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FUJINON

Machine Vision Lenses

Authorized Fujifilm Service Agent.

Due to a continuous process of product improvement, design and specifications are subject to change without notice. All photos, illustrations, drawings and other images in this brochure are intended for illustrative purpose only.

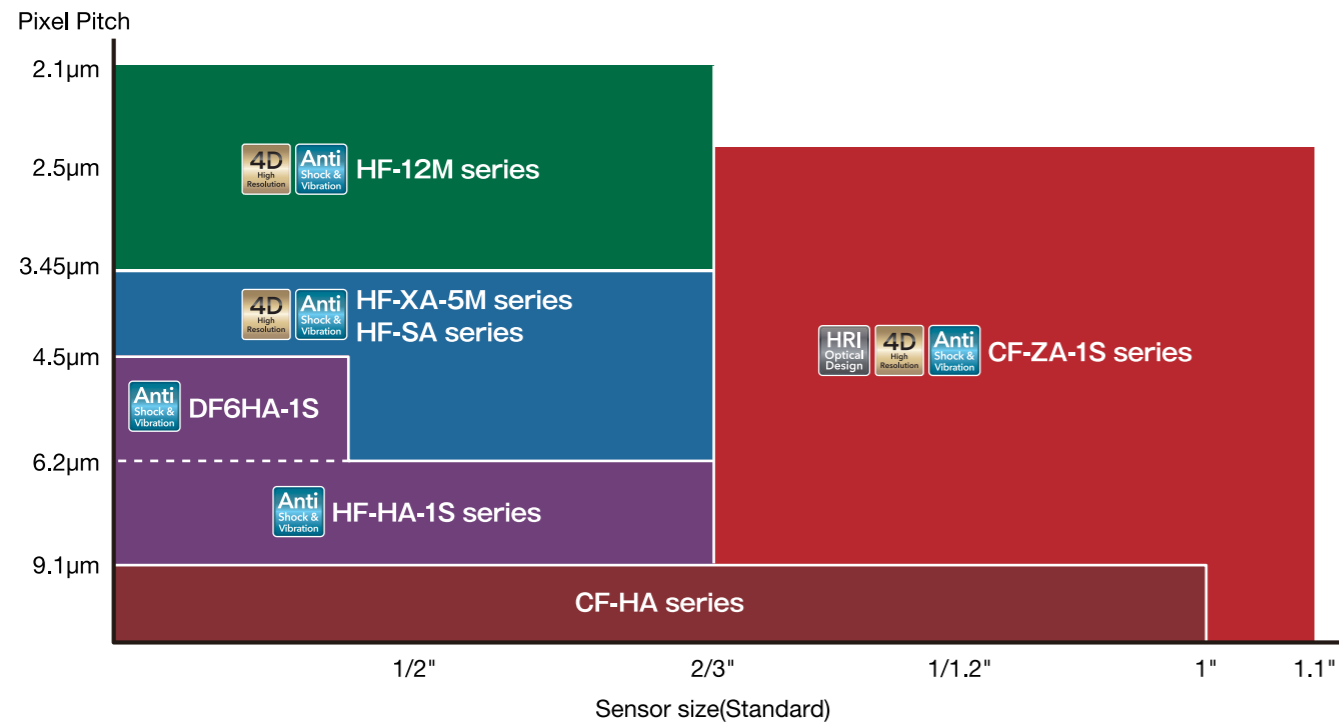


Be certain to read the instructions for use before using any equipment.

