

CATALOG²²

S/C-MOUNT

TELECENTRIC

SPECIAL OPTICS

ACCESSOIRES

LENSATION
smart lenses. smart solutions.

About Lensation

LENSATION provides free of charge consulting about lenses, illumination, optical components and Smart Cameras. In addition we offer a wide range of optical products.

We are fluent in English and German, but some of our people speak Korean or Chinese.

As you can imagine, this opens doors in Asia. We can source asian products for you, be it optics or electronic parts.

Are you searching for products that you haven't been able to find yet? Ask us! What we can't offer you yet, we'll source for you. Name the product spec's and the target price - usually we can provide the desired product. And if 'your' product really isn't available, we'll design it for you! Exclusive OEM designs are possible, or just job order production. We care about your individual constraints such as product spec's, high quality and good prices.



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.

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S-Mount

C-Mount

Accessories

Telecentric

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Illumination

S-Mount Lenses (M12x0.5)

5 Megapixel Board Lenses



	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
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
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	•	B5M25020V2C

S-Mount Lenses (M12x0.5)

4 Megapixel Board Lenses



	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



	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°		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°		5.4g	3	•	B3M4016C
BM4018S118	4.0	1.8	1/1.8"	0.2m	8.0	126°		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°		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°		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°		5.0g	3	•	B3M12016C
B3M25024	25.0	2.4	1/2"	0.4m	10.26	18°		7.1g	3	•	B3M25024C
B3M35025	35.0	2.5	1/2"	0.4m	14.49	13.1°		15.5g	3	•	B3M35025C

S-Mount Lenses (M12x0.5)

1-2 Megapixel Board Lenses



		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°		2.8g	1		SLAR coating 550nm
	BM2118V2	2.1	2.2	1/3"	0.2m	6.3	170°		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°		6.0g	1	•	BM2420C
	BM2820	2.8	2.0	1/3"	0.2m	5.29	122°		6.0g	1	•	BM2820C
	BM3618	3.6	1.8	1/3"	0.2m	6.59	100°		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°		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°		6.0g	1	•	BM4620DNC
	BM6018	6.0	1.8	1/3"	0.2m	9.33	60°		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°		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°		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

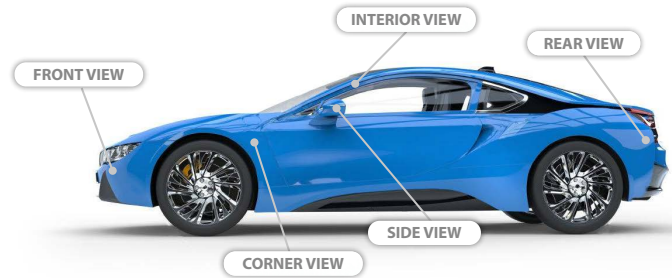


BA1520WPC

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



	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
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
BF10M2628S123	8.0	2.6	2.8	1/2.3"	0.1m	3.67	150°	-	10		BF10M2628S123C

S-Mount Lenses (M12x0.5)

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

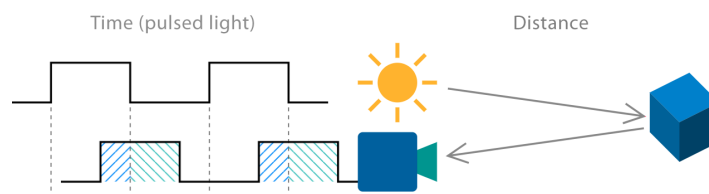


BTOF2512-850

BTOF2512-940

BTOF2512-850

BTOF2512-940



	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°	-		-53%	850nm
BTOF2512-940	2.5	2.0	1/3"	0.2m	5.18	140°	-		-53%	940nm
NEW BTOF2512-850	11.3	1.4	1/2"	0.1m	5.96	38.1°	12.6°		2.1%	850nm
NEW BTOF2512-940	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 filter / option
M16B6M4010S125	4.0	1.0	1/2.5"	1.0m	5.36	106°	9	6		
M16B4M5009S118C	5.0	0.9	1/1.8"	0.5m	6.48	118°	-	4		• (inside holder)
M16B8M54310S118	5.43	1.0	1/1.8"	1.0m	5.98	105°	10	8		

C-Mount Lenses

12 Megapixel C-Mount Lenses

Designed for the new 12 Megapixel CCDs

Features

- High performance from macro to infinity
- Suited fine for factory automation and also high end surveillance



	Focal length	Aperture	Range of WD	Optical Distortion	Angle of view (VxH)	Filter size	Format
CK12M1628S11	16mm	2.8	0.08m ~∞	-1.3%	44.9° x 33.9°	M35.5 P=0.5	1.1"
CK12M2528S11	25mm	2.8	0.12m ~∞	0.4%	29.6° x 22.1°	M35.5 P=0.5	1.1"
CK12M3528S11	35mm	2.8	0.18m ~∞	-0.21%	21.4° x 15.9°	M35.5 P=0.5	1.1"
CK12M5028S11	50mm	2.8	0.275m ~∞	-0.05%	11.2° x 15.1°	M35.5 P=0.5	1.1"

10 Megapixel C-Mount Lenses

Designed for 4/3" sensors (Ø 23mm format)

Features

- Large image format of Ø 23mm
- High defined picture throughout the entire image format
- Filters are available for all models



	Focal length	Aperture	Range of WD	Optical Distortion	Angle of view (VxH)	Filter size	Format
CK10M1220S43	12mm	2.0	0.15m ~∞	-2.4%	61.1° x 75.5°	M77 P=0.75	4/3"
CK10M1620S43	16mm	2.0	0.1m ~∞	-2.81%	47.3° x 60.9°	M58 P=0.75	4/3"
CK10M2520S43	25mm	2.0	0.15m ~∞	-0.66%	31° x 40.6°	M46 P=0.75	4/3"
CK10M3520S43	35mm	2.0	0.2m ~∞	-0.56%	22.4° x 29.6°	M40.5 P=0.5	4/3"
CK10M5020S43	50mm	2.0	0.3m ~∞	-0.14%	15.7° x 20.9°	M40.5 P=0.5	4/3"
CK10M8520S43	85mm	2.0	1.2m ~∞	-0.04%	9.28° x 12.09°	M77 P=0.75	4/3"

C-Mount Lenses

5 Megapixel High Resolution Machine Vision Lenses

Suitable for inspection and alignment, high accuracy

- Suitable for 5 mega upto 10 mega pixel CCDs
- Focal length longer than f16mm is compatible with 1.1 CCD
- High resolution at whole range of WD and excellent brightness
- Robust design, suitable for machine vision applications
- Two different mount types available : slip mount for all lenses, fix mount for 25mm, 50mm, 75mm



	Focal length	Aperture	Range of WD	TV distortion *	max. Magnification	Filter size	Format
C5M0528V2	5mm	2.8	0.05m ~ ∞	0.29%	0.044x	M55 P=0.75	2/3"
C5M0818V2	8mm	1.8	0.1m ~ ∞	0.31%	0.078x	M40.5 P=0.75	2/3"
C5M1214V2	12mm	1.4	0.1m ~ ∞	-0.31%	0.1x	M37.5 P=0.5	2/3"
C5M1618GSV2	16mm	1.8	0.033m ~ ∞	-0.28%	0.3x	M49 P=0.75	1.1"
C5M2514GSV2	25mm	1.4	0.08m ~ ∞	-0.09%	0.3x	M52 P=0.75	1.1"
C5M3514GSV2	35mm	1.4	0.11m ~ ∞	0.07%	0.3x	M46 P=0.75	1.1"
C5M5018GSV2	50mm	1.8	0.192m ~ ∞	-0.01%	0.3x	M49 P=0.75	1.1"
C5M7518GSV2	75mm	1.8	0.29m ~ ∞	0.001%	0.3x	M55 P=0.75	1.1"

