MTF. * Resolution indicates a theoretical resolution at wavelength of 550nm.
* Depth of field is calculated assuming F No. (∞) 5.6 and resolution of 14μ camera.

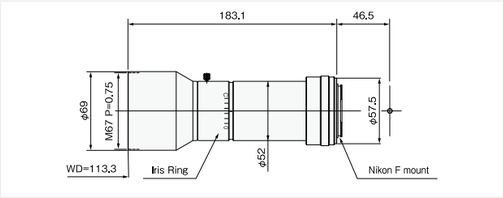
LSTL-H Series

High Resolution Telecentric Lens for F Mount

The highest NA for ϕ44mm sensor in the optical industry

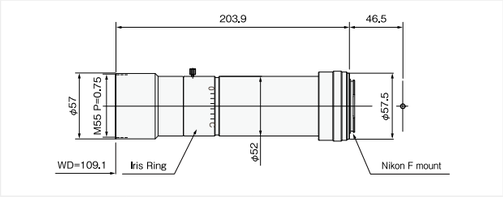
- Telecenric lens for line scan, ϕ44mm
- Suitable for large area sensor of high resolution such as 12 Mega, 16 Mega, and 29 Mega
- Design for large aperture
- Excellent uniformity of brightness and resolution
- Suitable for high speed and precise measurement
- Adjustable iris, possible to adjust depth of field
- Customized mount is available

LSTL10H-F



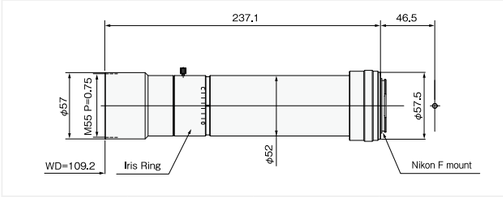
Magnification	1.0×	Resolution	4.3μ
WD	113mm	Optical distortion	0.01%
Depth of field	0.31mm	Maximum Compatible CCD	ϕ44mm
F No.	6.4	Mount	F

LSTL15H-F



Magnification	1.5×	Resolution	3.5μ
WD	109mm	Optical distortion	0.02%
Depth of field	0.17mm	Maximum Compatible CCD	ϕ44mm
F No.	7.8	Mount	F

LSTL20H-F



Magnification	2.0×	Resolution	2.9μ
WD	109mm	Optical distortion	-0.02%
Depth of field	0.12mm	Maximum Compatible CCD	ϕ44mm
F No.	8.7	Mount	F

* Indicated specifications are design values. * Resolution indicates the theoretical resolution at wavelength of 550nm.
* Depth of field is calculated assuming F No.(∞) 5.6 and resolution of 14μ camera.

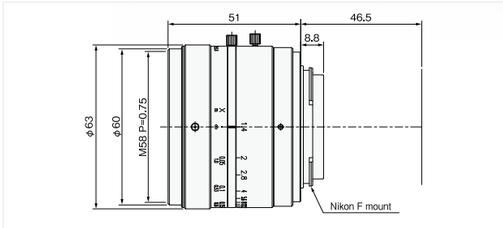
HB5014-F

Line Scan Lens for Large Aperture

Large aperture and design for machine vision

- Excellent brightness, F No. 1.4
- Suitable for high speed applications such as printing, food inspection, etc..
- High durability
- Metal design, avoid aged deterioration of plastic and gum, concerned about photographic lenses
- Suitable for large image circle and high speed camera

HB5014-F



Focal length	50mm	Optical distortion	0.17%
∞FNO	1.4	Maximum Compatible CCD	ϕ45mm
Range of WD	0.27m - ∞	Mount	F
Magnification at MOD	0.2×		

* Indicated specifications are design values.

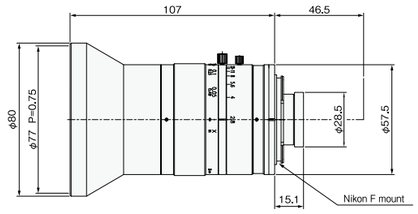
LSF Series

High Resolution and Wide Angle Lens for Area and Line Scan Camera

Excellent relative illumination High resolution at whole working distance

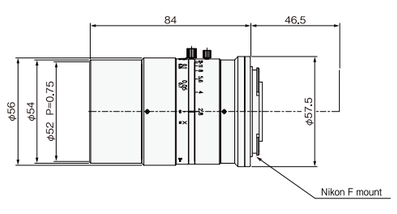
- Design for high resolution and low distortion, stable performance at whole working distance
- Possible to use for small pixel size, 3.5 μ line scan camera
- Very low color aberration, compatible with 3-line camera
- 「LSF5028-F」is available to 0.3x without extension ring
- Wide angle, f25mm is available
- Suitable for large area sensor, 12 Mega, 16 Mega, and 29 Mega

LSF2528-F



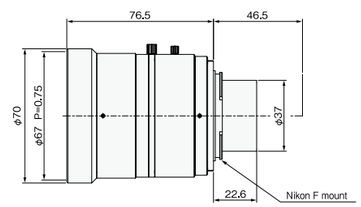
Focal length	25mm	Optical distortion	0.66%
∞F No.	2.8	Maximum Compatible CCD	φ44mm
Range of WD	140mm - ∞	Mount	F
Magnification at MOD	0.15×		

LSF3528-F



Focal length	35mm	Optical distortion	-0.31%
∞F No.	2.8	Maximum Compatible CCD	φ44mm
Range of WD	230mm - ∞	Mount	F
Magnification at MOD	0.15×		

LSF5028-F



Focal length	50mm	Optical distortion	-0.40%
∞F No.	2.8	Maximum Compatible CCD	φ44mm
Range of WD	190mm - ∞	Mount	F
Magnification at MOD	0.3×		

* Indicated specifications are design value.

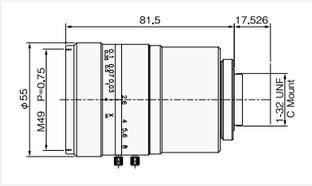
FV-L Series

Macro Lens for Line and Area Scan Sensor

Design for macro imaging, suitable for large area and line scan camera

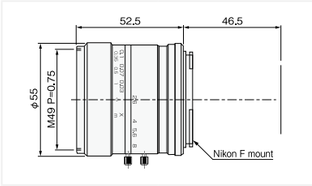
- Adjustable focus and iris
- Design for macro imaging, suitable for machine vision application
- Suitable for inspection of wafer, PCB, electronic parts, etc..., required for high resolution at short working distance
- FV8528L-M is compatible with M72 mount
- Compatible with large image format of high resolution area camera

FV3526L-C



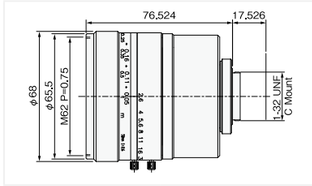
Magnification	35mm
∞F No.	2.6
Range of WD	0.18m - 0.4m
Magnification at MOD	0.2×
Optical distortion	-0.05%
Maximum Compatible CCD	1.2 inch (φ21.4mm)
Mount	C

FV3526L-F



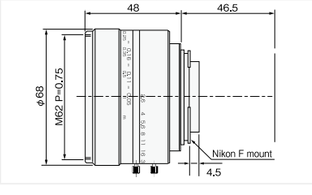
Magnification	35mm
∞F No.	2.6
Range of WD	0.18m - 0.4m
Magnification at MOD	0.2×
Optical distortion	-0.42%
Maximum Compatible CCD	φ36mm
Mount	F

FV5026L-C



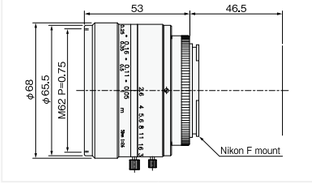
Magnification	50mm
∞F No.	2.6
Range of WD	0.25m - 0.4m
Magnification at MOD	0.22×
Optical distortion	-0.01%
Maximum Compatible CCD	1.2 inch (φ21.4mm)
Mount	C

FV5026L-F



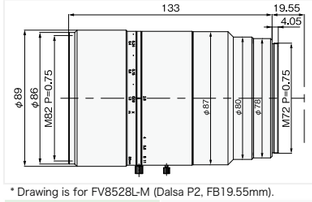
Magnification	50mm
∞F No.	2.6
Range of WD	0.25 - 0.4m
Magnification at MOD	0.22×
Optical distortion	-0.24%
Maximum Compatible CCD	φ45mm
Mount	F

FV5026LⅡ-F



Magnification	50mm
∞F No.	2.6
Range of WD	0.15m - 0.35mm
Magnification at MOD	0.32×
Optical distortion	-0.80%
Maximum Compatible CCD	φ45mm
Mount	F

FV8528L-□



* Drawing is for FV8528L-M (Dalsa P2, FB19.55mm).

Magnification	85mm
∞F No.	2.8
Range of WD	0.25m - 0.45m
Magnification at MOD	0.4×
Optical distortion	-0.18%
Maximum Compatible CCD	φ62mm
Mount	F or M72

* Indicated specifications are design value. * □ = Mount: F = Nikon F Mount, M = Dalsa P2 (FB19.55mm), H = Dalsa P2-HS and P3 (FB6.56mm), N = NED ClisBee (FB31.8mm)

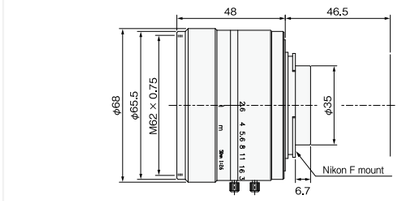
FV-W Series

Line Scan Lens for Wide Field of View

Machine vision lens for large field of view

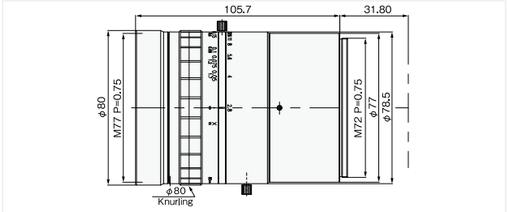
- Adjustable focus and iris
- Design for infinite distance (∞), suitable for wide field of view
- Design for machine vision application
- Suitable for various applications such as printing, large size of PCB and glass, textile, etc..
- FV8528W is compatible with M72 mount
- FV5026W is compatible with TFL-II mount
- Compatible with large image format of high resolution area camera

FV5026W-F



Focal length	50mm	Optical distortion	0.23%
∞F No.	2.6	Maximum Compatible CCD	φ45mm
Range of WD	0.32m - ∞	Mount	F
Magnification at MOD	0.18×		

FV8528W-□



* Drawing is for FV8528W-N (NED Clis Bee, FB31.8mm).

Focal length	85 mm	Optical distortion	0.04%
∞F No.	2.8	Maximum Compatible CCD	φ62mm
Range of WD	0.46m - ∞	Mount	F or M72
Magnification at MOD	0.2×		

* Indicated specifications are design value. * □ = Mount: F = Nikon F Mount, M = Dalsa P2 (FB19.55mm), H = Dalsa P2-HS and P3 (FB6.56mm), N = NED ClisBee (FB31.8mm)

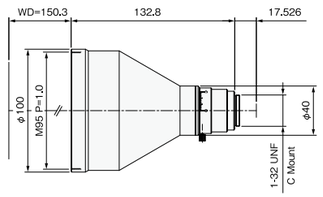
MGTL Series

Low Magnification Telecentric Lens for 5 Mega Pixel

Possible to capture large field of view with high resolution

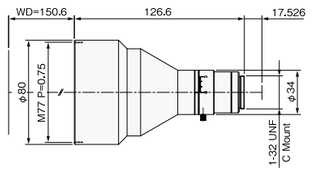
- Bring out the best quality in 5 mega pixel (3.45 μ of 2/3 inch)
- 0.14x, 0.17x, 0.22x are available
- Long working distance, WD150mm
- Compact design with low magnification
- Adjustable iris, possible to adjust depth of field

MGTL014VM



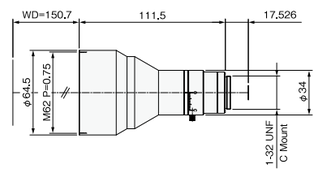
Magnification	0.14x	Depth of field	17.5mm
F No.	4.3	Resolution	20.5μ
Object side NA	0.016	TV distortion	0.01%
WD	150.3mm	Maximum Compatible CCD	2/3
OI	300.6mm	Mount	C

MGTL017VM



Magnification	0.17x	Depth of field	14.4mm
F No.	5.2	Resolution	20.5μ
Object side NA	0.016	TV distortion	0.00%
WD	150.6mm	Maximum Compatible CCD	2/3
OI	294.7mm	Mount	C

MGTL022VM



Magnification	0.22x	Depth of field	8.5mm
F No.	5.2	Resolution	15.8μ
Object side NA	0.021	TV distortion	0.00%
WD	150.7mm	Maximum Compatible CCD	2/3
OI	279.7mm	Mount	C

* Indicated specifications are design values. * Resolution indicates a theoretical resolution at a wavelength of 550nm.
* Depth of field is calculated assuming a horizontal 320 TV resolution using 1/2 CCD camera (Permissible circle of confusion 40μ).

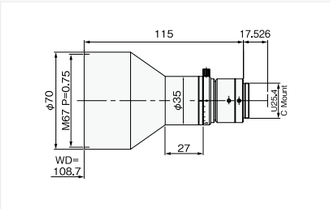
MGTL Series

Telecentric Lens for 5 Mega Pixel

Suitable for the inspection in ultra high accuracy

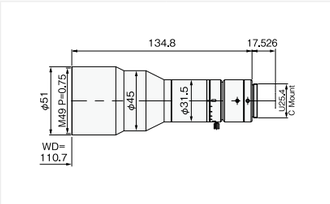
- Bring out the best quality in 5 mega pixel (3.45 μ of 2/3 inch)
- Excellent brightness, compared to mega pixel telecentric lenses
- Adjustable iris, possible to adjust depth of field
- 1.0x is compatible with 1.1 inch sensor
- Compact design
- Reduce hot spots of co-axial illumination

MGTL023H



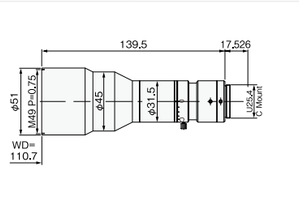
Magnification	0.23x
F No.	5.2
Object side NA	0.022
WD	109mm
OI	241mm
Depth of field	7.9mm
Resolution	8.7 μ
TV distortion	0.00%
Maximum Compatible CCD	2/3
Mount	C

MGTL03VM



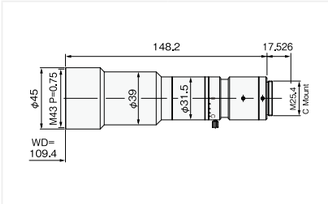
Magnification	0.3x
F No.	5.0
Object side NA	0.03
WD	111mm
OI	263mm
Depth of field	4.4mm
Resolution	6.6 μ
TV distortion	-0.04%
Maximum Compatible CCD	2/3
Mount	C

MGTL0345VM



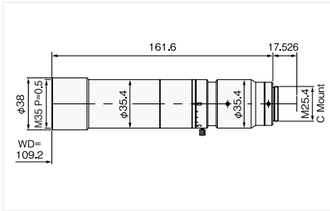
Magnification	0.345x
F No.	4.9
Object side NA	0.035
WD	111mm
OI	267mm
Depth of field	3.3mm
Resolution	5.5 μ
TV distortion	0.00%
Maximum Compatible CCD	2/3
Mount	C

MGTL04VM



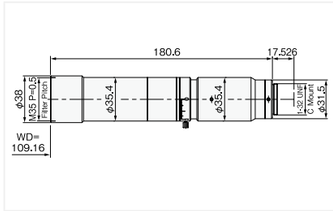
Magnification	0.4x
F No.	5.0
Object side NA	0.04
WD	109mm
OI	275mm
Depth of field	2.5mm
Resolution	4.9 μ
TV distortion	0.00%
Maximum Compatible CCD	2/3
Mount	C

MGTL05VM



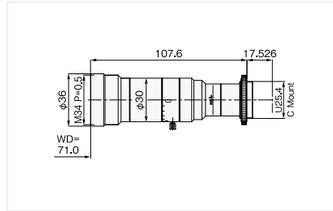
Magnification	0.5x
F No.	4.7
Object side NA	0.05
WD	109mm
OI	288mm
Depth of field	2.3mm
Resolution	3.8 μ
TV distortion	-0.03%
Maximum Compatible CCD	2/3
Mount	C

MGTL069VM



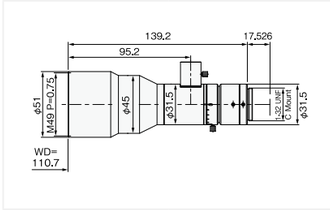
Magnification	0.69x
F No.	6.6
Object side NA	0.052
WD	109mm
OI	307mm
Depth of field	1.1mm
Resolution	3.9 μ
TV distortion	-0.04%
Maximum Compatible CCD	2/3
Mount	C

MGTL10V



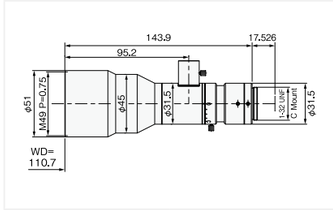
Magnification	1.0x
F No.	5.4
Object side NA	0.093
WD	71mm
OI	196mm
Depth of field	0.43mm
Resolution	2.5 μ
TV distortion	0.00%
Maximum Compatible CCD	1.1
Mount	C

MGTL03VMC



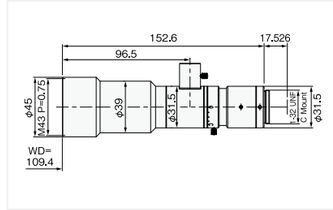
Magnification	0.3x
F No.	5.0
Object side NA	0.03
WD	111mm
OI	267mm
Depth of field	4.4mm
Resolution	6.6 μ
TV distortion	-0.04
Maximum Compatible CCD	2/3
Mount	C

MGTL0345VMC



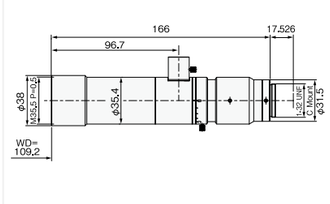
Magnification	0.345x
F No.	4.9
Object side NA	0.035
WD	111mm
OI	272mm
Depth of field	3.3mm
Resolution	5.5 μ
TV distortion	0.00%
Maximum Compatible CCD	2/3
Mount	C

MGTL04VMC



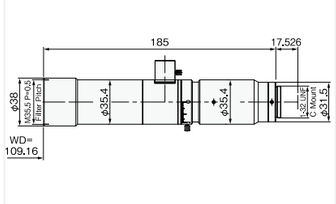
Magnification	0.4x
F No.	5.0
Object side NA	0.04
WD	109mm
OI	280mm
Depth of field	2.5mm
Resolution	4.9 μ
TV distortion	0.00%
Maximum Compatible CCD	2/3
Mount	C

MGTL05VMC



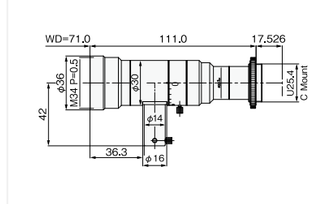
Magnification	0.5x
F No.	4.7
Object side NA	0.05
WD	109mm
OI	293mm
Depth of field	2.3mm
Resolution	3.8 μ
TV distortion	-0.03%
Maximum Compatible CCD	2/3
Mount	C

MGTL069VMC



Magnification	0.69x
F No.	6.6
Object side NA	0.052
WD	109mm
OI	312mm
Depth of field	1.1mm
Resolution	3.9 μ
TV distortion	-0.04%
Maximum Compatible CCD	2/3
Mount	C

MGTL10VC



Magnification	1.0x
F No.	5.4
Object side NA	0.093
WD	71mm
OI	200mm
Depth of field	0.43mm
Resolution	2.5 μ
TV distortion	0.00%
Maximum Compatible CCD	1.1
Mount	C

* Indicated specifications are design values. * Resolution indicates a theoretical resolution at a wavelength of 550nm.
* Depth of field is calculated assuming a horizontal 320 TV resolution using 1/2 CCD camera (permissible circle of confusion 40 μ).

