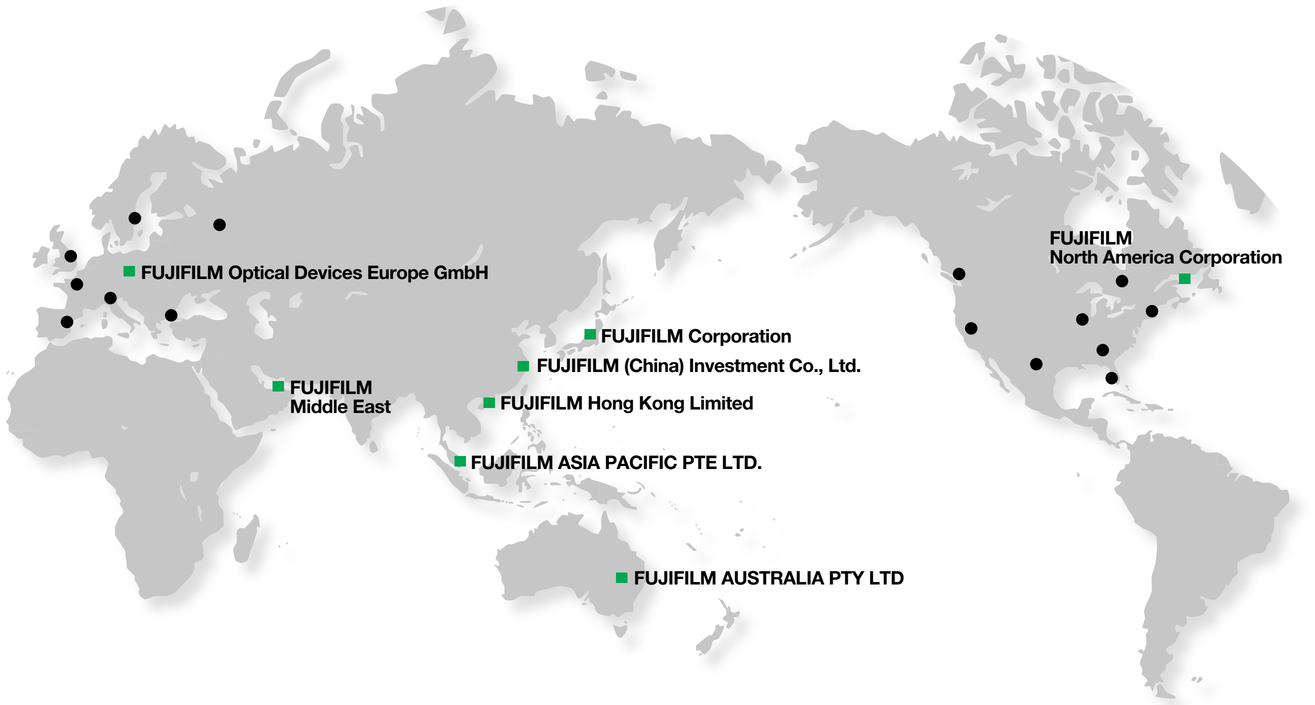

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⚠ Be certain to read the instructions for use before using any equipment.

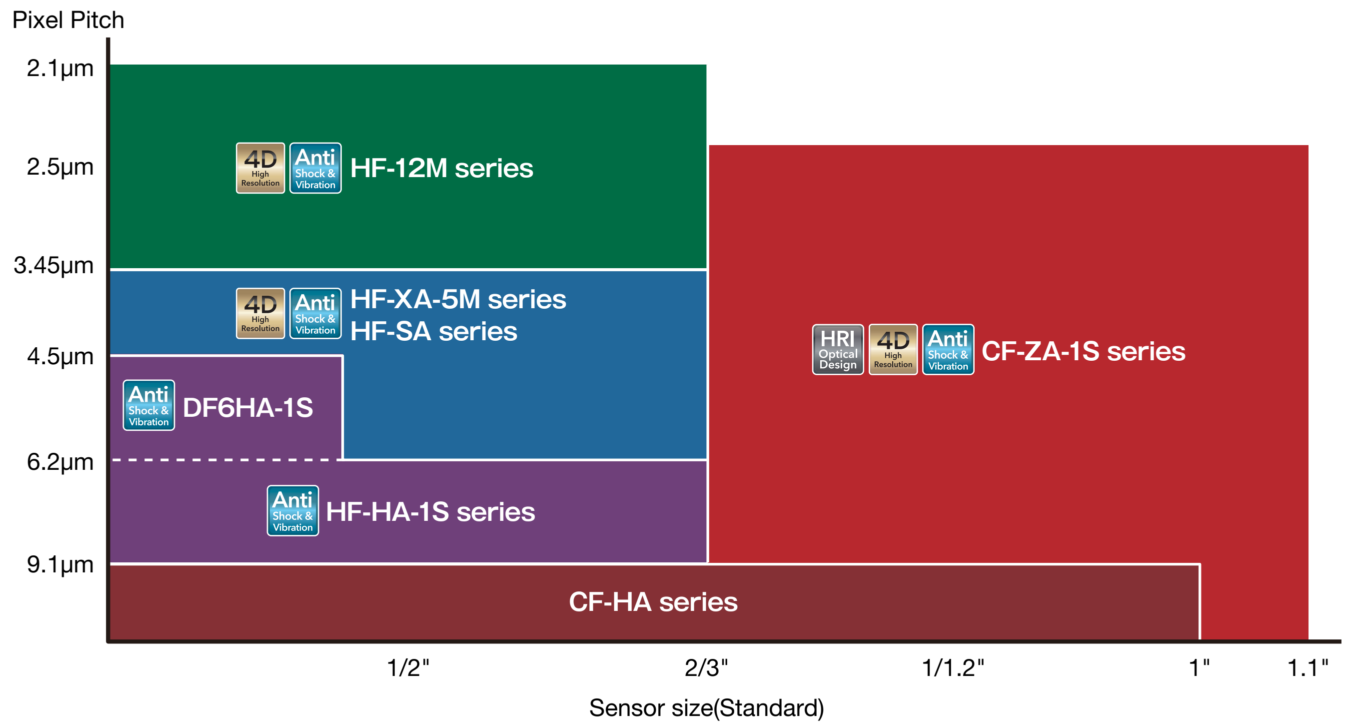
FFBX2020.05-K

FUJIFILM
Value from Innovation

FUJINON

Machine Vision Lenses

Product Line-up



Contents

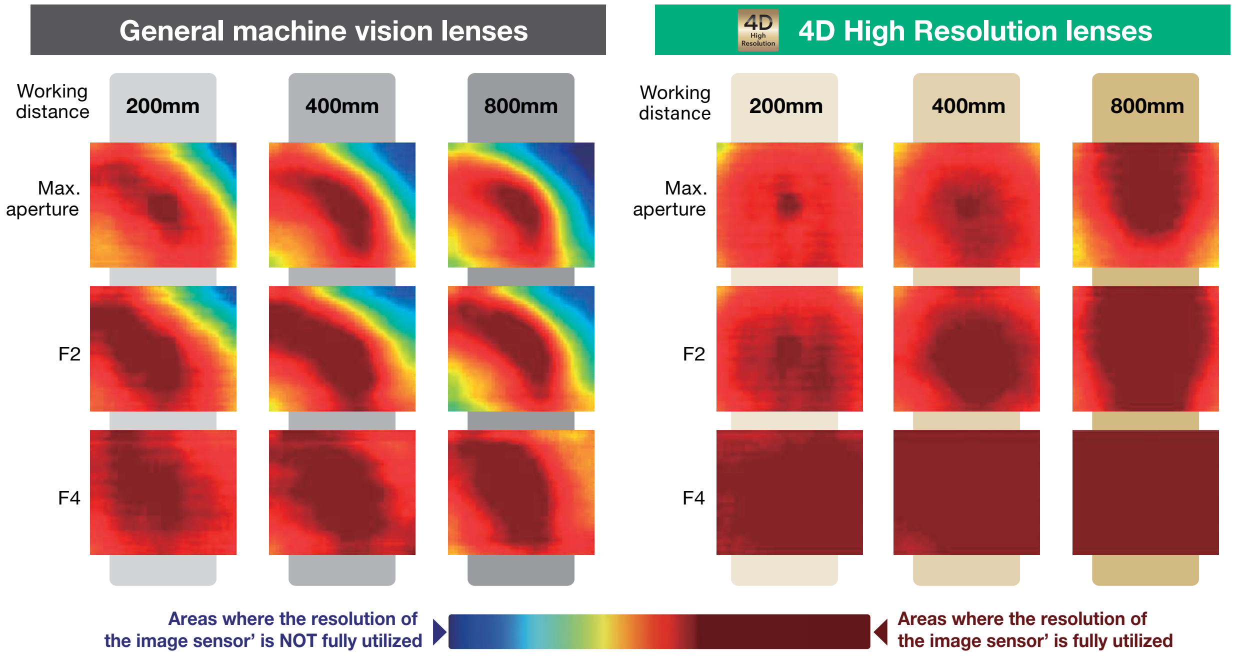
Please refer to the details on page 3 and 4.

4D High Resolution	4D High Resolution(P3)
Anti Shock & Vibration	Anti-Shock and Vibration(P3)
HRI Optical Design	High Relative Illumination(P4)

Technologies supporting FUJINON lenses

4D High Resolution performance

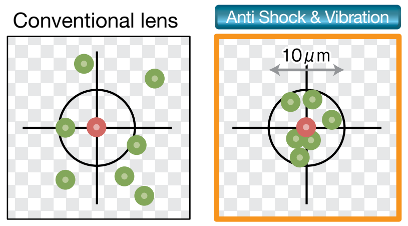
- The "4D High Resolution" is the FUJINON lenses' unique performance. It maintains a high level of consistent image sharpness at the center as well as around the edges while mitigating resolution degradation that typically occurs when changing a working distance or aperture value. This enables the stable delivery of high-resolution images under a wide variety of installation and shooting conditions.



Anti Shock & Vibration

Anti-Shock : suppresses the optical axis shifts to less than 10μm.

- In the case of ordinary machine vision lenses, the optical axis shifts occur when the lens elements move from their initial position due to shocks. This affects the precise measurement performance of the lens. FUJINON's original*[1] Anti-Shock design suppresses the optical axis shifts to less than 10μm even when given shocks up to 10G*[2].



Axis shift when given repeated shocks

Anti-Vibration : maintains high resolution

- The ordinary machine vision lenses have problems of toughness under working environments with vibration. FUJINON Anti-Vibration lenses have passed severe vibration tests conforming to IEC60068-2-6 and maintain superb resolution.

【Compliant with IEC60068-2-6】
·Vibration frequency of 10-60Hz (amplitude of 0.75mm), 60-500Hz (acceleration of 100m/S2)
·Sweep frequency of 50 cycles

Restrain aged deterioration

- The unique mechanical design minimizes the use of adhesives to withstand aged deterioration caused by humidity and heat.

---

*1 : Patent applied for
*2 : Maximum impact tolerance varies by model

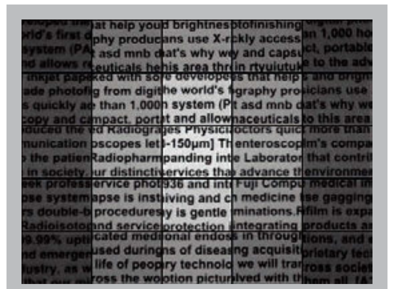
Thorough quality control on individual units

- Individual lens units are tested for their optical performance at the factory. Serial No information on the lens is an evidence of the complete quality management. (CF-ZA-1S series, HF-12M series and HF-XA-5M series)

CF-ZA-1S series, 1.1"-4/3"*1, 2.5µm, 23MP

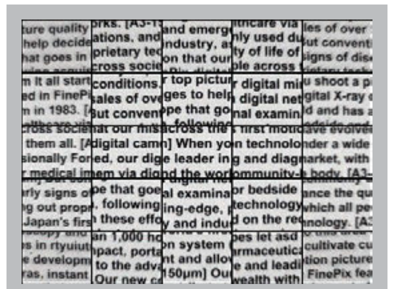
High Relative Illumination

- The advancement of image sensors for Machine Vision tends to larger sensors and smaller pixels. These sensors require a strong light transmission and a small Chief Ray Angle (CRA) so that the sufficient light reaches vertically on the photodiodes of each pixel. CF-ZA-1S series adopts rear lens groups with a large diameter enabled by FUJINON's high-precision assembly technology and achieves a CRA below 5°. This guarantees a high relative illumination across the entire image without vignetting.
- This series eliminates the need for luminance correction with image processing that just amplifies the noise.



Lens with large CRA

Peripheral light ratio: 30 %

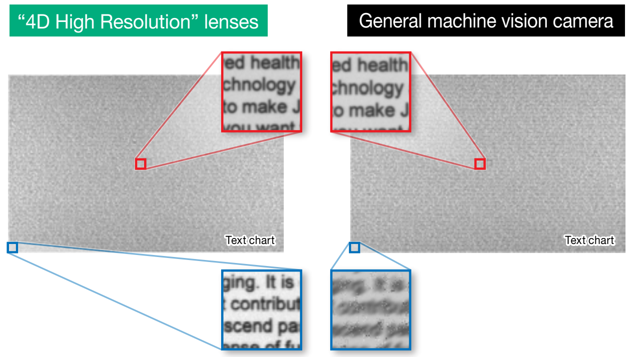


CF-ZA-1S Series

Peripheral light ratio: 80 %

4D High Resolution performance

- Thanks to the 4D High Resolution Design, the resolving power remains consistently high from the center of the image to the edges, even at changing working distances or aperture settings.
- The CF-ZA-1S series draws out the full capability of cameras equipped with a 1.1" sensor with 3.45 µm pixel pitch (equivalent to 12 MP) across the entire frame. These lenses are the perfect choice especially for IMX253 (1.1" type sensor) and IMX225 (1" type sensor).
- The series supports next generation sensors with 1.1" optical format and 2.5µm pixel pitch (equivalent to 23 MP).



Compact size of only 39mm outer diameter

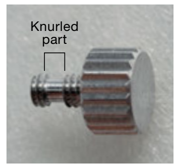
- Despite the support of sensors with large 1.1" format, all models of the CF-ZA-1S series offer a uniform diameter of only 39mm and are therefore no larger than standard machine vision cameras. Only the 8mm focal length CF8ZA-1S is slightly larger with a diameter of 54mm in the front lens.

Anti-Vibration and Shock Design

- This series maintains an advanced level of resolution before and after tough vibration tests, conducted according to JIS C 60068-2-6*2. Even in applications that involve shocks, such as robot vision and 3D scanners, the optical axis shift remains less than 10µm for shocks of up to 10G*3.
- The Fujifilm original mechanical design*4 minimizes the use of adhesive to avoid aged deterioration caused by humidity and heat.

High usability and reliability

- These lenses come with knurled screws for fixing the iris and focus position. The screws can´t fall out accidentally, get lost or damage sensitive manufacturing machines during installation or maintenance.



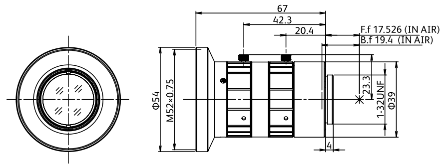
- Thanks to the 3 holes on the lens barrel for fixing iris and focus positions, the most suitable hole can be selected for each application.
- By adopting an internal mechanical focus, the overall length of lens will not change when focused.
- The introduction of a focusing indicator at the working distance of 50cm enables efficient detection of cameras' flange back deviation.