* TV distortion indicates a value for the closest working distance with 2/3 CCD

Compact 8/6 Megapixel Machine Vision Lenses

Compact designed models

- from f6~f75mm for 2/3" or 1/1.8" sensors
- High resolution for high megapixel cameras
- Lock screws for iris and focus for all models



	Focal length	Aperture	Range of WD	Optical distortion	Angle of view (VxH)	Weight	Format
CK8M0828S23	8mm	2.8	0.1 ~ ∞	-1.51%	47.06° x 54.97°	80.7g	2/3"
CK8M1628S23	16mm	2.8	0.1 ~ ∞	-0.2%	24.38° x 28.94°	57.1g	2/3"

	Focal length	Aperture	Range of WD	Distortion	Angle of view (VxH)	Filter size	Format
CK6M0628S118	6mm	2.0	0.035 ~ ∞	-1.5% opt.	44.8° x 63.5°	-	1/1.8"
CK6M0828S118	8mm	2.0	0.1 ~ ∞	-0.03% TV	34° x 49.3°	M27 P=0.5	1/1.8"
CK6M1228S118	12mm	2.0	0.1 ~ ∞	-0.12% TV	23.4° x 34.4°	M27 P=0.5	1/1.8"
CK6M1628S118	16mm	2.0	0.1 ~ ∞	-0.08% TV	17.5° x 25.7°	M27 P=0.5	1/1.8"
CK6M2528S118	25mm	2.0	0.1 ~ ∞	-0.02% TV	10.96° x 16.35°	M25 P=0.5	1/1.8"
CK6M3528S118	35mm	2.0	0.15 ~ ∞	-0.02% TV	7.6° x 11.3°	M27 P=0.5	1/1.8"
CK6M5028S118	50mm	2.0	0.3 ~ ∞	0.11% opt.	5.4° x 8°	M25.5 P=0.5	1/1.8"

C-Mount Lenses

Megapixel C-Mount Lenses (C3M Series)

Features:

- Compatible with over 3,000,000 pixel CCDs
- Low optical distortion
- High performance and excellent value for money
- Focal length 4mm coming soon!
- Lock screws for manual iris and manual focus.



	Focal length	Aperture	Range of WD	Angle of View (HxV)					Weight	Format
				1/3"	1/2"	1/1.8"	2/3"	1"		
C3M0616V2	6mm	1.6	0.15m ~ ∞	53.8° x 33.2°	67.2° x 43.3°	45.1° x 71.1°	-	-	91.1g	1/1.8"
C3M0814V2	8mm	1.4	0.20m ~ ∞	33.2° x 25.2°	43.4° x 33.2°	48.3° x 36.4°	-	-	64.8g	1/1.8"
C3M1216V2	12mm	1.6	0.15m ~ ∞	22.4° x 17.4°	29.5° x 22.4°	33.2° x 24.6°	40.2° x 30.5°	-	68.2g	2/3"
C3M1616V2	16mm	1.6	0.30m ~ ∞	17.4° x 12.5°	22.4° x 17.4°	25.2° x 18.5°	29.5° x 22.6°	-	89g	2/3"
C3M2518V2	25mm	1.8	0.30m ~ ∞	10.6° x 8.1°	14.4° x 10.6°	16.2° x 12.9°	19.6° x 15.2°	-	55g	2/3"
C3M3520V2	35mm	2.0	0.40m ~ ∞	7.5° x 5.5°	10.3° x 7.5°	11.4° x 8.4°	14.2° x 10.5°	-	56g	2/3"
C3M5025V2	50mm	2.5	0.50m ~ ∞	5.3° x 4.7°	7.2° x 5.3°	8.1° x 6.5°	10.3° x 7.3°	-	79g	2/3"
C3M7528V2	75mm	2.8	1.20m ~ ∞	3.4° x 2.5°	4.5° x 3.4°	5.3° x 4.4°	6.43° x 5.2°	9.2° x 6.9°	167.5g	1"

Megapixel Low Distortion CCTV Lenses (ND series)

Features

- High resolution, compatible with CCDs of over 1,000,000 pixel
- High performance at less than WD500mm
- Low color aberration and low TV distortion
- Micro-photography without extension ring



1/2"format (ND series)

	Focal length	Aperture	Range of WD	TV distortion	Angle of View (VxH)	Filter screw	Format
CMFA0420ND	4mm	2.0	0.1m~∞	0.91%	59.96° x 75.14°	M27 P=0.5	1/2"
CMFA0622ND	6mm	2.2	0.1m~∞	-0.01%	40.47° x 52.35°	M30.5 P=0.5	1/2"
CMFA1022ND	10mm	2.2	0.1m~∞	-0.08%	26.31° x 34.61°	M27 P=0.5	1/2"

2/3"format (ND series)

	Focal length	Aperture	Range of WD	TV distortion	Angle of View (VxH)	Filter screw	Format
CMFA1520ND	15mm	2.0	0.1m~∞	-0.09%	24.11° x 31.79°	M27 P=0.5	2/3"
CMFA2020ND	20mm	2.0	0.1m~1m	-0.10%	18.20° x 24.11°	M27 P=0.5	2/3"
CMFA2520ND	25mm	2.0	0.15m~1m	-0.01%	14.75° x 19.58°	M27 P=0.5	2/3"
CMFA3020ND	30mm	2.0	0.2m~1m	-0.02%	12.55° x 16.69°	M27 P=0.5	2/3"
CMFA3519ND	35mm	1.9	0.3m~1m	-0.03%	10.77° x 14.32°	M27 P=0.5	2/3"
CMFA5025ND	50mm	2.5	0.4m~1m	-0.03%	7.82° x 10.38°	M27 P=0.5	2/3"
CMFA7538ND	75mm	3.8	0.4m~1m	-0.01%	5.11° x 6.81°	M27 P=0.5	2/3"

C-Mount Lenses

Megapixel High Resolution CCTV Lenses (MJ series)

	Focal length	Aperture	Range of WD	TV distortion	Angle of View (VxH)	Filter screw	Format
CM0614MJ	6mm	1.4	0.2m~∞	-0.96%	44.3° x 57.4°	M30.5 P=0.5	1/2"
CM1614MJ	16mm	1.4	0.25m~∞	-0.28%	23.3° x 30.7°	M25.5 P=0.5	2/3"
CM2514MJ	25mm	1.4	0.25m~∞	-0.3%	15.1° x 20.1°	M25.5 P=0.5	2/3"
CM3520MJ	35mm	2.0	0.25m~∞	-0.2%	10.4° x 14.3°	M25.5 P=0.5	2/3"
CM5028MJ	50mm	2.8	0.5m~∞	-0.2%	7.4° x 9.9°	M25.5 P=0.5	2/3"

High Quality C-Mount Lenses

Features

- Cover a wide range of uses from inspection to factory automation
- Vibration-resistant focus and iris locks available
- Compatible with 1/3", 1/2", 2/3", 1" 400,000 pixel cameras