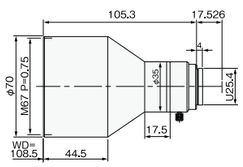
MGTL Series

Mega Pixel Telecentric Lens

Suitable for Mega Pixel Sensor

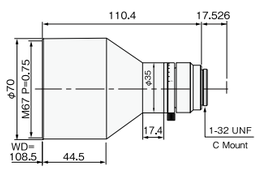
- High resolution, compatible with mega pixel camera
- Compact design, suitable for small device
- MGTL05-1.1 is compatible with 1.1 inch sensor
- Adjustable iris, possible to adjust depth of field
- TV distortion less than 0.05%

MGTL014



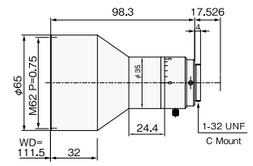
Magnification	0.14x	Depth of field	32.7mm
F No.	4.0	Resolution	19.7μ
Object side NA	0.017	TV distortion	0.02%
WD	108mm	Maximum Compatible CCD	1/2
OI	231mm	Mount	C

MGTL019



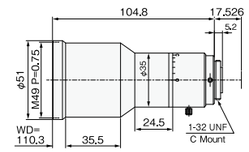
Magnification	0.19x	Depth of field	17.7mm
F No.	4.0	Resolution	14.0μ
Object side NA	0.024	TV distortion	0.01%
WD	108mm	Maximum Compatible CCD	2/3
OI	236mm	Mount	C

MGTL023



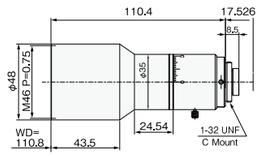
Magnification	0.23x	Depth of field	12mm
F No.	5.5	Resolution	16.0μ
Object side NA	0.021	TV distortion	0.01%
WD	111mm	Maximum Compatible CCD	2/3
OI	227mm	Mount	C

MGTL03



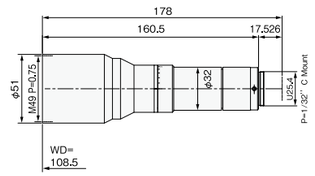
Magnification	0.3x	Depth of field	6.2mm
F No.	7.0	Resolution	16.0μ
Object side NA	0.021	TV distortion	0.05%
WD	110mm	Maximum Compatible CCD	2/3
OI	233mm	Mount	C

MGTL04



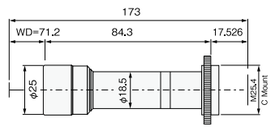
Magnification	0.4x	Depth of field	4.6mm
F No.	9.2	Resolution	15.2μ
Object side NA	0.022	TV distortion	0.00%
WD	110mm	Maximum Compatible CCD	2/3
OI	239mm	Mount	C

MGTL05-1.1



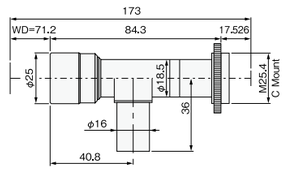
Magnification	0.5x	Depth of field	2mm
F No.	6.37	Resolution	8.6μ
Object side NA	0.039	TV distortion	0.00%
WD	108mm	Maximum Compatible CCD	1.1
OI	286mm	Mount	C

MGTL05S



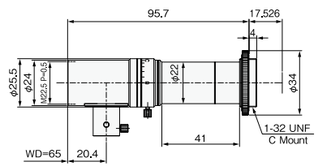
Magnification	0.5x	Depth of field	2.79mm
F No.	8.73	Resolution	11.7μ
Object side NA	0.0286	TV distortion	0.00%
WD	71mm	Maximum Compatible CCD	1/2
OI	173mm	Mount	C

MGTL05SC



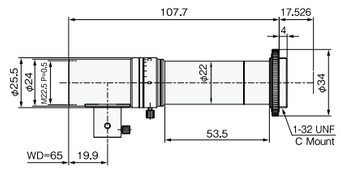
Magnification	0.5x	Depth of field	2.79mm
F No.	8.73	Resolution	11.7μ
Object side NA	0.0286	TV distortion	0.00%
WD	71mm	Maximum Compatible CCD	1/2
OI	173mm	Mount	C

MGTL40C



Magnification	4x	Depth of field	0.09mm
F No.	18.3	Resolution	3.1μ
Object side NA	0.11	TV distortion	0.00%
WD	65mm	Maximum Compatible CCD	2/3
OI	178mm	Mount	C

MGTL60C



Magnification	6x	Depth of field	0.06mm
F No.	27.5	Resolution	3.1μ
Object side NA	0.11	TV distortion	0.00%
WD	65mm	Maximum Compatible CCD	2/3
OI	190mm	Mount	C

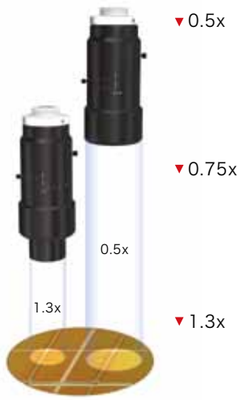
* Indicated specifications are design values. *Resolution indicates a theoretical resolution at a wavelength of 550nm.
* Depth of field is calculated assuming a horizontal 320 TV resolution using 1/2 CCD camera (permissible circle of confusion 40μ).
* Depth of field of MGTL014, 019, and 023 indicate values at effective F No. 8

VTL Series

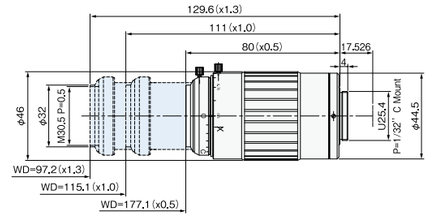
Vari Focal Telecentric Lens

Telecentric lens at the whole range of magnifications (0.5x - 1.3x)
Possible to change magnification range by using front converter

- Telecenric lens at the whole range of magnification
- Suitable for 5 Mega Pixel camera
- Magnification of VTL0513 can be converted from 0.25x - 2.6x by using front converter
- Reduce relative illumination
- TV distortion less than 0.01%
- VTL0513 is possible to use for 1.1 inch sensor (Optical design is for 2/3 in catalogue.)

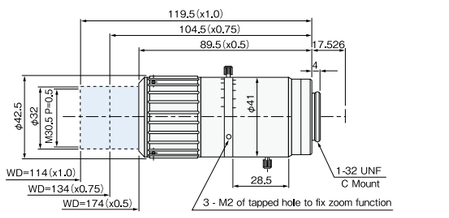


VTL0513



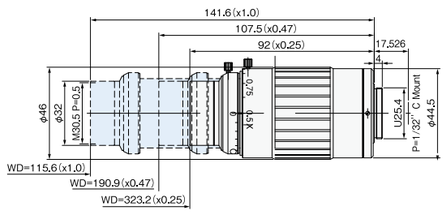
Magnification	0.5× - 1.3×	Depth of field	1.68mm - 0.47mm
F No.	5.26 - 10	Resolution	4.2μ - 2.9μ
Object side NA	0.048 - 0.065	TV distortion	0.01%
WD	173mm - 97mm	Maximum Compatible CCD	2/3
OI	271mm - 244mm	Mount	C

VTL0510



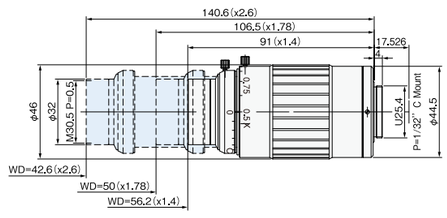
Magnification	0.5× - 1.0×	Depth of field	1.20mm - 0.47mm
F No.	3.76 - 5.89	Resolution	7.4μ - 5μ
Object side NA	0.066 - 0.085	TV distortion	0.01%
WD	174mm - 114mm	Maximum Compatible CCD	1/1.8
OI	281mm - 251mm	Mount	C

VTL0513 + VTL05FC



Magnification	0.25x - 1.0x
WD	323.2mm - 115.6mm
Application	For VTL0513

VTL0513 + VTL20FC



Magnification	1.4x - 2.6x
WD	56.2mm - 42.6mm
Application	For VTL0513

* Indicated specifications are design values. ＊Resolution indicates a theoretical resolution at a wavelength of 550nm.
* Depth of field is calculated assuming a horizontal 320 TV resolution using 1/2 CCD camera (permissible circle of confusion 40μ).

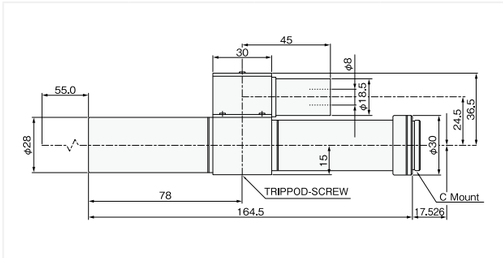
TL Series

10x Telecentric Lens

High resolution, possible to use in limited space

- Magnification of 10x, similar to microscopic range for machine vision applications
- Compact design with high resolution

TL100C-55



Magnification	10x	Depth of field	0.023mm
F No.	29.7	Resolution	2μ
Object side NA	0.17	TV distortion	0.02%
WD	55mm	Maximum Compatible CCD	1/1.8
OI	237mm	Mount	C

* Indicated specifications are design values. ＊Resolution indicates a theoretical resolution at a wavelength of 550nm.
* Depth of field is calculated assuming a horizontal 320 TV resolution using 1/2 CCD camera (permissible circle of confusion 40μ).

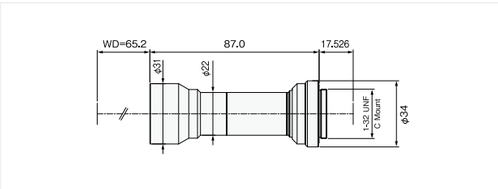
FT Series

WD65 High NA　Mega Pixel Telecentric Lens

Design for Mega Pixel　Compact and high durability

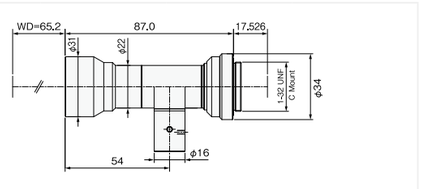
- Mega pixel telecentric lens for 2/3 sensor
- Suitable for 2 mega - 5 mega pixel camera
- High contrast with co-axial illumination
- TV distortion less than 0.01%

FT05-65



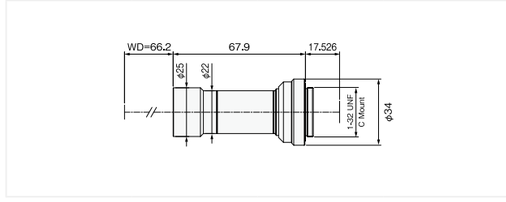
Magnification	0.5×	Depth of field	3.1mm
F No.	9.6	Resolution	12.9μ
Object side NA	0.026	TV distortion	0.00%
WD	65mm	Maximum Compatible CCD	2/3
OI	170mm	Mount	C

FT05C-65



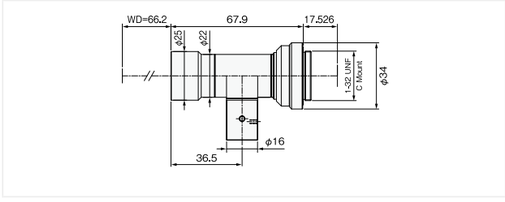
Magnification	0.5×	Depth of field	3.1mm
F No.	9.6	Resolution	12.9μ
Object side NA	0.026	TV distortion	0.00%
WD	65mm	Maximum Compatible CCD	2/3
OI	170mm	Mount	C

FT08-65



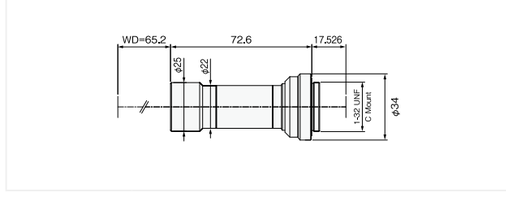
Magnification	0.8×	Depth of field	1.3mm
F No.	10	Resolution	8.4μ
Object side NA	0.04	TV distortion	0.00%
WD	66mm	Maximum Compatible CCD	2/3
OI	152mm	Mount	C

FT08C-65



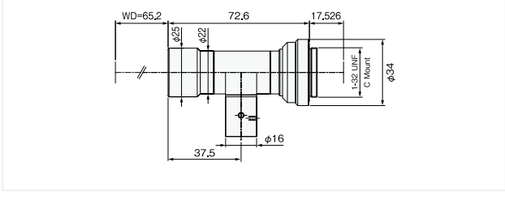
Magnification	0.8×	Depth of field	1.3mm
F No.	10	Resolution	8.4μ
Object side NA	0.04	TV distortion	0.00%
WD	66mm	Maximum Compatible CCD	2/3
OI	152mm	Mount	C

FT10-65



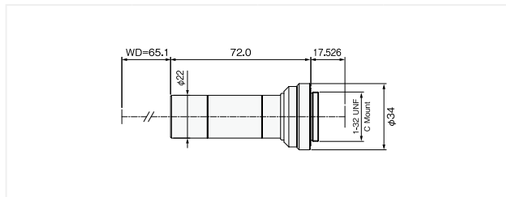
Magnification	1.0×	Depth of field	0.9mm
F No.	11.1	Resolution	7.5μ
Object side NA	0.045	TV distortion	0.00%
WD	65mm	Maximum Compatible CCD	2/3
OI	155mm	Mount	C

FT10C-65



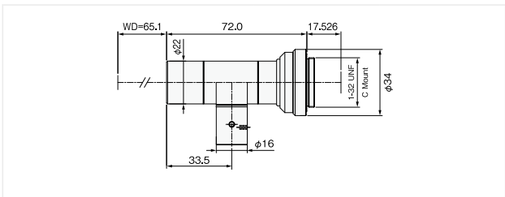
Magnification	1.0×	Depth of field	0.9mm
F No.	11.1	Resolution	7.5μ
Object side NA	0.045	TV distortion	0.00%
WD	65mm	Maximum Compatible CCD	2/3
OI	155mm	Mount	C

FT15-65



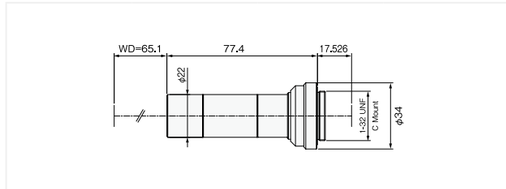
Magnification	1.5×	Depth of field	0.4mm
F No.	11.9	Resolution	5.3μ
Object side NA	0.063	TV distortion	0.01%
WD	65mm	Maximum Compatible CCD	2/3
OI	155mm	Mount	C

FT15C-65



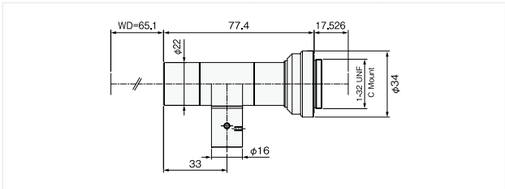
Magnification	1.5×	Depth of field	0.4mm
F No.	11.9	Resolution	5.3μ
Object side NA	0.063	TV distortion	0.30%
WD	65mm	Maximum Compatible CCD	2/3
OI	155mm	Mount	C

FT20-65



Magnification	2.0×	Depth of field	0.3mm
F No.	13.5	Resolution	4.5μ
Object side NA	0.074	TV distortion	0.00%
WD	65mm	Maximum Compatible CCD	2/3
OI	160mm	Mount	C

FT20C-65



Magnification	2.0×	Depth of field	0.3mm
F No.	13.5	Resolution	4.5μ
Object side NA	0.074	TV distortion	0.00%
WD	65mm	Maximum Compatible CCD	2/3
OI	160mm	Mount	C

* Indicated specifications are design values.　＊Resolution indicates a theoretical resolution at a wavelength of 550nm.
* Depth of field is calculated assuming a horizontal 320 TV resolution using 1/2 CCD camera (permissible circle of confusion 40μ).