---

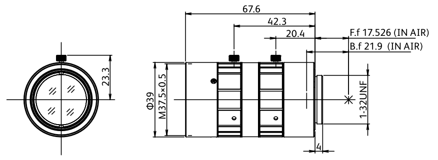
*1 Sensor size(max.): Adaptable sensor size varies depending on the model. Please check the amount of light and resolution on the edges pertaining to your particular application. *2 Compliance with JIS C 60068-2-6: Vibration frequency 10-60Hz (amplitude 0.75mm) vibration frequency 60-500Hz (acceleration 100m/S2) and 50 sweep cycles. *3 Supported shock G value varies from model to model. *4 FUJIFILM's patent-pending proprietary technology.

	Anti Shock & Vibration CF8ZA-1S	Anti Shock & Vibration CF12ZA-1S	Anti Shock & Vibration CF16ZA-1S	Anti Shock & Vibration CF25ZA-1S	Anti Shock & Vibration CF35ZA-1S	Anti Shock & Vibration CF50ZA-1S
Focal length [mm]	8	12	16	25	35	50
Iris range [F. no]	F1.8-F16	F1.8-F16	F1.8-F16	F1.8-F16	F1.8-F16	F2.4-F16
Angle of view	85.7°×67.5°	62.5°×47.8°	47.3°×36.1°	32.9°×24.8°	23.0°×17.3°	16.6°×12.5°
Working Distance*1 [mm]	∞-100	∞-100	∞-100	∞-100	∞-200	∞-200
Operation of focus	Manual	Manual	Manual	Manual	Manual	Manual
Operation of iris	Manual	Manual	Manual	Manual	Manual	Manual
Filter thread [mm]	M52×0.75	M37.5×0.5	M37.5×0.5	M37.5×0.5	M37.5×0.5	M37.5×0.5
Mount	C-mount	C-mount	C-mount	C-mount	C-mount	C-mount
Weight (approx.) [g]	180	180	180	170	165	155
Sensor size (std.)*2	1.1"(2.5µm)	1.1"(2.5µm)	1.1"(2.5µm)	1.1"(2.5µm)	1.1"(2.5µm)	1.1"(2.5µm)
Sensor size (max.)*3	1.1"(2.5µm)	1.1"(2.5µm)	1.1"(2.5µm)	4/3"(3.45µm)	4/3"(3.45µm)	4/3"(3.45µm)
CRA (Chief Ray Angle)	4.5	4.5	4.9	2.7	4.5	4.8
TV distortion [%]	-4.81	-2.82	-0.80	-0.83	-0.32	-0.17
Dimension [mm]	ø54×67	ø39×67.6	ø39×67.6	ø39×67.3	ø39×67.3	ø39×68

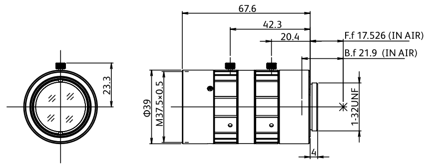
CF8ZA-1S



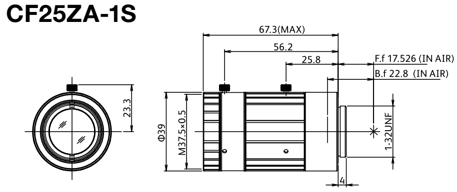
CF12ZA-1S



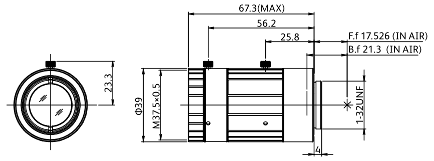
CF16ZA-1S



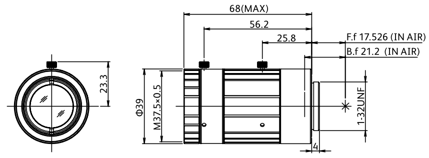
CF25ZA-1S



CF35ZA-1S



CF50ZA-1S



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*1 From front of lens barrel. *2 Sensor size(std.): Ideal size to maximize the target resolution.
*3 Sensor size(max.): Adaptable sensor size varies depending on the model. Please check the amount of light and resolution on the edges pertaining to your particular application.

HF-12M series, 2/3"-1"*3, 2.1µm, 12MP

Maximum sensor size: 8mm/12mm=2/3", 16mm/25mm=1/1.2", 35mm=1"

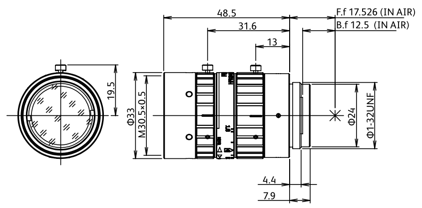
4D High Resolution

Anti Shock & Vibration

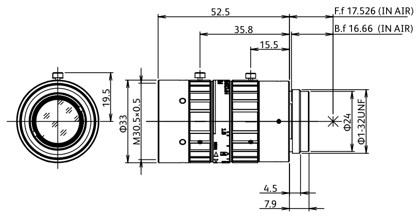
- Low distortion
- Compact design

	Anti Shock & Vibration **HF818-12M**	Anti Shock & Vibration **HF1218-12M**	Anti Shock & Vibration **HF1618-12M**	Anti Shock & Vibration **HF2518-12M**	Anti Shock & Vibration **HF3520-12M**
Focal length [mm]	8	12	16	25	35
Iris range [F. no]	F1.8-F22	F1.8-F22	F1.8-F22	F1.8-F22	F2.0-F22
Angle of view : 2/3"	56.9°×43.9°	39.3°×30.0°	30.8°×23.3°	20.0°×15.1°	14.7°×11.0°
Working Distance*1 [mm]	∞-100	∞-100	∞-100	∞-100	∞-200
Operation of focus	Manual	Manual	Manual	Manual	Manual
Operation of iris	Manual	Manual	Manual	Manual	Manual
Filter thread [mm]	M30.5×0.5	M30.5×0.5	M30.5×0.5	M30.5×0.5	M30.5×0.5
Mount	C-mount	C-mount	C-mount	C-mount	C-mount
Weight (approx.) [g]	95	85	90	85	85
Sensor size (std.)*2	2/3"(2.1µm)	2/3"(2.1µm)	2/3"(2.1µm)	2/3"(2.1µm)	2/3"(2.1µm)
Sensor size (max.)*3	2/3"(2.1µm)	1/1.2"(4.5µm)	1/1.2"(4.5µm)	1/1.2"(4.5µm)	1"(4.5µm)
TV distortion [%]	-1.03	0.18	-0.03	0.02	0.01
Dimension [mm]	ø33×48.5	ø33×52.5	ø33×52.5	ø33×53.1	ø33×53.1

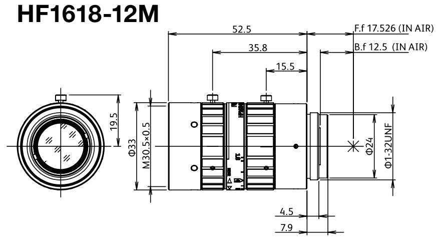
HF818-12M



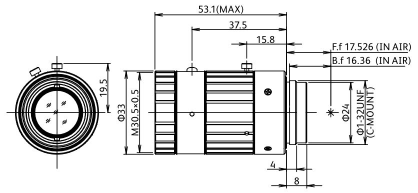
HF1218-12M



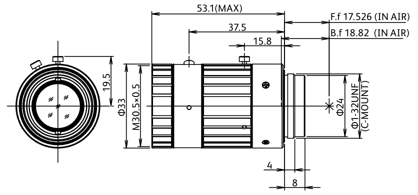
HF1618-12M



HF2518-12M



HF3520-12M



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*1 From front of lens barrel. *2 Sensor size(std.): Ideal size to maximize the target resolution.
*3 Sensor size(max.): Adaptable sensor size varies depending on the model. Please check the amount of light and resolution on the edges pertaining to your particular application.

HF-XA-5M series, 2/3"-1.1"*3, 3.45µm, 5MP

Maximum sensor size: 6mm/8mm=2/3", 12mm/16mm/25mm/35mm=1/1.2", 50mm=1.1"

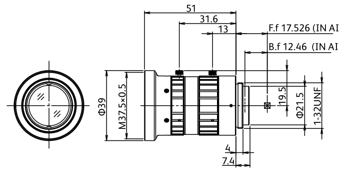
4D High Resolution

Anti Shock & Vibration

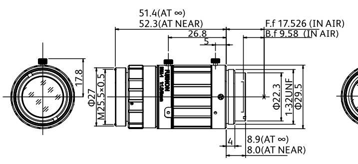
- Compact design

	Anti Shock & Vibration **HF6XA-5M**	**HF8XA-5M**	**HF12XA-5M**	**HF16XA-5M**	**HF25XA-5M**	**HF35XA-5M**	Anti Shock & Vibration **HF50XA-5M**
Focal length [mm]	6	8	12	16	25	35	50
Iris range [F. no]	F1.9-F16	F1.6-F16	F1.6-F16	F1.6-F16	F1.6-F16	F1.9-F16	F2.4-F16
Angle of view : 2/3"	74.7°×58.1°	58.4°×44.6°	40.1°×30.3°	31.4°×23.7°	20.0°×15.0°	14.2°×10.7°	10.4°×7.8°
Working Distance*1 [mm]	∞-100	∞-100	∞-100	∞-100	∞-100	∞-200	∞-200
Operation of focus	Manual	Manual	Manual	Manual	Manual	Manual	Manual
Operation of iris	Manual	Manual	Manual	Manual	Manual	Manual	Manual
Filter thread [mm]	M37.5×0.5	M25.5×0.5	M25.5×0.5	M25.5×0.5	M25.5×0.5	M25.5×0.5	M30.5×0.5
Mount	C-mount	C-mount	C-mount	C-mount	C-mount	C-mount	C-mount
Weight (approx.) [g]	100	79	79	71	72	60	95
Sensor size (std.)*2	2/3"(3.45µm)	2/3"(3.45µm)	2/3"(3.45µm)	2/3"(3.45µm)	2/3"(3.45µm)	2/3"(3.45µm)	2/3"(3.45µm)
Sensor size (max.)*3	2/3"(3.45µm)	2/3"(3.45µm)	1/1.2"(4.5µm)	1/1.2"(4.5µm)	1/1.2"(4.5µm)	1/1.2"(4.5µm)	1.1"(4.5µm)
TV distortion [%]	-2.88	-1.99	-1.26	-0.60	-0.07	0.10	0.01
Dimension [mm]	ø39×51	ø29.5×51.5	ø29.5×51.5	ø29.5×46	ø29.5×46.5	ø29.5×41.5	ø33×66.5

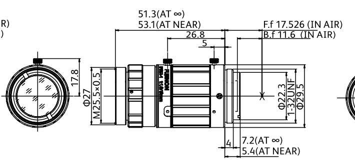
HF6XA-5M



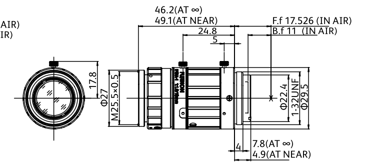
HF8XA-5M



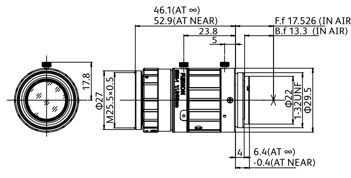
HF12XA-5M



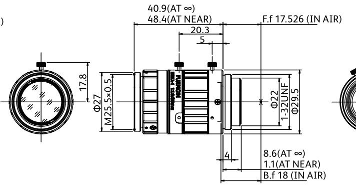
HF16XA-5M



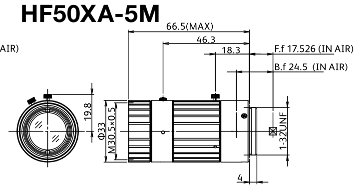
HF25XA-5M



HF35XA-5M



HF50XA-5M



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*1 From front of lens barrel. *2 Sensor size(std.): Ideal size to maximize the target resolution.
*3 Sensor size(max.): Adaptable sensor size varies depending on the model. Please check the amount of light and resolution on the edges pertaining to your particular application.

HF-HA-1S series, 1/2"-2/3", 6.2µm, 1.5MP

Anti Shock & Vibration

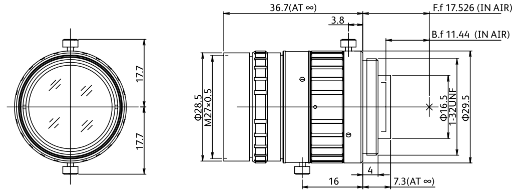
- Wide range of focal lengths with 8 models
- Compact design with an external diameter of 29.5mm*
- Large maximum aperture
- Short Minimum Object Distance

* HF75HA-1S has a diameter of 31.5mm

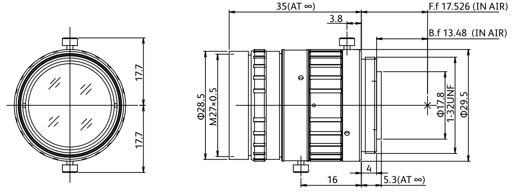
	Anti Shock & Vibration **DF6HA-1S**	Anti Shock & Vibration **HF9HA-1S**	Anti Shock & Vibration **HF12.5HA-1S**	Anti Shock & Vibration **HF16HA-1S**
Focal length [mm]	6	9	12.5	16
Iris range [F. no]	F1.2-F16	F1.4-F16	F1.4-F16	F1.4-F16
Angle of view	57.3°×43.8°(1/2")	53.3°×40.5°(2/3")	39.2°×29.4°(2/3")	30.5°×22.9°(2/3")
Working Distance*1 [mm]	∞-10	∞-40	∞-20	∞-40
Operation of focus	Manual	Manual	Manual	Manual
Operation of iris	Manual	Manual	Manual	Manual
Filter thread [mm]	M27×0.5	M27×0.5	M25.5×0.5	M25.5×0.5
Mount	C-mount	C-mount	C-mount	C-mount
Weight (approx.) [g]	50	50	40	40
Sensor size (std.)*2	1/2"(4.5µm)	2/3"(6.2µm)	2/3"(6.2µm)	2/3"(6.2µm)
Sensor size (max.)*3	1/2"(4.5µm)	2/3"(6.2µm)	2/3"(6.2µm)	2/3"(6.2µm)
TV distortion [%]	-1.84	-2.00	-1.95	-0.87
Dimension [mm]	ø29.5×36.7	ø29.5×35	ø29.5×29.5	ø29.5×29.5

	Anti Shock & Vibration **HF25HA-1S**	Anti Shock & Vibration **HF35HA-1S**	Anti Shock & Vibration **HF50HA-1S**	Anti Shock & Vibration **HF75HA-1S**
Focal length [mm]	25	35	50	75
Iris range [F. no]	F1.4-F16	F1.6-F22	F2.3-F22	F2.8-F22
Angle of view	19.4°×14.6°(2/3")	14.3°×10.8°(2/3")	10.1°×7.6°(2/3")	6.7°×5.0°(2/3")
Working Distance*1 [mm]	∞-120	∞-230	∞-500	∞-1,100
Operation of focus	Manual	Manual	Manual	Manual
Operation of iris	Manual	Manual	Manual	Manual
Filter thread [mm]	M25.5×0.5	M25.5×0.5	M25.5×0.5	M30.5×0.5
Mount	C-mount	C-mount	C-mount	C-mount
Weight (approx.) [g]	40	40	40	50
Sensor size (std.)*2	2/3"(6.2µm)	2/3"(6.2µm)	2/3"(6.2µm)	2/3"(6.2µm)
Sensor size (max.)*3	2/3"(6.2µm)	2/3"(6.2µm)	2/3"(6.2µm)	2/3"(6.2µm)
TV distortion [%]	-0.19	0.10	0.06	0.36
Dimension [mm]	ø29.5×29.5	ø29.5×29.5	ø29.5×29.5	ø31.5×48