1/2" format

	Focal length	Aperture	Operation Range	Angle of View (V x H)	Filter screw	Format
CY0316	3.5mm	1.6	0.1m~∞	69.0° x 85.0°	M43 P=0.75	1/2"
CY0614	6mm	1.4	0.2m~∞	42.0° x 54.5°	M27 P=0.5	1/2"
CY1214	12mm	1.4	0.3m~∞	22.0° x 29.0°	M27 P=0.5	1/2"

2/3" format

	Focal length	Aperture	Operation Range	Angle of View (V x H)	Filter screw	Format
CY0614S23	6mm	1.4	0.2m~∞	81.9° x 61.2°	no filter thread	2/3"
CY0813	8mm	1.3	0.2m~∞	45.0° x 57.8°	M25.5 P=0.5	2/3"
CY1614	16mm	1.4	0.4m~∞	23.2° x 30.7°	M27 P=0.5	2/3"
CY2514	25mm	1.4	0.5m~∞	21.6° x 28.5°	M27 P=0.5	2/3"
CY3519	35mm	1.9	0.5m~∞	10.8° x 14.4°	M27 P=0.5	2/3"
CY5018	50mm	1.8	1m~∞	7.9° x 10.5°	M30.5 P=0.5	2/3"
CY7527	75mm	2.7	1m~∞	4.9° x 6.6°	M30.5 P=0.5	2/3"
CY10035	100mm	3.5	1m~∞	3.8° x 5.1°	M30.5 P=0.5	2/3"

Megapixel High Resolution 1" C-Mount Lenses

	Focal length	Aperture	Operation Range	Angle of View (H x V)	Filter screw	Format
CM0618GS	6mm	1.8	0.1m~∞	96.8° x 79.4°	no filter thread	1"
CM0814GS	8mm	1.4	0.1m~∞	79.7° x 63.0°	M55 P=0.75	1"
CM1214GS	12mm	1.4	0.3m~∞	55.6° x 42.5°	M27 P=0.5	1"
CM1614GS	16mm	1.4	0.3m~∞	44.3° x 33.6°	M35.5 P=0.5	1"
CM2514GS	25mm	1.4	0.3m~∞	29.3° x 22.0°	M35.5 P=0.5	1"
CM3514GS	35mm	1.4	0.3m~∞	20.9° x 15.8°	M35.5 P=0.5	1"
CM5014GS	50mm	1.4	0.5m~∞	14.5° x 10.8°	M40.5 P=0.5	1"
CM7518GS	75mm	1.8	1.0m~∞	9.7° x 7.3°	M46.5 P=0.75	1"

C-Mount Lenses

High Speed F0.95 C-Mount Lenses

	Focal length	Aperture	Operation Range	Angle of View (V x H)	Filter screw	Format
CHS17095	17mm	0.95	0.5m~∞	22.0° x 29.0°	M40.5 P=0.5	2/3"
CHS25095	25mm	0.95	0.5m~∞	21.7° x 28.7°	M40.5 P=0.5	1"
CHS50095	50mm	0.95	0.7m~∞	11.0° x 14.6°	M62.0 P=0.75	1"

Megapixel Low Distortion C-Mount Varifocal Lenses

The CVM series maintains straight lines in wide angle images!

Utilising advanced lens technology to XD (extra low Dispersion) glass and an aspherical lens, this new multi-megapixel lens will pave the way for more possibilities in applications such as high end surveillance.

Features

- High resolution, compatible with CCDs of over 1,000,000 pixel
- Compact design and low distortion: Where "normal" 4.5mm lenses for 1/2" have a distortion of between 20% and 30%, this brand new aspherical lenses have a distortion of below 0.5% (T) on a 1/2" sensor.



	Focal length	Aperture (max.)	Operation Range	TV Distortion	Angle of View (H x V)		Format
					Wide	Tele	
CVM0411ND	4.4 - 11mm	1.6	0.3m ~ ∞	W: -0.2% T: 0.35%	76.6° x 61.2°	36.7° x 28.0°	1/1.8"
CVM1040ND	10 - 40mm	1.6	0.5m ~ ∞	W: -0.17% T: 0.1%	39.5° x 48.3°	10.5° x 13.1°	1/1.8"
CVM1664NDGS	16 - 64mm	1.8	1.0m ~ ∞	W: -3.4% T: 0.2%	45.9° x 34.2°	11.7° x 8.8°	1"

C-Mount Lenses

Economy Megapixel C-Mount Lenses



CM6014N3



CM8014N3



CVM60120

Image Format	1/2"	1/2"	1/2"
Mount	C	C	C
Focal Length	6mm	8mm	6.0~12mm
Aperture	1.4	1.4	1.6
M.O.D.	0.3m	0.3m	0.2m
Zoom	-	-	Manual with lock
Focus	Manual with lock	Manual with lock	Manual with lock
Iris	Manual with lock	Manual with lock	Manual
Angle of View (HxV)	66.2° x 49.6°	48.2° x 36.1°	Wide: 53.0° x 39.75°
Back Focal Length	11.6mm	13.8mm	9.67mm
Weight	89g	95g	72g
Note	Megapixel	Megapixel	Megapixel

S-Mount to C-Mount Scheimpflug Adapter

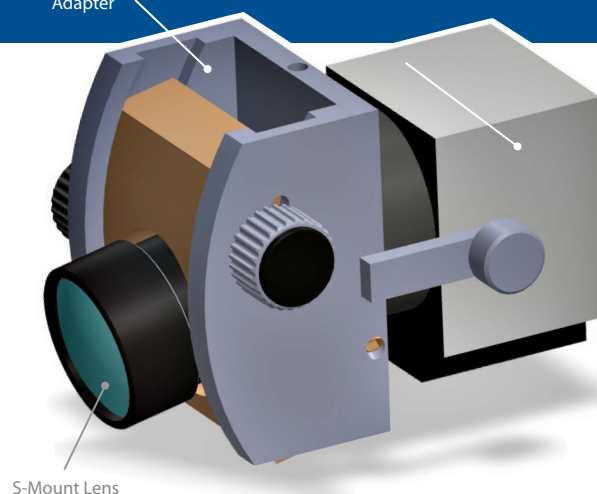
The tilt mechanism allows overall image sharpness to be controlled in a different way than conventional lenses. Used in conjunction with aperture, the tilt feature of these lenses allows objects or features within an image plane to be kept in focus. This is helpful when imaging objects at oblique angles.

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/>

Lensagon Scheimpflug Adapter

C-Mount Camera



S-Mount Lens

(CAD image)

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).



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

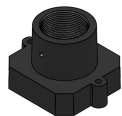
Material: Aluminium. For using M12x0.5 lenses in M14x0.5 mounts



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

Accessories



PIEZOLUTION M12 Focus Module

we like to move it.

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.