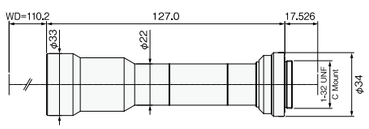
FT Series

WD110 High NA Mega Pixel Telecentric Lens

Design for Mega Pixel Compact and high durability

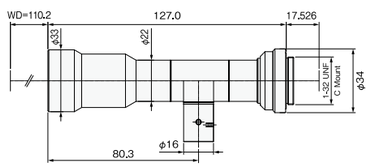
- Mega pixel telecentric lens for 2/3 sensor
- Suitable for 2 mega - 5 mega pixel camera
- High contrast with co-axial illumination
- TV distortion less than 0.01%

FT05-110



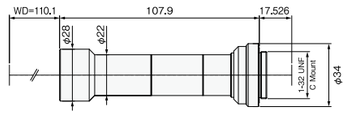
Magnification	0.5×	Depth of field	3.1mm
F No.	9.6	Resolution	12.9μ
Object side NA	0.026	TV distortion	0.00%
WD	110mm	Maximum Compatible CCD	2/3
OI	255mm	Mount	C

FT05C-110



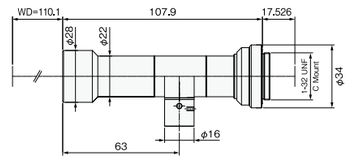
Magnification	0.5×	Depth of field	3.1mm
F No.	9.6	Resolution	12.9μ
Object side NA	0.026	TV distortion	0.00%
WD	110mm	Maximum Compatible CCD	2/3
OI	255mm	Mount	C

FT08-110



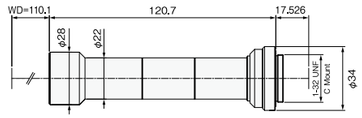
Magnification	0.8×	Depth of field	1.4mm
F No.	11.1	Resolution	9.3μ
Object side NA	0.036	TV distortion	0.01%
WD	110mm	Maximum Compatible CCD	2/3
OI	236mm	Mount	C

FT08C-110



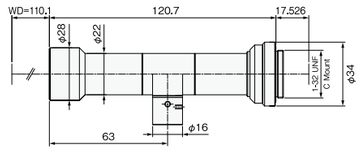
Magnification	0.8×	Depth of field	1.4mm
F No.	11.1	Resolution	9.3μ
Object side NA	0.036	TV distortion	0.01%
WD	110mm	Maximum Compatible CCD	2/3
OI	236mm	Mount	C

FT10-110



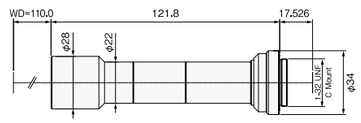
Magnification	1.0×	Depth of field	0.9mm
F No.	11.1	Resolution	7.5μ
Object side NA	0.045	TV distortion	0.00%
WD	110mm	Maximum Compatible CCD	2/3
OI	248mm	Mount	C

FT10C-110



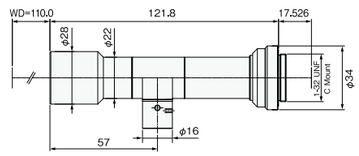
Magnification	1.0×	Depth of field	0.9mm
F No.	11.1	Resolution	7.5μ
Object side NA	0.045	TV distortion	0.00%
WD	110mm	Maximum Compatible CCD	2/3
OI	248mm	Mount	C

FT15-110



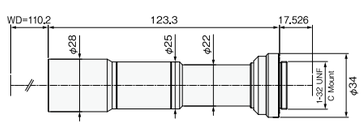
Magnification	1.5×	Depth of field	0.4mm
F No.	11.9	Resolution	5.3μ
Object side NA	0.063	TV distortion	0.00%
WD	110mm	Maximum Compatible CCD	2/3
OI	249mm	Mount	C

FT15C-110



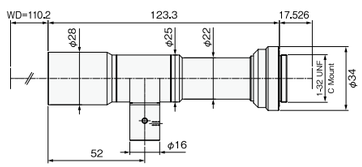
Magnification	1.5×	Depth of field	0.4mm
F No.	11.9	Resolution	5.3μ
Object side NA	0.063	TV distortion	0.00%
WD	110mm	Maximum Compatible CCD	2/3
OI	249mm	Mount	C

FT20-110



Magnification	2.0×	Depth of field	0.3mm
F No.	13.5	Resolution	4.5μ
Object side NA	0.074	TV distortion	0.00%
WD	110mm	Maximum Compatible CCD	2/3
OI	250mm	Mount	C

FT20C-110



Magnification	2.0×	Depth of field	0.3mm
F No.	13.5	Resolution	4.5μ
Object side NA	0.074	TV distortion	0.00%
WD	110mm	Maximum Compatible CCD	2/3
OI	250mm	Mount	C

* Indicated specifications are design values. ＊Resolution indicates a theoretical resolution at a wavelength of 550nm.
* Depth of field is calculated assuming a horizontal 320 TV resolution using 1/2 CCD camera (permissible circle of confusion 40μ).

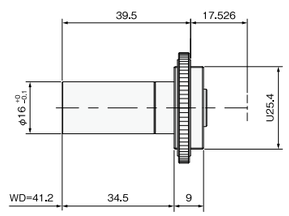
TL Series

WD40 Built-in type Telecentric Lens Series

Short WD: WD40mm　Suitable for small device and limited space

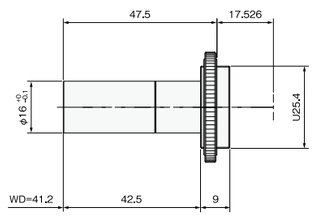
- φ16mm telecentric lens
- Suitable for bonding, chip mounter, etc..

TL20-40



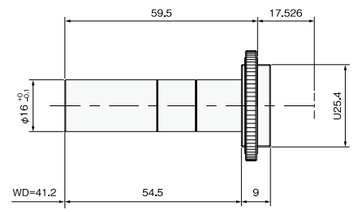
Magnification	2x	Depth of field	0.28mm
F No.	14.1	Resolution	4.7μ
Object side NA	0.071	TV distortion	0.13%
WD	40mm	Maximum Compatible CCD	1/2
OI	98mm	Mount	C

TL40-40



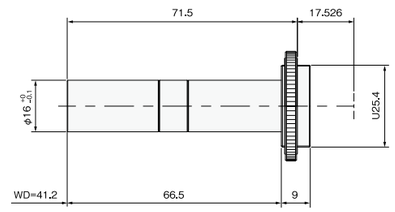
Magnification	4x	Depth of field	0.14mm
F No.	28.2	Resolution	4.7μ
Object side NA	0.071	TV distortion	-0.19%
WD	40mm	Maximum Compatible CCD	1/2
OI	106mm	Mount	C

TL60-40



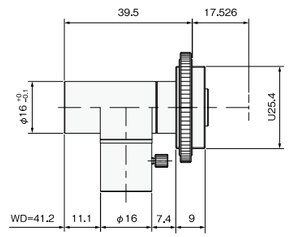
Magnification	6x	Depth of field	0.09mm
F No.	41.6	Resolution	4.7μ
Object side NA	0.072	TV distortion	-0.10%
WD	40mm	Maximum Compatible CCD	1/2
OI	118mm	Mount	C

TL80-40



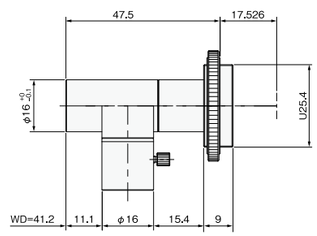
Magnification	8x	Depth of field	0.07mm
F No.	54.8	Resolution	4.6μ
Object side NA	0.073	TV distortion	0.11%
WD	40mm	Maximum Compatible CCD	1/2
OI	130mm	Mount	C

TL20C-40



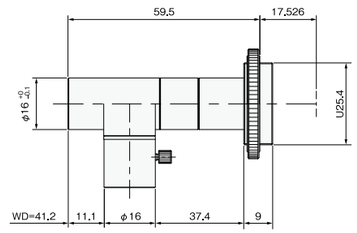
Magnification	2x	Depth of field	0.28mm
F No.	14.1	Resolution	4.7μ
Object side NA	0.071	TV distortion	0.13%
WD	40mm	Maximum Compatible CCD	1/2
OI	98mm	Mount	C

TL40C-40



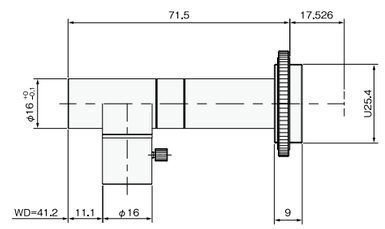
Magnification	4x	Depth of field	0.14mm
F No.	28.2	Resolution	4.7μ
Object side NA	0.071	TV distortion	-0.19%
WD	40mm	Maximum Compatible CCD	1/2
OI	106mm	Mount	C

TL60C-40



Magnification	6x	Depth of field	0.09mm
F No.	41.6	Resolution	4.7μ
Object side NA	0.072	TV distortion	-0.10%
WD	40mm	Maximum Compatible CCD	1/2
OI	118mm	Mount	C

TL80C-40



Magnification	8x	Depth of field	0.07mm
F No.	54.8	Resolution	4.6μ
Object side NA	0.073	TV distortion	0.11%
WD	40mm	Maximum Compatible CCD	1/2
OI	130mm	Mount	C

* Indicated specifications are design values.　* Resolution indicates a theoretical resolution at a wavelength of 550nm.
* Depth of field is calculated assuming a horizontal 320 TV resolution using 1/2 CCD camera (permissible circle of confusion 40μ).

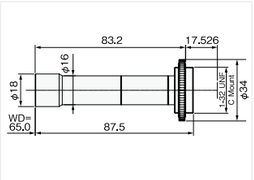
TL Series

WD65 Built-in type Telecentric Lens Series

Middle WD: WD65mm Short OI and High NA

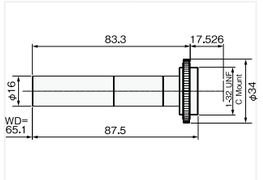
- φ16mm telecentric lens
- TL-**"R" type is improved contrast and relative illumination.

TL08-65R



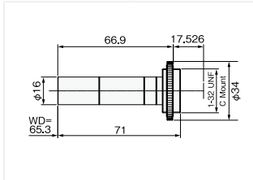
Magnification	0.8x
F No.	14.8
Object side NA	0.027
WD	65mm
OI	166mm
Depth of field	1.85mm
Resolution	12.3μ
TV distortion	0.00%
Maximum Compatible CCD	1/1.8
Mount	C

TL10-65R



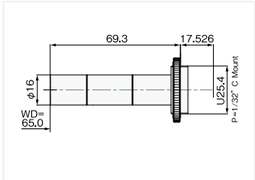
Magnification	1x
F No.	18.5
Object side NA	0.027
WD	65mm
OI	166mm
Depth of field	1.48mm
Resolution	12.4μ
TV distortion	0.00%
Maximum Compatible CCD	1/1.8
Mount	C

TL15-65R



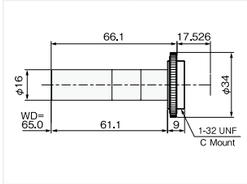
Magnification	1.5x
F No.	16.0
Object side NA	0.047
WD	65mm
OI	150mm
Depth of field	0.57mm
Resolution	7.22μ
TV distortion	0.00%
Maximum Compatible CCD	1/1.8
Mount	C

TL20-65R



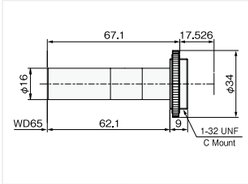
Magnification	2x
F No.	16.7
Object side NA	0.06
WD	65mm
OI	152mm
Depth of field	0.33mm
Resolution	5.6μ
TV distortion	-0.01%
Maximum Compatible CCD	1/2
Mount	C

TL30-65



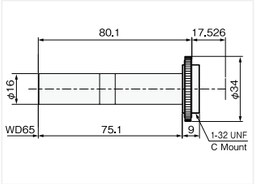
Magnification	3x
F No.	
Object side NA	0.075
WD	65mm
OI	149mm
Depth of field	0.18mm
Resolution	4.47μ
TV distortion	0.15%
Maximum Compatible CCD	2/3
Mount	C

TL40-65



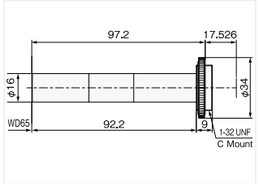
Magnification	4x
F No.	26.0
Object side NA	0.077
WD	65mm
OI	150mm
Depth of field	0.13mm
Resolution	4.36μ
TV distortion	0.30%
Maximum Compatible CCD	2/3
Mount	C

TL60-65



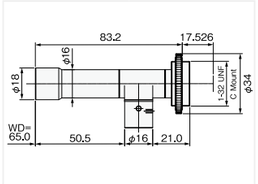
Magnification	6x
F No.	39.0
Object side NA	0.077
WD	65mm
OI	163mm
Depth of field	0.09mm
Resolution	4.36μ
TV distortion	0.33%
Maximum Compatible CCD	2/3
Mount	C

TL80-65



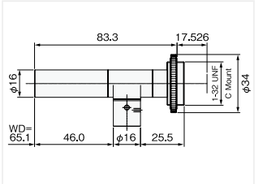
Magnification	8x
F No.	52.0
Object side NA	0.077
WD	65mm
OI	180mm
Depth of field	0.07mm
Resolution	4.36μ
TV distortion	0.20%
Maximum Compatible CCD	2/3
Mount	C

TL08C-65R



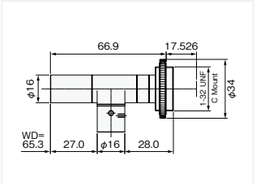
Magnification	0.8x
F No.	14.8
Object side NA	0.027
WD	65mm
OI	166mm
Depth of field	1.85mm
Resolution	12.3μ
TV distortion	0.00%
Maximum Compatible CCD	1/1.8
Mount	C

TL10C-65R



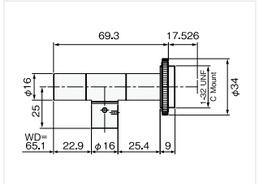
Magnification	1x
F No.	18.5
Object side NA	0.027
WD	65mm
OI	166mm
Depth of field	1.48mm
Resolution	12.4μ
TV distortion	0.00%
Maximum Compatible CCD	1/1.8
Mount	C

TL15C-65R



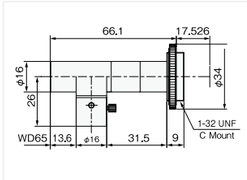
Magnification	1.5x
F No.	16.0
Object side NA	0.047
WD	65mm
OI	150mm
Depth of field	0.57mm
Resolution	7.22μ
TV distortion	0.00%
Maximum Compatible CCD	1/1.8
Mount	C

TL20C-65R



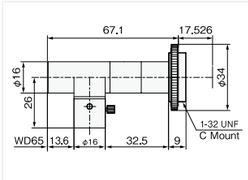
Magnification	2x
F No.	16.7
Object side NA	0.06
WD	65mm
OI	152mm
Depth of field	0.33mm
Resolution	5.6μ
TV distortion	-0.01%
Maximum Compatible CCD	1/2
Mount	C

TL30C-65



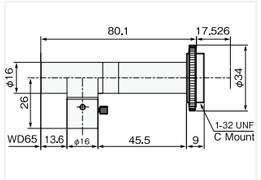
Magnification	3x
F No.	19.9
Object side NA	0.075
WD	65mm
OI	149mm
Depth of field	0.18mm
Resolution	4.47μ
TV distortion	0.15%
Maximum Compatible CCD	2/3
Mount	C

TL40C-65



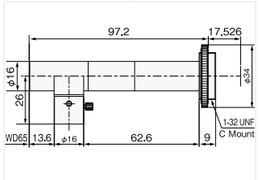
Magnification	4x
F No.	26.0
Object side NA	0.077
WD	65mm
OI	150mm
Depth of field	0.13mm
Resolution	4.36μ
TV distortion	0.30%
Maximum Compatible CCD	2/3
Mount	C

TL60C-65



Magnification	6x
F No.	39.0
Object side NA	0.077
WD	65mm
OI	163mm
Depth of field	0.09mm
Resolution	4.36μ
TV distortion	0.33%
Maximum Compatible CCD	2/3
Mount	C

TL80C-65



Magnification	8x
F No.	52.0
Object side NA	0.077
WD	65mm
OI	180mm
Depth of field	0.07mm
Resolution	4.36μ
TV distortion	0.20%
Maximum Compatible CCD	2/3
Mount	C

* Indicated specifications are design values. * Resolution is calculated based on MTF.
* Depth of field is calculated assuming a horizontal 320 TV resolution using 1/2 CCD camera (permissible circle of confusion 40μ).

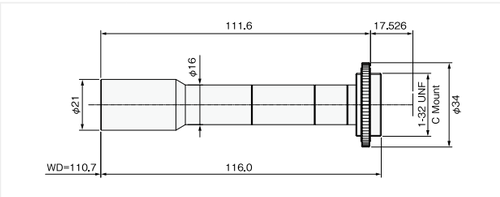
TL Series

WD110 Built-in type Telecentric Lens Series

Long WD: 110mm　Compact and suitable for customized optical systems

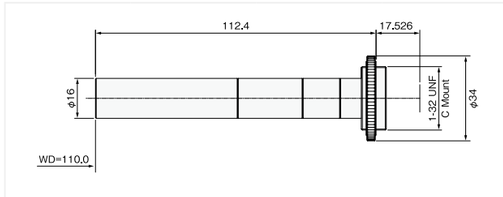
- ϕ16mm telecentric lens
- TL-**"R" type is improved contrast and relative illumination.

