LENSATION

smart lenses. smart solutions.

Catalog 2022

S マウントレンズ

太平貿易株式会社

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About Lensation

Our mission is to keep our customers excited.

With this goal in mind, we provide:

- Free consultancy.
- Exceptionally good value for money.
- Best performance.
- OEM design and development.
- Unique solutions.
- Products tailored especially according to your demands.

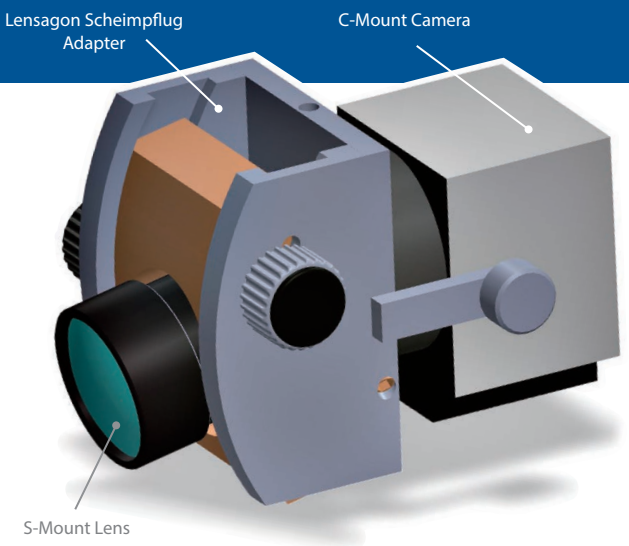
S-Mount Lenses (M12x0.5)

10+ Megapixel Board Lenses

B14M28620S123C B10M45545ND B10M5022S12 B10M5425 B10M7224 B14M20020S123C

	Focal length	Aperture	Image format	M.O.D.	BFL	FOV (dia.)	Distortion	Weight	MP	IR corr.	IR cut filter / option
B14M28620S123	2.86	2.0	1/2.3"	0.1m	5.71	170°	-25%	15.0g	14		B14M28620S123C
B10M45545ND	4.55	4.5	1/2.3"	0.1m	3.44	81.7°	<0.5%	8.2g	10		B10M45545NDC
B10M5022S12	5.0	2.2	1/2"	0.3m	8.5	94°		11.0g	10	•	B10M5022S12C
B10M5425	5.4	2.5	1/2.3"	0.2m	6.6	70°		6.0g	10	•	B10M5425C
B10M7224V2	7.2	2.4	1/2.3"	0.3m	7.23	57°		12.6g	10	•	B10M7224V2C
B14M20020S123	20	2.0	1/2.3"	0.2m	13.43	21.5°		6.0g	14		B14M20020S123C

S-Mount to C-Mount Scheimpflug Adapter



The tilt mechanism allows overall image sharpness to be controlled in a different way than conventional lenses. Used in conjunction with aperture, the tilt feature of these lenses allows objects or features within an image plane to be kept in focus. This is helpful when imaging objects at oblique angles.

If absolute sharpness in the foreground and background is required, it is necessary to first focus on the closest foreground object and then tilt the lens until the background object is focus. After selecting the correct aperture, both objects will be sharp. Using such tilt mechanisms provides an additional means of controlling depth of field and allows greater freedom over the aperture and shutter speed combinations.

http://www.optowiki.info/glossary/scheimpflug-principle/

Preview CAD image, finalproduct will be available soon.

S-Mount Lenses (M12x0.5)