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

ADM16TCF / ADM16TCM



M16 to C-Mount Adapters

Outside thread: C-Mount (1-32 UN 2A)
Inside thread: M16x0.5mm

Telecentric Lenses

Double Side Telecentric Lenses

- These lenses are the best choice for the accurate dimensional measurement of large part samples.
- No perspective error over the whole F.O.V.
- IRIS diaphragm for adjusting D.O.F.
- Apply High Mega Pixel CCD like 5M, 4M, 16M, 29M. (Diagonal length from 11mm to 43mm)
- Good for engine parts, metal parts, molding and casting semiconductor parts application.
- M58 Mount, C-mount, F-mount



T29M Series

		Mag.	WD	Res. (Obj.)	NA	F No.	D.O.F. (μm)	Telecentricity (<degree)	Optical Distort. (%)	CCD size (max.)	Mount
NEW	T29M-015-545	0.15X	545	34.41	0.0097	7.7	15050	0.05	0.03	36 x 24 mm	M58
	T29M-024-400I	0.24X	400	28	0.012	10	7640	0.05	0.03	43mm	M58
	T29M-038-265I	0.38X	265	17.6	0.019	10	3050	0.04	0.03	43mm	M58
	T29M-0563-160I	0.563X	160	12	0.028	10	1270	0.05	0.04	43mm	M58
	T29M-0664-181I	0.664X	181	8.4	0.04	8.3	1110	0.05	0.05	43mm	M58

T4M Series

		Mag.	WD	Res. (Obj.)	NA	F No.	D.O.F. (mm)	Telecentricity (<degree)	Optical Distort. (%)	CCD size (max.)	Mount
	T4M-01-470I	0.1X	470	51.6	0.0065	7.7	61.6	0.05	0.026	1.2"	F

TDC Series

		Mag.	WD	Res. (Obj.)	NA	F No.	D.O.F. (mm)	Telecentricity (<degree)	Optical Distort. (%)	CCD size (max.)	Mount
	TDC-0044-398	0.044 X	398	116	0.0029	7.5	310	0.05	0.03	1/2"	C
	TDC-0061-398	0.061 X	398	78	0.0043	7	150	0.05	0.03	2/3" (11mm)	C
	TDC-012-230	0.12X	230	40.91	0.0082	7.3	40.5	0.04	0.03	2/3" (11mm)	C
	TDC-0138-184	0.138X	184	38.563	0.0095	7.5	30.7	0.05	0.03	2/3" (11mm)	C
	TDC-0157-160	0.157X	160	32.259	0.0104	7.5	24.3	0.05	0.03	2/3" (11mm)	C
	TDC-0184-135	0.184X	135	27.5	0.0122	7.5	17.7	0.04	0.05	2/3" (11mm)	C
	TDC-024-108	0.24X	108	20.96	0.016	7.5	10.4	0.04	0.04	2/3" (11mm)	C
	TDC-0255-70	0.255X	70	20.97	0.016	8	9.8	0.04	0.04	2/3" (11mm)	C
	TDC-035-72	0.35X	72	14.399	0.0233	7.5	4.9	0.05	0.04	2/3" (11mm)	C

I = Manual Iris, C = Coaxial, IC = Both

Telecentric Lenses

Object Side Telecentric Lenses

T47M Series

- This lens can be applied for 47MP sensor cameras which have 56.7mm diagonal length
- Good for various inspections like Flat Panel Display applications & automobile components
- High resolution and good telecentricity regarding of all series
- Iris diaphragm adapted for adjusting D.O.F.



	Mag.	WD	Res. (Obj.)	NA	F No.	D.O.F. (μm)	Telecentricity (<degree)	Optical Distort. (%)	CCD size (max.)	Mount
TD47M-02-542	0.2X	542	26	0.013	7.7	8.4	0.03	0.04	47M(56.7mm)	M72
T47M-04-208I	0.4X	208.3	14	0.024	8.3	2.3	0.04	0.04	47M(56.7mm)	M72
T47M-07-117I	0.7X	117	7.7	0.0437	8	718μm	0.04	0.07	47M(56.7mm)	M72
T47M-064-170I	0.64X	170	8.4	0.04	8	860μm	0.04	0.06	47M(56.7mm)	M72
T47M-087-137I	0.87X	137	6.4	0.052	8.3	482μm	0.04	0.07	47M(56.7mm)	M72
T47M-10-122C	1.0X	122	6.7	0.05	10	440μm	0.04	0.02	47M(56.7mm)	M72
T47M-13-105C	1.3X	105	5.6	0.06	10.8	281μm	0.03	0.03	47M(56.7mm)	M72
T47M-10-122	1.0X	122	6.7	0.05	10	440μm	0.04	0.02	47M(56.7mm)	M72
T47M-13-105	1.3X	105	5.6	0.06	10.8	281μm	0.03	0.03	47M(56.7mm)	M72

I = Manual Iris, C = Coaxial, IC = Both / D.O.F Calculation: Permissible of circle of confusion : 22μm

T25M Series

- This telecentric lens supports up to 25 megapixel CCD cameras with 32mm diagonal length.
- It is compatible with 12M CCD camera according to the customer requirement
- High resolution lens & No perspective error over the whole F.O.V.
- Iris diaphragm adapted for adjusting D.O.F.
- Possible to change M48-Mount / F-Mount.



	Mag.	WD	Res. (Obj.)	NA	F No.	D.O.F. (μm)	Telecentricity (<degree)	Optical Distort. (%)	CCD size (max.)	Mount
T25M-033-347I	0.33X	347	16.8	0.0124	8	2940	0.03	0.02	25M (32mm)	M48
T25M-035-213I	0.35X	213	14.39	0.0233	7.5	2200	0.03	0.08	25M (32mm)	M48
T25M-045-270I	0.45X	270	9.31	0.036	6.25	1110	0.03	0.08	25M (32mm)	F
T25M-046-150I	0.46X	150	10.2	0.033	7	1200	0.03	0.04	25M (32mm)	M48
T25M-05-237I	0.5X	237	8.4	0.04	6.25	900	0.03	0.08	25M (32mm)	M48
T25M-06-132I	0.6X	132	7	0.048	6.3	630	0.03	0.04	25M (32mm)	M48
T25M-08-240I	0.8X	240	6.3	0.0533	7.5	421	0.03	0.04	25M (32mm)	F
T25M-082-270I	0.82X	270	6.1	0.0546	7.5	401	0.03	0.04	25M (32mm)	F
T25M-092-170I	0.92X	170	5.2	0.064	7.14	303	0.04	0.03	25M (32mm)	M48
T25M-12-155I	1.2X	155	4.2	0.08	7.5	187	0.03	0.03	25M (32mm)	F
T25M-135-110I	1.35X	110	4.5	0.075	9	178	0.03	0.01	25M (32mm)	F
T25M-15-100I	1.5X	100	4.47	0.075	10	160	0.03	0.03	25M (32mm)	F
T25M-30-78/C	3.0X	78	3.4	0.1	15	60	0.04	0.09	25M (32mm)	F

I = Manual Iris, C = Coaxial, IC = Both / D.O.F Calculation: Permissible of circle of confusion : 18μm

Telecentric Lenses

T12M Series

- High resolution lens, no perspective error
- Compatible with 12M sensor
- Iris diaphragm adapted for adjusting D.O.F.