TL08-110R



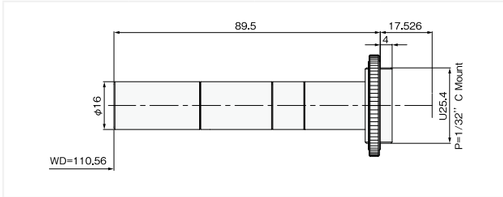
Magnification	0.8×	Depth of field	2.09mm
F No.	16.7	Resolution	14.0μ
Object side NA	0.024	TV distortion	0.00%
WD	111mm	Maximum Compatible CCD	1/1.8
OI	240mm	Mount	C

TL10-110R



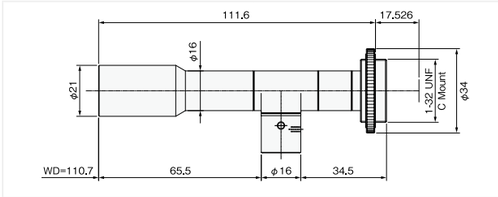
Magnification	1×	Depth of field	1.67mm
F No.	20.9	Resolution	14μ
Object side NA	0.024	TV distortion	0.00%
WD	110mm	Maximum Compatible CCD	1/1.8
OI	240mm	Mount	C

TL20-110R



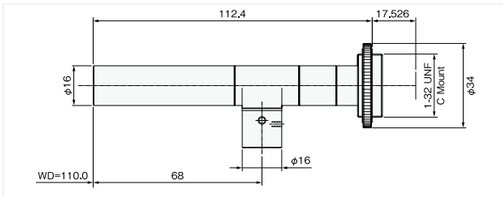
Magnification	2×	Depth of field	0.67mm
F No.	33.45	Resolution	11.2μ
Object side NA	0.03	TV distortion	-0.03%
WD	110mm	Maximum Compatible CCD	1/2
OI	218mm	Mount	C

TL08C-110R



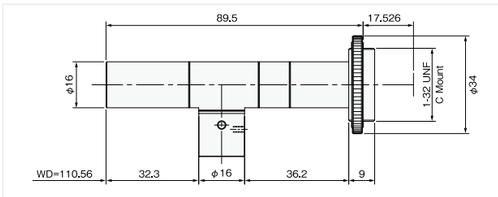
Magnification	0.8×	Depth of field	2.09mm
F No.	16.7	Resolution	14.0μ
Object side NA	0.024	TV distortion	0.00%
WD	111mm	Maximum Compatible CCD	1/1.8
OI	240mm	Mount	C

TL10C-110R



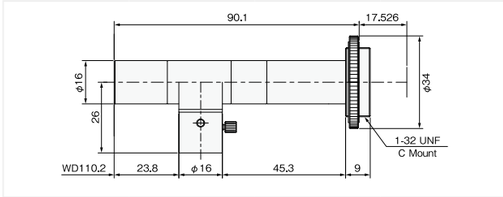
Magnification	1×	Depth of field	1.67mm
F No.	20.9	Resolution	14μ
Object side NA	0.024	TV distortion	0.00%
WD	110mm	Maximum Compatible CCD	1/1.8
OI	240mm	Mount	C

TL20C-110R



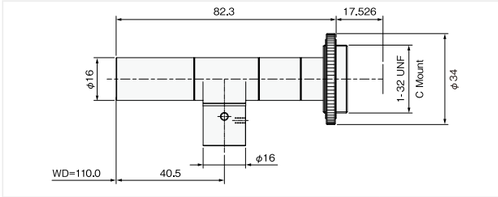
Magnification	2×	Depth of field	0.67mm
F No.	33.45	Resolution	11.2μ
Object side NA	0.03	TV distortion	-0.03%
WD	110mm	Maximum Compatible CCD	1/2
OI	218mm	Mount	C

TL30C-110



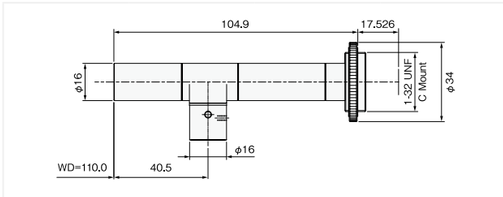
Magnification	3×	Depth of field	0.27mm
F No.	30.4	Resolution	6.8μ
Object side NA	0.049	TV distortion	0.06%
WD	110mm	Maximum Compatible CCD	2/3
OI	218mm	Mount	C

TL40C-110R



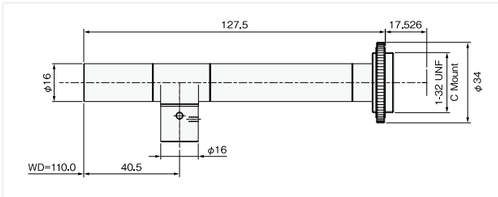
Magnification	4×	Depth of field	0.22mm
F No.	44.4	Resolution	7.5μ
Object side NA	0.045	TV distortion	0.00%
WD	110mm	Maximum Compatible CCD	1/1.8
OI	210mm	Mount	C

TL60C-110R



Magnification	6×	Depth of field	0.15mm
F No.	66.7	Resolution	7.5μ
Object side NA	0.045	TV distortion	0.00%
WD	110mm	Maximum Compatible CCD	1/1.8
OI	232mm	Mount	C

TL80C-110R



Magnification	8×	Depth of field	0.11mm
F No.	88.9	Resolution	7.5μ
Object side NA	0.045	TV distortion	0.00%
WD	110mm	Maximum Compatible CCD	1/1.8
OI	255mm	Mount	C

* Indicated specifications are design values.　＊Resolution indicates a theoretical resolution at a wavelength of 550nm.
* Depth of field is calculated assuming a horizontal 320 TV resolution using 1/2 CCD camera (permissible circle of confusion 40μ).

TL Series

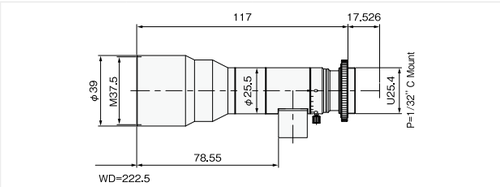
WD220 Built-in type Telecentric Lens Series

Long WD: 220mm High resolution and compact design

Due to the complication of production process, requirement of long working distance has been increasing.
In general, if long working distance, the size of a lens becomes large to maintain lens's NA.
TL-220 is designed for high resolution and compact design with long WD.

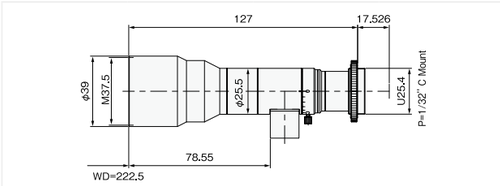
- Suitable for various applications, alignment, inspection, measurement, etc..
- Adjustable iris for 0.5x and 0.7x
- High resolution with long WD

TL05C-220



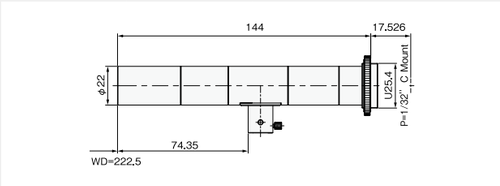
Magnification	0.5x	Depth of field	2.17mm
F No.	6.79	Resolution	9.1 μ
Object side NA	0.037	TV distortion	0.02%
WD	222mm	Maximum Compatible CCD	1/1.8
OI	357mm	Mount	C

TL07C-220



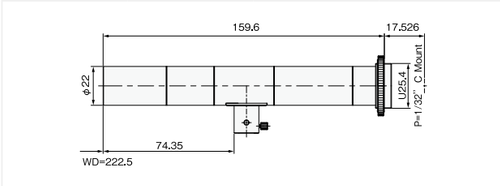
Magnification	0.7x	Depth of field	1.55mm
F No.	9.50	Resolution	9.1 μ
Object side NA	0.037	TV distortion	0.02%
WD	222mm	Maximum Compatible CCD	1/1.8
OI	367mm	Mount	C

TL10C-220



Magnification	1x	Depth of field	1.07mm
F No.	13.35	Resolution	9.0 μ
Object side NA	0.037	TV distortion	0.00%
WD	222mm	Maximum Compatible CCD	1/1.8
OI	384mm	Mount	C

TL20C-220



Magnification	2x	Depth of field	0.53mm
F No.	26.42	Resolution	8.8 μ
Object side NA	0.038	TV distortion	0.04%
WD	222mm	Maximum Compatible CCD	1/1.8
OI	400mm	Mount	C

* Indicated specifications are design values. ＊Resolution indicates a theoretical resolution at a wavelength of 550nm.
* Depth of field is calculated assuming a horizontal 320 TV resolution using 1/2 CCD camera (permissible circle of confusion 40 μ).

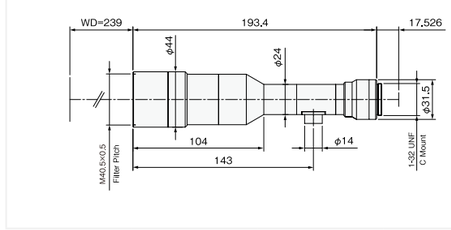
TL Series

WD240 High Magnification Telecentric Lens for Long WD

Suitable for vacuum chamber, working environment in high temperature, etc.., required for long WD

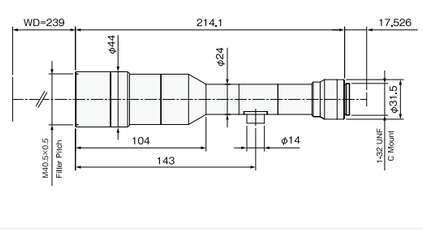
- Suitable for alignment, inspection, and other various applications
- 4, 6, 8, and 10x are available
- All models are designed for co-axial illumination

TL40C-240



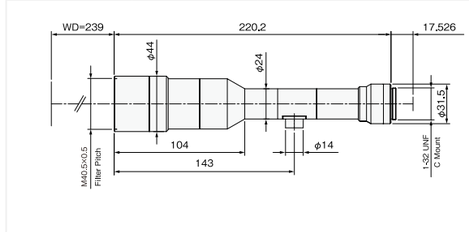
Magnification	4x	Depth of field	0.14mm
F No.	28.6	Resolution	4.8 μ
Object side NA	0.07	TV distortion	0.22%
WD	239mm	Maximum Compatible CCD	2/3
OI	450.0mm	Mount	C

TL60C-240



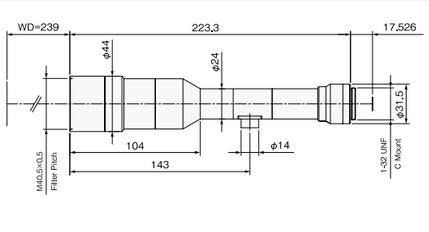
Magnification	6x	Depth of field	0.1mm
F No.	42.9	Resolution	4.8 μ
Object side NA	0.07	TV distortion	0.0%
WD	239mm	Maximum Compatible CCD	2/3
OI	470.6mm	Mount	C

TL80C-240



Magnification	8x	Depth of field	0.07mm
F No.	57.1	Resolution	4.8 μ
Object side NA	0.07	TV distortion	0.03%
WD	239mm	Maximum Compatible CCD	2/3
OI	476.7mm	Mount	C

TL100C-240



Magnification	10x	Depth of field	0.06mm
F No.	71.4	Resolution	4.8 μ
Object side NA	0.07	TV distortion	0.32%
WD	239mm	Maximum Compatible CCD	2/3
OI	479.8 mm	Mount	C

* Indicated specifications are design values. ＊Resolution indicates a theoretical resolution at a wavelength of 550nm.
* Depth of field is calculated assuming a horizontal 320 TV resolution using 1/2 CCD camera (permissible circle of confusion 40 μ).

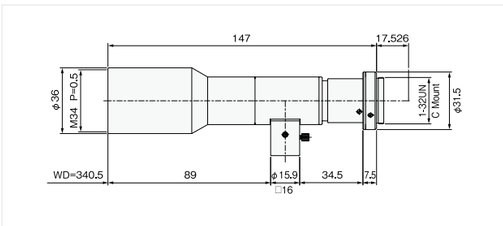
TL Series

WD300mm Telecentric Lens for Super Long WD

Suitable for applications required for super long WD

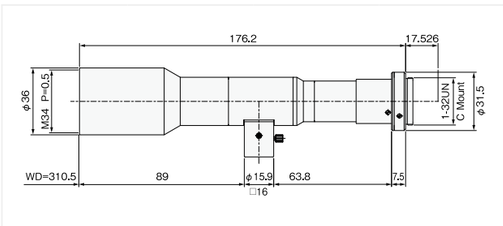
- Super long WD, over 300mm
- TL10C-310 is compatible with 2/3 inch camera
- TV distortion is less than 0.00%

TL07C-340



Magnification	0.7x	Depth of field	1.9mm
F No.	11.6	Resolution	7.8μ
Object side NA	0.043	TV distortion	0.00%
WD	341mm	Maximum Compatible CCD	1/1.8
OI	506mm	Mount	C

TL10C-310



Magnification	1.0x	Depth of field	1.2mm
F No.	15.5	Resolution	10.5μ
Object side NA	0.032	TV distortion	0.00%
WD	311mm	Maximum Compatible CCD	2/3
OI	505mm	Mount	C

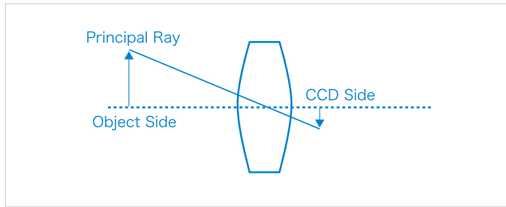
* Indicated specifications are design values. ＊Resolution indicates a theoretical resolution at a wavelength of 550nm.
* Depth of field is calculated assuming a horizontal 320 TV resolution using 1/2 CCD camera (permissible circle of confusion 40μ).

Telecentric Lens for Image Processing

The most suitable optical system for measurement in high accuracy

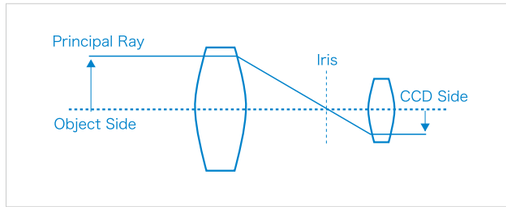
Telecentric optical system is an optical design that where the principal ray in parallel to the optical axis. It eliminates distortion problems by collimating the light entering the lens and suitable for imaging 3D objects. Co-axial illumination is suitable for recognizing object with high reflectance such as wafer, glass, and metal.

Non-telecentric lens



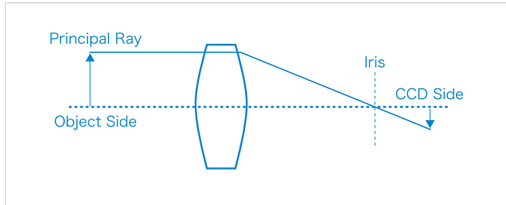
- Smaller size
- The number of lenses is fewer.
- Object size changes as the object goes up and down.

Double side telecentric lens



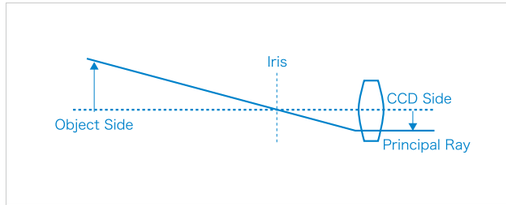
- Primary lays of object and image side are parallel to optical axis.
- Object size does not change when object goes up and down.
- Large size and high cost

Object side telecentric lens



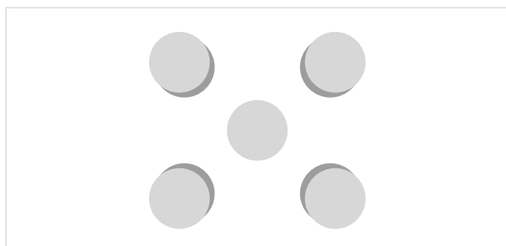
- Principal ray of object side is parallel to optical axis.
- Required for co-axial illumination
- Object size does not change when object goes up and down.
- Small size, compared to double side telecentric lens

Image side telecentric lens



- Principal ray of image side is parallel to optical axis.
- Object size changes when object size goes up and down.
- A lens for video camera should be this optical system to correct color aberration.

Standard Lens



Telecentric lens

Size of 3D object changes when it goes up and down when non-telecentric lens is used.
Telecentric lens is suitable for accurate measurement of 3D object.

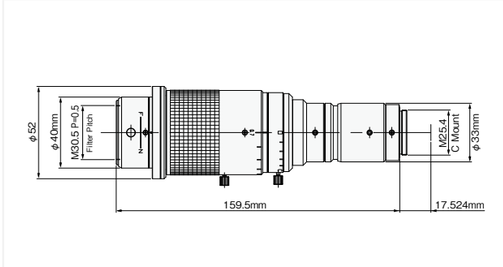
HMZ Series

High Resolution Macro Zoom Lens

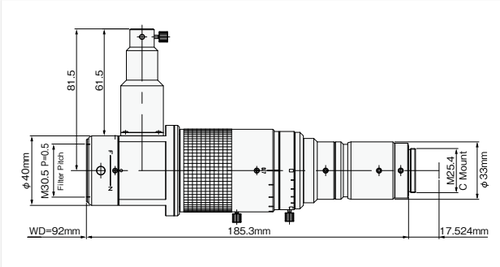
High resolution and compact design

- Compatible with 1/1.8 CCD of mega pixel camera
- High resolution and compact design
- High contrast and low distortion
- Improve uniformity of brightness for co-axial illumination
- Magnification and working distance can be converted to 0.21x - 18x, WD40 - 332mm by using converters

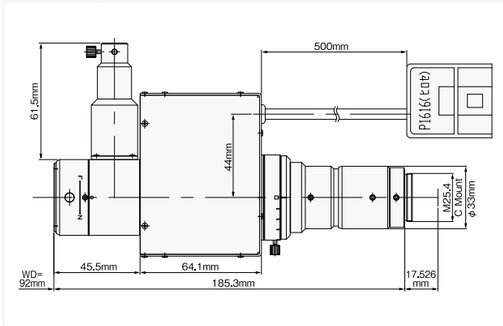
HMZ0745 (Manual Zoom/Straight type)



HMZ0745C (Manual Zoom/Co-axial type)



HMZ0745C-SM (Motorized Zoom/Co-axial type)



Lens

Model	HMZ0745 / HMZ0745C / HMZ0745C-SM		
Magnification	0.7× - 4.5×	Depth of field	2mm - 0.08mm
WD	92mm	TV distortion	0.05% - 0.08%
Resolution	11.5μ - 2.87μ	Maximum Compatible CCD	1/1.8
Object side NA	0.03 - 0.12		

* Indicated specifications are design values.
* Resolution indicates a theoretical resolution at a wavelength of 550nm.
* Depth of field is calculated assuming a horizontal 320 TV resolution using 1/2 CCD camera (permissible circle of confusion 40μ).

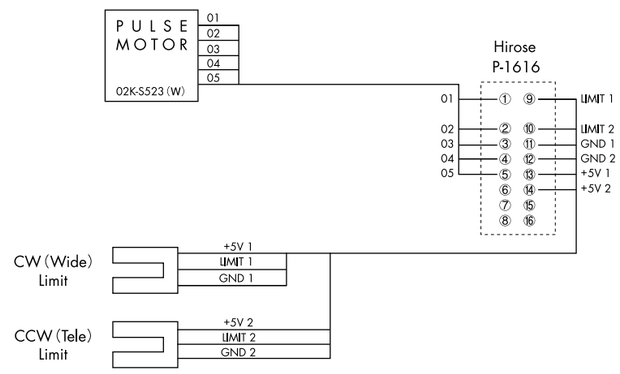
Front Converter

Model	Magnification	WD with converter
HMZ-FC03	0.3×	332mm
HMZ-FC04	0.4×	238mm
HMZ-FC05	0.5×	185mm
HMZ-FC067	0.67×	121mm
HMZ-FC20	2.0×	40mm

Rear Converter

Model	Magnification
HMZ-RC20	2.0×

(Wiring Diagram) HMZ0745C-SM



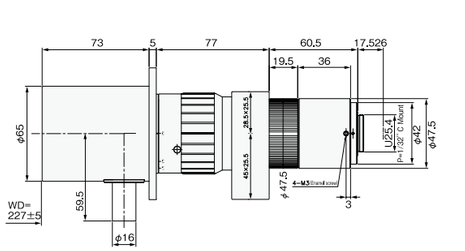
TLZ Series

Low Magnification Zoom Lens with Co-axial Illumination

Built-in co-axial illumination
Suitable for various applications, inspection of wafer, IC chip, etc...