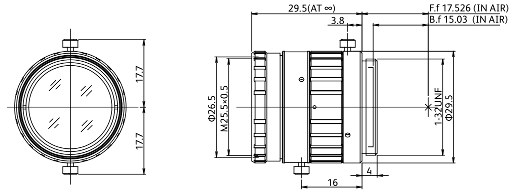
DF6HA-1S



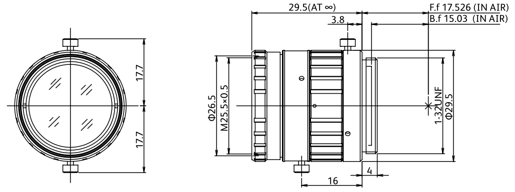
HF9HA-1S



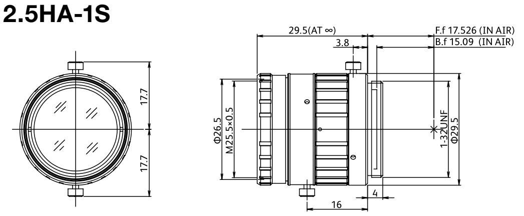
HF25HA-1S



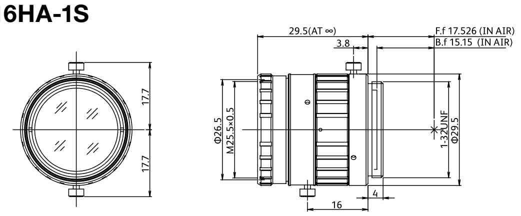
HF35HA-1S



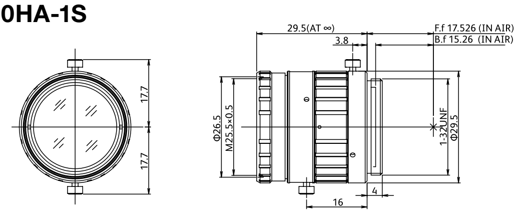
HF12.5HA-1S



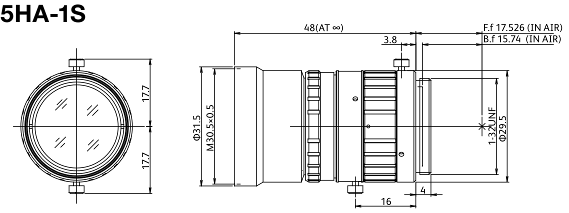
HF16HA-1S



HF50HA-1S



HF75HA-1S



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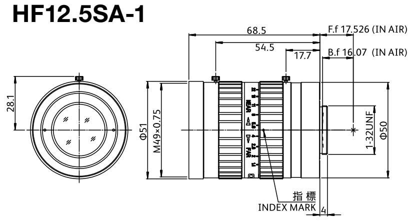
*1 From front of lens barrel. *2 Sensor size(std.): Ideal size to maximize the target resolution.
*3 Sensor size(max.): Adaptable sensor size varies depending on the model. Please check the amount of light and resolution on the edges pertaining to your particular application.

HF-SA series, 2/3", 3.45µm, 5MP

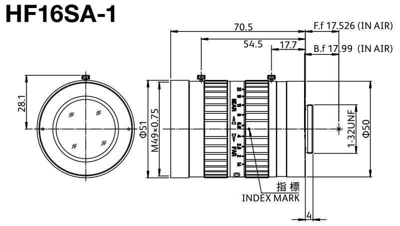
- Low distortion
- Large maximum aperture

	HF12.5SA-1	HF16SA-1	HF25SA-1	HF35SA-1	HF50SA-1	HF75SA-1
Focal length [mm]	12.5	16	25	35	50	75
Iris range [F. no]	F1.4-F22	F1.4-F22	F1.4-F22	F1.4-F22	F1.8-F22	F1.8-F22
Angle of view : 2/3"	38.0°×29.0°	30.2°×22.9°	20.8°×15.7°	14.0°×10.5°	9.7°×7.3°	6.7°×5.0°
Working Distance*1 [mm]	∞-100	∞-100	∞-100	∞-200	∞-400	∞-900
Operation of focus	Manual	Manual	Manual	Manual	Manual	Manual
Operation of iris	Manual	Manual	Manual	Manual	Manual	Manual
Filter thread [mm]	M49×0.75	M49×0.75	M49×0.75	M49×0.75	M49×0.75	M49×0.75
Mount	C-mount	C-mount	C-mount	C-mount	C-mount	C-mount
Weight (approx.) [g]	295	285	315	185	240	305
Sensor size (std.)*2	2/3"(3.45µm)	2/3"(3.45µm)	2/3"(3.45µm)	2/3"(3.45µm)	2/3"(3.45µm)	2/3"(3.45µm)
Sensor size (max.)*3	2/3"(3.45µm)	2/3"(3.45µm)	2/3"(3.45µm)	2/3"(3.45µm)	2/3"(3.45µm)	2/3"(3.45µm)
TV distortion [%]	-0.08	0.11	-0.06	0.07	0.08	0.01
Dimension [mm]	ø51×68.5	ø51×70.5	ø51×75.5	ø51×48.5	ø51×55.5	ø51×76

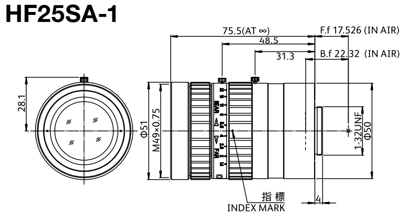
HF12.5SA-1



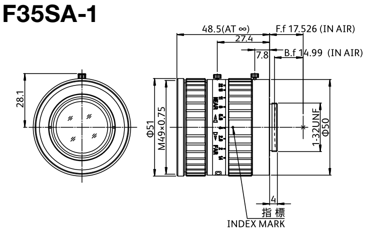
HF16SA-1



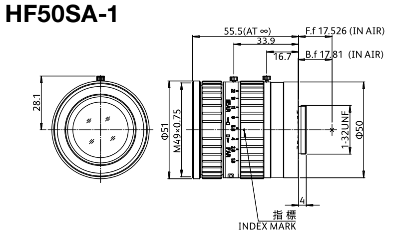
HF25SA-1



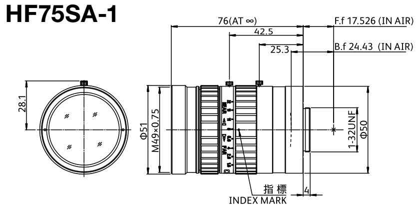
HF35SA-1



HF50SA-1



HF75SA-1



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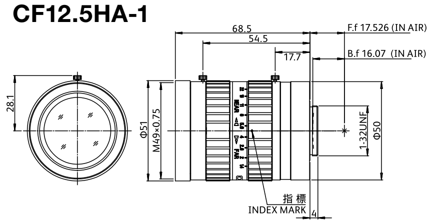
*1 From front of lens barrel. *2 Sensor size(std.): Ideal size to maximize the target resolution.
*3 Sensor size(max.): Adaptable sensor size varies depending on the model. Please check the amount of light and resolution on the edges pertaining to your particular application.

CF-HA series, 1", 9.1µm, 1.5MP

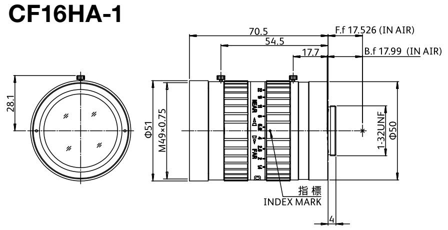
- Low distortion
- Large maximum aperture

	CF12.5HA-1	CF16HA-1	CF25HA-1	CF35HA-1	CF50HA-1	CF75HA-1
Focal length [mm]	12.5	16	25	35	50	75
Iris range [F. no]	F1.4-F22	F1.4-F22	F1.4-F22	F1.4-F22	F1.8-F22	F1.8-F22
Angle of view : 1"	53.1°×41.2°	42.6°×32.8°	29.9°×22.7°	20.3°×15.3°	14.1°×10.6°	9.8°×7.3°
Working Distance*1 [mm]	∞-100	∞-100	∞-100	∞-200	∞-400	∞-900
Operation of focus	Manual	Manual	Manual	Manual	Manual	Manual
Operation of iris	Manual	Manual	Manual	Manual	Manual	Manual
Filter thread [mm]	M49×0.75	M49×0.75	M49×0.75	M49×0.75	M49×0.75	M49×0.75
Mount	C-mount	C-mount	C-mount	C-mount	C-mount	C-mount
Weight (approx.) [g]	290	280	310	180	235	300
Sensor size (std.)*2	1"(9.1µm)	1"(9.1µm)	1"(9.1µm)	1"(9.1µm)	1"(9.1µm)	1"(9.1µm)
Sensor size (max.)*3	1"(9.1µm)	1"(9.1µm)	1"(9.1µm)	1"(9.1µm)	1"(9.1µm)	1"(9.1µm)
TV distortion [%]	0.86	0.79	0.36	0.18	0.20	0.01
Dimension [mm]	ø51×68.5	ø51×70.5	ø51×75.5	ø51×48.5	ø51×55.5	ø51×76

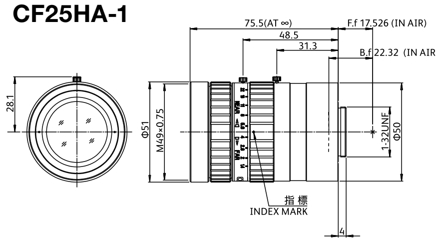
CF12.5HA-1



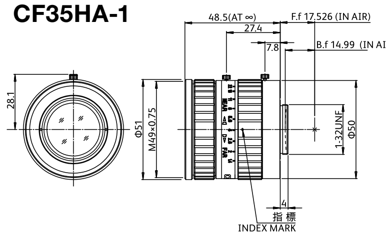
CF16HA-1



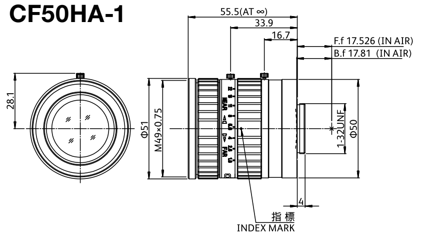
CF25HA-1



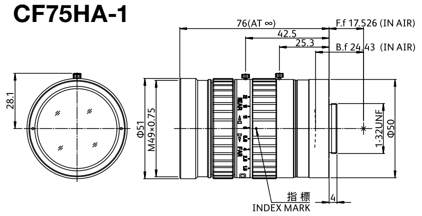
CF35HA-1



CF50HA-1



CF75HA-1



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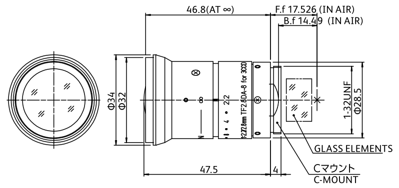
*1 From front of lens barrel. *2 Sensor size(std.): Ideal size to maximize the target resolution.
*3 Sensor size(max.): Adaptable sensor size varies depending on the model. Please check the amount of light and resolution on the edges pertaining to your particular application.

TF series 3CCD, 1/3"

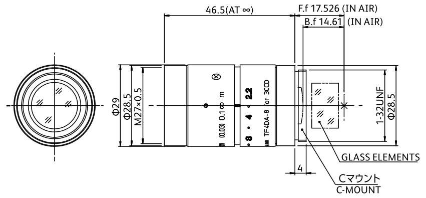
- Ultra-compact, lightweight and robust design
- Supporting 2 MP sensor (TF4XA-1)

	TF2.8DA-8	TF4DA-8	TF4XA-1 2MP	TF8DA-8B	TF15DA-8
Focal length [mm]	2.8	4	4	8	15
Iris range [F. no]	F2.2-F16·Close	F2.2-F16·Close	F2.2-F16·Close	F2.2-F16·Close	F2.2-F16·Close
Angle of view : 1/3"	89.1°×69.3°	64.5°×49.0°	64.5°×49.1°	33.4°×25.1°	18.0°×13.5°
Working Distance[1] [mm]	∞-100	∞-100	∞-100	∞-100	∞-100
Operation of focus	Manual	Manual	Manual	Manual	Manual
Operation of iris	Manual	Manual	Manual	Manual	Manual
Filter thread [mm]	-	M27×0.5	M27×0.5 (INSIDE) M30.5×0.5 (OUTSIDE)	M25.5×0.5	M25.5×0.5
Mount	C-mount	C-mount	C-mount	C-mount	C-mount
Weight (approx.) [g]	75	70	100	60	60
Sensor size (std.)[2]	1/3"(6.7μm)	1/3"(6.7μm)	1/3"(6.7μm)	1/3"(6.7μm)	1/3"(6.7μm)
Sensor size (max.)[3]	1/3"(6.7μm)	1/3"(6.7μm)	1/3"(6.7μm)	1/3"(6.7μm)	1/3"(6.7μm)
TV distortion [%]	-6.25	-3.77	-4.27	-1.30	-0.31
Dimension [mm]	ø34×47.5	ø29×46.5	ø30.5×44	ø29×39	ø29×39

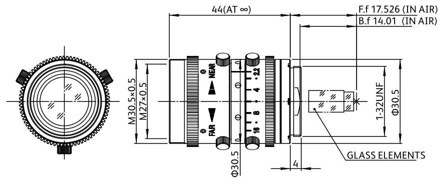
TF2.8DA-8



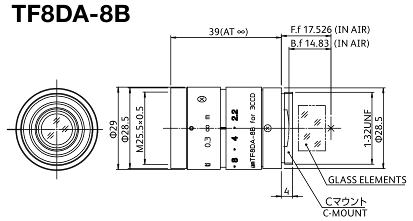
TF4DA-8



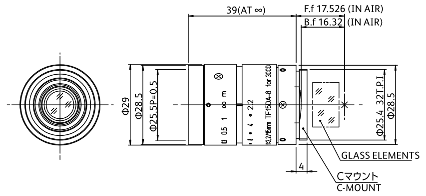
TF4XA-1 2MP



TF8DA-8B



TF15DA-8



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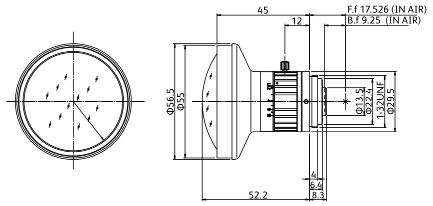
*1 From front of lens barrel. *2 Sensor size(std.): Ideal size to maximize the target resolution.
*3 Sensor size(max.): Adaptable sensor size varies depending on the model. Please check the amount of light and resolution on the edges pertaining to your particular application.