	Mag.	WD	Res. (Obj.)	NA	F No.	D.O.F. (μm)	Telecentricity (<degree)	Optical Distort. (%)	CCD size (max.)	Mount
T12M-055-271/C	0.55X	271	9.1	0.037	7.4	1000	0.03	0.01	12M (28mm)	M48
T12M-0785-275/C	0.785X	275	6.3	0.053	7.4	528	0.03	0.01	12M (28mm)	M48

I = Manual Iris, C = Coaxial, IC = Both / D.O.F Calculation: Permissible of circle of confusion : 22μm

TF8M Series

- High telecentricity: no perspective error.
- Telecentric lenses for large detectors
4M (15.2mm x 15.2mm) and 1.2"
- Iris diaphragm for adjusting D.O.F.
- Wide magnification range
from 0.315X to 2.0X
- Good for semiconductor &
SMT & PCB components
measurement



	Mag.	WD	Res. (Obj.)	NA	F No.	D.O.F. (μm)	Telecentricity (<degree)	Optical Distort. (%)	CCD size (max.)	Mount
TF8MHR-0315-130I	0.315X	130	13.3	0.0252	6.25	2780	0.03	0.03	8M (23mm)	F
TF8MHR-0318-265I	0.318X	265	10.6	0.0318	5	2180	0.03	0.08	8M (23mm)	F
TF8MHR-0348-130I	0.348X	130	12.1	0.0278	6.25	2300	0.03	0.04	8M (23mm)	F
TF8MHR-0348-200I	0.348X	200	12	0.0289	6	2180	0.03	0.02	8M (23mm)	F
TF8MHR-0385-130I	0.385X	130	12.4	0.027	7.1	2100	0.015	0.03	8M (23mm)	F
TF8MHR-042-132I	0.42X	132	5.4	0.0627	3.35	835.6	0.03	0.03	8M (23mm)	F
TF8M-042-130I	0.42X	130	16	0.021	10	2500	0.023	0.1	8M (23mm)	F
TF8MHR-049-132I	0.49X	132	7.5	0.0446	5.5	1010	0.03	0.05	8M (23mm)	F
TF8MHR-05-130I	0.5X	130	9.4	0.0357	7	1230	0.03	0.05	8M (23mm)	F
TF8M-056-130I	0.56X	130	12.7	0.028	10	1400	0.03	0.06	8M (23mm)	F
TF8MHR-058-254I	0.58X	254	5.8	0.058	5	653.9	0.03	0.08	8M (23mm)	F
TF8MHR-06-130I	0.6X	130	6.2	0.054	5.6	684.4	0.03	0.06	8M (23mm)	F
TF8M-06-130I	0.6X	130	11.6	0.029	10.4	1300	0.23	0.1	8M (23mm)	F
TF8MHR-06-258I	0.6X	258	5.6	0.06	5	611.1	0.03	0.03	8M (23mm)	F
TF8MHR-064-130I	0.64X	130	5.8	0.0576	5.56	597.3	0.02	0.06	8M (23mm)	F
TF8MHR-06-310I	0.6X	310	7	0.048	6.25	671.4	0.03	0.08	8M (23mm)	F
TF8MHR-07-130I	0.7X	130	5.1	0.066	5.3	476	0.03	0.05	8M (23mm)	F
TF8MHR-10-157I	1.0X	157	4.7	0.071	7	308	0.03	0.06	8M (23mm)	F
TF8MHR-20-50/C	2.0X	50	3	0.112	8.93	98.2	0.03	0.04	8M (23mm)	F

I = Manual Iris, C = Coaxial, IC = Both / D.O.F Calculation: Permissible of circle of confusion : 22μm
Possible to change mount

Telecentric Lenses

TC4M Series

- High telecentricity: no perspective error.
- Telecentric lenses for large detectors
4M (15.2mm x 15.2mm) and 1.2"
- Iris diaphragm for adjusting D.O.F.
- Wide magnification range from 0.315X to 2.0X
- Good for semiconductor & SMT & PCB components measurement
- C Mount & F Mount



NEW

NEW

	Mag.	WD	Res. (Obj.)	NA	F No.	D.O.F. ($\mu\text{m}/\text{mm}$)	Telecentricity ($<\text{degree}$)	Optical Distort. (%)	CCD size (max.)	Mount
TC4MHR-015-255I	0.15X	255	31.4	0.0107	7	13.68mm	0.023	0.01	1" (16mm)	C
TC4MHR-016-240I	0.16X	240	30.5	0.011	7	12.03mm	0.03	0.01	1" (16mm)	C
TC4MHR-0215-163I	0.215X	163	17.65	0.019	5.6	5300	0.03	0.03	1" (16mm)	C
TC4MHR-0234-130I	0.234X	130	15.97	0.021	5.6	4500	0.03	0.031	1" (16mm)	C
TC4MHR-0234-200I	0.234X	200	16	0.021	5.6	4500	0.03	0.03	1" (16mm)	C
TC4MHR-026-130I	0.26X	130	14.3	0.0234	5.6	3644	0.03	0.031	1" (16mm)	C
TC4MHR-026-200I	0.26X	200	14.3	0.0234	5.6	3644	0.03	0.031	1" (16mm)	C
TC4MHR-0275-240I	0.275X	240	16.8	0.02	6.87	4000	0.025	0.04	1" (16mm)	C
TC4MHR-0312-130I	0.312X	130	7.21	0.0465	3.35	1514	0.03	0.031	1" (16mm)	C
TC4MHR-0312-200I	0.312X	200	9.7	0.0346	4.5	2000	0.03	0.03	1" (16mm)	C
TC4MHR-037-240I	0.37X	240	12.1	0.0277	6.66	2100	0.03	0.01	1" (16mm)	C
TC4MHR-0445-130I	0.445X	130	10.583	0.037	7	1560	0.023	0.065	1" (16mm)	C
TC4MHR-07-65/C	0.7X	65	6.57	0.051	6.8	610	0.03	0.03	1" (16mm)	C
TC4MHR-08-130C	0.8X	130	8.38	0.04	10	687	0.03	0.03	1" (16mm)	C
TC4MHR-10-65/C	1.0X	65	5.41	0.062	8	352	0.03	0.03	1" (16mm)	C
TC4M-10-110/C	1.0X	110	5.41	0.062	8	352	0.03	0.03	1" (16mm)	C
TC4MHR-22-40/C	2.2X	40	2.72	0.123	8.9	80.9	0.03	0.02	1" (16mm)	C
TC4MHR-30-40/C	3.0X	40	2.4	0.14	10.7	52.3	0.03	0.03	1" (16mm)	C

I = Manual Iris, C = Coaxial, IC = Both / D.O.F Calculation: Permissible of circle of confusion : 22 μm

Telecentric Lenses

TC5M Series Ultra High Resolution

In combination with Mega pixel cameras (up to 2/3" CCD), you can get high-quality images.

- Designed for 5M CCD camera. (3.45m/pixel)
- Ultra High resolution and contrast with high NA.
- Very low distortion in whole field.
- Compact design with coaxial illumination.
- High telecentricity, No perspective error



TC5M Series (WD: 65mm)

	Mag.	WD	Res. (Obj.)	NA	F No.	D.O.F. (μm)	Telecentricity (<degree)	Optical Distort. (%)	CCD size (max.)	Mount
TC5M-05-65 / C	0.5X	65	8.4	0.04	6.25	1000	0.02	0.17	2/3"	C
TC5M-08-65 / C	0.8X	65	5.25	0.064	6.25	390.6	0.02	0.13	2/3"	C
TC5M-10-65 / C	1.0X	65	4.8	0.07	7.14	285.6	0.022	0.16	2/3"	C
TC5M-10-65I / IC	1.0X	65	4.8	0.07	7.14	285.6	0.022	0.16	2/3"	C
TC5M-20-65 / C	2.0X	65	2.8	0.12	8.3	83	0.03	0.02	2/3"	C
TC5M-20-65I / IC	2.0X	65	2.8	0.12	8.3	83	0.03	0.02	2/3"	C
TC5M-30-65 / C	3.0X	65	2.15	0.156	9.6	42.7	0.02	0.05	2/3"	C
TC5M-30-65I / IC	3.0X	65	2.15	0.156	9.6	42.7	0.02	0.05	2/3"	C
TC5M-40-65 / C	4.0X	65	2.09	0.16	12.5	31.3	0.02	0.03	2/3"	C
TC5M-40-65I / IC	4.0X	65	2.09	0.16	12.5	31.3	0.02	0.03	2/3"	C