5 Megapixel Board Lenses


B5M2524


B5M2916


B5M2920S118


B5M29740ND


B5M3428S123

B5M3618


BK5M3920


B5M4018

B5M4020


B5M41430ND


BK5M5020

B5M6018

B5M6020


B5M7630


BK5M7620

B5M8018

B5M8020


B5M8556S12

B5M12020


B5M12028


B5M12056

B5M16020V2

B5M25024V2

	Focal length	Aperture	Image format	M.O.D.	BFL	FOV (dia.)	Distortion	Weight	MP	IR corr.	IR cut filter / option
B5M2524	2.5	2.4	1/2.5"	0.1m	4.98	166°		6.1g	5		B5M2524C
B5M2916	2.9	2.0	1/2.5"	0.1m	4.47	152°		7.2g	5	•	B5M2916C
NEW B5M2920S118	2.95	2.8	1/1.8"	0.3m	6.81	180°	-4.3%		5	•	B5M2920S118C
B5M29740ND	2.97	4.0	1/2.5"	0.2m	2.97	102°	< 1%	3.5g	5		B5M29740NDC
NEW B5M3428S123	3.4	2.8	1/2.3"	0.1m	6.3	150°	-12%	8.2g	5		B5M3428S123C
B5M3618	3.6	1.8	1/2.5"	0.2m	7.25	128°		5.0g	5		B5M3618C
BK5M3920	3.9	2.0	1/2.5"	-	6.1	127°		11.0g	5	•	
B5M4018	4.0	1.8	1/2.5"	0.2m	7.72	112°		5.0g	5		B5M4018C
B5M4020	4.0	2.0	1/2.5"	0.3m	6.7	114°		5.0g	5		B5M4020C
B5M41430ND	4.14	3.0	1/2.5"	0.2m	5.25	82°	< 0.2%	8.3g	5		B5M41430NDC
BK5M5020	5.0	2.0	1/2.5"	-	6.2	99°		11.0g	5	•	
B5M6018	6.0	1.8	1/2.5"	0.2m	9.58	75°		6.5g	5		B5M6018C
B5M6020	6.0	2.0	1/2.5"	0.3m	7.3	67°		6.0g	5		B5M6020C
B5M7630	7.6	3.0	1/1.8"	0.2m	5.38	58°		6.0g	5		B5M7630C
BK5M7620	7.6	2.0	1/2.5"	-	6.1	61°		10.5g	5	•	
B5M8018	8.0	1.8	1/2.5"	0.2m	7.8	56°		6.5g	5		B5M8018C
B5M8020	8.0	2.0	1/2.5"	0.3m	8.0	50°		5.0g	5		B5M8020C
B5M8556S12	8.5	5.6	1/2"	0.1m	5.85	54.3		5.0g	5		B5M8556S12C
B5M12020	12.0	2.0	1/2.5"	0.3m	7.6	35°		5.0g	5	•	B5M12020C
B5M12028	12.0	2.8	1/1.8"	0.1m	8.57	41°		7.0g	5		B5M12028C
B5M12056	12.0	5.6	1/1.8"	0.1m	8.57	41°		7.0g	5		B5M12056C
B5M16020V2	16.0	2.0	1/2.5"	0.3m	7.1	28°		5.0g	5	•	B5M16020V2C
B5M25024V2	25.0	2.4	1/2"	0.3m	11.98	18.8°		5.0g	5	•	B5M25024V2C

S-Mount Lenses (M12x0.5)

4 Megapixel Board Lenses

B4M1920NDC B4M3516S12 B4M50028S117

	Focal length	Aperture	Image format	M.O.D.	BFL	FOV (dia.)	Distortion	Weight	MP	IR corr.	IR cut filter / option
B4M1920NDC	1.93	2.0	1/2.9"		1.137	117°	-5% (opt.)	5.7g	4		•
B4M3516S12	3.5	1.6	1/2"	0.85m	4.8	160°	-13.9 (TV)	7.7g	4		B4M3516S12C
B4M50028S117	5.0	2.8	1/1.7"	1m	18.7	18.7°	-0.1% (opt.)		4		B4M50028S117C