FE185 series Fisheye lens

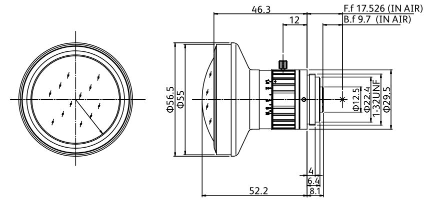
- Super wide-angle with a 185° field of view
- 2 models for 1" and 2/3"
- Supporting 5 MP sensor

	FE185C086HA-1	FE185C057HA-1
Focal length [mm]	2.7	1.8
Iris range [F. no]	F1.8-F16	F1.4-F16
Angle of view : 1"	185.0°×185.0°(ø8.6mm)	185.0°×185.0°(ø5.7mm)
Angle of view : 2/3"	185.0°×140.6°	185.0°×154.1°
Angle of view : 1/2"	136.3°×102.3°	154.1°×115.4°
Working Distance[1] [mm]	∞-200	∞-100
Operation of focus	Fixed	Fixed
Operation of iris	Manual	Manual
Mount	C-mount	C-mount
Weight (approx.) [g]	160	135
Sensor size (std.)[2]	-	-
Sensor size (max.)[3]	1"(5μm)	2/3"(3.45μm)
Dimension [mm]	ø56.5×60.5	ø56.5×60.3

FE185C086HA-1



FE185C057HA-1



Simulation images

FE185C086HA-1

1" sensors

2/3" sensors

1/2" sensors

FE185C057HA-1

2/3" sensors

1/2" sensors

1/3" sensors

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*1 From front of lens. *2 Sensor size(std.): Ideal size to maximize the target resolution.
*3 Sensor size(max.): Adaptable sensor size varies depending on the model. Please check the amount of light and resolution on the edges pertaining to your particular application.

FUJINON Lens Shooting Range Chart

CF-ZA-1S series

CF8ZA-1S

Working Distance	Optical Magnification	Extension Tube	Field of View [mm]					
			1.1"		1"		2/3"	
[mm]		[mm]	H	V	H	V	H	V
1000	0.008x	-	1888.5	1361.5	1684.7	1221.8	1112.6	822.2
950	0.009x	-	1795.5	1294.5	1601.8	1161.6	1057.8	781.7
900	0.009x	-	1702.5	1227.4	1518.8	1101.4	1003.0	741.2
850	0.010x	-	1609.6	1160.3	1435.9	1041.2	948.2	700.7
800	0.010x	-	1516.6	1093.3	1352.9	981.0	893.4	660.2
750	0.011x	-	1423.6	1026.2	1269.9	920.9	838.6	619.7
700	0.012x	-	1330.6	959.2	1187.0	860.7	783.7	579.1
650	0.013x	-	1237.7	892.1	1104.0	800.5	728.9	538.6
600	0.014x	-	1144.7	825.0	1021.1	740.3	674.1	498.1
550	0.015x	-	1051.7	758.0	938.1	680.1	619.3	457.6
500	0.016x	-	958.7	690.9	855.2	619.9	564.5	417.1
450	0.018x	-	865.8	623.9	772.2	559.8	509.7	376.6
400	0.020x	-	772.8	556.8	689.2	499.6	454.9	336.1
350	0.023x	-	679.8	489.7	606.3	439.4	400.1	295.6
300	0.026x	-	586.8	422.7	523.3	379.2	345.2	255.0
250	0.031x	-	493.8	355.6	440.3	319.0	290.4	214.5
200	0.039x	-	400.8	288.5	357.3	258.8	235.6	174.0
150	0.050x	-	307.8	221.4	274.4	198.6	180.8	133.5
100	0.073x	-	214.8	154.3	191.3	138.4	125.9	92.9

CF12ZA-1S

Working Distance	Optical Magnification	Extension Tube	Field of View [mm]					
			1.1"		1"		2/3"	
[mm]		[mm]	H	V	H	V	H	V
1000	0.012x	-	1238.5	906.0	1112.2	815.2	743.6	551.4
950	0.013x	-	1177.7	861.5	1057.6	775.1	707.1	524.3
900	0.013x	-	1116.9	817.1	1003.0	735.1	670.6	497.2
850	0.014x	-	1056.2	772.6	948.4	695.1	634.1	470.2
800	0.015x	-	995.4	728.1	893.8	655.0	597.5	443.1
750	0.016x	-	934.6	683.6	839.3	615.0	561.0	416.0
700	0.017x	-	873.8	639.1	784.7	575.0	524.5	388.9
650	0.019x	-	813.1	594.6	730.1	535.0	488.0	361.8
600	0.020x	-	752.3	550.1	675.5	494.9	451.5	334.7
550	0.022x	-	691.5	505.7	620.9	454.9	414.9	307.6
500	0.024x	-	630.7	461.2	566.3	414.9	378.4	280.6
450	0.026x	-	570.0	416.7	511.7	374.8	341.9	253.5
400	0.030x	-	509.2	372.2	457.1	334.8	305.4	226.4
350	0.034x	-	448.4	327.7	402.5	294.7	268.8	199.3
300	0.039x	-	387.6	283.2	347.9	254.7	232.3	172.2
250	0.046x	-	326.8	238.6	293.2	214.6	195.7	145.1
200	0.057x	-	265.9	194.1	238.6	174.6	159.2	118.0
150	0.074x	-	205.0	149.5	183.9	134.5	122.6	90.8
100	0.105x	-	144.0	104.9	129.1	94.3	86.0	63.7

CF16ZA-1S

Working Distance	Optical Magnification	Extension Tube	Field of View [mm]					
			1.1"		1"		2/3"	
[mm]		[mm]	H	V	H	V	H	V
1000	0.016x	-	896.4	667.9	811.0	603.4	552.2	412.4
950	0.017x	-	852.6	635.2	771.3	573.9	525.1	392.2
900	0.018x	-	808.7	602.5	731.6	544.3	498.1	372.0
850	0.019x	-	764.8	569.7	691.9	514.8	471.0	351.8
800	0.020x	-	721.0	537.0	652.2	485.2	444.0	331.6
750	0.021x	-	677.1	504.3	612.5	455.7	416.9	311.4
700	0.023x	-	633.2	471.6	572.8	426.1	389.9	291.2
650	0.025x	-	589.4	438.9	533.1	396.5	362.8	271.0
600	0.026x	-	545.5	406.2	493.4	367.0	335.8	250.7
550	0.029x	-	501.6	373.5	453.7	337.4	308.7	230.5
500	0.032x	-	457.7	340.8	414.0	307.8	281.7	210.3
450	0.035x	-	413.8	308.0	374.2	278.3	254.6	190.1
400	0.039x	-	369.9	275.3	334.5	248.7	227.5	169.9
350	0.044x	-	326.0	242.6	294.8	219.1	200.5	149.6
300	0.051x	-	282.1	209.8	255.0	189.5	173.4	129.4
250	0.061x	-	238.1	177.0	215.2	159.9	146.3	109.2
200	0.075x	-	194.1	144.2	175.4	130.2	119.1	88.9
150	0.097x	-	150.0	111.4	135.5	100.6	92.0	68.6
100	0.138x	-	105.7	78.4	95.4	70.7	64.7	48.2

CF25ZA-1S

Working Distance	Optical Magnification	Extension Tube	Field of View [mm]					
			1.1"		1"		2/3"	
[mm]		[mm]	H	V	H	V	H	V
1000	0.024x	-	604.4	450.8	546.9	407.5	373.0	278.9
950	0.025x	-	574.8	428.7	520.1	387.5	354.7	265.2
900	0.026x	-	545.2	406.6	493.4	367.6	336.5	251.5
850	0.028x	-	515.6	384.5	466.6	347.6	318.2	237.9
800	0.030x	-	486.0	362.5	439.8	327.6	299.9	224.2
750	0.031x	-	456.4	340.4	413.0	307.7	281.6	210.5
700	0.034x	-	426.8	318.3	386.2	287.7	263.4	196.9
650	0.036x	-	397.2	296.2	359.4	267.7	245.1	183.2
600	0.039x	-	367.6	274.1	332.6	247.8	226.8	169.5
550	0.043x	-	338.0	252.0	305.8	227.8	208.5	155.9
500	0.047x	-	308.4	229.9	279.0	207.8	190.2	142.2
450	0.052x	-	278.7	207.8	252.2	187.8	171.9	128.5
400	0.058x	-	249.1	185.6	225.3	167.8	153.6	114.8
350	0.066x	-	219.4	163.5	198.5	147.8	135.3	101.1
300	0.076x	-	189.7	141.3	171.6	127.7	116.9	87.4
250	0.090x	-	159.9	119.1	144.6	107.6	98.5	73.6
200	0.111x	-	130.0	96.8	117.6	87.5	80.1	59.8
150	0.144x	-	100.0	74.4	90.4	67.2	61.5	46.0
100	0.208x	-	69.5	51.6	62.8	46.6	42.7	31.9

CF35ZA-1S

Working Distance	Optical Magnification	Extension Tube	Field of View [mm]					
			1.1"		1"		2/3"	
[mm]		[mm]	H	V	H	V	H	V
1000	0.034x	-	419.8	314.5	380.6	284.6	260.7	195.3
950	0.036x	-	399.4	299.2	362.1	270.8	248.0	185.8
900	0.038x	-	379.0	283.9	343.5	256.9	235.3	176.2
850	0.040x	-	358.5	268.6	325.0	243.0	222.6	166.7
800	0.042x	-	338.1	253.2	306.5	229.2	209.9	157.2
750	0.045x	-	317.6	237.9	287.9	215.3	197.2	147.7
700	0.048x	-	297.2	222.6	269.4	201.4	184.5	138.2
650	0.051x	-	276.7	207.2	250.8	187.5	171.8	128.6
600	0.056x	-	256.2	191.9	232.3	173.6	159.1	119.1
550	0.060x	-	235.8	176.5	213.7	159.7	146.3	109.6
500	0.066x	-	215.3	161.2	195.1	145.8	133.6	100.0
450	0.073x	-	194.7	145.8	176.5	131.9	120.8	90.5
400	0.082x	-	174.2	130.4	157.9	118.0	108.1	80.9
350	0.093x	-	153.6	115.0	139.2	104.0	95.3	71.3
300	0.107x	-	133.0	99.5	120.5	90.0	82.5	61.7
250	0.127x	-	112.3	84.0	101.8	76.0	69.6	52.1
200	0.156x	-	91.5	68.4	82.9	61.9	56.7	42.4
150	0.201x	1.5	71.0	53.1	64.3	48.0	44.0	32.9
100	0.282x	5	50.8	38.0	46.0	34.3	31.4	23.5

CF50ZA-1S

Working Distance	Optical Magnification	Extension Tube	Field of View [mm]					
			1.1"		1"		2/3"	
[mm]		[mm]	H	V	H	V	H	V
1000	0.048x	-	296.6	222.6	269.0	201.5	184.6	138.4
950	0.050x	-	282.0	211.6	255.8	191.5	175.5	131.5
900	0.053x	-	267.3	200.6	242.5	181.6	166.4	124.7
850	0.056x	-	252.7	189.6	229.2	171.6	157.3	117.9
800	0.059x	-	238.0	178.6	215.9	161.7	148.2	111.0
750	0.063x	-	223.4	167.6	202.6	151.7	139.0	104.2
700	0.068x	-	208.7	156.6	189.3	141.7	129.9	97.3
650	0.073x	-	194.0	145.6	176.0	131.8	120.7	90.5
600	0.079x	-	179.3	134.5	162.7	121.8	111.6	83.6
550	0.086x	-	164.6	123.5	149.3	111.8	102.4	76.8
500	0.095x	-	149.9	112.5	136.0	101.8	93.3	69.9
450	0.105x	-	135.2	101.4	122.6	91.8	84.1	63.0
400	0.118x	-	120.4	90.3	109.2	81.7	74.9	56.1
350	0.134x	-	105.5	79.1	95.7	71.6	65.6	49.2
300	0.157x	-	90.6	67.9	82.2	61.5	56.3	42.2
250	0.188x	-	75.6	56.6	68.5	51.3	47.0	35.2
200	0.236x	-	60.3	45.2	54.6	40.9	37.5	28.1
150	0.308x	5	46.1	34.5	41.8	31.2	28.6	21.4
100	0.414x	10	34.3	25.7	31.1	23.3	21.3	16.0

* This data shows simulation value.
* When attached with a extension tube, the optical performance of the lenses is not covered under warranty.

<Sensor size>

1.1"	14.1X10.6
1"	12.8X9.6
1/1.2"	10.7X8.0
2/3"	8.8X6.6
1/2"	6.4X4.8
1/3"	4.8X3.6

[mm]

HF-12M series

HF818-12M

Working Distance	Optical Magnification	Extension Tube	Field of View [mm]					
			2/3"		1/2"		1/3"	
[mm]		[mm]	H	V	H	V	H	V
1000	0.008x	-	1099.9	818.7	793.5	593.5	593.5	444.5
950	0.009x	-	1045.7	778.3	754.4	564.2	564.2	422.6
900	0.009x	-	991.5	738.0	715.3	535.0	535.0	400.7
850	0.009x	-	937.3	697.7	676.2	505.7	505.7	378.8
800	0.010x	-	883.2	657.3	637.1	476.5	476.5	356.9
750	0.011x	-	829.0	617.0	598.0	447.3	447.3	335.0
700	0.011x	-	774.8	576.7	558.9	418.0	418.0	313.1
650	0.012x	-	720.6	536.3	519.8	388.8	388.8	291.2
600	0.013x	-	666.4	496.0	480.7	359.5	359.5	269.3
550	0.015x	-	612.3	455.6	441.6	330.3	330.3	247.4
500	0.016x	-	558.1	415.3	402.5	301.0	301.0	225.5
450	0.018x	-	503.9	375.0	363.4	271.8	271.8	203.5
400	0.020x	-	449.7	334.6	324.4	242.5	242.5	181.6
350	0.023x	-	395.5	294.3	285.3	213.3	213.3	159.7
300	0.026x	-	341.4	254.0	246.2	184.1	184.1	137.8
250	0.031x	-	287.2	213.6	207.1	154.8	154.8	115.9
200	0.038x	-	233.0	173.3	168.0	125.6	125.6	94.0
150	0.050x	-	178.8	133.0	128.9	96.3	96.3	72.1
100	0.072x	-	124.6	92.6	89.8	67.1	67.1	50.2

HF1218-12M

Working Distance	Optical Magnification	Extension Tube	Field of View [mm]					
			1/1.2"		2/3"		1/2"	
[mm]		[mm]	H	V	H	V	H	V
1000	0.012x	-	884.6	664.8	727.3	546.0	529.5	397.3
950	0.013x	-	841.2	632.2	691.6	519.2	503.5	377.8
900	0.013x	-	797.8	599.6	655.9	492.4	477.5	358.3
850	0.014x	-	754.5	567.0	620.3	465.6	451.6	338.8
800	0.015x	-	711.1	534.3	584.6	438.9	425.6	319.3
750	0.016x	-	667.7	501.7	548.9	412.1	399.6	299.8
700	0.017x	-	624.3	469.1	513.2	385.3	373.6	280.3
650	0.018x	-	581.0	436.5	477.6	358.5	347.6	260.8
600	0.020x	-	537.6	403.9	441.9	331.7	321.6	241.3
550	0.022x	-	494.2	371.3	406.2	304.9	295.7	221.8
500	0.024x	-	450.8	338.7	370.5	278.1	269.7	202.3
450	0.026x	-	407.5	306.0	334.9	251.3	243.7	182.8
400	0.029x	-	364.1	273.4	299.2	224.5	217.7	163.3
350	0.033x	-	320.7	240.8	263.5	197.7	191.7	143.8
300	0.039x	-	277.3	208.2	227.8	170.9	165.7	124.3
250	0.046x	-	233.9	175.6	192.2	144.1	139.8	104.8
200	0.056x	-	190.6	143.0	156.5	117.3	113.8	85.3
150	0.073x	-	147.2	110.3	120.8	90.5	87.8	65.8
100	0.104x	-	103.8	77.7	85.1	63.7	61.8	46.3