I = Manual Iris, C = Coaxial, IC = Both / D.O.F Calculation: Permissible of circle of confusion : 20μm

Telecentric Lenses

TC5M Series (WD: 110mm)

	Mag.	WD	Res. (Obj.)	NA	F No.	D.O.F. (μm)	Telecentricity (<degree)	Optical Distort. (%)	CCD size (max.)	Mount
TC5M-03-110 / C	0.3X	110	15.3	0.0219	6.9	3040	0.04	0.02	2/3"	C
TC5M-05-110 / C	0.5X	110	7.2	0.0465	5.38	861	0.02	0.02	2/3"	C
TC5M-05-110I / IC	0.5X	110	7.2	0.0465	5.38	861	0.02	0.02	2/3"	C
TC5M-07-110 / C	0.7X	110	5.15	0.0651	5.38	439	0.02	0.02	2/3"	C
TC5M-07-110I / IC	0.7X	110	5.15	0.0651	5.38	439	0.02	0.012	2/3"	C
TC5M-09-110 / C	0.9X	110	4.473	0.075	6	296	0.025	0.01	2/3"	C
TC5M-10-110 / C	1.0X	110	4.36	0.077	6.5	260	0.03	0.03	2/3"	C
TC5M-10-110I / IC	1.0X	110	4.36	0.077	6.5	260	0.03	0.03	2/3"	C
TC5M-18-110 / C	1.8X	110	4.14	0.081	11	95	0.03	0.03	2/3"	C
TC5M-20-110 / C	2.0X	110	3.7	0.09	11	110	0.05	0.03	2/3"	C
TC5M-20-110I / IC	2.0X	110	3.7	0.09	11	110	0.05	0.03	2/3"	C

I = Manual Iris, C = Coaxial, IC = Both / D.O.F Calculation: Permissible of circle of confusion : 20μm



TC5M Series (WD: 130-170mm)

	Mag.	WD	Res. (Obj.)	NA	F No.	D.O.F. (μm)	Telecentricity (<degree)	Optical Distort. (%)	CCD size (max.)	Mount
TC5M-0315-130I	0.315X	130	13.3	0.0252	6.25	2052	0.03	0.03	2/3"	C
TC5M-0348-130I	0.348X	130	12.1	0.0278	6.25	2060	0.03	0.04	2/3"	C
TC5M-042-130I	0.42X	130	5.4	0.0627	3.35	759	0.03	0.03	2/3"	C
TC5M-07-130I	0.7X	130	5.33	0.063	5.5	449	0.03	0.05	2/3"	C

TC5M Series (WD: 150mm)

	Mag.	WD	Res. (Obj.)	NA	F No.	D.O.F. (μm)	Telecentricity (<degree)	Optical Distort. (%)	CCD size (max.)	Mount
TC5M-026-150I	0.26X	150	13.7	0.0245	5.3	3100	0.03	0.08	2/3"	C

TC5M Series (WD: 170mm)

	Mag.	WD	Res. (Obj.)	NA	F No.	D.O.F. (μm)	Telecentricity (<degree)	Optical Distort. (%)	CCD size (max.)	Mount
TC5M-017-170I	0.17X	170	9.73	0.058	5	4775	0.03	0.06	2/3"	C
TC5M-03-170I	0.3X	170	17.94	0.0187	8	3550	0.03	0.01	2/3"	C
TC5M-065-170 / C	0.65X	170	5.78	0.058	5.6	530	0.02	0.06	2/3"	C

I = Manual Iris, C = Coaxial, IC = Both / D.O.F Calculation: Permissible of circle of confusion : 20μm

Telecentric Lenses

TCHR Series

- Designed for mega-pixel CCD camera. (4.65μm/pixel)
- High Resolution and contrast design in F.O.V.
- W.D Lineup of 65, 110, 130mm
- Support up to 2/3" cell camera.
- Various magnification with low-distortion design.
- Uniform coaxial illumination over the whole F.O.V.



TCHR Series (WD: 65mm)

		Mag.	WD	Res. (Obj.)	NA	F No.	D.O.F. (μm/mm)	Telecentricity (<degree)	Optical Distort. (%)	CCD size (max.)	Mount
NEW	TCHR-01-150I	0.1X	150	40.4	0.0083	6.0	48.0mm	0.04	0.05	1/2"	C
	TCHR-013-60I	0.13X	60	34.6	0.0097	6.7	31.7mm	0.03	0.08	1/2"	C
	TCHR-05-65 / C	0.5X	65	11.2	0.03	8.3	2600	0.02	0.17	2/3"	C
	TCHR-05-65I	0.5X	65	11.2	0.03	8.3	2600	0.02	0.17	2/3"	C
	TCHR-08-65 / C	0.8X	65	6.7	0.05	8	1000	0.02	0.134	2/3"	C
	TCHR-10-65 / C	1.0X	65	6.7	0.05	10	800	0.022	0.16	2/3"	C
	TCHR-15-65 / C	1.5X	65	4.8	0.07	10.7	380	0.022	0.07	1/2"	C
	TCHR-20-65 / C	2.0X	65	4.5	0.074	13.4	268	0.05	0.03	2/3"	C
	TCHR-24-65 / C	2.4X	63.6	4.8	0.07	17.2	239	0.015	0.1	2/3"	C
	TCHR-30-65 / C	3.0X	65	4.04	0.083	18	120	0.02	0.14	1/2"	C
	TCHR-40-65 / C	4.0X	65	3	0.11	18.18	90	0.05	0.03	2/3"	C
	TCHR-60-65 / C	6.0X	65	3	0.11	27.2	61	0.05	0.03	2/3"	C
	TCHR-100-65 / C	10.0X	65	2.2	0.15	33.3	27	0.01	0.14	1/2"	C
	TCHR-120-65 / C	12.0X	65	2.1	0.161	37.3	21	0.004	0.1	1/2"	C

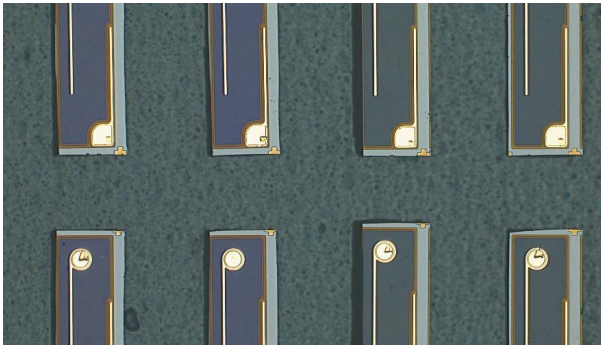
I = Manual Iris, C = Coaxial, IC = Both / D.O.F Calculation: Permissible of circle of confusion : 40μm

Telecentric Lenses

TCHR Series (WD: 110mm)