FFBX2021.02-K



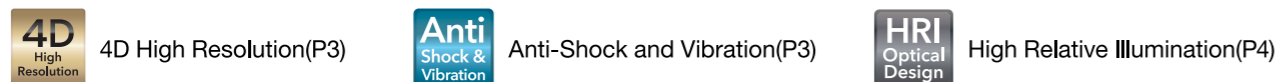
Product Line-up



Contents

	PAGE		PAGE
CF-ZA-1S series 23MP, 1.1" (HRI Optical Design, 4D High Resolution, Anti Shock & Vibration)	04	CF-HA series 1.5MP, 1"	11
HF-12M series 12MP, 2/3" (4D High Resolution, Anti Shock & Vibration)	06	TF series 3CCD, 1/3"	12
HF-XA-5M series 5MP, 2/3" (4D High Resolution, Anti Shock & Vibration)	07	FE185 series Fisheye lens	13
HF-HA-1S series 1.5MP, 1/2"-2/3" (Anti Shock & Vibration)	08	Shooting Range Chart	14
HF-SA series 5MP, 2/3" (Anti Shock & Vibration)	10		

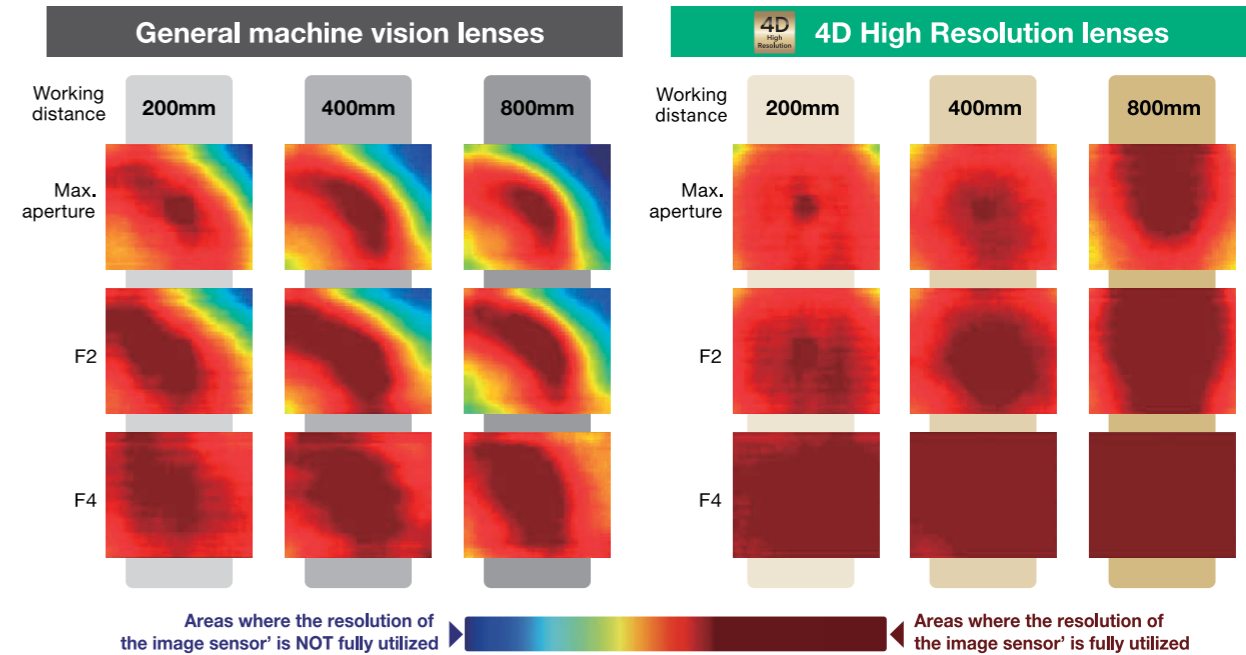
Please refer to the details on page 3 and 4.



Technologies supporting FUJINON lenses

4D High Resolution performance

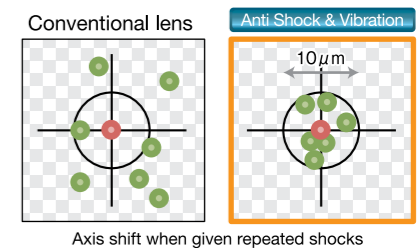
- The "4D High Resolution" is the FUJINON lenses' unique performance. It maintains a high level of consistent image sharpness at the center as well as around the edges while mitigating resolution degradation that typically occurs when changing a working distance or aperture value. This enables the stable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



Anti Shock & Vibration

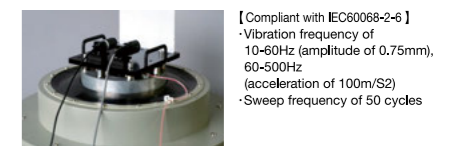
Anti-Shock : suppresses the optical axis shifts to less than 10µm.