3 Megapixel Board Lenses

B3M21835ND B3M2818 BM3516ND BM3518S125ND BM3524S12ND B3M4016 BM4018S118 BM4518S125ND BM5518S12ND

BM6020ND B3M6016 B3M6020S12 B3M8016 B3M8018S12 B3M12016 B3M25024 B3M35025

	Focal length	Aperture	Image format	M.O.D.	BFL	FOV (dia.)	Distortion	Weight	MP	IR corr.	IR cut filter / option
B3M21835ND	2.18	3.5	1/4"	0.1m	1.30	94°	<0.6%	4.0g	3		B3M21835NDC
B3M2818	2.8	2.2	1/2.5"	0.3m	6.2	147°	< 1.9%	5.0g	3	•	B3M2818C
BM3516ND	3.5	1.6	1/3"	0.2m	5.97	81°	< 1.9%	10.0g	3	•	BM3516NDC
BM3518S125ND	3.5	1.8	1/2.5"	0.2m	5.97	90°	< 1.9%	12.0g	3	•	BM3518S125NDC
BM3524S12ND	3.5	2.4	1/2"	0.1m	6.09	97°	<-3.1%	21.8g	3	•	BM3524S12NDC
B3M4016	4.0	2.2	1/2.5"	0.2m	7.28	112°	-12%	5.4g	3	•	B3M4016C
BM4018S118	4.0	1.8	1/1.8"	0.2m	8.0	126°	-45%	10.0g	3	•	BM4018S118C
BM4518S125ND	4.5	1.8	1/2.5"	0.2m	6.14	76.4°	< 1.9%	13.0g	3	•	BM4518S125NDC
BM5518S12ND	5.5	1.8	1/1.8"	0.2m	6.87	76°	< 1.9%	10.0g	2	•	BM5518S12NDC
BM6020ND	6.0	2.0	1/3"	0.2m	6.27	57°	<-2.6%	5.9g	3	•	BM6020NDC
B3M6016	6.0	2.2	1/2.5"	0.3m	6.8	72°	-19%	5.8g	3	•	B3M6016C
B3M6020S12	6.0	2.0	1/2"	0.5m	8.3	81°		9.9g	3		
B3M8016	8.0	2.2	1/2.5"	0.4m	8.0	54°	-3.8%	5.0g	3		B3M8016C
B3M8018S12	8.0	1.8	1/2"	0.5m	7.9	57.7°		10.7g	3		
B3M12016	12.0	2.3	1/2.5"	0.3m	6.44	35°	-6%	5.0g	3	•	B3M12016C
B3M25024	25.0	2.4	1/2"	0.4m	10.26	18°	3.3%	7.1g	3	•	B3M25024C
NEW B3M35025V2	35.0	2.8	1/1.7"	0.5m	14.42	15.5°	0.1%	15.5g	3	•	B3M35025CV2

1-2 Megapixel Board Lenses

BMK2119C/2320C | BM2118V2 | BM2420 | BM2820 | BM3618 | B2M3814 | BM4218 | BM4518S118ND-810 | BM4525S118ND

BM4620DN | BM6018 | BSM6016S12 | BM6020S12 | BM8021S118ND | BM8018 | BSM8016S12 | BM8020S12 | BM9040

BM9050 | BM10028S12 | B2M10030N2 | BSM12016S12 | BM16018

		Focal length	Aperture	Image format	M.O.D.	BFL	FOV (dia.)	Distortion	Weight	MP	IR corr.	IR cut filter / option
NEW	BMK2119C	2.1	1.9	1/3"		2.2	160°	-73%	2.8g	1		SLAR coating 550nm
	BM2118V2	2.1	2.2	1/3"	0.2m	6.3	170°	-88.1%	6.5g	1	•	BM2118V2C
NEW	BMK2320C	2.3	2.0	1/3"		2.3	140°		2.8g	1		SLAR coating 550nm
	BM2420	2.4	2.0	1/3"	0.15m	4.56	132°	-25%	6.0g	1	•	BM2420C
	BM2820	2.8	2.0	1/3"	0.2m	5.29	122°	-40%	6.0g	1	•	BM2820C
	BM3618	3.6	1.8	1/3"	0.2m	6.59	100°	34.1%	6.0g	1	•	BM3618C
	B2M3814	3.85	1.4	1/2.5"	0.2m	6.76	122°		9.0g	2		B2M3814C
	BM4218	4.2	1.8	1/3"	0.2m	7.21	89°	-29%	7.0g	1	•	BM4218C
	BM4518S118ND-810	4.5	1.8	1/1.8"	0.1m	6.4	90°	<2.8%	14.0g	1	•	810nm Coating
	BM4525S118ND	4.5	2.5	1/1.8"	0.1m	6.4	90°	-2.8%	15.0g	1		
	BM4620DN	4.6	2.0	1/3"	0.2m	5.63	80°	-22%	6.0g	1	•	BM4620DNC
	BM6018	6.0	1.8	1/3"	0.2m	9.33	60°	-17%	6.0g	1	•	BM6018C
	BSM6016S12	6.0	1.8	1/2"	0.2m	8.73	88°		4.5g	2	•	
	BM6020S12	6.0	2.0	1/2"	0.2m	10.7	85°		6.0g	1.3		
NEW	BM8021S118ND	7.84	2.1	1/1.8"	0.5m	7.8	60°	-2.9% (opt.)	14.3g	1	•	BM8021S118NDC
	BM8018	8.0	1.8	1/3"	0.2m	5.4	45°		6.0g	1	•	BM8018C
	BSM8016S12	8.0	1.9	1/2"	0.2m	5.4	62°	-12%	6.0g	2	•	
	BM8020S12	8.0	2.0	1/2"	0.2m	8.6	56°		6.0g	1.3		
	BM9040	9.0	4.0	1/3"	0.1m	8.0	34°		3.9g	1.3	•	
	BM9050	9.0	5.0	1/3"	0.1m	8.0	34°		3.9g	1.3	•	
	BM10028S12	10.0	2.8	1/2"	0.4m	8.0	44°		6.0g	1.2		BM10028S12C
	B2M10030N2	10.3	3.0	1/2"	0.2m	8.77	42°	2.1%	3.5g	2		B2M10030N2C
	BSM12016S12	12.0	2.0	1/2"	0.2m	6.54	39°		6.0g	2	•	
	BM16018	16.0	1.8	1/3"	0.2m	6.59	21°		6.0g	1	•	BM16018C