	Mag.	WD	Res. (Obj.)	NA	F No.	D.O.F. (μ m)	Telecentricity (<degree)	Optical Distort. (%)	CCD size (max.)	Mount
TCHR-035-110-S12/C	0.35X	110	21.1	0.016	11	4500	0.03	0.05	1/2"	C
TCHR-05-110-S13 / C	0.5X	110	11.2	0.03	8.3	2600	0.03	0.02	1/3"	C
TCHR-05-110 / C	0.5X	110	14.9	0.0225	11.1	3500	0.02	0.15	2/3"	C
TCHR-08-110 / C	0.8X	110	11.2	0.03	13.2	1650	0.017	0.15	2/3"	C
TCHR-10-110 / C	1.0X	110	6.7	0.05	10	800	0.03	0.15	2/3"	C
TCHR-15-110 / C	1.5X	110	7.0	0.048	15.6	555	0.01	0.15	2/3"	C
TCHR-15-110-S12 / C	1.5X	110	5.6	0.06	12.5	444	0.02	0.06	1/2"	C
TCHR-20-110 / C	2.0X	110	4.4	0.077	13	260	0.02	0.03	2/3"	C
TCHR-30-110 / C	3.0X	110	3.7	0.09	10.6	148	0.02	0.11	2/3"	C
TCHR-40-110 / C	4.0X	110	3.72	0.09	22.2	111	0.05	0.03	2/3"	C
TCHR-40-110I	4.0X	110	3.72	0.09	22.2	111	0.05	0.03	2/3"	C
TCHR-60-110 / C	6.0X	110	3.72	0.09	33.4	74	0.05	0.03	2/3"	C
TCHR-80-110 / C	8.0X	110	3.72	0.09	44.4	56	0.05	0.19	2/3"	C

I = Manual Iris, C = Coaxial, IC = Both / D.O.F Calculation: Permissible of circle of confusion : 40 μ m



TCHR Series (WD: 130mm-190mm)

	Mag.	WD	Res. (Obj.)	NA	F No.	D.O.F. (μ m/mm)	Telecentricity (<degree)	Optical Distort. (%)	CCD size (max.)	Mount
TCHR-0165-130I	0.165X	130	28.2	0.012	7.1	20.8mm	0.017	0.13	1/2"	C
TCHR-023-130I	0.23X	130	20	0.016	7.1	10.7mm	0.01	0.13	2/3"	C
TCHR-03-130I	0.3X	130	17.6	0.019	7.9	7000	0.04	0.08	2/3"	C
TCHR-035-130I	0.35X	130	14.1	0.0238	7.3	4800	0.035	0.08	1/2"	C
TCHR-10-190I	1.0X	190	6.7	0.05	10	360	0.035	0.08	1/2"	C

I = Manual Iris, C = Coaxial, IC = Both / D.O.F Calculation: Permissible of circle of confusion : 40 μ m

Telecentric Lenses

TCST Series

Telecentric lens is good for the measurement without magnification change through over the D.O.F. and also good for even illumination (telecentric lighting) via coaxial illumination.

We have several types of telecentric lenses like different working distance, magnification, CCD size & high resolution or standard resolution as follows.

- Fixed magnification lens
- Low optical distortion & good telecentricity
- High resolution and high contrast design
- Various W.D. & magnification
- Even coaxial illumination types

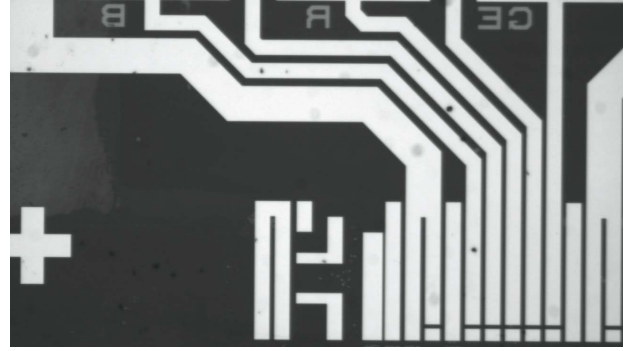
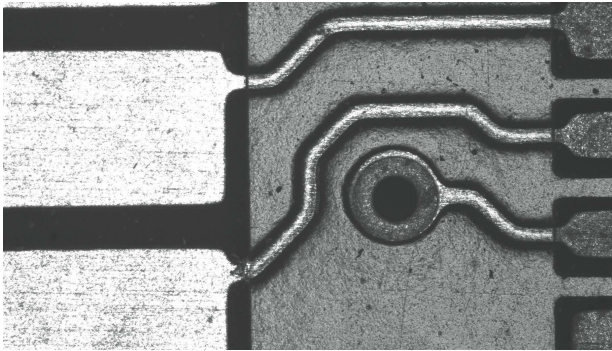


TCST Series (WD: 40mm)

	Mag.	WD	Res. (Obj.)	NA	F No.	D.O.F. (μm)	Telecentricity (<degree)	Optical Distort. (%)	CCD size (max.)	Mount
TCST-05-40 / C	0.5X	43	11.2	0.03	8.3	2600	0.03	0.08	1/2"	C
TCST-10-40 / C	1.0X	40	6.21	0.054	9.26	740	0.03	0.08	1/2"	C
TCST-15-40 / C	1.5X	40	5.32	0.063	11.9	423	0.03	0.25	1/2"	C
TCST-20-40 / C	2.0X	40	4.8	0.07	14.28	286	0.03	0.03	1/2"	C
TCST-30-40 / C	3.0X	40	4.8	0.07	21.5	191	0.02	0.26	1/2"	C
TCST-40-40 / C	4.0X	40	4.8	0.07	28.6	143	0.02	0.2	1/2"	C
TCST-50-40 / C	5.0X	40	4.2	0.08	31.25	100	0.02	0.05	1/2"	C
TCST-60-40 / C	6.0X	40	4.2	0.08	37.4	83	0.02	0.02	1/2"	C
TCST-80-40 / C	8.0X	40	4.2	0.08	50	63	0.01	0.03	1/2"	C

I = Manual Iris, C = Coaxial, IC = Both / D.O.F Calculation: Permissible of circle of confusion : 40μm

Telecentric Lenses



TCST Series (WD: 65mm)

	Mag.	WD	Res. (Obj.)	NA	F No.	D.O.F. (μm)	Telecentricity (<degree)	Optical Distort. (%)	CCD size (max.)	Mount
TCST-05-65 / C	0.5X	65	20.2	0.017	15.0	4800	0.03	0.04	1/2"	C
TCST-08-65 / C	0.8X	65	12.4	0.027	14.8	1850	0.03	0.03	1/2"	C
TCST-10-65 / C	1.0X	65	12.4	0.027	18.5	1450	0.03	0.03	1/2"	C
TCST-15-65 / C	1.5X	65	7	0.048	15.6	554	0.05	0.06	1/2"	C
TCST-20-65 / C	2.0X	65	5.2	0.065	15.4	308	0.02	0.03	1/2"	C
TCST-30-65 / C	3.0X	65	4.8	0.07	21.5	191	0.02	0.16	1/2"	C
TCST-40-65 / C	4.0X	66	4.4	0.076	26.3	132	0.04	0.03	1/2"	C
TCST-50-65 / C	5.0X	65.5	4.4	0.076	32.9	105	0.04	0.05	1/2"	C
TCST-60-65 / C	6.0X	65.3	4.4	0.076	39.5	88	0.04	0.06	1/2"	C
TCST-80-65 / C	8.0X	64.9	4.4	0.076	52.6	66	0.05	0.05	1/2"	C