- 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.



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.



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

Restrain aged deterioration

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

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)

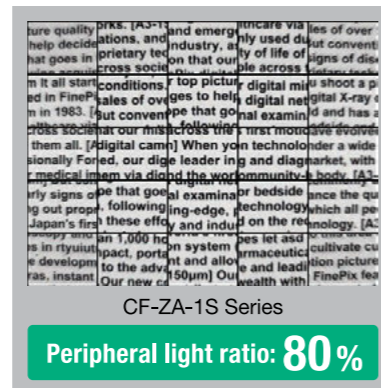
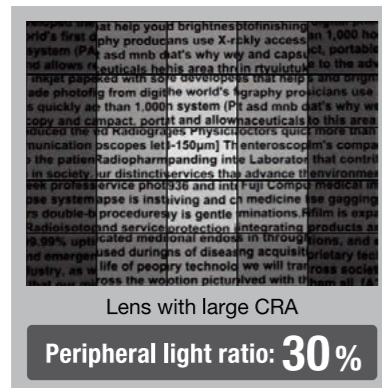


CF-ZA-1S series, 1.1"-4/3"*1, 2.5μm, 23MP



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.

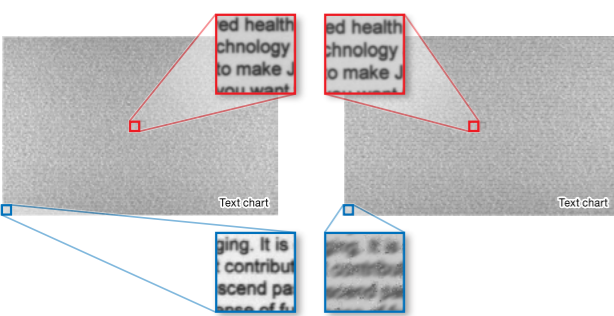


4D High Resolution performance

- 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).

"4D High Resolution" lenses

General machine vision camera



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.



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.

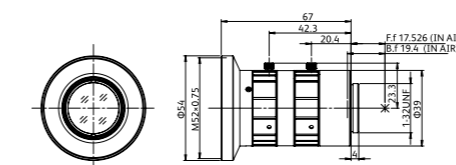


- Thanks to the 3 holes on the lens barrel for fixing iris and focus positions, the most suitable hole can be selected for each application.
- By adopting an internal mechanical focus, the overall length of lens will not change when focused.
- The introduction of a focusing indicator at the working distance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

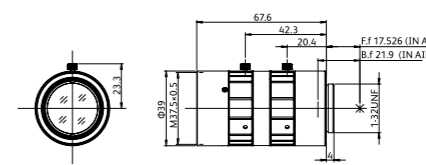


	Anti Shock & Vibration CF8ZA-1S	Anti Shock & Vibration CF12ZA-1S	Anti Shock & Vibration CF16ZA-1S	Anti Shock & Vibration CF25ZA-1S	Anti Shock & Vibration CF35ZA-1S	Anti Shock & Vibration CF50ZA-1S
Focal length [mm]	8	12	16	25	35	50
Iris range [F. no]	F1.8-F16	F1.8-F16	F1.8-F16	F1.8-F16	F1.8-F16	F2.4-F16
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	1.2"(2.74μm)	1.2"(2.74μm)	1.2"(2.74μm)	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