S-Mount Lenses (M12x0.5)

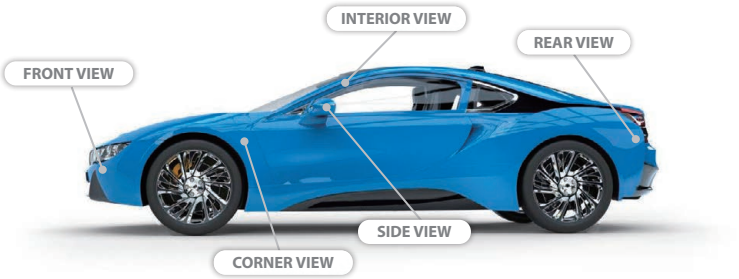
VGA & High Resolution Board Lenses

	Focal length	Aperture	Image format	M.O.D.	BFL	FOV (dia.)	Weight	Megapixel	IR corr.	IR cut filter / option
BK1220	1.2	2.0	1/4"	0.2m	3.4	192°	5.2g	**0.3**		BK1220C
BK1820	1.8	2.0	1/4"	0.2m	3.65	160°	5.5g	**<1**		BK1820C
BT1922	1.9	2.2	1/4"	0.05m	4.7	156°	3.5g	**<1**		BT1922C
BT2120	2.1	2.0	1/3"	0.2m	4.92	151°	6.5g	**<1**		BT2120C
BHR2125	2.1	2.5	1/3"	0.2m	4.25	165.7°	6.1g	**0.7**		
BT2520	2.5	2.0	1/3"	0.2m	5.18	140°	5.3g	**<1**		BT2520C
BHR2525	2.5	2.5	1/3"	0.2m	5.04	142.7°	6.8g	**0.7**		
BT2920	2.9	2.0	1/3"	0.2m	5.02	138°	4.5g	**<1**		BT2920C
BT3020	3.0	2.0	1/3"	0.2m	5.35	124°	3.5g	**<1**		BT3020C
BHR3020	3.0	2.0	1/3"	0.2m	5.67	126.0°	5.9g	**0.7**		
BT3620	3.6	2.0	1/3"	0.2m	5.00	100°	4.1g	**<1**		BT3620C
BHR4318	4.3	1.8	1/3"	0.2m	6.16	83.1°	4.0g	**0.7**		
BHR5620	5.6	2.0	1/3"	0.2m	8.07	65.3°	4.0g	**0.7**		
BT6020V2	6.1	2.0	1/3"	0.2m	8.03	62°	6.5g	**<1**		BT6020V2C
BT8020N	8.0	2.0	1/3"	0.2m	8.25	44°	3.5g	**0.3**		BT8020NC
BHR8020	8.0	2.0	1/3"	0.2m	7.6	43.0°	6.0g	**0.7**		
BT12020	12.0	2.0	1/3"	0.4m	8.97	29°	3.2g	**<1**		BT12020C
BHR12020	12.0	2.0	1/3"	0.2m	6.7	28.0°	4.5g	**0.7**		
BHR16012S12	16.0	1.2	1/2"	0.3m	7.2	21.8°	11.0g	**0.7**		
B16020S12	16.0	2.0	1/2"	0.2m	12.3	27.8°	4.2g	**<1**		
BT25020S12	25.0	2.0	1/2" (1/3")	0.2m	8.29	18.6° (13.8°)	7.0g	**2**		BT25020S12C
B25020S12	25.0	2.0	1/2"	0.2m	11.8	18.2°	17.6g	**<1**		
B35020S12	35.0	2.0	1/2"	0.2m	18.9	13.0°	15.4g	**<1**		
B50020S12	50.0	2.0	1/2"	0.4m	33.9	9.2°	27.1g	**<1**		