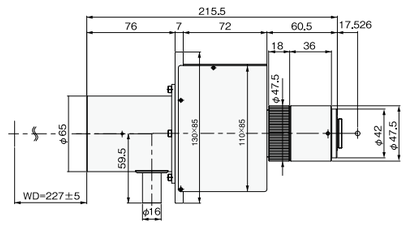
- 10x Zoom (0.2x - 2.0x)
- Compact design of 10x zoom ratio
- Reduce relative illumination
- High resolution at the whole magnification
- Motorized zoom type is available
- Long WD, 227mm

TLZ0220C (Manual Zoom)



Magnification	0.2x-2.0x	Depth of field	13.1mm - 0.45mm
WD	227mm	TV distortion	-0.16% - 0.16%
Resolution	22.4μ - 7.6μ	Maximum Compatible CCD	1/1.8
Object side NA	0.015 - 0.044mm		

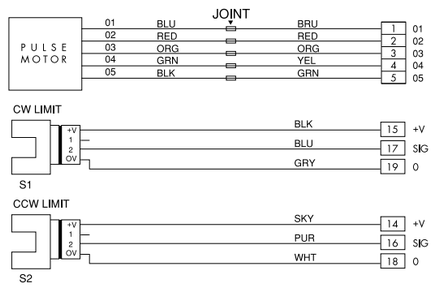
TLZ0220C-SM (Motorized Zoom)

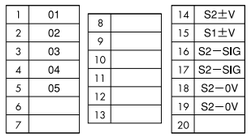


Magnification	0.2x - 2.0x	Depth of field	13.1mm - 0.45mm
WD	227mm	TV distortion	-0.16% - 0.16%
Resolution	22.4μ - 7.6μ	Maximum Compatible CCD	1/1.8
Object side NA	0.015 - 0.044mm		

* Indicated specifications are design values. * Resolution indicates a theoretical resolution at a wavelength of 550nm.
* Depth of field is calculated assuming a horizontal 320 TV resolution using 1/2 CCD camera (permissible circle of confusion 40μ).

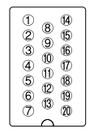
(Wiring Diagram) TLZ0220C-SM





PIN ASSIGNMENT

CONNECTOR
MR-20RM (HONDA)



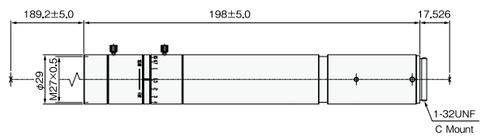
PIN LOCATION

8.0x Compact Macro Zoom Lens

Compact and wide zoom ratio, suitable for inspection of various objects

- Long WD, 189mm
- Focus function is available
- φ29mm, suitable for small and limited spaces

CMZ0540



Magnification	0.5x - 4.0x	Depth of field	3.52mm - 0.19mm
WD	189.2mm	TV distortion	0.04%
Resolution	14.6 - 6.45μ	Maximum Compatible CCD	1/3
Object side NA	0.023 - 0.052		

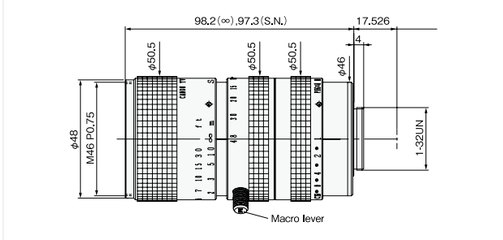
* Indicated specifications are design values.
* Resolution indicates a theoretical resolution at a wavelength of 550nm.
* Depth of field is calculated assuming a horizontal 320 TV resolution using 1/2 CCD camera (permissible circle of confusion 40μ).

F1.0, 6.0x Zoom Lens

Suitable for high speed applications

- WD500mm - ∞
  *Macro photography: Possible to use at WD10mm by pulling a macro lever
- Large aperture, suitable for high speed camera

PH6 x 8Macro



Model Focal length (Zoom Ratio)	8 - 48mm (6.0x)	Magnification at WD500mm	0.017 - 0.1
∞F No.	1.0	Filter Pitch	M46 P=75
WD	500mm - ∞	Maximum Compatible CCD	1/2

* Indicated specifications are design values.

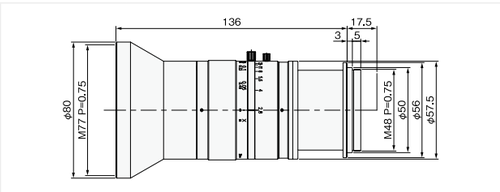
TFL Ⅱ Series

Area Scan Lens for TFL Ⅱ Mount

Design for TFL Ⅱ mount, improve accuracy of inspection

- Improve accuracy and durability, more stable than F mount
- Suitable for 12 Mega camera
- 「LSF series」is designed for high resolution and low distortion at the whole range of WD, from macro to infinity
- 「LS series」and「LSTL series」are suitable for macro imaging

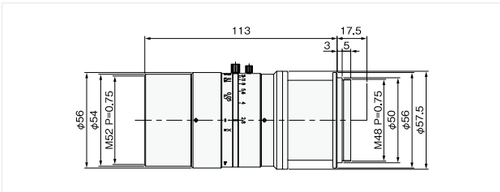
LSF2528-TFL Ⅱ (for wide field of view)



Focal length	25mm	TV distortion	-0.11%
∞F No.	2.8	Maximum Compatible CCD	φ44mm
Range of WD	140mm～∞	Mount	TFL-Ⅱ
Maximum Magnification	0.15×		

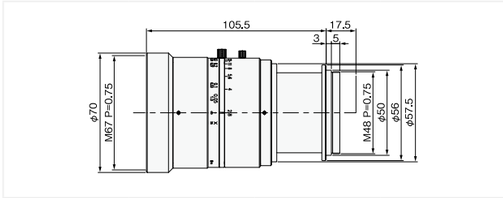
* TV distortion indicates the value for 33mm sensor.

LSF3528-TFL Ⅱ (for wide field of view)



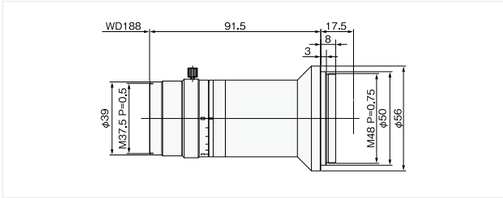
Focal length	35mm	TV distortion	-0.20%
∞F No.	2.8	Maximum Compatible CCD	φ44mm
Range of WD	230mm～∞	Mount	TFL-Ⅱ
Maximum Magnification	0.15×		

LSF5028-TFL Ⅱ (for wide field of view)



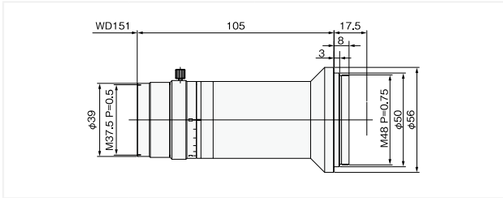
Focal length	50mm	TV distortion	-0.07%
∞F No.	2.8	Maximum Compatible CCD	φ44mm
Range of WD	190mm～∞	Mount	TFL-Ⅱ
Maximum Magnification	0.3×		

LS05-TFL Ⅱ (for macro)



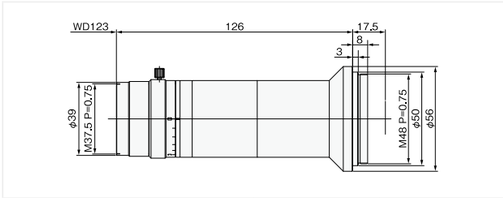
WD	188mm	TV distortion	-0.02%
Depth of field	0.94mm	Maximum Compatible CCD	φ36mm
F No.	5.1	Mount	TFL-Ⅱ
Resolution	11μ		

LS07-TFL Ⅱ (for macro)



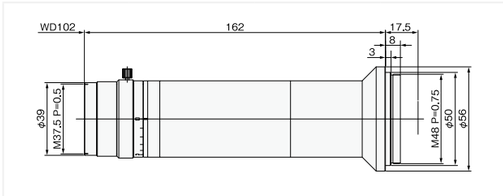
WD	151mm	TV distortion	-0.02%
Depth of field	0.54mm	Maximum Compatible CCD	φ36mm
F No.	6	Mount	TFL-Ⅱ
Resolution	10μ		

LS10-TFL Ⅱ (for macro)



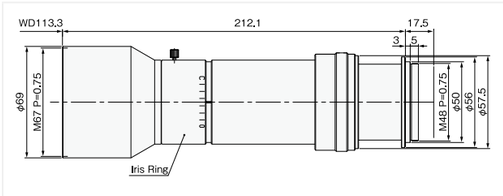
WD	123mm	TV distortion	0.00%
Depth of field	0.31mm	Maximum Compatible CCD	φ36mm
F No.	7.5	Mount	TFL-Ⅱ
Resolution	8μ		

LS15-TFL Ⅱ (for macro)



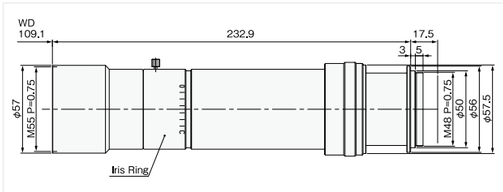
WD	102mm	TV distortion	0.06%
Depth of field	0.17mm	Maximum Compatible CCD	φ36mm
F No.	9.9	Mount	TFL-Ⅱ
Resolution	7μ		

LSTL10H-TFL Ⅱ (Telecentric type)



WD	113mm	TV distortion	0.00%
Depth of field	0.31mm	Maximum Compatible CCD	φ44mm
F No.	6.4	Mount	TFL-Ⅱ
Resolution	2.9μ		

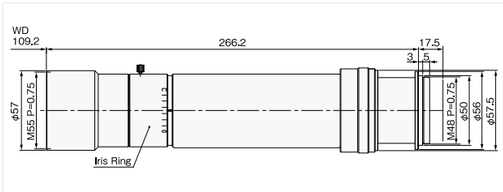
LSTL15H-TFL Ⅱ (Telecentric type)



WD	109mm	TV distortion	0.00%
Depth of field	0.17mm	Maximum Compatible CCD	φ44mm
F No.	7.8	Mount	TFL-Ⅱ
Resolution	3.5μ		

* TV distortion indicates the value for 33mm sensor.

LSTL20H-TFL Ⅱ (Telecentric type)



WD	109mm	TV distortion	0.00%
Depth of field	0.12mm	Maximum Compatible CCD	φ44mm
F No.	8.7	Mount	TFL-Ⅱ
Resolution	2.9μ		

HF Series

High Resolution Machine Vision Lens for 5 Mega Pixel

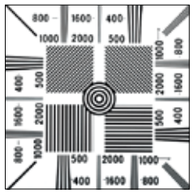
Suitable for inspection and alignment , required for high accuracy

- Bring out the best quality in 5 mega pixel CCD
- Focal length, longer than f16mm is compatible with 1.1 CCD
- Excellent performance at macro imaging, compared with conventional CCTV lenses
- Stable performance at different working distance by floating design
- Large aperture
- High durability, suitable for machine vision applications
- Design for mount slip mechanism, easy to adjust the lens rotation

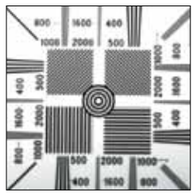
(When slip is stopped, please do not tighten anymore. Lens mount is damaged.)

Comparison of resolution

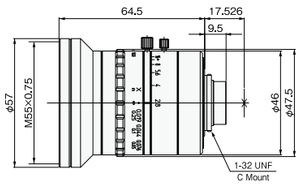
5 Mega Pixel Lens



Mega Pixel Lens

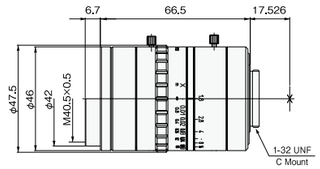


HF0528J



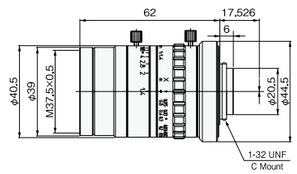
Focal length	5mm	TV distortion	0.29%
∞F No.	2.8	Filter pitch	M55 P=0.75
MOD	50mm	Maximum Compatible CCD	2/3
Maximum Magnification	0.076x		

HF0818J



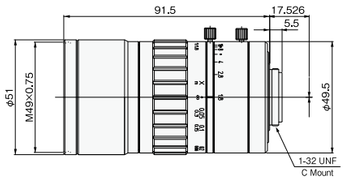
Focal length	8mm	TV distortion	0.31%
∞F No.	1.8	Filter pitch	M40.5 P=0.75
MOD	100mm	Maximum Compatible CCD	2/3
Maximum Magnification	0.078x		

HF1214J



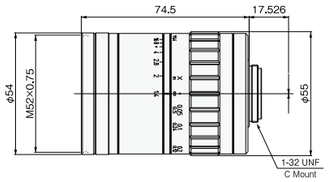
Focal length	12mm	TV distortion	-0.31%
∞F No.	1.4	Filter pitch	M37.5 P=0.5
MOD	100mm	Maximum Compatible CCD	2/3
Maximum Magnification	0.1x		

HF1618V



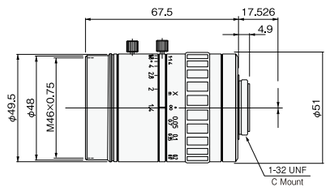
Focal length	16mm	TV distortion	-0.28%
∞F No.	1.8	Filter pitch	M49 P=0.75
MOD	33mm	Maximum Compatible CCD	1.1
Maximum Magnification	0.3x		

HF2514V



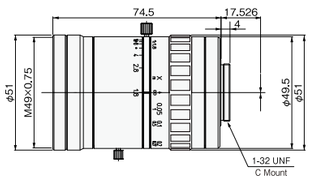
Focal length	25mm	TV distortion	-0.09%
∞F No.	1.4	Filter pitch	M52 P=0.75
MOD	80mm	Maximum Compatible CCD	1.1
Maximum Magnification	0.3x		

HF3514V



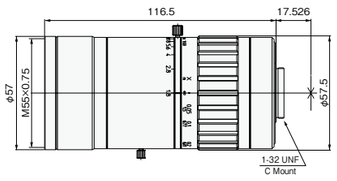
Focal length	35mm	TV distortion	-0.027%
∞F No.	1.4	Filter pitch	M46 P=0.75
MOD	110mm	Maximum Compatible CCD	1.1
Maximum Magnification	0.3x		

HF5018V



Focal length	50mm	TV distortion	-0.01%
∞F No.	1.8	Filter pitch	M49 P=0.75
MOD	192mm	Maximum Compatible CCD	1.2
Maximum Magnification	0.3x		

HF7518V



Focal length	75mm	TV distortion	0.00%
∞F No.	1.8	Filter pitch	M55 P=0.75
MOD	290mm	Maximum Compatible CCD	1.2
Maximum Magnification	0.3x		

* Indicated specifications are design values. *TV distortion indicates a value for the minimum working distance with 2/3 CCD.

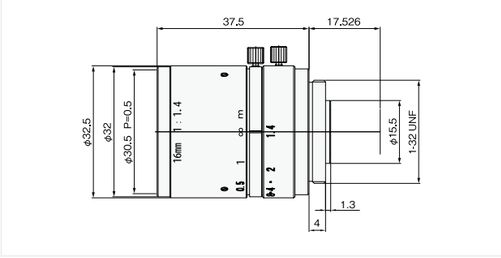
HS Series

2 Mega Pixel CCTV Lens

High resolution and large aperture, F No. 1.4 Suitable for various applications

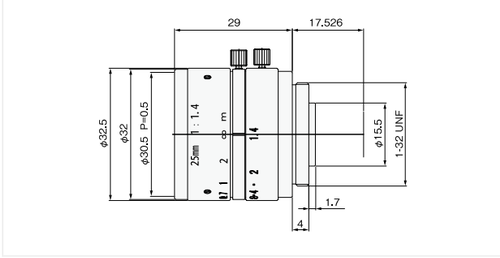
- Excellent brightness, F No. 1.4, suitable for high speed application
- Design for 2 mega pixel (1/1.8 and 2/3 sensor)
- Stable performance from macro to infinity (∞)
- Design for high durability

HS1614J



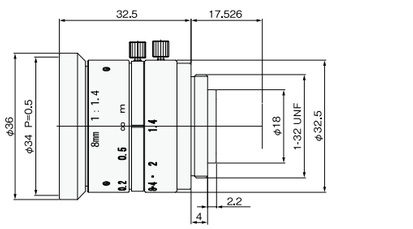
Focal length	16mm	Angle of view(V×H)	30°×23°
∞F No.	1.4	Filter pitch	M30.5 P=0.5
Range of WD	200mm - ∞	Maximum Compatible CCD	2/3
TV distortion	-0.14%		

HS2514J



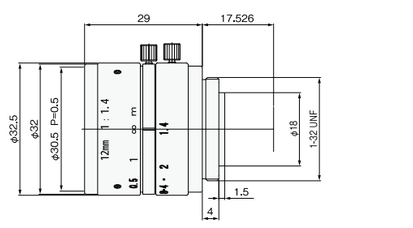
Focal length	25mm	Angle of view(V×H)	19°×15°
∞F No.	1.4	Filter pitch	M30.5 P=0.5
Range of WD	300mm - ∞	Maximum Compatible CCD	2/3
TV distortion	-0.12%		

HS0814J



Focal length	8mm	Angle of view(V×H)	56°×44°
∞F No.	1.4	Filter pitch	M34 P=0.5
Range of WD	100mm - ∞	Maximum Compatible CCD	2/3
TV distortion	0.83%		

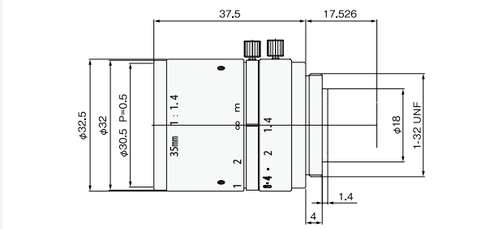
HS1214J



Focal length	12mm	Angle of view(V×H)	39°×30°
∞F No.	1.4	Filter pitch	M30.5 P=0.5
Range of WD	150mm - ∞	Maximum Compatible CCD	2/3
TV distortion	-0.12%		

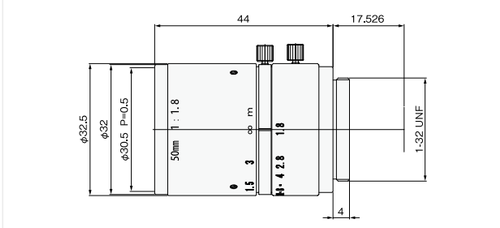
* Indicated specifications are design values. * TV distortion indicates the value for minimum working distance.
* Value of wide angle is for maximum compatible CCD.