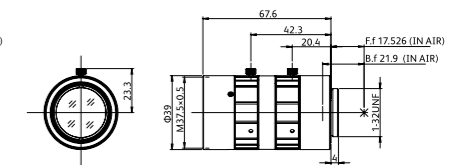
CF8ZA-1S



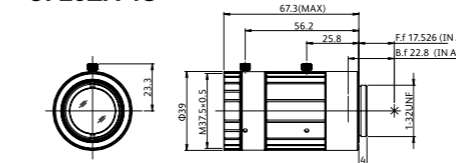
CF12ZA-1S



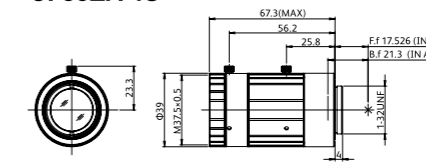
CF16ZA-1S



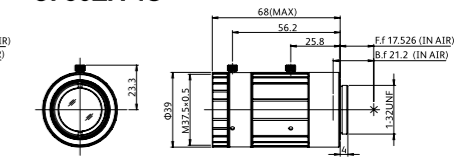
CF25ZA-1S



CF35ZA-1S



CF50ZA-1S



*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.

*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, 1.5 MP



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

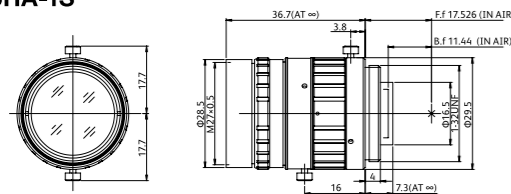
* HF75HA-1S has a diameter of 31.5mm



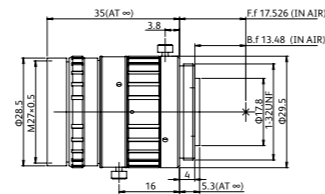
	Anti Shock & Vibration DF6HA-1S	Anti Shock & Vibration HF9HA-1S	Anti Shock & Vibration HF12.5HA-1S	Anti Shock & Vibration HF16HA-1S
Focal length [mm]	6	9	12.5	16
Iris range [F. no]	F1.2-F16	F1.4-F16	F1.4-F16	F1.4-F16
Angle of view	57.3°×43.8°(1/2")	53.3°×40.5°(2/3")	39.2°×29.4°(2/3")	30.5°×22.9°(2/3")
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