HF1618-12M

Working Distance	Optical Magnification	Extension Tube	Field of View [mm]					
			1/1.2"		2/3"		1/2"	
[mm]		[mm]	H	V	H	V	H	V
1000	0.016x	-	683.0	512.1	560.6	420.2	407.5	305.5
950	0.017x	-	649.5	487.0	533.1	399.6	387.5	290.5
900	0.017x	-	616.0	461.9	505.6	379.0	367.5	275.5
850	0.018x	-	582.5	436.7	478.1	358.4	347.5	260.5
800	0.020x	-	549.0	411.6	450.6	337.7	327.5	245.5
750	0.021x	-	515.5	386.5	423.1	317.1	307.5	230.5
700	0.022x	-	482.0	361.4	395.6	296.5	287.5	215.5
650	0.024x	-	448.5	336.2	368.1	275.9	267.5	200.5
600	0.026x	-	415.0	311.1	340.6	255.3	247.5	185.5
550	0.028x	-	381.5	286.0	313.1	234.6	227.5	170.5
500	0.031x	-	347.9	260.8	285.6	214.0	207.5	155.6
450	0.034x	-	314.4	235.7	258.0	193.4	187.5	140.6
400	0.038x	-	280.9	210.6	230.5	172.8	167.5	125.6
350	0.043x	-	247.4	185.5	203.0	152.2	147.5	110.6
300	0.050x	-	213.9	160.3	175.5	131.5	127.5	95.6
250	0.060x	-	180.4	135.2	148.0	110.9	107.5	80.6
200	0.073x	-	146.9	110.1	120.5	90.3	87.5	65.6
150	0.095x	-	113.4	84.9	93.0	69.7	67.6	50.6
100	0.135x	-	79.8	59.8	65.5	49.0	47.6	35.6

HF2518-12M

Working Distance	Optical Magnification	Extension Tube	Field of View [mm]					
			1/1.2"		2/3"		1/2"	
[mm]		[mm]	H	V	H	V	H	V
1000	0.024x	-	440.7	330.4	361.7	271.2	262.9	197.2
950	0.026x	-	419.2	314.3	344.0	257.9	250.1	187.5
900	0.027x	-	397.7	298.2	326.4	244.7	237.3	177.9
850	0.029x	-	376.2	282.0	308.7	231.5	224.4	168.3
800	0.030x	-	354.7	265.9	291.1	218.2	211.6	158.6
750	0.032x	-	333.2	249.8	273.4	205.0	198.7	149.0
700	0.034x	-	311.7	233.6	255.8	191.7	185.9	139.4
650	0.037x	-	290.2	217.5	238.1	178.5	173.1	129.7
600	0.040x	-	268.7	201.4	220.4	165.2	160.2	120.1
550	0.043x	-	247.1	185.2	202.8	152.0	147.4	110.5
500	0.048x	-	225.6	169.1	185.1	138.7	134.5	100.8
450	0.053x	-	204.1	152.9	167.4	125.5	121.6	91.2
400	0.059x	-	182.5	136.7	149.7	112.2	108.8	81.5
350	0.067x	-	161.0	120.6	132.0	98.9	95.9	71.9
300	0.077x	-	139.4	104.4	114.3	85.6	83.0	62.2
250	0.091x	-	117.8	88.2	96.5	72.3	70.1	52.5
200	0.112x	-	96.1	71.9	78.7	59.0	57.2	42.8
150	0.145x	-	74.3	55.5	60.8	45.5	44.1	33.1
100	0.207x	-	52.2	39.0	42.7	31.9	31.0	23.2

HF3520-12M

Working Distance	Optical Magnification	Extension Tube	Field of View [mm]					
			1"		2/3"		1/2"	
[mm]		[mm]	H	V	H	V	H	V
1000	0.034x	-	380.5	285.3	261.5	196.1	190.1	142.6
950	0.035x	-	361.8	271.2	248.6	186.4	180.8	135.6
900	0.037x	-	343.1	257.2	235.7	176.8	171.4	128.5
850	0.040x	-	324.4	243.1	222.9	167.1	162.0	121.5
800	0.042x	-	305.6	229.1	210.0	157.5	152.7	114.5
750	0.045x	-	286.9	215.0	197.1	147.8	143.3	107.5
700	0.048x	-	268.2	201.0	184.2	138.1	133.9	100.4
650	0.051x	-	249.4	186.9	171.3	128.5	124.6	93.4
600	0.056x	-	230.7	172.9	158.4	118.8	115.2	86.4
550	0.061x	-	211.9	158.8	145.5	109.1	105.8	79.3
500	0.066x	-	193.1	144.7	132.6	99.4	96.4	72.3
450	0.074x	-	174.3	130.6	119.7	89.7	87.0	65.2
400	0.083x	-	155.5	116.5	106.8	80.0	77.6	58.2
350	0.094x	-	136.7	102.4	93.8	70.3	68.2	51.1
300	0.109x	-	117.8	88.2	80.8	60.6	58.8	44.1
250	0.130x	-	98.9	74.0	67.8	50.8	49.3	36.9
200	0.161x	-	79.8	59.7	54.7	41.0	39.8	29.8
150	0.213x	2	60.5	45.2	41.5	31.1	30.1	22.6
100	0.318x	10	40.6	30.3	27.8	20.8	20.2	15.1

* This data shows simulation value.
* When attached with a extension tube, the optical performance of the lenses is not covered under warranty.
* The extension tubes of 5mm to 9mm cannot be attached to the HF-12M series.

<Sensor size>

1.1"	14.1X10.6
1"	12.8X9.6
1/1.2"	10.7X8.0
2/3"	8.8X6.6
1/2"	6.4X4.8
1/3"	4.8X3.6

[mm]

HF-XA-5M series

HF6XA-5M

Working Distance	Optical Magnification	Extension Tube	Field of View [mm]					
			2/3"		1/2"		1/3"	
[mm]		[mm]	H	V	H	V	H	V
1000	0.006x	-	1548.2	1126.4	1089.5	802.1	802.1	594.9
950	0.006x	-	1471.8	1070.9	1035.7	762.5	762.5	565.6
900	0.007x	-	1395.5	1015.3	982.0	722.9	722.9	536.3
850	0.007x	-	1319.1	959.8	928.3	683.4	683.4	506.9
800	0.008x	-	1242.8	904.2	874.6	643.8	643.8	477.6
750	0.008x	-	1166.5	848.7	820.8	604.3	604.3	448.2
700	0.009x	-	1090.1	793.1	767.1	564.7	564.7	418.9
650	0.009x	-	1013.8	737.6	713.4	525.2	525.2	389.6
600	0.010x	-	937.4	682.0	659.6	485.6	485.6	360.2
550	0.011x	-	861.1	626.5	605.9	446.1	446.1	330.9
500	0.012x	-	784.8	570.9	552.2	406.5	406.5	301.5
450	0.013x	-	708.4	515.4	498.5	367.0	367.0	272.2
400	0.015x	-	632.1	459.8	444.7	327.4	327.4	242.9
350	0.017x	-	555.7	404.3	391.0	287.8	287.8	213.5
300	0.020x	-	479.4	348.7	337.3	248.3	248.3	184.2
250	0.024x	-	403.0	293.2	283.5	208.7	208.7	154.8
200	0.029x	-	326.7	237.6	229.8	169.2	169.2	125.5
150	0.038x	-	250.4	182.1	176.1	129.6	129.6	96.2
100	0.055x	-	174.0	126.5	122.4	90.1	90.1	66.8

HF8XA-5M

Working Distance	Optical Magnification	Extension Tube	Field of View [mm]					
			2/3"		1/2"		1/3"	
[mm]		[mm]	H	V	H	V	H	V
1000	0.008x	-	1130.4	830.5	803.9	595.5	595.5	443.3
950	0.009x	-	1074.6	789.5	764.2	566.1	566.1	421.4
900	0.009x	-	1018.8	748.5	724.5	536.6	536.6	399.5
850	0.010x	-	962.9	707.4	684.8	507.2	507.2	377.6
800	0.010x	-	907.1	666.4	645.1	477.8	477.8	355.7
750	0.011x	-	851.2	625.4	605.4	448.4	448.4	333.8
700	0.012x	-	795.4	584.3	565.7	419.0	419.0	311.9
650	0.013x	-	739.6	543.3	525.9	389.6	389.6	290.0
600	0.014x	-	683.7	502.3	486.2	360.1	360.1	268.1
550	0.015x	-	627.9	461.3	446.5	330.7	330.7	246.2
500	0.016x	-	572.0	420.2	406.8	301.3	301.3	224.3
450	0.018x	-	516.2	379.2	367.1	271.9	271.9	202.4
400	0.020x	-	460.3	338.2	327.4	242.5	242.5	180.5
350	0.023x	-	404.5	297.1	287.6	213.0	213.0	158.6
300	0.027x	-	348.7	256.1	247.9	183.6	183.6	136.7
250	0.032x	-	292.8	215.1	208.2	154.2	154.2	114.8
200	0.039x	-	237.0	174.1	168.5	124.8	124.8	92.9
150	0.051x	-	181.1	133.0	128.8	95.4	95.4	71.0
100	0.074x	-	125.3	92.0	89.1	66.0	66.0	49.1

HF12XA-5M

Working Distance	Optical Magnification	Extension Tube	Field of View [mm]					
			1/1.2"		2/3"		1/2"	
[mm]		[mm]	H	V	H	V	H	V
1000	0.012x	-	913.0	673.6	740.5	548.9	531.8	396.2
950	0.013x	-	868.0	640.4	704.0	521.9	505.6	376.7
900	0.014x	-	823.0	607.2	667.5	494.8	479.4	357.2
850	0.014x	-	778.0	574.0	631.0	467.8	453.2	337.7
800	0.015x	-	733.0	540.8	594.5	440.7	427.0	318.1
750	0.016x	-	688.0	507.6	558.0	413.7	400.8	298.6
700	0.017x	-	643.1	474.5	521.6	386.6	374.6	279.1
650	0.019x	-	598.1	441.3	485.1	359.6	348.3	259.6
600	0.020x	-	553.1	408.1	448.6	332.5	322.1	240.0
550	0.022x	-	508.1	374.9	412.1	305.5	295.9	220.5
500	0.024x	-	463.1	341.7	375.6	278.4	269.7	201.0
450	0.027x	-	418.2	308.5	339.1	251.4	243.5	181.5
400	0.030x	-	373.2	275.3	302.6	224.3	217.3	161.9
350	0.034x	-	328.2	242.1	266.2	197.3	191.1	142.4
300	0.039x	-	283.2	208.9	229.7	170.2	164.9	122.9
250	0.047x	-	238.2	175.7	193.2	143.2	138.7	103.4
200	0.058x	-	193.2	142.5	156.7	116.1	112.5	83.8
150	0.075x	-	148.3	109.3	120.2	89.1	86.3	64.3
100	0.108x	-	103.3	76.1	83.7	62.0	60.1	44.8

HF16XA-5M

Working Distance	Optical Magnification	Extension Tube	Field of View [mm]					
			1/1.2"		2/3"		1/2"	
[mm]		[mm]	H	V	H	V	H	V
1000	0.016x	-	701.9	522.1	572.8	427.0	413.9	309.3
950	0.016x	-	667.5	496.5	544.7	406.0	393.6	294.2
900	0.017x	-	633.1	470.9	516.6	385.1	373.2	279.0
850	0.018x	-	598.7	445.3	488.4	364.1	352.9	263.8
800	0.019x	-	564.2	419.7	460.3	343.2	332.6	248.6
750	0.021x	-	529.8	394.0	432.2	322.2	312.3	233.4
700	0.022x	-	495.4	368.4	404.1	301.3	292.0	218.2
650	0.024x	-	461.0	342.8	376.0	280.3	271.7	203.0
600	0.026x	-	426.5	317.2	347.9	259.3	251.4	187.9
550	0.028x	-	392.1	291.5	319.8	238.4	231.0	172.7
500	0.031x	-	357.7	265.9	291.7	217.4	210.7	157.5
450	0.034x	-	323.3	240.3	263.6	196.5	190.4	142.3
400	0.038x	-	288.8	214.7	235.5	175.5	170.1	127.1
350	0.043x	-	254.4	189.1	207.4	154.6	149.8	111.9
300	0.050x	-	220.0	163.4	179.3	133.6	129.5	96.7
250	0.059x	-	185.6	137.8	151.2	112.6	109.2	81.6
200	0.073x	-	151.1	112.2	123.1	91.7	88.9	66.4
150	0.094x	-	116.7	86.6	95.0	70.7	68.5	51.2
100	0.134x	-	82.3	60.9	66.9	49.8	48.2	36.0

HF25XA-5M

Working Distance	Optical Magnification	Extension Tube	Field of View [mm]					
			1/1.2"		2/3"		1/2"	
[mm]		[mm]	H	V	H	V	H	V
1000	0.025x	-	436.0	326.6	357.6	267.9	259.8	194.7
950	0.026x	-	414.6	310.5	340.0	254.7	247.0	185.1
900	0.027x	-	393.1	294.4	322.4	241.5	234.2	175.5
850	0.029x	-	371.7	278.4	304.8	228.4	221.4	166.0
800	0.031x	-	350.3	262.3	287.2	215.2	208.6	156.4
750	0.033x	-	328.8	246.2	269.6	202.0	195.9	146.8
700	0.035x	-	307.4	230.2	252.0	188.8	183.1	137.2
650	0.038x	-	285.9	214.1	234.5	175.6	170.3	127.6
600	0.041x	-	264.5	198.1	216.9	162.5	157.5	118.1
550	0.044x	-	243.1	182.0	199.3	149.3	144.7	108.5
500	0.049x	-	221.6	165.9	181.7	136.1	132.0	98.9
450	0.054x	-	200.2	149.9	164.1	122.9	119.2	89.3
400	0.060x	-	178.8	133.8	146.5	109.7	106.4	79.7
350	0.068x	-	157.3	117.7	128.9	96.6	93.6	70.2
300	0.079x	-	135.9	101.7	111.4	83.4	80.8	60.6
250	0.094x	-	114.4	85.6	93.8	70.2	68.1	51.0
200	0.116x	-	93.0	69.5	76.2	57.0	55.3	41.4
150	0.151x	-	71.5	53.5	58.6	43.8	42.5	31.8
100	0.216x	-	50.1	37.4	41.0	30.7	29.7	22.3