S-Mount Lenses (M12x0.5)

Waterproof Automotive Board Lenses

BA1520WPC BA1825WPC BA2025WPC BA2325WPC



	Focal length	Aperture	Image format	M.O.D.	BFL	FOV (dia.)	Weight	Megapixel	IR corr.	IR cut
BA1520WPC	1.5	2.0	1/4"	0.2m	2.2	163.0°	5.5g	<1		•
BA1825WPC	1.8	2.5	1/4"	0.2m	2.2	160.0°	5.5g	<1		•
BA2025WPC	2.0	2.5	1/4"	0.2m	2.47	160.0°	5.5g	<1		•
BA2325WPC	2.3	2.5	1/3"	0.2m	2.7	163.0°	6.0g	<1		•

Fisheye Board Lenses

BF5M12721 BF13M0922S13C BF5M11920 BF10M10526S132 BFM1220C BF5M15828S125

BF5M15828S125 BF16M220D BF9M1422 BF10M14522S18 BFM1524S125 BF3M2122S13 BF5M19622 BF10M19828S118 BF5M2223S129 BF10M2628S123

	Image Circle	Focal Length	Aperture	Image Format	M.O.D.	BFL	Angle of View (D)	Weight	MP	IR corr.	IR cut filter / option
BF5M12721	2.8	1.27	2.1	1/4.0"	0.1m	4.18	185°	4.7g	5	•	BF5M12721C
NEW BF13M0922S13C	2.9	0.9	2.2	1/3.2"	0.1m	2.01	200°	5.6g	13		•
BF5M11920	3.24	1.19	2.0	1/3.2"	0.2m	6.44	180°	14.7g	5	•	BF5M11920C
BF10M10526S132	3.5	1.05	2.6	1/3.2"	0.1m	3.2	200°	13.7g	10	•	BF10M10526S132C
BFM1220C	3.84	1.2	2.0	1/3.0"	0.2m	2.91	190°	7.5g	1.3		•
BF5M15828S125	4.1	1.58	2.8	1/2.5"	0.1m	5.75	180°	10.9g	5	•	BF5M15828S125C
BF16M220D	4.2	1.2	2.5	1/2.3"	0.1m	2.95	220°	14.0g	16		BF16M220DC
BF9M1422	4.5	1.41	2.2	1/2.3"	0.1m	3.69	183°	24.0g	9	•	BF9M1422C
BF10M14522S18	4.6	1.45	2.2	1/1.8"	0.1m	4.62	190°	14.0g	10	•	BF10M14522S18C
BFM1524S125	4.7	1.49	2.4	1/2.5"	0.06m	2.94	183°	4.0g	1.3		BFM1524S125C
BF3M2122S13	4.8	2.1	2.2	1/3.0"	0.1m	3.67	184°	3.9g	3	•	BF3M2122S13C
BF5M19622	5.6	1.96	2.2	1/2.5"	0.1m	2.77	180°	2.3g	5	•	
BF10M19828S118	5.6	1.98	2.8	1/1.8"	0.1m	6.32	180°	15.6g	10	•	BF10M19828S118C
BF5M2223S129	6.2	2.2	2.3	1/2.9"	0.1m	4.71	195°	4.8g	5	•	BF5M2223S129C
NEW BF10M2628S123	8.0	2.6	2.8	1/2.3"	0.1m	3.67	150°	-	10		BF10M2628S123C

S-Mount Lenses (M12x0.5), M16

Pinhole Board Lenses

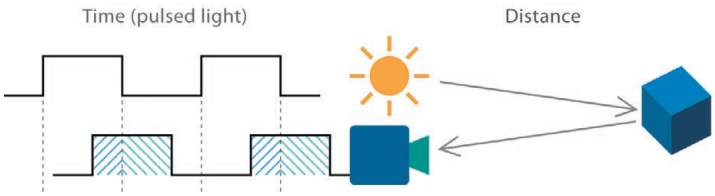
BP2824S13 BPM3725C BP3M3728S127

	Focal length	Aperture	Image format	M.O.D.	BFL	FOV (dia.)	Weight	MP	IR corr.	IR cut filter / option
BP2824S13	2.8	2.4	1/3"	0.1m	3.1	125°	1.5g			BP2824S13C
BPM3725C	3.7	2.5	1/3"	0.2m	3.64	106°	-	1		•
BP3M3728S127	3.7	2.8	1/2.7"	0.3m	3.7	108.4°	1.8g	3		BP3M3728S127C