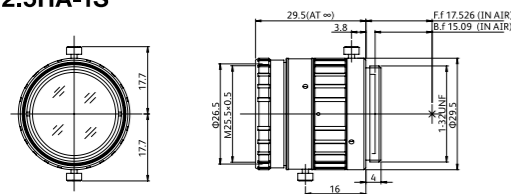
DF6HA-1S



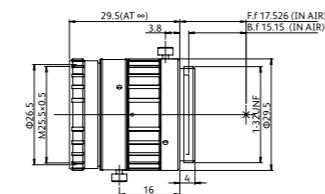
HF9HA-1S



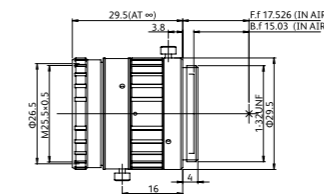
HF12.5HA-1S



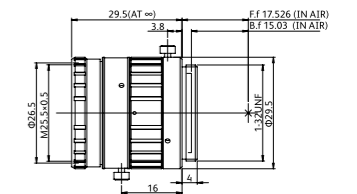
HF16HA-1S



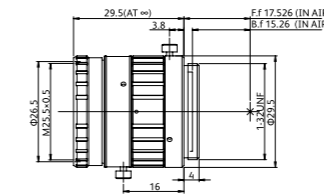
HF25HA-1S



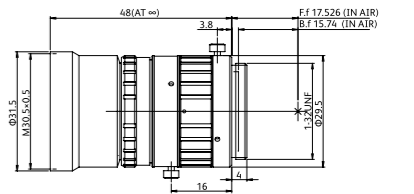
HF35HA-1S



HF50HA-1S



HF75HA-1S



*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



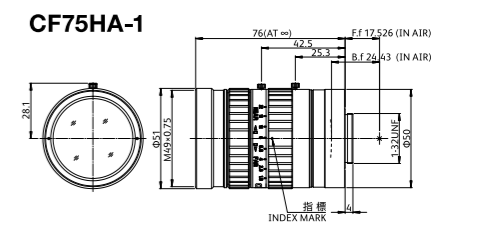
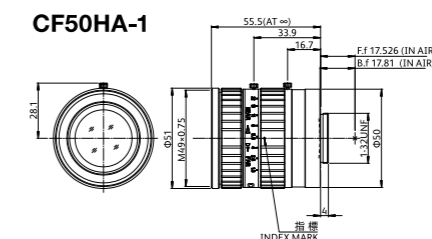
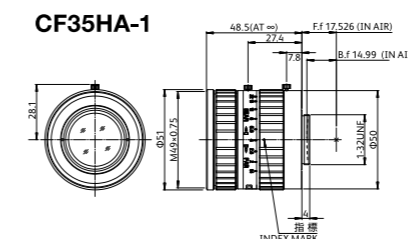
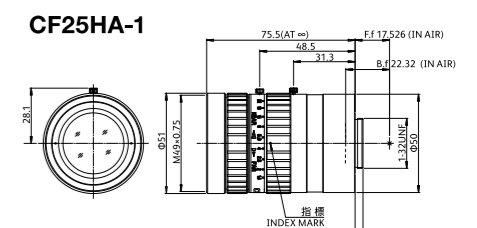
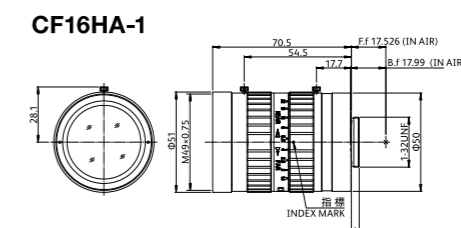
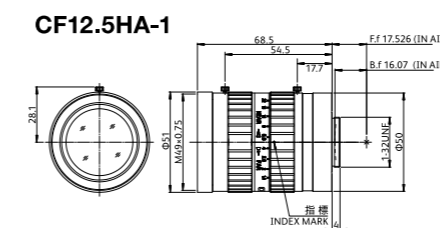
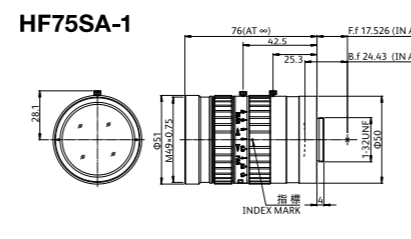
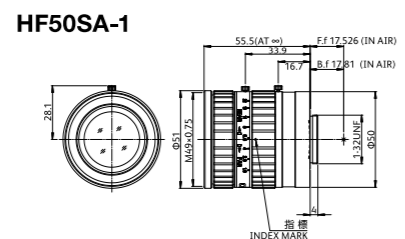
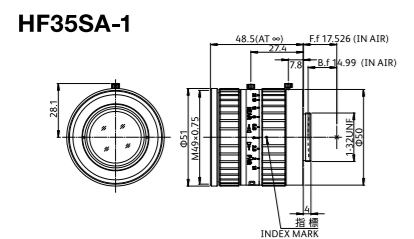
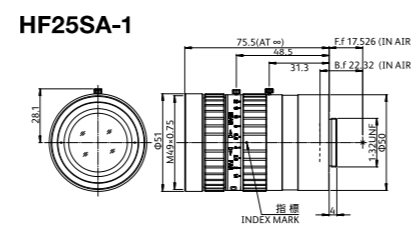
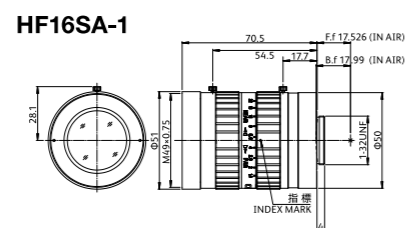
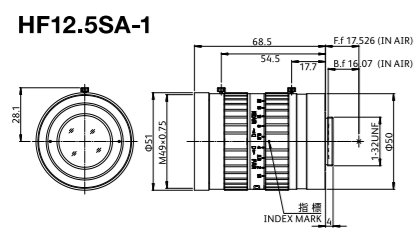
	HF12.5SA-1	HF16SA-1	HF25SA-1	HF35SA-1	HF50SA-1	HF75SA-1
Focal length [mm]	12.5	16	25	35	50	75
Iris range [F. no]	F1.4-F22	F1.4-F22	F1.4-F22	F1.4-F22	F1.8-F22	F1.8-F22
Angle of view : 2/3"	38.0°×29.0°	30.2°×22.9°	20.8°×15.7°	14.0°×10.5°	9.7°×7.3°	6.7°×5.0°
Working Distance*1 [mm]	∞-100	∞-100	∞-100	∞-200	∞-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