HS3514J



Focal length	35mm	Angle of view(V×H)	14°×11°
∞F No.	1.4	Filter pitch	M30.5 P=0.5
Range of WD	300mm - ∞	Maximum Compatible CCD	2/3
TV distortion	-0.06%		

HS5018J



Focal length	50mm	Angle of view(V×H)	10°×7.7°
∞F No.	1.8	Filter pitch	M30.5 P=0.5
Range of WD	500mm - ∞	Maximum Compatible CCD	2/3
TV distortion	0.07%		

* Indicated specifications are design values. * TV distortion indicates a value for minimum working distance.
* Angle of view indicates a value when the maximum compatible CCD is used.

FV Series

Mega Pixel Low Distortion CCTV Lens

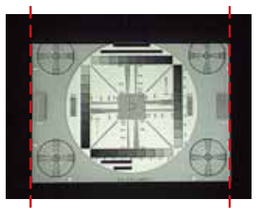
Design for low distortion and mega pixel

- High resolution, suitable for mega pixel camera
- Design for machine vision application, excellent performance at short WD, less than 500mm
- Reduce color aberration, compared with conventional CCTV lens
- TV distortion less than 0.1% (except for f4mm)
- Possible to use for macro imaging without extension ring

Comparison of Distortion

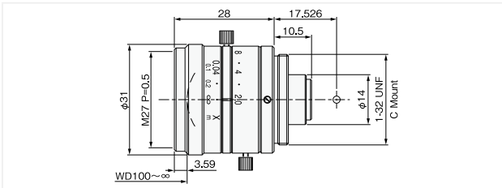
FV0420 0.9%
Conventional f4mm lens Approx. 18%

FV low distortion lens



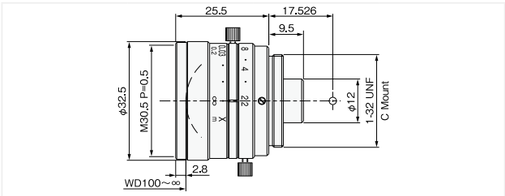
Conventional CCTV lens

FV0420



Focal length	4mm	Angle of view(V×H)	59.96°×75.14°
∞ F No.	2.0	Filter pitch	M27 P=0.5
Range of WD	0.1m - ∞	Maximum Compatible CCD	1/2
TV distortion	0.91%		

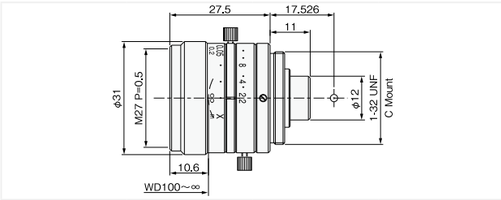
FV0622



Focal length	6.5mm	Angle of view(V×H)	40.47°×52.35°
∞ F No.	2.2	Filter pitch	M30.5 P=0.5
Range of WD	0.1m - ∞	Maximum Compatible CCD	1/2
TV distortion	-0.01%		

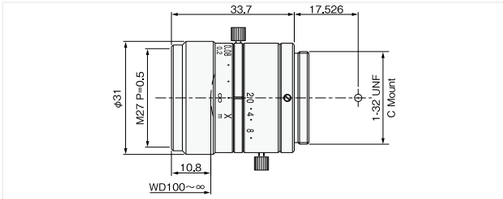
* Indicated specifications are design values. * Angle of view indicates a value when the maximum compatible CCD is used.
* TV distortion indicates a value for the minimum working distance.

FV1022



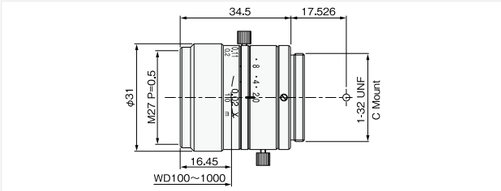
Focal length	10mm	Angle of view(V×H)	26.31°×34.61°
∞ F No.	2.2	Filter pitch	M27 P=0.5
Range of WD	0.1m - ∞	Maximum Compatible CCD	1/2
TV distortion	-0.08%		

FV1520



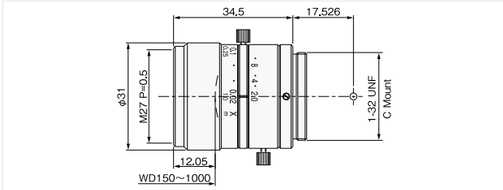
Focal length	15mm	Angle of view(V×H)	24.11°×31.79°
∞ F No.	2.0	Filter pitch	M27 P=0.5
Range of WD	0.1m - ∞	Maximum Compatible CCD	2/3
TV distortion	-0.09%		

FV2020



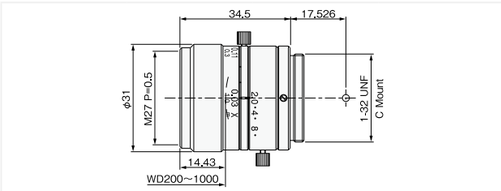
Focal length	20mm	Angle of view(V×H)	18.2°×24.11°
∞ F No.	2.0	Filter pitch	M27 P=0.5
Range of WD	0.1m - 1m	Maximum Compatible CCD	2/3
TV distortion	-0.10%		

FV2520



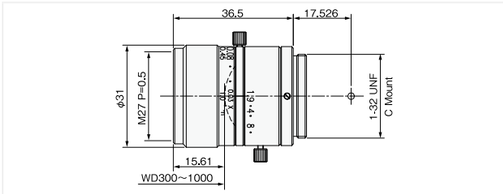
Focal length	25mm	Angle of view(V×H)	14.75°×19.58°
∞ F No.	2.0	Filter pitch	M27 P=0.5
Range of WD	0.15m - 1m	Maximum Compatible CCD	2/3
TV distortion	-0.01%		

FV3020



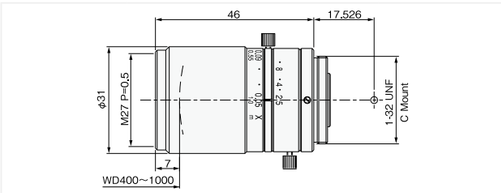
Focal length	30mm	Angle of view(V×H)	12.55°×16.69°
∞ F No.	2.0	Filter pitch	M27 P=0.5
Range of WD	0.2m - 1m	Maximum Compatible CCD	2/3
TV distortion	-0.02%		

FV3519



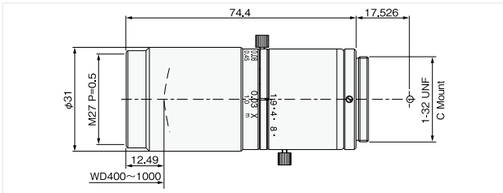
Focal length	35mm	Angle of view(V×H)	10.77°×14.32°
∞ F No.	1.9	Filter pitch	M27 P=0.5
Range of WD	0.3m - 1m	Maximum Compatible CCD	2/3
TV distortion	-0.03%		

FV5025



Focal length	50mm	Angle of view(V×H)	7.82°×10.38°
∞ F No.	2.5	Filter pitch	M27 P=0.5
Range of WD	0.4m - 1m	Maximum Compatible CCD	2/3
TV distortion	0.03%		

FV7538



Focal length	75mm	Angle of view(V×H)	5.11°×6.81°
∞ F No.	3.8	Filter pitch	M27 P=0.5
Range of WD	0.4m - 1m	Maximum Compatible CCD	2/3
TV distortion	-0.01%		

* Indicated specifications are design values. * Angle of view indicates a value when the maximum compatible CCD is used.
* TV distortion indicates a value for the minimum working distance.

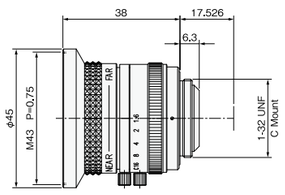
MV Series

CCTV Lens

Wide range of focal length is available Suitable for various applications

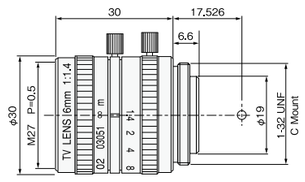
- Focal length f3.5mm - f100mm, 10 models are available
- Available for focus and iris lock screws
- Suitable for various applications

MV0316



Focal length	3.5mm	Angle of view(V×H)	68.9°×84.9°
∞F No.	1.6	Filter pitch	M43 P=0.75
MOD	0.1m	Maximum Compatible CCD	1/2

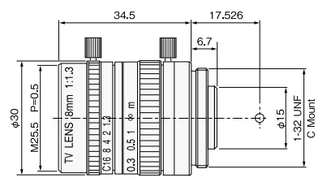
MV0614



Focal length	6.0mm	Angle of view(V×H)	42.3°×54.6°
∞F No.	1.4	Filter pitch	M27 P=0.5
MOD	0.2m	Maximum Compatible CCD	1/2

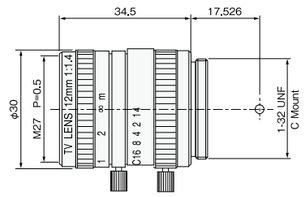
* Indicated specifications are design values. * Angle of view indicates a value when a lens is used with the maximum compatible CCD.

MV0813



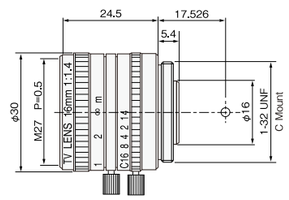
Focal length	8.0mm	Angle of view(V×H)	45°×57.8°
∞F No.	1.3	Filter pitch	M25.5 P=0.5
MOD	0.2m	Maximum Compatible CCD	2/3

MV1214



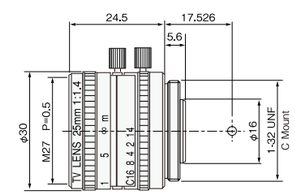
Focal length	12mm	Angle of view(V×H)	21.9°×29°
∞F No.	1.4	Filter pitch	M27 P=0.5
MOD	0.3m	Maximum Compatible CCD	1/2

MV1614



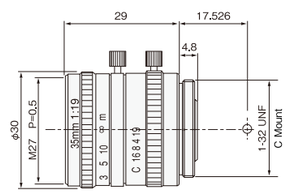
Focal length	16mm	Angle of view(V×H)	23°×30.4°
∞F No.	1.4	Filter pitch	M27 P=0.5
MOD	0.4m	Maximum Compatible CCD	2/3

MV2514



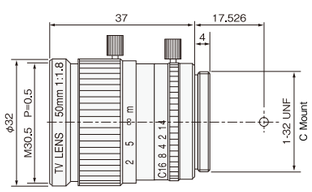
Focal length	25mm	Angle of view(V×H)	21.6°×28.5°
∞F No.	1.4	Filter pitch	M27 P=0.5
MOD	0.5m	Maximum Compatible CCD	2/3

MV3519



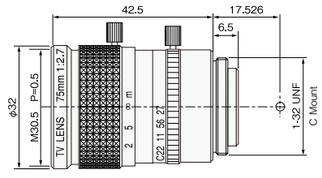
Focal length	35mm	Angle of view(V×H)	10.8°×14.4°
∞F No.	1.9	Filter pitch	M27 P=0.5
MOD	0.5m	Maximum Compatible CCD	2/3

MV5018



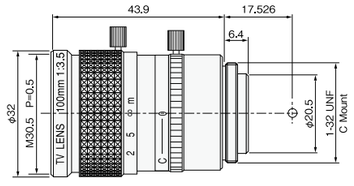
Focal length	50mm	Angle of view(V×H)	7.9°×10.5°
∞F No.	1.8	Filter pitch	M30.5 P=0.5
MOD	1m	Maximum Compatible CCD	2/3

MV7527



Focal length	75mm	Angle of view(V×H)	4.9°×6.5°
∞F No.	2.7	Filter pitch	M30.5 P=0.5
MOD	1m	Maximum Compatible CCD	2/3

MV10035



Focal length	100mm	Angle of view(V×H)	3.8°×5.1°
∞F No.	3.5	Filter pitch	M30.5 P=0.5
MOD	1m	Maximum Compatible CCD	2/3

* Indicated specifications are design values. * Angle of view indicates a value when a lens is used with the maximum compatible CCD.

Extension Ring

CCTV lens can be changed into macro lens with extension rings

- Attach to the end of a lens to change magnification and WD

Model	Specification
SR-02	0.2mm
SR-05	0.5mm
SR-1	1mm
SR-2	2mm
SR-5	5mm
SR-10	10mm
SR-15	15mm
SR-20	20mm
SR-30	30mm
SR-40	40mm
SR-50	50mm
SR-100	100mm
SR-SET	0.5mm、1mm、2mm、5mm、10mm、20mm、40mm

Magnification, WD and FOV Chart for Extension Ring
CCTV Lens (MV Series)

Extension Ring (mm)	MV0316				MV0614				MV0813				MV1214				MV1614			
	FOV (V x H)		WD (mm)	magnification	FOV (V x H)		WD (mm)	magnification	FOV (V x H)		WD (mm)	magnification	FOV (V x H)		WD (mm)	magnification	FOV (V x H)		WD (mm)	magnification
	1/2" CCD	1/3" CCD			1/2" CCD	1/3" CCD			1/2" CCD	1/3" CCD			1/2" CCD	1/3" CCD			1/2" CCD	1/3" CCD		
0	147×196	110×147	100	0.03	165×221	124×165	200	0.03	96×128	72×96	148	0.05	103×137	77×103	248	0.05	109×145	82×109	358	0.04
0.5	28×37	21×28	10	0.17	44×58	33×44	43	0.11	43×57	32×43	59	0.11	55×73	41×55	125	0.09	64×86	48×64	206	0.07
	35×46	26×35	14	0.14	60×79	45×60	63	0.08	77×102	57×77	115	0.06	119×159	89×119	289	0.04	156×208	117×156	515	0.03
1					25×34	19×25	19	0.19	27×37	21×27	34	0.18	38×50	28×38	80	0.13	45×61	34×45	143	0.11
					30×40	22×30	25	0.16	38×51	29×38	52	0.13	59×79	45×59	136	0.08	78×104	58×78	252	0.06
1.5									20×27	15×20	22	0.24	29×38	21×29	57	0.17	35×47	26×35	108	0.14
									26×34	19×26	31	0.19	40×53	30×40	85	0.12	52×69	39×52	164	0.09
2													23×31	17×23	42	0.21	29×38	22×29	86	0.17
													30×40	22×30	59	0.16	39×52	29×39	120	0.12
5																	14×18	10×14	35	0.35
																	16×21	12×16	42	0.31
10																	7.3×9.7	5.4×7.3	14	0.66
																	7.8×10	5.8×7.8	15	0.62

Extension Ring (mm)	MV2514				MV3519				MV5018				MV7527				MV10035			
	FOV (V x H)		WD (mm)	magnification	FOV (V x H)		WD (mm)	magnification	FOV (V x H)		WD (mm)	magnification	FOV (V x H)		WD (mm)	magnification	FOV (V x H)		WD (mm)	magnification
	1/2" CCD	1/3" CCD			1/2" CCD	1/3" CCD			1/2" CCD	1/3" CCD			1/2" CCD	1/3" CCD			1/2" CCD	1/3" CCD		
0	87×115	65×87	458	0.06	66×87	49×66	500	0.07	90×120	68×90	943	0.05	60×80	45×60	1000	0.08	46×62	35×46	1000	0.1
0.5	64×85	48×64	338	0.08	55×73	41×55	422	0.09												
	242×322	181×242	1270	0.02	335×447	251×335	2459	0.01												
1	50×67	38×50	269	0.1	47×63	35×47	366	0.1												
	121×161	91×121	637	0.04	168×223	126×168	1240	0.03												
1.5	42×56	31×42	223	0.12	41×55	31×41	324	0.12	57×76	43×57	610	0.08								
	81×107	60×81	425	0.06	112×149	84×112	834	0.04	154×205	115×154	1577	0.03								
2	36×47	27×36	191	0.13	37×49	28×37	291	0.13	51×67	38×51	548	0.1	43×57	32×43	776	0.11				
	60×81	45×60	320	0.08	84×112	63×84	631	0.06	115×154	86×115	1193	0.04	184×246	138×184	3189	0.03				
5	19×25	14×19	103	0.25	22×30	17×22	185	0.22	31×41	23×31	347	0.16	30×40	23×30	607	0.16	27×37	21×27	724	0.18
	24×32	18×24	130	0.2	34×45	25×34	265	0.14	46×61	35×46	503	0.1	74×98	55×74	1422	0.07	95×127	71×95	2413	0.05
10	11×14	8.0×11	60	0.45	13×18	10×13	121	0.36	18×25	14×18	226	0.26	20×27	15×20	475	0.24	19×26	15×19	609	0.25
	12×16	9.1×12	66	0.4	17×22	13×17	143	0.29	23×31	17×23	273	0.21	37×49	28×37	833	0.13	48×63	36×48	1432	0.1
15	7.4×9.8	5.5×7.4	43	0.65	9.5×13	7.2×9.5	93	0.5	13×18	10×13	174	0.37	15×20	11×15	408	0.32	15×20	11×15	546	0.32
	8.1×11	6.0×8.1	45	0.6	11×15	8.4×11	103	0.43	15×21	12×15	196	0.31	25×33	18×25	636	0.2	32×42	24×32	1105	0.15
20	5.6×7.5	4.2×5.6	34	0.85	7.4×9.9	5.6×7.4	78	0.65	10×14	7.7×10	145	0.47	12×16	9×12	369	0.4	12×16	9×12	505	0.39
	6.0×8.1	4.5×6.0	35	0.79	8.4×11	6.3×8.4	82	0.57	12×15	8.6×12	158	0.42	18×25	14×18	538	0.26	24×32	18×24	941	0.2
25					6.1×8.1	4.6×6.1	68	0.79	8.4×11	6.3×8.4	126	0.57	10×14	7.6×10	342	0.47	10×14	8×10	478	0.46
					6.7×8.9	5.0×6.7	70	0.72	9.2×12	6.9×9.2	134	0.52	15×20	11×15	479	0.33	19×25	14×19	843	0.25
30									7.1×9.4	5.3×7.1	113	0.68	8.7×12	6.5×8.7	323	0.55	9.0×12	6.7×9.0	458	0.54
									7.7×10	5.8×7.7	119	0.63	12×16	9.2×12	440	0.39	16×21	12×16	778	0.3
35									6.1×8.2	4.6×6.1	104	0.78	7.6×10	5.7×7.6	309	0.63	7.9×11	5.9×7.9	443	0.61
									6.6×8.8	4.9×6.6	108	0.73	11×14	7.9×11	412	0.46	14×18	10×14	731	0.35
40									5.4×7.2	4.1×5.4	97	0.89	6.7×9.0	5.1×6.7	297	0.71	7.1×9.4	5.3×7.1	430	0.68
									5.8×7.7	4.3×5.8	100	0.83	9.2×12	6.9×9.2	391	0.52	12×16	8.9×12	696	0.4
45													6.1×8.1	4.6×6.1	289	0.79	6.4×8.5	4.8×6.4	421	0.75
													8.2×11	6.1×8.2	375	0.59	11×14	7.9×11	669	0.45
50													5.5×7.4	4.1×5.5	281	0.87	5.8×7.8	4.4×5.8	412	0.82
													7.4×9.8	5.5×7.4	361	0.65	9.5×13	7.1×9.5	647	0.5