Time-of-Flight Board Lenses

- Light sensitive lenses with special bandpass filters for Time-of-Flight 3D Cameras
- Suited fine for factory automation, robotics and logistics

BTOF2512-850 BTOF2512-940 BTOF1114S12-850 BTOF1114S12-940



	Focal length	Aperture	Image format	M.O.D.	BFL	FOV (dia.)	Chief ray	IR cut	Optical Distortion	bandpass filter
BTOF2512-850	2.5	2.0	1/3"	0.2m	5.18	140°	13.07°		-53%	850nm
BTOF2512-940	2.5	2.0	1/3"	0.2m	5.18	140°	13.07°		-53%	940nm
NEW BTOF1114S12-850	11.3	1.4	1/2"	0.1m	5.96	38.1°	12.6°		2.1%	850nm
NEW BTOF1114S12-940	11.3	1.4	1/2"	0.1m	5.96	38.1°	12.6°		2.1%	940nm

M16 CCTV Lenses

- Light sensitive lenses with 16mm thread
- incl. M16 lens holder

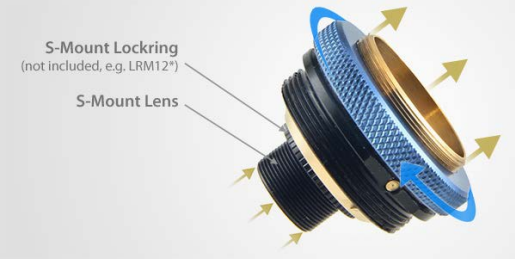
M16B6M4010S125 M16B4M5009S118C M16B8M54310S118

	Focal length	Aperture	Image format	M.O.D.	BFL	FOV (dia.)	Weight	MP	IR corr.	IR cut / option
NEW M16B6M4010S125	4.0	1.0	1/2.5"	1.0m	5.36	106°	9	6		
NEW M16B4M5009S118C	5.0	0.9	1/1.8"	0.5m	6.48	118°	-	4		• (inside holder)
NEW M16B8M54310S118	5.43	1.0	1/1.8"	1.0m	5.98	105°	10	8		

Accessories

C/S/CS-Mount Accessories

Lensation offers a wide range of accessories for Board Lenses and C-/CS-Mount lenses. You will find simple extension/lock rings, S-Mount holders and e.g. our focussable S- to C-Mount adapter AD05OH(V2).



PIEZOLUTION M12 Focus Module

A compact one-chip focus module for M12 lenses, driven by piezoelectric ultrasonic linear motor. Precise, quick-responsive and simple to integrate.

Connection with 5Pin flat cable, communication over UART or I²C. The 6mm stroke in Z-axis enables a wide scope of motorized solutions. Customizing available on demand.

S-Mount Accessories

ST05
M12 Extension ring 5mm
Material: Aluminium, Height: 5 mm

ST10
M12 Extension ring 10mm
Material: Aluminium, Height: 10 mm

M12TM14
M12 to M14 Adapter
Material: Aluminium. For using M12x0.5 lenses in M14x0.5 mounts

SH02M13V3
S-mount lens holder 13mm
Material: Plastic, mounting hole distance 22mm, Height: 13 mm, Width: 20.3 mm

SH03H16V3
S-mount lens holder 16mm
Material: Plastic, mounting hole distance 22mm, side hole for lock screw. Inner height 5mm

LRM12V2
M12 x 0.5 Lock Ring
Material: Aluminium, Black anodized, Height: 2 mm, Diameter: 15.8 mm

FAM12D14H08
Iris/Filter adapter for M12x0.5
allows to add a filter to standard S-Mount (M12x0.5) Lenses or to modify the F-Number.

NEW

SHM16
M16 to S-Mount Lens Holder
Material: Plastic

NEW

DC-D27H11 / DC-D46H27
Scratch Resistant Dome Cover
Hard coating 1.2 or 2 inch dome with plating, 3.5/7.6cm, PE film

C-Mount Accessories

ADCTS
C-Mount to CS-Mount Adapter
with male and female thread, 5mm effective height, for use of c-mount lenses with cs-mount cameras

CT40
Extension Tube 40mm
Material: Aluminium, Height: 40 mm
40mm extension tube for C-Mount lenses.