HF35XA-5M

Working Distance	Optical Magnification	Extension Tube	Field of View [mm]					
			1/1.2"		2/3"		1/2"	
[mm]		[mm]	H	V	H	V	H	V
1000	0.035x	-	304.5	228.5	250.1	187.6	182.0	136.5
950	0.037x	-	289.3	217.1	237.6	178.3	172.9	129.7
900	0.039x	-	274.1	205.7	225.1	168.9	163.8	122.9
850	0.041x	-	258.9	194.3	212.6	159.5	154.7	116.0
800	0.044x	-	243.7	182.8	200.1	150.1	145.6	109.2
750	0.047x	-	228.4	171.4	187.6	140.8	136.5	102.4
700	0.050x	-	213.2	160.0	175.1	131.4	127.4	95.6
650	0.054x	-	198.0	148.6	162.6	122.0	118.3	88.7
600	0.059x	-	182.8	137.2	150.1	112.6	109.2	81.9
550	0.064x	-	167.6	125.7	137.6	103.2	100.1	75.1
500	0.070x	-	152.4	114.3	125.1	93.9	91.0	68.3
450	0.078x	-	137.2	102.9	112.6	84.5	81.9	61.4
400	0.088x	-	122.0	91.5	100.1	75.1	72.8	54.6
350	0.100x	-	106.8	80.1	87.6	65.7	63.7	47.8
300	0.117x	-	91.5	68.6	75.1	56.3	54.6	41.0
250	0.141x	-	76.3	57.2	62.6	47.0	45.5	34.1
200	0.176x	-	61.1	45.8	50.1	37.6	36.4	27.3
150	0.234x	5	45.9	34.4	37.6	28.2	27.3	20.5
100	0.352x	10	30.6	22.9	25.1	18.8	18.2	13.7

HF50XA-5M

Working Distance	Optical Magnification	Extension Tube	Field of View [mm]					
			1.1"		2/3"		1/2"	
[mm]		[mm]	H	V	H	V	H	V
1000	0.048x	-	293.1	219.7	183.1	137.3	133.1	99.8
950	0.051x	-	278.6	208.9	174.0	130.5	126.5	94.9
900	0.053x	-	264.1	198.0	164.9	123.7	119.9	89.9
850	0.056x	-	249.6	187.1	155.9	116.9	113.3	85.0
800	0.060x	-	235.1	176.2	146.8	110.1	106.7	80.0
750	0.064x	-	220.6	165.3	137.7	103.3	100.1	75.1
700	0.068x	-	206.1	154.4	128.7	96.5	93.5	70.1
650	0.074x	-	191.5	143.5	119.6	89.7	86.9	65.2
600	0.080x	-	177.0	132.7	110.5	82.9	80.3	60.2
550	0.087x	-	162.5	121.8	101.4	76.1	73.7	55.3
500	0.095x	-	148.0	110.9	92.4	69.2	67.1	50.4
450	0.106x	-	133.5	100.0	83.3	62.4	60.5	45.4
400	0.119x	-	118.9	89.1	74.2	55.6	54.0	40.5
350	0.135x	-	104.4	78.2	65.1	48.8	47.4	35.5
300	0.157x	-	89.9	67.3	56.1	42.0	40.8	30.6
250	0.188x	-	75.4	56.4	47.0	35.2	34.2	25.6
200	0.232x	-	60.8	45.5	37.9	28.4	27.6	20.7
150	0.306x	5	46.3	34.6	28.8	21.6	21.0	15.7
100	0.447x	15	31.7	23.7	19.7	14.8	14.3	10.8

* This data shows simulation value.
* When attached with a extension tube, the optical performance of the lenses is not covered under warranty.

<Sensor size>

1.1"	14.1X10.6
1"	12.8X9.6
1/1.2"	10.7X8.0
2/3"	8.8X6.6
1/2"	6.4X4.8
1/3"	4.8X3.6

[mm]

HF-HA-1S series

DF6HA-1S

Working Distance	Optical Magnification	Extension Tube	Field of View [mm]					
			2/3"		1/2"		1/3"	
[mm]		[mm]	H	V	H	V	H	V
1000	0.006x	-	-	-	1109.3	816.0	816.0	604.3
950	0.006x	-	-	-	1054.7	775.8	775.8	574.6
900	0.007x	-	-	-	1000.1	735.6	735.6	544.8
850	0.007x	-	-	-	945.4	695.3	695.3	515.0
800	0.008x	-	-	-	890.8	655.1	655.1	485.2
750	0.008x	-	-	-	836.2	614.9	614.9	455.4
700	0.009x	-	-	-	781.6	574.7	574.7	425.6
650	0.009x	-	-	-	726.9	534.5	534.5	395.8
600	0.010x	-	-	-	672.3	494.3	494.3	366.1
550	0.011x	-	-	-	617.7	454.1	454.1	336.3
500	0.012x	-	-	-	563.1	413.9	413.9	306.5
450	0.013x	-	-	-	508.4	373.7	373.7	276.7
400	0.015x	-	-	-	453.8	333.5	333.5	246.9
350	0.017x	-	-	-	399.2	293.3	293.3	217.1
300	0.020x	-	-	-	344.6	253.1	253.1	187.3
250	0.023x	-	-	-	289.9	212.9	212.9	157.5
200	0.029x	-	-	-	235.3	172.7	172.7	127.8
150	0.037x	-	-	-	180.7	132.5	132.5	98.0
100	0.054x	-	-	-	126.0	92.3	92.3	68.2

HF9HA-1S

Working Distance	Optical Magnification	Extension Tube	Field of View [mm]					
			2/3"		1/2"		1/3"	
[mm]		[mm]	H	V	H	V	H	V
1000	0.009x	-	1018.3	747.5	723.6	535.9	535.9	399.0
950	0.010x	-	968.1	710.6	687.9	509.4	509.4	379.3
900	0.010x	-	917.9	673.8	652.2	483.0	483.0	359.6
850	0.011x	-	867.7	636.9	616.5	456.5	456.5	339.9
800	0.011x	-	817.4	600.0	580.8	430.1	430.1	320.2
750	0.012x	-	767.2	563.1	545.1	403.6	403.6	300.5
700	0.013x	-	717.0	526.2	509.4	377.2	377.2	280.8
650	0.014x	-	666.8	489.3	473.7	350.8	350.8	261.1
600	0.015x	-	616.6	452.5	438.0	324.3	324.3	241.4
550	0.016x	-	566.4	415.6	402.2	297.9	297.9	221.7
500	0.018x	-	516.2	378.7	366.5	271.4	271.4	202.0
450	0.020x	-	465.9	341.8	330.8	245.0	245.0	182.3
400	0.022x	-	415.7	304.9	295.1	218.5	218.5	162.7
350	0.025x	-	365.5	268.0	259.4	192.1	192.1	143.0
300	0.029x	-	315.3	231.1	223.7	165.6	165.6	123.3
250	0.035x	-	265.1	194.3	188.0	139.2	139.2	103.6
200	0.043x	-	214.8	157.4	152.3	112.7	112.7	83.9
150	0.057x	-	164.6	120.5	116.6	86.3	86.3	64.2
100	0.082x	-	114.4	83.6	80.9	59.8	59.8	44.5

HF12.5HA-1S

Working Distance	Optical Magnification	Extension Tube	Field of View [mm]					
			2/3"		1/2"		1/3"	
[mm]		[mm]	H	V	H	V	H	V
1000	0.013x	-	723.3	532.3	515.4	382.7	382.7	285.4
950	0.013x	-	687.6	506.1	490.0	363.8	363.8	271.3
900	0.014x	-	652.0	479.8	464.6	344.9	344.9	257.2
850	0.015x	-	616.3	453.6	439.2	326.1	326.1	243.2
800	0.016x	-	580.7	427.3	413.8	307.2	307.2	229.1
750	0.017x	-	545.0	401.1	388.4	288.3	288.3	215.0
700	0.018x	-	509.4	374.8	363.0	269.5	269.5	200.9
650	0.019x	-	473.7	348.6	337.5	250.6	250.6	186.9
600	0.021x	-	438.1	322.4	312.1	231.7	231.7	172.8
550	0.023x	-	402.4	296.1	286.7	212.8	212.8	158.7
500	0.025x	-	366.8	269.9	261.3	194.0	194.0	144.6
450	0.028x	-	331.1	243.6	235.9	175.1	175.1	130.6
400	0.031x	-	295.5	217.4	210.5	156.2	156.2	116.5
350	0.035x	-	259.8	191.1	185.0	137.3	137.3	102.4
300	0.041x	-	224.2	164.9	159.6	118.5	118.5	88.3
250	0.049x	-	188.5	138.6	134.2	99.6	99.6	74.3
200	0.060x	-	152.9	112.4	108.8	80.7	80.7	60.2
150	0.079x	-	117.2	86.1	83.4	61.9	61.9	46.1
100	0.113x	-	81.5	59.8	57.9	43.0	43.0	32.0

HF16HA-1S

Working Distance	Optical Magnification	Extension Tube	Field of View [mm]					
			2/3"		1/2"		1/3"	
[mm]		[mm]	H	V	H	V	H	V
1000	0.016x	-	555.0	412.2	399.4	297.9	297.9	222.7
950	0.017x	-	527.7	391.9	379.8	283.2	283.2	211.7
900	0.018x	-	500.4	371.7	360.1	268.6	268.6	200.8
850	0.019x	-	473.1	351.4	340.5	253.9	253.9	189.8
800	0.020x	-	445.8	331.1	320.8	239.3	239.3	178.9
750	0.022x	-	418.6	310.8	301.2	224.6	224.6	167.9
700	0.023x	-	391.3	290.6	281.5	209.9	209.9	156.9
650	0.025x	-	364.0	270.3	261.9	195.3	195.3	146.0
600	0.027x	-	336.7	250.0	242.2	180.6	180.6	135.0
550	0.029x	-	309.4	229.7	222.6	166.0	166.0	124.1
500	0.032x	-	282.1	209.4	202.9	151.3	151.3	113.1
450	0.035x	-	254.8	189.2	183.3	136.7	136.7	102.2
400	0.040x	-	227.6	168.9	163.6	122.0	122.0	91.2
350	0.045x	-	200.3	148.6	144.0	107.4	107.4	80.2
300	0.052x	-	173.0	128.3	124.3	92.7	92.7	69.3
250	0.062x	-	145.7	108.1	104.7	78.0	78.0	58.3
200	0.076x	-	118.4	87.8	85.0	63.4	63.4	47.4
150	0.099x	-	91.1	67.5	65.4	48.7	48.7	36.4
100	0.142x	-	63.8	47.2	45.7	34.1	34.1	25.5

HF25HA-1S

Working Distance	Optical Magnification	Extension Tube	Field of View [mm]					
			2/3"		1/2"		1/3"	
[mm]		[mm]	H	V	H	V	H	V
1000	0.026x	-	344.7	257.9	250.1	187.3	187.3	140.4
950	0.027x	-	327.6	245.1	237.6	178.0	178.0	133.4
900	0.029x	-	310.5	232.3	225.2	168.7	168.7	126.4
850	0.030x	-	293.4	219.5	212.8	159.4	159.4	119.4
800	0.032x	-	276.3	206.7	200.4	150.1	150.1	112.5
750	0.034x	-	259.1	193.8	187.9	140.8	140.8	105.5
700	0.037x	-	242.0	181.0	175.5	131.4	131.4	98.5
650	0.039x	-	224.9	168.2	163.1	122.1	122.1	91.5
600	0.043x	-	207.8	155.4	150.6	112.8	112.8	84.5
550	0.046x	-	190.6	142.6	138.2	103.5	103.5	77.6
500	0.051x	-	173.5	129.8	125.8	94.2	94.2	70.6
450	0.057x	-	156.4	116.9	113.4	84.9	84.9	63.6
400	0.064x	-	139.3	104.1	100.9	75.6	75.6	56.6
350	0.073x	-	122.1	91.3	88.5	66.3	66.3	49.6
300	0.084x	-	105.0	78.5	76.1	56.9	56.9	42.7
250	0.101x	-	87.9	65.6	63.6	47.6	47.6	35.7
200	0.126x	-	70.7	52.8	51.2	38.3	38.3	28.7
150	0.166x	-	53.6	40.0	38.8	29.0	29.0	21.7
100	0.245x	5	36.4	27.2	26.3	19.7	19.7	14.7

HF35HA-1S

Working Distance	Optical Magnification	Extension Tube	Field of View [mm]					
			2/3"		1/2"		1/3"	
[mm]		[mm]	H	V	H	V	H	V
1000	0.036x	-	247.6	185.7	180.1	135.1	135.1	101.4
950	0.037x	-	235.0	176.3	171.0	128.3	128.3	96.2
900	0.040x	-	222.5	166.9	161.9	121.4	121.4	91.1
850	0.042x	-	209.9	157.5	152.7	114.6	114.6	85.9
800	0.045x	-	197.4	148.1	143.6	107.7	107.7	80.8
750	0.048x	-	184.8	138.7	134.5	100.9	100.9	75.7
700	0.051x	-	172.3	129.2	125.3	94.0	94.0	70.5
650	0.055x	-	159.7	119.8	116.2	87.2	87.2	65.4
600	0.060x	-	147.2	110.4	107.0	80.3	80.3	60.2
550	0.065x	-	134.6	101.0	97.9	73.4	73.4	55.1
500	0.072x	-	122.1	91.6	88.8	66.6	66.6	49.9
450	0.080x	-	109.5	82.1	79.6	59.7	59.7	44.8
400	0.091x	-	97.0	72.7	70.5	52.9	52.9	39.7
350	0.104x	-	84.4	63.3	61.4	46.0	46.0	34.5
300	0.123x	-	71.9	53.9	52.2	39.2	39.2	29.4
250	0.149x	-	59.3	44.4	43.1	32.3	32.3	24.2
200	0.189x	1.5	46.7	35.0	34.0	25.5	25.5	19.1
150	0.258x	5	34.1	25.6	24.8	18.6	18.6	13.9
100	0.409x	10	21.6	16.1	15.7	11.7	11.7	8.8

HF50HA-1S

Working Distance	Optical Magnification	Extension Tube	Field of View [mm]					
			2/3"		1/2"		1/3"	
[mm]		[mm]	H	V	H	V	H	V
1500	0.034x	-	254.8	191.2	185.4	139.1	139.1	104.4
1450	0.036x	-	245.9	184.5	179.0	134.3	134.3	100.7
1400	0.037x	-	237.1	177.9	172.5	129.4	129.4	97.1
1350	0.039x	-	228.2	171.2	166.1	124.6	124.6	93.5
1300	0.040x	-	219.4	164.6	159.6	119.8	119.8	89.8
1250	0.042x	-	210.5	157.9	153.2	114.9	114.9	86.2
1200	0.044x	-	201.7	151.3	146.7	110.1	110.1	82.6
1150	0.046x	-	192.8	144.7	140.3	105.2	105.2	78.9
1100	0.048x	-	183.9	138.0	133.8	100.4	100.4	75.3
1050	0.050x	-	175.1	131.4	127.4	95.6	95.6	71.7
1000	0.053x	-	166.2	124.7	120.9	90.7	90.7	68.1
950	0.056x	-	157.4	118.1	114.5	85.9	85.9	64.4
900	0.059x	-	148.5	111.4	108.0	81.0	81.0	60.8
850	0.063x	-	139.6	104.8	101.6	76.2	76.2	57.2
800	0.067x	-	130.8	98.1	95.1	71.4	71.4	53.5
750	0.072x	-	121.9	91.5	88.7	66.5	66.5	49.9
700	0.078x	-	113.1	84.8	82.2	61.7	61.7	46.3
650	0.084x	-	104.2	78.2	75.8	56.9	56.9	42.6
600	0.092x	-	95.3	71.5	69.3	52.0	52.0	39.0
550	0.102x	-	86.5	64.9	62.9	47.2	47.2	35.4
500	0.113x	-	77.6	58.2	56.4	42.3	42.3	31.8
450	0.128x	1	68.7	51.6	50.0	37.5	37.5	28.1
400	0.147x	2	59.9	44.9	43.5	32.7	32.7	24.5
350	0.173x	5	51.0	38.2	37.1	27.8	27.8	20.9
300	0.209x	5	42.1	31.6	30.6	23.0	23.0	17.2
250	0.265x	10	33.3	24.9	24.2	18.1	18.1	13.6
200	0.361x	15	24.4	18.3	17.7	13.3	13.3	10.0
150	0.568x	25	15.5	11.6	11.3	8.5	8.5	6.3
100	1.330x	65	6.6	5.0	4.8	3.6	3.6	2.7