Magnification, WD and FOV Chart for Extension Ring
Mega Pixel Low Distorting CCTV Lens (FV Series)

Extension Ring (mm)	FV0420				FV0622				FV1022				FV1520			
	FOV (V x H)		WD (mm)	magnification	FOV (V x H)		WD (mm)	magnification	FOV (V x H)		WD (mm)	magnification	FOV (V x H)		WD (mm)	magnification
	1/2" CCD	1/3" CCD			1/2" CCD	1/3" CCD			1/2" CCD	1/3" CCD			1/2" CCD	1/3" CCD		
0	126×168	95×126	97	0.038	86×114	64×86	97	0.056	49×65	37×49	91	0.098	33×44	24×33	92	0.147
	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
0.5	30×41	23×30	14	0.158	36×48	27×36	30	0.132	33×44	25×33	56	0.146	27×36	20×27	73	0.179
	40×53	30×40	23	0.120	62×83	47×62	65	0.077	98×131	73×98	196	0.049	150×200	113×150	462	0.032
1	17×23	13×17	3	0.279	23×31	17×23	12	0.209	25×33	18×25	38	0.195	23×30	17×23	60	0.212
	20×27	15×20	6	0.240	31×42	23×31	23	0.154	49×66	37×49	90	0.097	74×98	55×74	223	0.065
1.5					17×22	13×17	4	0.286	20×26	15×20	28	0.244	20×26	15×20	50	0.244
					21×28	16×21	9	0.230	33×44	25×33	55	0.146	49×66	37×49	144	0.097
2									16×22	12×16	21	0.292	17×23	13×17	43	0.276
									25×33	18×25	38	0.195	37×50	28×37	104	0.129
5									8.2×11	6.2×8.2	3	0.585	10×14	7.7×10	20	0.470
									9.9×13	7.4×9.9	6	0.487	15×20	11×15	32	0.324
10													6.0×8.1	4.5×6.0	6	0.794
													7.4×9.9	5.6×7.4	8	0.647

Extension Ring (mm)	FV2020				FV2520				FV3020				FV3519			
	FOV (V x H)		WD (mm)	magnification	FOV (V x H)		WD (mm)	magnification	FOV (V x H)		WD (mm)	magnification	FOV (V x H)		WD (mm)	magnification
	1/2" CCD	1/3" CCD			1/2" CCD	1/3" CCD			1/2" CCD	1/3" CCD			1/2" CCD	1/3" CCD		
0	22×29	17×22	88	0.217	27×35	20×27	142	0.181	29×39	22×29	190	0.164	37×49	27×37	288	0.131
	229×305	171×229	984	0.021	185×246	138×185	988	0.026	155×206	116×155	986	0.031	133×178	100×133	985	0.036
0.5	20×27	15×20	79	0.241	24×32	18×24	128	0.200	27×35	20×27	173	0.181	33×44	25×33	262	0.145
	107×142	80×107	447	0.045	107×142	80×107	559	0.045	102×136	77×102	639	0.047	96×128	72×96	711	0.050
1	18×24	14×18	71	0.265	22×29	16×22	117	0.220	24×32	18×24	159	0.198	30×40	23×30	241	0.159
	70×93	52×70	287	0.069	74×98	55×74	390	0.065	75×100	56×75	473	0.064	74×98	55×74	558	0.065
1.5	17×22	12×17	64	0.290	20×27	15×20	107	0.240	22×30	17×22	148	0.214	28×37	21×28	222	0.174
	51×68	38×51	209	0.094	56×75	42×56	299	0.085	59×79	44×59	376	0.081	61×81	46×61	461	0.079
2	15×20	11×15	59	0.314	19×25	14×19	99	0.259	21×28	16×21	137	0.231	26×34	19×26	207	0.188
	41×54	31×41	164	0.118	46×62	35×46	242	0.104	49×66	37×49	312	0.097	52×69	39×52	393	0.093
5	10×14	7.8×10	38	0.459	13×17	9.5×13	69	0.377	15×19	11×15	98	0.331	18×23	13×18	149	0.273
	18×24	14×18	67	0.263	22×29	16.2×22	112	0.222	24×32	18×24	156	0.197	27×36	20×27	213	0.179
10	6.8×9.1	5.1×6.8	22	0.702	8.4×11	6.3×8.4	45	0.573	9.6×13	7.2×9.6	68	0.498	12×15	9×12	105	0.416
	9.5×13	7.1×9.5	30	0.506	11×15	8.6×11	58	0.418	13×18	9.9×13	86	0.364	15×20	11×15	126	0.322
15	5.1×6.8	3.8×5.1	15	0.945	6.2×8.3	4.7×6.2	34	0.769	7.2×9.6	5.4×7.2	53	0.664	8.6×11	6.4×8.6	83	0.559
	6.4×8.5	4.8×6.4	17	0.749	7.8×10	5.9×7.8	39	0.614	9.0×12	6.8×9.0	60	0.531	10×14	7.7×10	93	0.465
20					5.0×6.6	3.7×5.0	27	0.965	5.8×7.7	4.3×5.8	44	0.831	6.8×9.1	5.1×6.8	71	0.702
					5.9×7.9	4.4×5.9	28	0.810	6.9×9.2	5.2×6.9	47	0.697	7.9×11	5.9×7.9	75	0.607
25													5.7×7.6	4.3×5.7	62	0.845
													6.4×8.5	4.8×6.4	64	0.750

Extension Ring (mm)	FV5025				FV7538			
	FOV (V x H)		WD (mm)	magnification	FOV (V x H)		WD (mm)	magnification
	1/2" CCD	1/3" CCD			1/2" CCD	1/3" CCD		
0	37×50	28×37	397	0.129	24×31	18×24	398	0.204
	96×128	72×96	993	0.050	62×83	47×62	988	0.077
0.5	35×46	26×35	370	0.139	23×30	17×23	386	0.211
	80×107	60×80	826	0.060	57×76	43×57	910	0.084
1	32×43	24×32	345	0.150	22×29	17×22	375	0.218
	69×91	51×69	707	0.070	53×71	40×53	844	0.090
1.5	30×40	23×30	324	0.160	21×28	16×21	364	0.225
	59×79	44×59	619	0.081	49×66	37×49	787	0.097
2	28×38	21×28	306	0.170	21×28	16×21	356	0.231
	53×70	40×53	551	0.091	46×62	35×46	738	0.104
5	21×28	16×21	230	0.232	18×24	13×18	307	0.272
	31×42	24×31	335	0.153	33×44	25×33	538	0.144
10	14×19	11×14	166	0.335	14×19	11×14	253	0.340
	19×25	14×19	207	0.256	23×30	17×23	375	0.212
15	11×15	8.2×11	132	0.438	12×16	8.8×12	217	0.407
	13×18	10×13	153	0.359	17×23	13×17	290	0.280
20	8.9×12	6.6×8.9	111	0.542	10×13	7.6×10	191	0.475
	10×14	7.8×10	122	0.462	14×18	10×14	239	0.347
25	7.4×9.9	5.6×7.4	97	0.645	8.9×12	6.6×8.9	172	0.542
	8.5×11	6.4×8.5	103	0.566	12×15	8.7×12	204	0.415
30	6.4×8.6	4.8×6.4	86	0.748	7.9×10	5.9×7.9	157	0.610
	7.2×9.6	5.4×7.2	90	0.669	10×13	7.5×10	179	0.482
35	5.6×7.5	4.2×5.6	78	0.851	7.1×9.5	5.3×7.1	145	0.677
	6.2×8.3	4.7×6.2	80	0.772	8.7×12	6.5×8.7	160	0.550
40	5.0×6.7	3.8×5.0	72	0.954	6.4×8.6	4.8×6.4	135	0.745
	5.5×7.3	4.1×5.5	73	0.875	7.8×10	5.8×7.8	146	0.618
45					5.9×7.9	4.4×5.9	126	0.813
					7.0×9.3	5.3×7.0	134	0.685
50					5.5×7.3	4.1×5.5	119	0.880
					6.4×8.5	4.8×6.4	124	0.753

WD and FOV Chart for Extension Ring
2 Mega CCTV Lens (HS Series)

Extension Ring (mm)	HS0818J				HS1214J				HS1614J			
	FOV (V x H)		WD (mm)	Magnification	FOV (V x H)		WD (mm)	Magnification	FOV (V x H)		WD (mm)	Magnification
	1/2" CCD	1/3" CCD			1/2" CCD	1/3" CCD			1/2" CCD	1/3" CCD		
0	65×86	49×65	90	0.074	61×81	46×61	145	0.079	60 x 80	45 x 60	197	0.08
	600×800	450×600	989	0.008	400×533	300×400	994	0.012	300 x 400	225 x 300	996	0.016
0.5	36×47	27×36	40	0.135	40×54	30×40	92	0.119	44 x 58	33 x 44	141	0.11
	70×93	52×70	98	0.069	91×121	68×91	223	0.053	102 x 136	77 x 102	343	0.047
1	24×33	18×24	21	0.196	30×40	23×30	65	0.16	34 x 45	26 x 34	108	0.141
	37×49	28×37	42	0.13	52×69	39×52	120	0.093	62 x 83	47 x 62	204	0.077
1.5	19×25	14×19	11	0.256	24×32	18×24	50	0.2	28 x 37	21 x 28	87	0.171
	25×34	19×25	21	0.19	36×48	27×36	80	0.133	45 x 60	34 x 45	144	0.107
2	15×20	11×15	5	0.317	20×27	15×20	39	0.24	24 x 32	18 x 24	73	0.201
	19×25	14×19	11	0.251	28×37	21×28	58	0.173	35 x 46	26 x 35	110	0.138
5					10×13	7.5×10	13	0.482	13 x 17	9.4 x 13	34	0.383
					12×15	8.7×12	17	0.415	15 x 20	11 x 15	42	0.32
10					5.4×7.2	4.1×5.4	2	0.885	7 x 9.3	5.2 x 7	15	0.686
					5.9×7.8	4.4×5.9	2	0.818	7.7 x 10	5.8 x 7.7	16	0.623

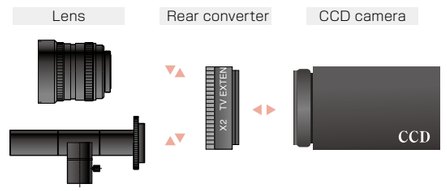
Extension Ring (mm)	HS2514J				HS3514J				HS5018J			
	FOV (V x H)		WD (mm)	Magnification	FOV (V x H)		WD (mm)	Magnification	FOV (V x H)		WD (mm)	Magnification
	1/2" CCD	1/3" CCD			1/2" CCD	1/3" CCD			1/2" CCD	1/3" CCD		
0	55 x 74	41 x 55	291	0.087	47 x 63	35 x 47	337	0.102	43 x 58	32 x 43	438	0.111
	185 x 246	138 x 185	988	0.026	98 x 131	73 x 98	701	0.049	80 x 107	60 x 80	813	0.06
0.5	45 x 60	34 x 45	236	0.107	41 x 55	31 x 41	295	0.116	40 x 53	30 x 40	402	0.121
	107 x 142	80 x 107	560	0.045	75 x 100	56 x 75	542	0.064	69 x 91	51 x 69	693	0.07
1	38 x 51	29 x 38	200	0.126	37 x 49	28 x 37	263	0.13	37 x 49	27 x 37	371	0.131
	74 x 98	55 x 74	390	0.065	62 x 82	46 x 62	441	0.078	60 x 80	45 x 60	604	0.08
1.5	33 x 44	25 x 33	172	0.146	33 x 44	25 x 33	235	0.145	34 x 45	26 x 34	345	0.141
	57 x 76	43 x 57	298	0.084	52 x 70	39 x 52	371	0.092	53 x 70	40 x 53	536	0.091
2	29 x 39	22 x 29	151	0.166	21 x 28	16 x 21	145	0.231	24 x 32	18 x 24	239	0.203
	46 x 62	35 x 46	241	0.104	27 x 36	20 x 27	188	0.178	32 x 42	24 x 32	317	0.152
5	17 x 23	13 x 17	87	0.283	13 x 17	10 x 13	87	0.374	16 x 21	12 x 16	159	0.305
	22 x 29	16 x 22	111	0.221	15 x 20	11 x 15	101	0.321	19 x 25	14 x 19	188	0.254
10	10 x 13	7.5 x 10	50	0.479	9.3 x 12	7 x 9.3	62	0.517	12 x 16	9 x 12	118	0.408
	12 x 15	8.6 x 12	57	0.417	10 x 14	7.8 x 10	67	0.464	13 x 18	10 x 13	133	0.357
15	7.1 x 9.5	5.3 x 7.1	35	0.674	7.3 x 10	5.5 x 7.3	47	0.66	9 x 13	7.1 x 9.4	95	0.51
	7.8 x 10	5.9 x 7.8	37	0.613	7.9 x 11	5.9 x 7.9	50	0.607	10 x 14	7.8 x 10	103	0.459
20	5.5 x 7.4	4.1 x 5.5	26	0.87	6 x 8	4.5 x 6	37	0.803	7.8 x 10.4	5.9 x 7.8	78	0.613
	5.9 x 7.9	4.5 x 5.9	27	0.808	6.4 x 8.5	4.8 x 6.4	39	0.75	8.5 x 11.4	6.4 x 8.5	83	0.562
30									6.7 x 9	5 x 6.7	67	0.715
									7.2 x 9.6	5.4 x 7.2	70	0.664
35									5.9 x 7.8	4.4 x 5.9	59	0.818
									6.3 x 8.3	4.7 x 6.3	60	0.767

Rear Converter

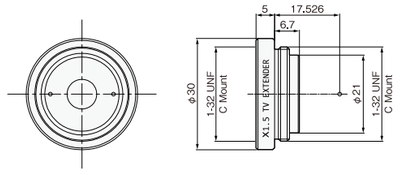
Rear converter for C mount

- Easy to convert magnification without changing the working distance
  * Using rear converter lowers resolution and F No.

Configuration

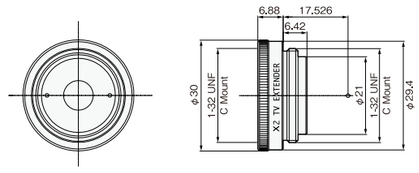


RC15



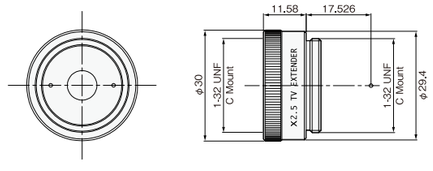
Magnification 1.5x

RC20



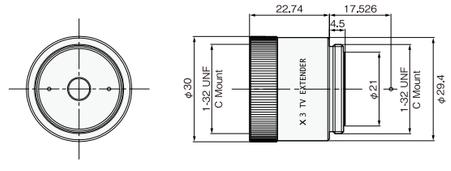
Magnification 2.0x

RC25



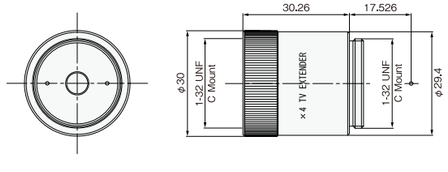
Magnification 2.5x

RC30



Magnification 3.0x

RC40



Magnification 4.0x

Filter

Attach to the tip of lenses and use for adjustment of wavelength and brightness

UV Cut Fiter (Protection cover filter)

Model	Filter	Screw Pitch
UV225	UV-CUT	22.5
UV255	UV-CUT	25.5
UV270	UV-CUT	27.0
UV305	UV-CUT	30.5

IR Cut Fiter

Model	Filter	Screw Pitch
IR225	IR-CUT	22.5
IR255	IR-CUT	25.5
IR270	IR-CUT	27.0
IR305	IR-CUT	30.5

Polarized Fiter

Model	Filter	Screw Pitch
PL225	PL225	22.5
PL255R	PL255 Rotation type	25.5
PL270R	PL270 Rotation type	27.0
PL305R	PL305 Rotation type	30.5

ND Fiter

Model	Filter	Screw Pitch
ND2225	ND2 (50%)	22.5
ND2255	ND2 (50%)	25.5
ND2270	ND2 (50%)	27.0
ND2305	ND2 (50%)	30.5
ND2405	ND2 (50%)	40.5
ND4225	ND4 (25%)	22.5

Model	Filter	Screw Pitch
ND4255	ND4(25%)	25.5
ND4270	ND4(25%)	27.0
ND4305	ND4(25%)	30.5
ND4405	ND4(25%)	40.5
ND8270	ND8(12.5%)	27.0
ND8305	ND8(12.5%)	30.5

Color Fiter

Model	Filter	Screw Pitch
B225	Blue	22.5
B255	Blue	25.5
B270	Blue	27.0
B305	Blue	30.5
G225	Green	22.5
G255	Green	25.5
G270	Green	27.0
G305	Green	30.5
Y225	Yellow	22.5

Model	Filter	Screw Pitch
Y255	Yellow	25.5
Y270	Yellow	27.0
Y305	Yellow	30.5
R225	Red	22.5
R255	Red	25.5
R270	Red	27.0
R305	Red	30.5
R405	Red	40.5

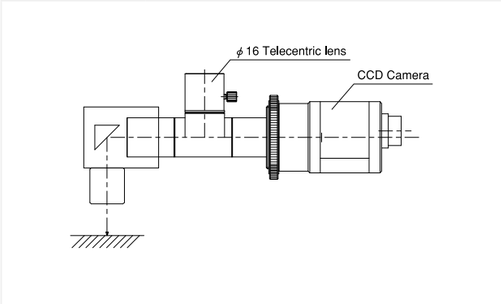
* Please ask if you need different filters not listed in the catalogue.