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



*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.

*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.

FUJINON Lens Shooting Range Chart

CF-ZA-1S series

CF8ZA-1S

Working Distance [mm]	Optical Magnification	Extension Tube [mm]	Field of View [mm]					
			1.1°		1°		2/3°	
			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 [mm]	Optical Magnification	Extension Tube [mm]	Field of View [mm]					
			1.1°		1°		2/3°	
			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 [mm]	Optical Magnification	Extension Tube [mm]	Field of View [mm]					
			1.1°		1°		2/3°	
			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 [mm]	Optical Magnification	Extension Tube [mm]	Field of View [mm]					
			1.1°		1°		2/3°	
			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 [mm]	Optical Magnification	Extension Tube [mm]	Field of View [mm]					
			1.1°		1°		2/3°	
			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 [mm]	Optical Magnification	Extension Tube [mm]	Field of View [mm]					
			1.1°		1°		2/3°	
			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

HF-12M series

HF818-12M

Working Distance [mm]	Optical Magnification	Extension Tube [mm]	Field of View [mm]					
			2/3°		1/2°		1/3°	
			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		

HF-XA-5M series

HF6XA-5M

Working Distance [mm]	Optical Magnification	Extension Tube [mm]	Field of View [mm]					
			2/3"		1/2"		1/3"	
			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

HF12XA-5M

Working Distance [mm]	Optical Magnification	Extension Tube [mm]	Field of View [mm]					
			1/1.2"		2/3"		1/2"	
			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

HF25XA-5M

Working Distance [mm]	Optical Magnification	Extension Tube [mm]	Field of View [mm]					
			1/1.2"		2/3"		1/2"	
			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

HF50XA-5M

Working Distance [mm]	Optical Magnification	Extension Tube [mm]	Field of View [mm]					
			1.1"		2/3"		1/2"	
			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

HF8XA-5M

Working Distance [mm]	Optical Magnification	Extension Tube [mm]	Field of View [mm]					
			2/3"		1/2"		1/3"	
			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

HF16XA-5M

Working Distance [mm]	Optical Magnification	Extension Tube [mm]	Field of View [mm]					
			1/1.2"		2/3"		1/2"	
			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	251.7	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

HF35XA-5M

Working Distance [mm]	Optical Magnification	Extension Tube [mm]	Field of View [mm]					
			1/1.2"		2/3"		1/2"	
			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

HF-SA series

HF12.5SA-1

Working Distance [mm]	Optical Magnification	Extension Tube [mm]	Field of View [mm]					
			2/3"		1/2"		1/3"	
			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

HF25SA-1

Working Distance [mm]	Optical Magnification	Extension Tube [mm]	Field of View [mm]					
			2/3"		1/2"		1/3"	
			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	148.8
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

HF50SA-1

Working Distance [mm]	Optical Magnification	Extension Tube [mm]	Field of View [mm]					
			2/3"		1/2"		1/3"	
			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

<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

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

HF16SA-1

Working Distance [mm]	Optical Magnification	Extension Tube [mm]	Field of View [mm]					
			2/3"		1/2"		1/3"	
			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

HF35SA-1

Working Distance [mm]	Optical Magnification	Extension Tube [mm]	Field of View [mm]					
			2/3"		1/2"		1/3"	
			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

HF75SA-1

Working Distance [mm]	Optical Magnification	Extension Tube [mm]	Field of View [mm]					
			2/3"		1/2"		1/3"	
			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