AD02F
S-Mount to C-Mount Adapter Flat
Male c-mount thread and female M12x0.5 thread, for use of s-mount lenses in c-mount cameras.

AD03H
S-Mount to C-Mount Adapter High
Male c-mount thread and female M12x0.5 thread, for use of s-mount lenses in c-mount cameras.

AD01S
S-Mount to C-Mount Adapter Standard
Male c-mount thread and female M12x0.5 thread, for use of s-mount lenses in c-mount cameras.

AD04M
S-Mount to C-Mount Adapter Medium
Male c-mount thread and female M12x0.5 thread, H: 6mm, for s-mount lenses in c-mount cameras.

AD05OH V2
Focussable s-mount to c-mount adapter
Adapter with a male c-mount thread and a 12mm hole for M12x0.5 (s-mount) lenses.

LRICM / LROCM
C-Mount Lock Rings
Outside thread: Dia.: 20mm, H: 2.5mm
Inside thread: Dia.: 31mm, Height 2mm

NEW

ADM16TCF / ADM16TCM
M16 to C-Mount Adapters
Outside thread: C-Mount (1-32 UN 2A)
Inside thread: M16x0.5mm

Optical Formulas

How to calculate optical magnification

Most of Lensagon lens series are designed at finite distance. Optical magnification is the image size (CCD) ratio against the object size (FOV) and the most important for selection of a lens.

Sensor size

Area Sensor

Examples of area sensor used for machine vision.
It is expected that various sensors will be available for next generation.

Image Size inch	1/4	1/3	1/2	1/1.8	2/3	1	1.1
Vertical mm	2.7	3.6	4.8	5.35	6.6	9.6	12
Horizontal mm	3.6	4.8	6.4	7.14	8.8	12.8	12
Diagonal mm	4.5	6	8	8.93	11	16	17

Line Sensor

Length of line sensor is formed, depended on pixel size and resolution. As the line sensor is larger, the dimension of a lens becomes larger. Design and manufacture of lenses for the large line sensors are required for high specification.

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

Formula of optical magnification

FOV

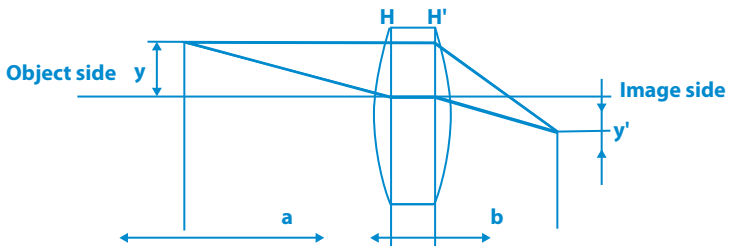
Field of view (FOV) The actual size of a viewed object that can be taken when the lens is attached to the camera.
Ex. Optical magnification: 0.5x Sensor: 1/2"

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

Magnification

Optical magnification (M) = Sensor size/FOV

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



Electronic magnification and monitor magnification

Electronic magnification — **Magnification of an image on a sensor when it is displayed on a monitor screen.**

Monitor magnification — **Magnification of an object displayed on a monitor screen through a lens.**

Ex. Optical magnification: 0.5x Sensor: 1/2 Monitor size: 15 inch (1 inch = 25.4mm)

Electronic magnification 15 x 25.4 ÷ 8 47.6x

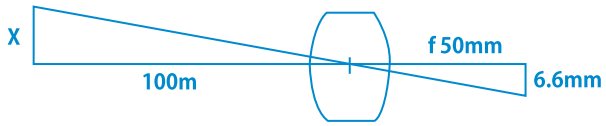
Monitor magnification 0.5 x 47.65 23.8x

How to calculate focal length and photographic range

Formula of photographic range

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

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

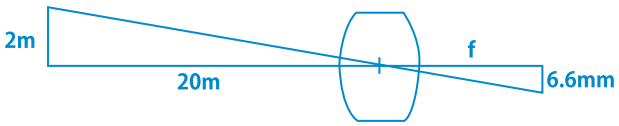


$$X = \frac{100{,}000 \times 6.6}{50} = 13{,}200\,(\text{mm})$$ **Height: 13.2m**