Prism Adapter

Prism adapters for telecentric lenses

Bend the optical axis at 90° and suitable for mark recognition

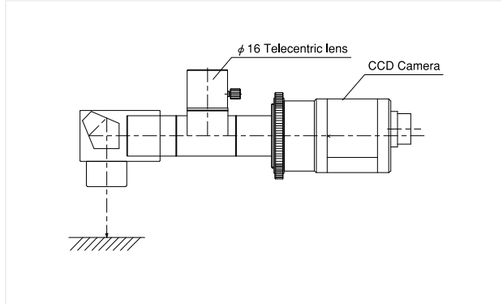
90° slide-looking rectangular mirror type



Optical axis can be bent 90°degrees. Effective when there is no space above the object. Monitored image is a mirror image.

Model	Compatible model
TL-PM16-1	ϕ16 Telecentric Series
TL-PM22-1	WD220 Telecentric ϕ22
TL-PM39-1	WD220 Telecentric ϕ39

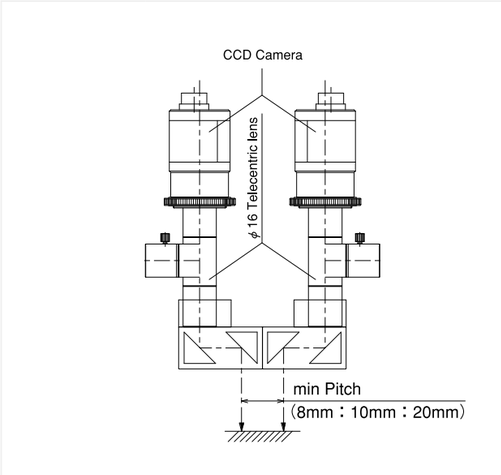
90° slide-looking pentaprism type



Optical axis can be bent 90°degrees. Effective when there is no space above the object. Monitored image is an electing image.

Model	Compatible model
TL-PP16-1	ϕ16 Telecentric Series
TL-PP22-1	WD220 Telecentric ϕ22
TL-PP39-1	WD220 Telecentric ϕ39

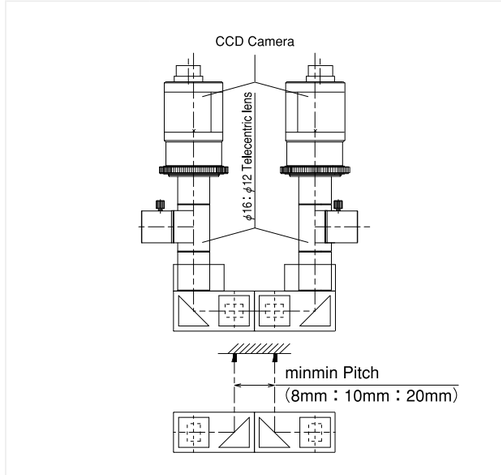
Optical axis pitch conversion type



Narrow pitch marks between two points can be recognized.

Model	Compatible model
TL-PT16-1	ϕ16 Telecentric (Pitch 8mm/One side 4mm)
TL-PT16-2	ϕ16 Telecentric (Pitch 10mm/One side 5mm)
TL-PT16-3	ϕ16 Telecentric (Pitch 20mm/One side 10mm)

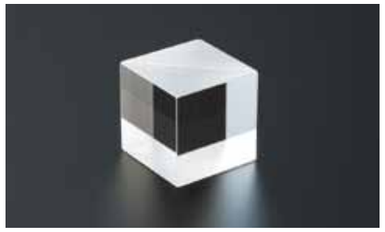
Optical axis pitch 90° conversion type



Narrow pitch marks between two points can be recognized. Effective when there is no space above the object.

Model	Compatible model
TL-PTV16-1	ϕ16 Telecentric (Pitch 8mm/One side 4mm)
TL-PTV16-2	ϕ16 Telecentric (Pitch 10mm/One side 5mm)
TL-PTV16-3	ϕ16 Telecentric (Pitch 20mm/One side 10mm)

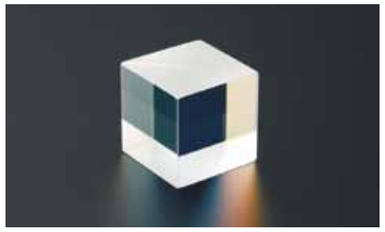
Optical Lens Parts



Beam splitter

Wavelength	400nm-700nm
Coating	Slope: Dielectric multilayer coating Side: AR multi-coated
Spectral ratio	T : R = 50 : 50
Surface tolerance	λ／4
Angle	±3°
Size tolerance	+0.1／-0.3mm
Material	BK-7

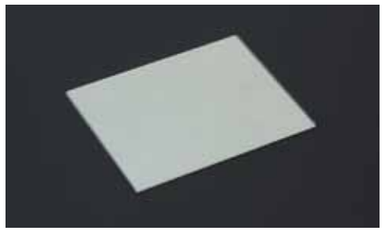
Model	Dimension(mm)
BS-10	10×10×10
BS-15	15×15×15
BS-20	20×20×20
BS-25	25×25×25



Polarized beam splitter

Wavelength	450nm-650nm
Coating	Slope: Dielectric multilayer coating Side: AR multi-coated
Spectral ratio	Tp ＞ 95　Rs ＞ 95
Surface tolerance	λ／4
Angle	±3°
Size tolerance	+0.1／-0.3mm
Material	BK-7

Model	Dimension(mm)
BSP-03	3×3×3
BSP-05	5×5×5
BSP-08	8×8×8
BSP-10	10×10×10



Half mirror

Coating	Surface: Dielectric multilayer coating Rear surface : AR multi-coated
Spectral ratio	T : R = 50 : 50
Surface tolerance	λ - 3λ
Parallelism	Within 1°
Angle of incidence	45°
Material	Crown

Model	Dimension(mm)	Thickness(mm)
HM-30-1	30×30	1
HM-50-1	50×50	1
HM-100-1	100×100	1
HM-30-2	30×30	2
HM-50-2	50×50	2
HM-100-2	100×100	2

Aluminized surface mirror

Coating	Aluminum + Sio
Surface tolerance	λ
Size tolerance	+0／-0.2mm
Material	Crown

Model	Dimension(mm)	Thickness(mm)
AM-5	5×5	1
AM-10	10×10	1
AM-30	30×30	2
AM-50	50×50	3
AM-100	100×100	3

Right angle prism

Coating	Slope: Aluminum coated Vertical plane: AR multi-coated
Surface tolerance	λ／2
Angle	±3°
Size tolerance	+0／-0.2mm
Material	BK-7

Model	Dimension(mm)
TP-5	5×5×5
TP-10	10×10×10
TP-15	15×15×15
TP-20	20×20×20
TP-25	25×25×25
TP-30	30×30×30
TP-40	40×40×40
TP-50	50×50×50

Penta prism

Coating	Two sided: AR multi-coated Two sided: black coated aluminum
Surface tolerance	λ／2
Angle	±3°
Size tolerance	±0.2mm
Material	BK-7

Model	Dimension(mm)
PP-5	5×5×5
PP-10	10×10×10
PP-15	15×15×15
PP-20	20×20×20
PP-25	25×25×25
PP-30	30×30×30

Glossary

Resolution(μ m)

Resolution indicates the ability to recognize two points that are close together.
Resolution values in this catalogue are theoretical resolution at 550nm.
Resolution = 0.61 x λ /NA

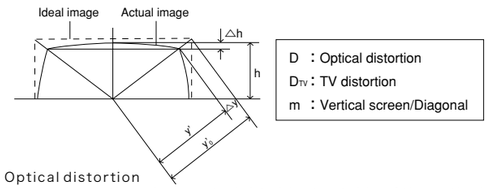
Resolving power(line/mm)

Resolving power indicates the number of black and white lines distinguished within 1mm in an image through a black and white grid-like chart lens. It is expressed by line/mm.
For example, 100 line/mm means that black and white pitch 1/100mm(10μ) can be distinguished. The width of both the black and white lines is 1/200mm(5μ).

Horizontal TV resolution

The total number of black and white horizontal stripes on a TV monitor screen.
It is expressed in TV lines. For resolving power, a pair of black and white lines is counted as one line.
However, for TV lines, one pair is counted as 2 TV lines. For example, if 470 horizontal TV lines of 1/2 CCD (H = 6.4mm) is used, required resolving power is 1mm/(6.4mm/(470/2)) = 36.72/mm.

Distortion



Optical distortion
Lens's aberration where a straight object outside of the optical axis appears curved.

$$D=\frac{y'-y'_0}{y'_0}\times 100\%$$

Positive distortion of a straight line is called pincushion distortion. Negative distortion is called barrel distortion.

TV distortion
Image distortion on a TV monitor. The closer to zero, the better the performance.

$$D_{TV}=\frac{\triangle h}{2h}\times 100\%$$

Object	Pincushion distortion	Barrel distortion

Aperture efficiency/Relative illumination (%)

Aperture efficiency indicates the brightness difference between the optical axis of the image formation plane and its surrounding area when an evenly bright object is captured with a lens. It is expressed by percent(%) assuming that the center brightness is 100. It is one of a lens's optical characteristics.

Shading

Shading is the brightness difference between TV monitor's center and its edges when an evenly bright object is captured with a lens. Shading indicates comprehensive performance of a lens and TV camera.

Chromatic aberration

In lenses' optional systems, positions where images are formed and image magnification differ according to light's wavelength. Rays with different wavelengths have different colors. This is called chromatic aberration. Aberration on the optical axis is called chromatic aberration on the axis and magnification difference is called magnification chromatic aberration.

F Number (F No)

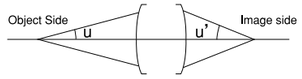
The brightness of a lens at infinity. It is calculated by dividing the focal length by the diameter of entrance pupil (D) (effective aperture)).
F No. = f/D

Effective F No

The brightness of a lens at a certain magnification.
Effective F No. = (1 + M) x F No.

NA

The higher the NA, the greater the resolution and brightness are. When the half angle that an image makes on exit pupil is u' and refractive index is n', n' xsin u' is called image side numberical aperture, NA'.
NA in this catalogue indicates object side numerical aperture.



NA=n × sin u
NA'=n' × sin u'

NA=M/2xF, NA'=1/2xF.
Relation of NA and NA' is NA=NA' x Optical magnfification or NA'=NA/optical magnficiattion.

MTF

It provides a graph analyzing a lens' ability to resolve sharp details in very fine sets of parallel lines, and a lens' contrast or ability to provide a sharp transfer between light and dark areas in sets of thicker parallel lines.

Depth of field

Images through lenses theoretically form as points. Acceptable blur on an acceptably clear image is called the permissible circle of confusion.Depth is the distance between the nearest and farthest points that appear in acceptably sharp focus when an object is shifted back and force from the best focal point. Depth range of the object side is called depth of field.Depth of field = 2(Permissible circle of confusion x Effective F No/Magnificaition2)

Depth of focus

Depth is the distance between the nearest and farthest points that appear in acceptably sharp forcus when a CCD is shifted back and force from the best focal point. Depth range of the image side is called depth of focus.

Angle of view

The angle formed by imaginary lines connecting the lens second principal point with both ends of the image diagonal. Angle of view is directly associated with lens focal length. As the focal length is longer, the angle of view is narrower.
Angle of view＝2xtan—1D (Image size) ／2 f (Focal length)

WD

Distance from the object to the front lens.

OI

Distance from the object to the image sensor.

Focal length

Focal length is the distance from the optical system's principle point to the focal point. Distance from the vertex of the last lens to the back focal point is called back length. Distance from the vertex of the first lens to the front focal point is called front focal length.

Image size

The diameter of the sharp image circle formed by a lens. Area sensor is expressed by inch, and diameter of image circle is equal to diagonal of sensor. Image circle of diameter for line sensor is equal to the maximum sensor size. It is expressed by pixel size x resolution.

Optical Data

How to calculate optical magnification

Most of lenses in this catalogue are designed for finite distance. Image format (sensor size) divided by object size equal to optical magnification. It is the most important to select a lens.

Image Format

Area Sensor

Examples of area sensor used for machine vision.
Different size of sensor will be expected to be available for various applications.

Image Size(inch)	1/4	1/3	1/2	1/1.8	2/3	2/3 (5 Mega)	1	1.1	1.2
Vertical(mm)	2.7	3.6	4.8	5.35	6.6	7.1	9.6	12.2	15.15
Horizontal(mm)	3.6	4.8	6.4	7.14	8.8	8.47	12.8	12	15.15
Diagonal(mm)	4.5	6	8	8.93	11	11	16	17.4	21.4

Line Sensor

Length of line sensor is formed, depended on pixel size and resolution. As the sensor size is larger, design and manufacture of a lens for line sensor are more difficult and complicated.

Sensor Size(mm)	10.24	14.34	20.48	28.67	28.67	35	36	57.34	61.44
Pixel size(μm)	10	14	10	14	7	4.7	7	7	5
Resolution(pixel)	1024	1024	2048	2048	4096	7450	5150	8192	12288

Formula of optical magnification

Field of View (FOV)

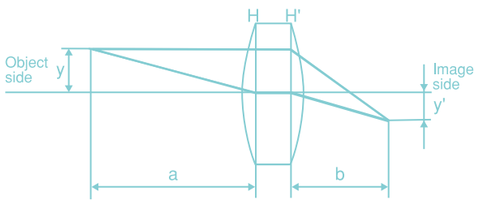
The actual size of a viewed object that can be taken when a lens is mounted to a camera.
Ex). Magnification: 0.5x Image format: 1/2

Vertical FOV = 4.8 ÷ 0.5 = 9.6mm Horizontal FOV = 6.4 ÷ 0.5 = 12.8mm

Magnification

Magnification (M) = Image format/FOV

$M = y'/y$
$= b/a$



Electronic magnification and monitor magnification

Electronic magnification

Magnification of an image on a CCD camera when it is displayed on a monitor screen.

Monitor magnification

Magnification of an object displayed on a monitor screen through a lens.

Ex). Magnification: 0.5x Image format: 1/2 Monitor size: 15 inch (1 inch = 25.4mm)

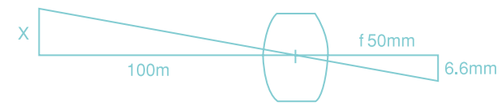
Electronic magnification 15 x 25.4 ÷ 8 = 47.6x Monitor magnification 0.5 x 47.65 = 23.8x

How to calculate focal length and photographic range

Formula of photographic range

$$X = \frac{\text{(Distance from lens to object)} \times \text{(Image size)}}{\text{Focal length}}$$

Ex. Object distance: 100mm Focal length: 50mm CCD: 2/3



$X = \frac{100{,}000 \times 6.6}{50} = 13{,}200$ (mm) Height: 13.2m

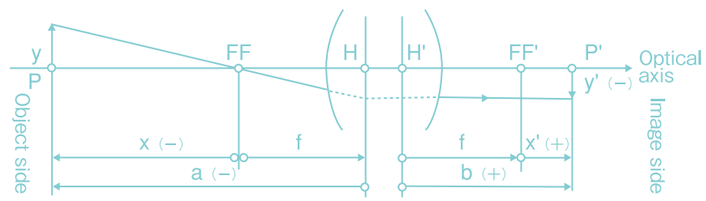
Formula of Focal length

$$f = \frac{\text{(Distance from lens to object)} \times \text{(Image size)}}{\text{Height}}$$

Ex. Object distance: 20m Height: 6.6m CCD: 2/3

$f = \frac{20{,}000 \times 6.6}{2{,}000} = 66$ (mm) Focal length: 66mm

Formula of conjugation relationship



f : Focal length
FF : Front side focal point
FF' : Rear side focal point
H : Front side principal point
H' : Rear side principal point
P : Object point
P' : Image point
a : Distance from front side point to object point
b : Distance from rear side principal point to image point
x : Distance from front side focal point to object point
x' : Distance from rear side focal point to image side point
M : Magnification

Basics formula	Horizontal magnification	Object point distance	Image point distance
$-\frac{1}{a}+\frac{1}{b}=\frac{1}{f}$	$M=\frac{y'}{y}=\frac{b}{a}$	$-a=(1-\frac{1}{M})\times f$	$b=(1-M)\times f$

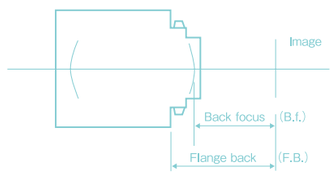
F No./NA Formula

Relationship of object side NA and image side NA (NA')	Relationship of F No. and Effective F no.(Fe)	Relationship of NA and Effective F No.
$NA'=\frac{NA}{M}$	$Fe=(1+M)F$	$NA'=\frac{1}{2Fe}$ $NA'=\frac{1}{2(1+M)F}$ $NA=\frac{M}{2Fe}$ $NA=\frac{M}{2(1+M)F}$

Camera mount and flange back

Back focus Distance from the vertex of the last lens to the image plane

Flange back Distance from the surface of lens mount to the image plane



Name	Flange back	Screw size
C Mount	17.526mm	25.4mm 32tpi thread
CS Mount	12.5mm	25.4mm 32tpi thread
F Mount	46.5mm	Bayonet
K Mount	45.5mm	Bayonet

Myutron Thailand
imRN Asia Co.,Ltd
Email : sale@imrnasia.com Tel: 087-803 1661
Website : www.imrnasia.com