HF75HA-1S

Working Distance	Optical Magnification	Extension Tube	Field of View [mm]					
			2/3"		1/2"		1/3"	
[mm]		[mm]	H	V	H	V	H	V
2000	0.040x	-	218.4	164.2	159.2	119.6	119.6	89.8
1950	0.041x	-	212.6	159.8	155.0	116.4	116.4	87.4
1900	0.042x	-	206.7	155.4	150.7	113.2	113.2	85.0
1850	0.044x	-	200.9	151.0	146.5	110.0	110.0	82.6
1800	0.045x	-	195.1	146.7	142.2	106.8	106.8	80.2
1750	0.046x	-	189.3	142.3	138.0	103.6	103.6	77.8
1700	0.048x	-	183.4	137.9	133.7	100.4	100.4	75.4
1650	0.049x	-	177.6	133.5	129.5	97.2	97.2	73.0
1600	0.051x	-	171.8	129.1	125.2	94.1	94.1	70.6
1550	0.053x	-	166.0	124.8	121.0	90.9	90.9	68.2
1500	0.055x	-	160.1	120.4	116.7	87.7	87.7	65.8
1450	0.057x	-	154.3	116.0	112.5	84.5	84.5	63.4
1400	0.059x	-	148.5	111.6	108.2	81.3	81.3	61.0
1350	0.061x	-	142.7	107.2	104.0	78.1	78.1	58.6
1300	0.064x	-	136.8	102.8	99.7	74.9	74.9	56.2
1250	0.067x	-	131.0	98.5	95.5	71.7	71.7	53.8
1200	0.070x	-	125.2	94.1	91.2	68.5	68.5	51.4
1150	0.073x	-	119.4	89.7	87.0	65.3	65.3	49.0
1100	0.077x	-	113.5	85.3	82.7	62.1	62.1	46.6
1050	0.081x	0.5	107.7	80.9	78.5	58.9	58.9	44.2
1000	0.086x	1	101.9	76.6	74.2	55.7	55.7	41.8
950	0.091x	1.5	96.1	72.2	70.0	52.5	52.5	39.4
900	0.097x	1.5	90.2	67.8	65.7	49.4	49.4	37.0
850	0.104x	5	84.4	63.4	61.5	46.2	46.2	34.6
800	0.112x	5	78.6	59.0	57.2	43.0	43.0	32.2
750	0.121x	5	72.7	54.6	53.0	39.8	39.8	29.8
700	0.131x	5	66.9	50.2	48.7	36.6	36.6	27.4
650	0.144x	5	61.1	45.9	44.5	33.4	33.4	25.0
600	0.159x	10	55.2	41.5	40.2	30.2	30.2	22.7
550	0.178x	10	49.4	37.1	36.0	27.0	27.0	20.3
500	0.202x	10	43.6	32.7	31.7	23.8	23.8	17.9
450	0.233x	15	37.7	28.3	27.5	20.6	20.6	15.5
400	0.276x	15	31.9	23.9	23.2	17.4	17.4	13.1
350	0.338x	20	26.0	19.5	18.9	14.2	14.2	10.7
300	0.436x	30	20.2	15.1	14.7	11.0	11.0	8.3
250	0.614x	45	14.3	10.7	10.4	7.8	7.8	5.9

* This data shows simulation value.
* When attached with a extension tube, the optical performance of the lenses is not covered under warranty.

<Sensor size>

1.1"	14.1X10.6
1"	12.8X9.6
1/1.2"	10.7X8.0
2/3"	8.8X6.6
1/2"	6.4X4.8
1/3"	4.8X3.6

[mm]

HF-SA series

HF12.5SA-1

Working Distance	Optical Magnification	Extension Tube	Field of View [mm]					
			2/3"		1/2"		1/3"	
[mm]		[mm]	H	V	H	V	H	V
1000	0.013x	-	705.4	528.0	511.9	383.3	383.3	287.2
950	0.013x	-	670.9	502.2	486.9	364.6	364.6	273.2
900	0.014x	-	636.4	476.4	461.8	345.8	345.8	259.1
850	0.015x	-	601.9	450.5	436.8	327.1	327.1	245.1
800	0.016x	-	567.5	424.7	411.8	308.3	308.3	231.0
750	0.017x	-	533.0	398.9	386.7	289.6	289.6	217.0
700	0.018x	-	498.5	373.1	361.7	270.8	270.8	202.9
650	0.019x	-	464.1	347.3	336.7	252.1	252.1	188.9
600	0.021x	-	429.6	321.5	311.7	233.3	233.3	174.8
550	0.022x	-	395.1	295.6	286.6	214.6	214.6	160.8
500	0.025x	-	360.6	269.8	261.6	195.8	195.8	146.7
450	0.027x	-	326.2	244.0	236.6	177.1	177.1	132.7
400	0.030x	-	291.7	218.2	211.5	158.3	158.3	118.6
350	0.034x	-	257.2	192.4	186.5	139.6	139.6	104.6
300	0.040x	-	222.8	166.6	161.5	120.8	120.8	90.5
250	0.047x	-	188.3	140.7	136.4	102.1	102.1	76.5
200	0.058x	-	153.8	114.9	111.4	83.4	83.4	62.4
150	0.075x	-	119.3	89.1	86.4	64.6	64.6	48.4
100	0.105x	-	84.9	63.3	61.3	45.9	45.9	34.3

HF16SA-1

Working Distance	Optical Magnification	Extension Tube	Field of View [mm]					
			2/3"		1/2"		1/3"	
[mm]		[mm]	H	V	H	V	H	V
1000	0.016x	-	556.0	416.9	404.3	303.1	303.1	227.2
950	0.017x	-	529.1	396.7	384.7	288.4	288.4	216.2
900	0.018x	-	502.1	376.5	365.1	273.7	273.7	205.2
850	0.019x	-	475.2	356.3	345.5	259.0	259.0	194.2
800	0.020x	-	448.2	336.0	325.8	244.3	244.3	183.1
750	0.021x	-	421.3	315.8	306.2	229.6	229.6	172.1
700	0.022x	-	394.3	295.6	286.6	214.8	214.8	161.1
650	0.024x	-	367.4	275.4	267.0	200.1	200.1	150.0
600	0.026x	-	340.4	255.2	247.4	185.4	185.4	139.0
550	0.028x	-	313.5	234.9	227.8	170.7	170.7	128.0
500	0.031x	-	286.5	214.7	208.2	156.0	156.0	117.0
450	0.034x	-	259.6	194.5	188.6	141.3	141.3	105.9
400	0.038x	-	232.6	174.3	169.0	126.6	126.6	94.9
350	0.043x	-	205.7	154.0	149.4	111.9	111.9	83.9
300	0.049x	-	178.7	133.8	129.7	97.2	97.2	72.8
250	0.058x	-	151.8	113.6	110.1	82.5	82.5	61.8
200	0.071x	-	124.8	93.4	90.5	67.8	67.8	50.8
150	0.091x	-	97.9	73.1	70.9	53.1	53.1	39.8
100	0.126x	-	70.9	52.9	51.3	38.4	38.4	28.7

HF25SA-1

Working Distance	Optical Magnification	Extension Tube	Field of View [mm]					
			2/3"		1/2"		1/3"	
[mm]		[mm]	H	V	H	V	H	V
1000	0.023x	-	378.4	283.4	274.8	205.9	205.9	154.4
950	0.025x	-	360.0	269.6	261.4	195.9	195.9	146.8
900	0.026x	-	341.6	255.9	248.1	185.9	185.9	139.3
850	0.027x	-	323.2	242.1	234.7	175.9	175.9	131.8
800	0.029x	-	304.9	228.3	221.4	165.9	165.9	124.3
750	0.031x	-	286.5	214.5	208.0	155.9	155.9	116.8
700	0.033x	-	268.1	200.8	194.7	145.8	145.8	109.3
650	0.035x	-	249.7	187.0	181.3	135.8	135.8	101.8
600	0.038x	-	231.3	173.2	167.9	125.8	125.8	94.3
550	0.042x	-	212.9	159.4	154.6	115.8	115.8	86.8
500	0.045x	-	194.6	145.7	141.2	105.8	105.8	79.3
450	0.050x	-	176.2	131.9	127.9	95.8	95.8	71.8
400	0.056x	-	157.8	118.1	114.5	85.8	85.8	64.3
350	0.063x	-	139.4	104.3	101.1	75.8	75.8	56.8
300	0.073x	-	121.0	90.5	87.8	65.7	65.7	49.3
250	0.086x	-	102.6	76.8	74.4	55.7	55.7	41.8
200	0.105x	-	84.2	63.0	61.1	45.7	45.7	34.3
150	0.135x	-	65.9	49.2	47.7	35.7	35.7	26.8
100	0.187x	-	47.5	35.4	34.3	25.7	25.7	19.2

HF35SA-1

Working Distance	Optical Magnification	Extension Tube	Field of View [mm]					
			2/3"		1/2"		1/3"	
[mm]		[mm]	H	V	H	V	H	V
1000	0.035x	-	249.2	186.9	181.2	135.9	135.9	101.9
950	0.037x	-	236.9	177.6	172.2	129.2	129.2	96.9
900	0.039x	-	224.6	168.4	163.3	122.5	122.5	91.8
850	0.041x	-	212.3	159.2	154.3	115.7	115.7	86.8
800	0.044x	-	200.0	149.9	145.4	109.0	109.0	81.8
750	0.047x	-	187.7	140.7	136.4	102.3	102.3	76.7
700	0.050x	-	175.4	131.5	127.5	95.6	95.6	71.7
650	0.054x	-	163.1	122.2	118.5	88.9	88.9	66.7
600	0.058x	-	150.8	113.0	109.6	82.2	82.2	61.6
550	0.064x	-	138.5	103.8	100.6	75.5	75.5	56.6
500	0.070x	-	126.2	94.6	91.7	68.7	68.7	51.5
450	0.077x	-	113.9	85.3	82.7	62.0	62.0	46.5
400	0.087x	-	101.6	76.1	73.8	55.3	55.3	41.5
350	0.099x	-	89.3	66.9	64.8	48.6	48.6	36.4
300	0.115x	-	76.9	57.6	55.9	41.9	41.9	31.4
250	0.137x	-	64.6	48.4	46.9	35.2	35.2	26.4
200	0.169x	-	52.3	39.2	38.0	28.4	28.4	21.3
150	0.221x	2	40.0	29.9	29.0	21.7	21.7	16.3
100	0.320x	10	27.6	20.7	20.0	15.0	15.0	11.2

HF50SA-1

Working Distance	Optical Magnification	Extension Tube	Field of View [mm]					
			2/3"		1/2"		1/3"	
[mm]		[mm]	H	V	H	V	H	V
1500	0.034x	-	255.5	191.6	185.8	139.4	139.4	104.5
1450	0.036x	-	247.0	185.3	179.7	134.8	134.8	101.1
1400	0.037x	-	238.5	178.9	173.5	130.1	130.1	97.6
1350	0.038x	-	230.0	172.5	167.3	125.5	125.5	94.1
1300	0.040x	-	221.5	166.1	161.1	120.8	120.8	90.6
1250	0.041x	-	213.0	159.8	154.9	116.2	116.2	87.1
1200	0.043x	-	204.5	153.4	148.7	111.6	111.6	83.7
1150	0.045x	-	196.0	147.0	142.6	106.9	106.9	80.2
1100	0.047x	-	187.5	140.6	136.4	102.3	102.3	76.7
1050	0.049x	-	179.0	134.3	130.2	97.6	97.6	73.2
1000	0.052x	-	170.5	127.9	124.0	93.0	93.0	69.7
950	0.054x	-	162.0	121.5	117.8	88.4	88.4	66.3
900	0.057x	-	153.5	115.1	111.6	83.7	83.7	62.8
850	0.061x	-	145.0	108.7	105.4	79.1	79.1	59.3
800	0.064x	-	136.5	102.4	99.3	74.4	74.4	55.8
750	0.069x	-	128.0	96.0	93.1	69.8	69.8	52.3
700	0.074x	-	119.5	89.6	86.9	65.2	65.2	48.9
650	0.079x	-	111.0	83.2	80.7	60.5	60.5	45.4
600	0.086x	-	102.5	76.9	74.5	55.9	55.9	41.9
550	0.094x	-	94.0	70.5	68.3	51.2	51.2	38.4
500	0.103x	-	85.5	64.1	62.2	46.6	46.6	34.9
450	0.114x	-	77.0	57.7	56.0	42.0	42.0	31.5
400	0.129x	-	68.5	51.3	49.8	37.3	37.3	28.0
350	0.147x	1	60.0	45.0	43.6	32.7	32.7	24.5
300	0.171x	5	51.5	38.6	37.4	28.0	28.0	21.0
250	0.205x	5	43.0	32.2	31.2	23.4	23.4	17.5
200	0.256x	10	34.5	25.8	25.0	18.8	18.8	14.1
150	0.340x	15	25.9	19.4	18.8	14.1	14.1	10.6
100	0.507x	20	17.4	13.0	12.6	9.5	9.5	7.1

HF75SA-1

Working Distance	Optical Magnification	Extension Tube	Field of View [mm]					
			2/3"		1/2"		1/3"	
[mm]		[mm]	H	V	H	V	H	V
2000	0.038x	-	230.8	173.1	167.9	125.9	125.9	94.4
1950	0.039x	-	225.0	168.7	163.6	122.7	122.7	92.0
1900	0.040x	-	219.1	164.3	159.3	119.5	119.5	89.6
1850	0.041x	-	213.2	159.9	155.1	116.3	116.3	87.2
1800	0.042x	-	207.4	155.5	150.8	113.1	113.1	84.8
1750	0.044x	-	201.5	151.1	146.5	109.9	109.9	82.4
1700	0.045x	-	195.6	146.7	142.3	106.7	106.7	80.0
1650	0.046x	-	189.8	142.3	138.0	103.5	103.5	77.6
1600	0.048x	-	183.9	137.9	133.7	100.3	100.3	75.2
1550	0.049x	-	178.0	133.5	129.5	97.1	97.1	72.8
1500	0.051x	-	172.2	129.1	125.2	93.9	93.9	70.4
1450	0.053x	-	166.3	124.7	120.9	90.7	90.7	68.0
1400	0.055x	-	160.4	120.3	116.7	87.5	87.5	65.6
1350	0.057x	-	154.6	115.9	112.4	84.3	84.3	63.2
1300	0.059x	-	148.7	111.5	108.1	81.1	81.1	60.8
1250	0.062x	-	142.8	107.1	103.9	77.9	77.9	58.4
1200	0.064x	-	137.0	102.7	99.6	74.7	74.7	56.0
1150	0.067x	-	131.1	98.3	95.3	71.5	71.5	53.6
1100	0.070x	-	125.2	93.9	91.1	68.3	68.3	51.2
1050	0.074x	-	119.4	89.5	86.8	65.1	65.1	48.8
1000	0.078x	-	113.5	85.1	82.5	61.9	61.9	46.4
950	0.082x	-	107.6	80.7	78.3	58.7	58.7	44.0
900	0.087x	-	101.7	76.3	74.0	55.5	55.5	41.6
850	0.092x	0.5	95.9	71.9	69.7	52.3	52.3	39.2
800	0.098x	1	90.0	67.5	65.4	49.1	49.1	36.8
750	0.105x	1.5	84.1	63.1	61.2	45.9	45.9	34.4
700	0.112x	2	78.3	58.7	56.9	42.7	42.7	32.0
650	0.122x	5	72.4	54.3	52.6	39.5	39.5	29.6
600	0.132x	5	66.5	49.9	48.4	36.3	36.3	27.2
550	0.145x	5	60.7	45.5	44.1	33.1	33.1	24.8
500	0.161x	10	54.8	41.1	39.8	29.9	29.9	22.4
450	0.180x	10	48.9	36.7	35.6	26.7	26.7	20.0
400	0.205x	10	43.1	32.3	31.3	23.5	23.5	17.6
350	0.237x	15	37.2	27.9	27.0	20.3	20.3	15.2
300	0.281x	15	31.3	23.5	22.8	17.1	17.1	12.8
250	0.346x	20	25.4	19.1	18.5	13.9	13.9	10.4
200	0.450x	30	19.6	14.7	14.2	10.7	10.7	8.0
150	0.644x	45	13.7	10.3	9.9	7.5	7.5	5.6

<Sensor size>

1.1"	14.1X10.6
1"	12.8X9.6
1/1.2"	10.7X8.0
2/3"	8.8X6.6
1/2"	6.4X4.8
1/3"	4.8X3.6

[mm]

* This data shows simulation value.
* When attached with a extension tube, the optical performance of the lenses is not covered under warranty.