Formula of Focal length

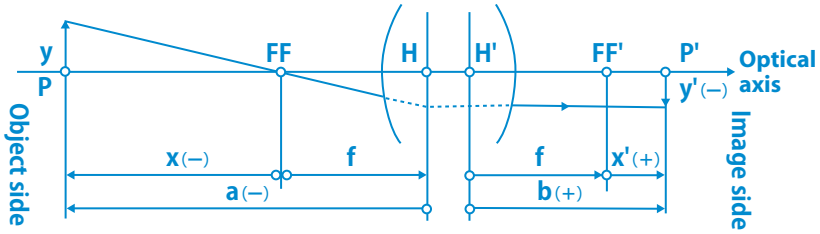
$$f = \frac{\text{Distance from lens to object} \times \text{Image size}}{\text{Height}}$$

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



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

Formula of conjugation relationship



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

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

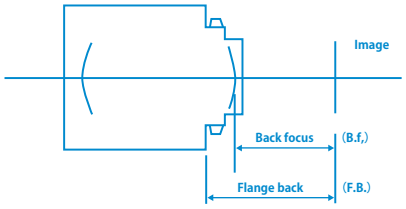
F No./NA Formula

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

Camera mount and flange back

Back focus — Distance from the vertex of the last lens to the back focal point.

Flange back — Distance from the camera's lens mount reference surface to the focal plane.



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

Optical Glossary

Resolution(μm)

Resolution is a measure of how closely spaced two points may be before they cannot be distinguished.For example, 1μm resolution means that two points that are 1μm away from each other can be distinguished. Resolution values in this catalog are lenses' theoretical resolutions. The following is a formula to calculate theoretical resolution based on an aplanatic lens's ray diffraction. (Rayleigh formula) Wavelength 0.61× NA

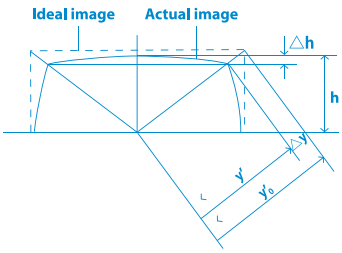
Resolving power(line/mm)

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

Horizontal TV resolution

The total number of black and white horizontal stripes on a TV monitor screen. It is expressed in TV lines.
For example, 200TV lines of horizontal TV resolution means that 100 white horizontal lines is counted as one line. However, for TV lines, one pair is counted as 2 TV lines. For example, if a 1/2-inch CCD camera is used with a lens of 50 lines/mm resolving power, horizontal TV resolution on a TV monitor screen is calculated as follows; 50×6.4(CCD width)×2=640TV

Distortion



D	Optical distortion
D_{TV}	TV distortion
m	Vertical screen/Diagonal

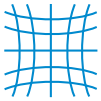
Optical distortion
Lens's aberration where a straight object outside of the optical axis appears curved.

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

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

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

$$D_{TV}=\frac{\triangle h}{2h}\times 100\% \quad D_{TV}=\frac{1}{2}(1-m^2)D \quad m=0.6 \quad D_{TV}=0.32D$$

Object	Pincushion distortion	Barrel distortion
		

Aperture efficiency / Marginal light quantity (%)

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

Shading

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

Chromatic aberration

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

F Number (F No)

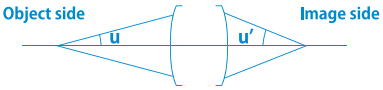
The value indicates a lens's brightness. It is calculated by dividing the lens's focal length by the lens's effective diameter(entrance pupil D mm) looking from object side. It can be also calculated by NA and lens's optical magnification( ). The smaller the number, the brighter the lens is. F No = f/D

Effective F No

The value indicates a lens's brightness. It is calculated by dividing the lens's focal length by the lens's effective diameter(entrance pupil D mm) looking from object side. It can be also calculated by NA and Lens's optical magnification(). The smaller the number, the brighter the lens is. Effective F No = (1+M) x F No

Numerical aperture

The higher the NA, the greater the resolution and brightness are.
When the half angle that an image makes on exit pupil is u' and refractive index is n', n' x sin u' is called image side numberical aperture, NA'.
NAs in this catalog indicate object side numerical apertures.



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

MTF

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

Depth of field

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

Depth of focus

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

Angle of view

The angle formed by imaginary lines connecting the lens second principal point with both ends of the image diagonal. Angle of view is directly associated with lens focal length. As the focal length is longer, the angle of view is narrower.

Angle of view 2x tan ^{1}D Image size 2f Focal length

WD

Distance from the front end of a lens system to the object under inspection.

OI

Distance from the object to the image sensor.

Focal length

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

Image size

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

Memo

Catalog 2022

LENSATION

smart lenses. smart solutions.

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