CF-HA series

CF12.5HA-1

Working Distance	Optical Magnification	Extension Tube	Field of View [mm]					
			1"		2/3"		1/2"	
[mm]		[mm]	H	V	H	V	H	V
1000	0.013x	-	1024.8	769.8	705.4	528.0	511.9	383.3
950	0.013x	-	974.8	732.2	670.9	502.2	486.9	364.6
900	0.014x	-	924.8	694.6	636.4	476.4	461.8	345.8
850	0.015x	-	874.8	657.0	601.9	450.5	436.8	327.1
800	0.016x	-	824.8	619.4	567.5	424.7	411.8	308.3
750	0.017x	-	774.8	581.8	533.0	398.9	386.7	289.6
700	0.018x	-	724.8	544.1	498.5	373.1	361.7	270.8
650	0.019x	-	674.8	506.5	464.1	347.3	336.7	252.1
600	0.021x	-	624.8	468.9	429.6	321.5	311.7	233.3
550	0.022x	-	574.8	431.3	395.1	295.6	286.6	214.6
500	0.025x	-	524.8	393.7	360.6	269.8	261.6	195.8
450	0.027x	-	474.8	356.1	326.2	244.0	236.6	177.1
400	0.030x	-	424.8	318.5	291.7	218.2	211.5	158.3
350	0.034x	-	374.8	280.9	257.2	192.4	186.5	139.6
300	0.040x	-	324.8	243.2	222.8	166.6	161.5	120.8
250	0.047x	-	274.7	205.6	188.3	140.7	136.4	102.1
200	0.058x	-	224.7	168.0	153.8	114.9	111.4	83.4
150	0.075x	-	174.7	130.4	119.3	89.1	86.4	64.6
100	0.105x	-	124.7	92.8	84.9	63.3	61.3	45.9

CF16HA-1

Working Distance	Optical Magnification	Extension Tube	Field of View [mm]					
			1"		2/3"		1/2"	
[mm]		[mm]	H	V	H	V	H	V
1000	0.016x	-	806.4	606.5	556.0	416.9	404.3	303.1
950	0.017x	-	767.4	577.1	529.1	396.7	384.7	288.4
900	0.018x	-	728.4	547.7	502.1	376.5	365.1	273.7
850	0.019x	-	689.4	518.3	475.2	356.3	345.5	259.0
800	0.020x	-	650.4	488.9	448.2	336.0	325.8	244.3
750	0.021x	-	611.4	459.6	421.3	315.8	306.2	229.6
700	0.022x	-	572.4	430.2	394.3	295.6	286.6	214.8
650	0.024x	-	533.4	400.8	367.4	275.4	267.0	200.1
600	0.026x	-	494.3	371.4	340.4	255.2	247.4	185.4
550	0.028x	-	455.3	342.0	313.5	234.9	227.8	170.7
500	0.031x	-	416.3	312.6	286.5	214.7	208.2	156.0
450	0.034x	-	377.3	283.2	259.6	194.5	188.6	141.3
400	0.038x	-	338.3	253.8	232.6	174.3	169.0	126.6
350	0.043x	-	299.3	224.4	205.7	154.0	149.4	111.9
300	0.049x	-	260.3	195.1	178.7	133.8	129.7	97.2
250	0.058x	-	221.2	165.7	151.8	113.6	110.1	82.5
200	0.071x	-	182.2	136.3	124.8	93.4	90.5	67.8
150	0.091x	-	143.2	106.9	97.9	73.1	70.9	53.1
100	0.126x	-	104.2	77.5	70.9	52.9	51.3	38.4

CF25HA-1

Working Distance	Optical Magnification	Extension Tube	Field of View [mm]					
			1"		2/3"		1/2"	
[mm]		[mm]	H	V	H	V	H	V
1000	0.023x	-	551.0	413.0	378.4	283.4	274.8	205.9
950	0.025x	-	524.2	392.9	360.0	269.6	261.4	195.9
900	0.026x	-	497.5	372.9	341.6	255.9	248.1	185.9
850	0.027x	-	470.8	352.8	323.2	242.1	234.7	175.9
800	0.029x	-	444.1	332.7	304.9	228.3	221.4	165.9
750	0.031x	-	417.3	312.7	286.5	214.5	208.0	155.9
700	0.033x	-	390.6	292.6	268.1	200.8	194.7	145.8
650	0.035x	-	363.9	272.6	249.7	187.0	181.3	135.8
600	0.038x	-	337.2	252.5	231.3	173.2	167.9	125.8
550	0.042x	-	310.4	232.4	212.9	159.4	154.6	115.8
500	0.045x	-	283.7	212.4	194.6	145.7	141.2	105.8
450	0.050x	-	257.0	192.3	176.2	131.9	127.9	95.8
400	0.056x	-	230.2	172.3	157.8	118.1	114.5	85.8
350	0.063x	-	203.5	152.2	139.4	104.3	101.1	75.8
300	0.073x	-	176.8	132.1	121.0	90.5	87.8	65.7
250	0.086x	-	150.0	112.1	102.6	76.8	74.4	55.7
200	0.105x	-	123.3	92.0	84.2	63.0	61.1	45.7
150	0.135x	-	96.5	71.9	65.9	49.2	47.7	35.7
100	0.187x	-	69.8	51.9	47.5	35.4	34.3	25.7

CF35HA-1

Working Distance	Optical Magnification	Extension Tube	Field of View [mm]					
			1"		2/3"		1/2"	
[mm]		[mm]	H	V	H	V	H	V
1000	0.035x	-	362.6	271.9	249.2	186.9	181.2	135.9
950	0.037x	-	344.7	258.4	236.9	177.6	172.2	129.2
900	0.039x	-	326.9	245.0	224.6	168.4	163.3	122.5
850	0.041x	-	309.0	231.6	212.3	159.2	154.3	115.7
800	0.044x	-	291.1	218.2	200.0	149.9	145.4	109.0
750	0.047x	-	273.3	204.8	187.7	140.7	136.4	102.3
700	0.050x	-	255.4	191.4	175.4	131.5	127.5	95.6
650	0.054x	-	237.5	177.9	163.1	122.2	118.5	88.9
600	0.058x	-	219.7	164.5	150.8	113.0	109.6	82.2
550	0.064x	-	201.8	151.1	138.5	103.8	100.6	75.5
500	0.070x	-	183.9	137.7	126.2	94.6	91.7	68.7
450	0.077x	-	166.0	124.3	113.9	85.3	82.7	62.0
400	0.087x	-	148.1	110.8	101.6	76.1	73.8	55.3
350	0.099x	-	130.2	97.4	89.3	66.9	64.8	48.6
300	0.115x	-	112.3	84.0	76.9	57.6	55.9	41.9
250	0.137x	-	94.4	70.6	64.6	48.4	46.9	35.2
200	0.169x	-	76.5	57.1	52.3	39.2	38.0	28.4
150	0.221x	2	58.5	43.7	40.0	29.9	29.0	21.7
100	0.320x	10	40.5	30.2	27.6	20.7	20.0	15.0

CF50HA-1

Working Distance	Optical Magnification	Extension Tube	Field of View [mm]					
			1"		2/3"		1/2"	
[mm]		[mm]	H	V	H	V	H	V
1500	0.034x	-	371.4	278.7	255.5	191.6	185.8	139.4
1450	0.036x	-	359.1	269.4	247.0	185.3	179.7	134.8
1400	0.037x	-	346.8	260.2	238.5	178.9	173.5	130.1
1350	0.038x	-	334.4	250.9	230.0	172.5	167.3	125.5
1300	0.040x	-	322.1	241.6	221.5	166.1	161.1	120.8
1250	0.041x	-	309.7	232.4	213.0	159.8	154.9	116.2
1200	0.043x	-	297.4	223.1	204.5	153.4	148.7	111.6
1150	0.045x	-	285.1	213.8	196.0	147.0	142.6	106.9
1100	0.047x	-	272.7	204.6	187.5	140.6	136.4	102.3
1050	0.049x	-	260.4	195.3	179.0	134.3	130.2	97.6
1000	0.052x	-	248.0	186.0	170.5	127.9	124.0	93.0
950	0.054x	-	235.7	176.7	162.0	121.5	117.8	88.4
900	0.057x	-	223.4	167.5	153.5	115.1	111.6	83.7
850	0.061x	-	211.0	158.2	145.0	108.7	105.4	79.1
800	0.064x	-	198.7	148.9	136.5	102.4	99.3	74.4
750	0.069x	-	186.3	139.7	128.0	96.0	93.1	69.8
700	0.074x	-	174.0	130.4	119.5	89.6	86.9	65.2
650	0.079x	-	161.6	121.1	111.0	83.2	80.7	60.5
600	0.086x	-	149.3	111.9	102.5	76.9	74.5	55.9
550	0.094x	-	136.9	102.6	94.0	70.5	68.3	51.2
500	0.103x	-	124.6	93.3	85.5	64.1	62.2	46.6
450	0.114x	-	112.2	84.0	77.0	57.7	56.0	42.0
400	0.129x	-	99.8	74.8	68.5	51.3	49.8	37.3
350	0.147x	1	87.5	65.5	60.0	45.0	43.6	32.7
300	0.171x	5	75.1	56.2	51.5	38.6	37.4	28.0
250	0.205x	5	62.7	46.9	43.0	32.2	31.2	23.4
200	0.256x	10	50.3	37.6	34.5	25.8	25.0	18.8
150	0.340x	15	37.9	28.3	25.9	19.4	18.8	14.1
100	0.507x	20	25.4	19.0	17.4	13.0	12.6	9.5

CF75HA-1

Working Distance	Optical Magnification	Extension Tube	Field of View [mm]					
			1"		2/3"		1/2"	
[mm]		[mm]	H	V	H	V	H	V
2000	0.038x	-	335.8	251.8	230.8	173.1	167.9	125.9
1950	0.039x	-	327.3	245.4	225.0	168.7	163.6	122.7
1900	0.040x	-	318.8	239.0	219.1	164.3	159.3	119.5
1850	0.041x	-	310.2	232.6	213.2	159.9	155.1	116.3
1800	0.042x	-	301.7	226.2	207.4	155.5	150.8	113.1
1750	0.044x	-	293.2	219.8	201.5	151.1	146.5	109.9
1700	0.045x	-	284.6	213.4	195.6	146.7	142.3	106.7
1650	0.046x	-	276.1	207.0	189.8	142.3	138.0	103.5
1600	0.048x	-	267.6	200.6	183.9	137.9	133.7	100.3
1550	0.049x	-	259.0	194.2	178.0	133.5	129.5	97.1
1500	0.051x	-	250.5	187.8	172.2	129.1	125.2	93.9
1450	0.053x	-	242.0	181.4	166.3	124.7	120.9	90.7
1400	0.055x	-	233.4	175.0	160.4	120.3	116.7	87.5
1350	0.057x	-	224.9	168.6	154.6	115.9	112.4	84.3
1300	0.059x	-	216.4	162.2	148.7	111.5	108.1	81.1
1250	0.062x	-	207.8	155.8	142.8	107.1	103.9	77.9
1200	0.064x	-	199.3	149.4	137.0	102.7	99.6	74.7
1150	0.067x	-	190.8	143.0	131.1	98.3	95.3	71.5
1100	0.070x	-	182.2	136.6	125.2	93.9	91.1	68.3
1050	0.074x	-	173.7	130.2	119.4	89.5	86.8	65.1
1000	0.078x	-	165.2	123.8	113.5	85.1	82.5	61.9
950	0.082x	-	156.6	117.4	107.6	80.7	78.3	58.7
900	0.087x	-	148.1	111.0	101.7	76.3	74.0	55.5
850	0.092x	0.5	139.6	104.6	95.9	71.9	69.7	52.3
800	0.098x	1	131.0	98.2	90.0	67.5	65.4	49.1
750	0.105x	1.5	122.5	91.8	84.1	63.1	61.2	45.9
700	0.112x	2	113.9	85.4	78.3	58.7	56.9	42.7
650	0.122x	5	105.4	79.0	72.4	54.3	52.6	39.5
600	0.132x	5	96.9	72.6	66.5	49.9	48.4	36.3
550	0.145x	5	88.3	66.2	60.7	45.5	44.1	33.1
500	0.161x	10	79.8	59.8	54.8	41.1	39.8	29.9
450	0.180x	10	71.2	53.4	48.9	36.7	35.6	26.7
400	0.205x	10	62.7	47.0	43.1	32.3	31.3	23.5
350	0.237x	15	54.1	40.6	37.2	27.9	27.0	20.3
300	0.281x	15	45.6	34.2	31.3	23.5	22.8	17.1
250	0.346x	20	37.0	27.8	25.4	19.1	18.5	13.9
200	0.450x	30	28.5	21.3	19.6	14.7	14.2	10.7
150	0.644x	45	19.9	14.9	13.7	10.3	9.9	7.5

<Sensor size>

1.1"	14.1X10.6
1"	12.8X9.6
1/1.2"	10.7X8.0
2/3"	8.8X6.6
1/2"	6.4X4.8
1/3"	4.8X3.6

[mm]

* This data shows simulation value.
* When attached with a extension tube, the optical performance of the lenses is not covered under warranty.