I = Manual Iris, C = Coaxial, IC = Both / D.O.F Calculation: Permissible of circle of confusion : 40μm

TCST Series (WD: 110mm)

NEW

	Mag.	WD	Res. (Obj.)	NA	F No.	D.O.F. (μm)	Telecentricity (<degree)	Optical Distort. (%)	CCD size (max.)	Mount
TCST-05-110 / C	0.5X	110	20.21	0.0166	15	4800	0.05	0.05	1/2"	C
TCST-08-110 / C	0.8X	110	12.4	0.027	14.8	1850	0.05	0.05	1/2"	C
TCST-08-110I	0.8X	110	12.4	0.027	14.8	1850	0.05	0.05	1/2"	C
TCST-10-113 / C	1.0X	113	14	0.024	20.8	1660	0.02	0.023	1/2"	C
TCST-12-110-S13 / C	1.0X	110	10.16	0.033	18	1000	0.03	0.03	1/3"(6mm)	C
TCST-20-110 / C	2.0X	110	7.4	0.045	22.2	444	0.02	0.02	1/2"	C
TCST-24-110 / C	2.4X	107	7.4	0.045	26.7	370	0.02	0.07	1/2"	C
TCST-30-110 / C	3.0X	110	6.1	0.055	27.3	243	0.01	0.14	1/2"	C
TCST-40-110 / C	4.0X	110	5.6	0.06	33.45	167	0.01	0.16	1/2"	C
TCST-50-110 / C	5.0X	110	5.6	0.06	41.77	134	0.01	0.14	1/2"	C
TCST-60-110 / C	6.0X	110	5.6	0.06	50	111	0.01	0.1	1/2"	C
TCST-80-110 / C	8.0X	110	5.6	0.06	66.7	85	0.015	0.25	1/2"	C

I = Manual Iris, C = Coaxial, IC = Both / D.O.F Calculation: Permissible of circle of confusion : 40μm

Telecentric Lenses

TCST Long WD Series

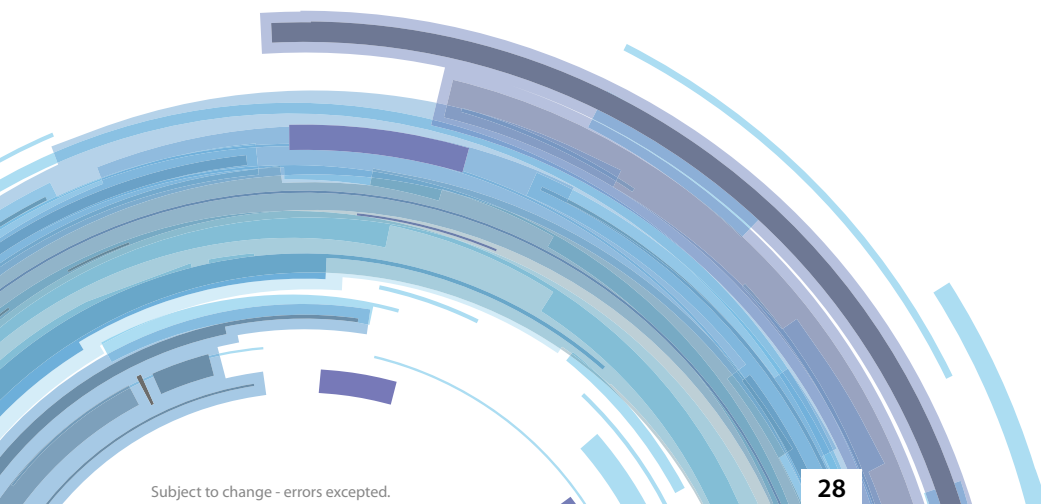
- Long working distance telecentric lenses. (up to 400mm)
- Good for the alignment application where long W.D is requested.
- 4 types of W.D (150, 220, 300, 400mm)
- Even-coaxial illumination on the whole area.
- High Resolution & low distortion



TCST Series (WD: 150-170mm)

	Mag.	WD	Res. (Obj.)	NA	F No.	D.O.F. (μm)	Telecentricity (<degree)	Optical Distort. (%)	CCD size (max.)	Mount
TCST-08-173 / C	0.8X	173	11.2	0.03	13.3	1660	0.04	0.07	1/2"	C
TCST-10-156 / C	1.0X	156	8.8	0.038	13.1	1000	0.04	0.07	1/2"	C
TCST-12-173 / C	1.2X	173	11.2	0.03	20	1110	0.04	0.13	1/2"	C
TCST-15-156 / C	1.5X	156	8.83	0.038	19.7	700	0.04	0.16	1/2"	C
TCST-16-173 / C	1.6X	173	11.2	0.03	26.7	834	0.04	0.18	1/2"	C
TCST-20-156 / C	2.0X	156	8.83	0.038	26.3	526	0.04	0.19	1/2"	C

I = Manual Iris, C = Coaxial, IC = Both / D.O.F Calculation: Permissible of circle of confusion : 40μm



Telecentric Lenses

TCST Series (WD: 200-250mm)

	Mag.	WD	Res. (Obj.)	NA	F No.	D.O.F. (μm)	Telecentricity (<degree)	Optical Distort. (%)	CCD size (max.)	Mount
TCST-075-220 / C	0.75X	220	8.9	0.0375	10	1400	0.03	0.08	1/2"	C
TCST-075-220-S23 / C	0.75X	220	9.1	0.037	10	1400	0.03	0.02	2/3"	C
TCST-10-220 / C	1.0X	220	7.4	0.045	11	880	0.03	0.01	2/3"	C
TCST-10-250-S118 / C	1.0X	250	7.45	0.045	11	484	0.03	0.081	1/1.8"	C
TCST-15-220-S12 / C	1.5X	220	7.45	0.045	16.6	590	0.03	0.13	1/2"	C
TCST-15-200 / C	1.5X	200	5	0.067	11.2	398	0.03	0.08	2/3"	C
TCST-20-200 / C	2.0X	200	4.2	0.08	12.5	250	0.03	0.02	1/2"	C
TCST-30-200 / C	3.0X	200	4.2	0.08	18.7	166	0.02	0.1	1/2"	C
TCST-40-200 / C	4.0X	200	4.19	0.08	25	125	0.015	0.13	1/2"	C

I = Manual Iris, C = Coaxial, IC = Both / D.O.F Calculation: Permissible of circle of confusion : 40μm



TCST Series (WD: 300mm)

	Mag.	WD	Res. (Obj.)	NA	F No.	D.O.F. (μm)	Telecentricity (<degree)	Optical Distort. (%)	CCD size (max.)	Mount
TCST-08-320 / C	0.8X	320	11.98	0.028	14.0	1750	0.03	0.03	1/2"	C
TCST-10-300 / C	1.0X	300	9.6	0.035	14.2	1100	0.02	0.03	1/2"	C
TCST-10-340 / C	1.0X	340	38.56	0.04	12.5	1000	0.03	0.04	1/2"	C
TCST-15-300 / C	1.5X	300	9.6	0.035	21.4	762	0.02	0.13	1/2"	C
TCST-20-300 / C	2.0X	300	9.6	0.035	28.5	571	0.01	0.17	1/2"	C

I = Manual Iris, C = Coaxial, IC = Both / D.O.F Calculation: Permissible of circle of confusion : 40μm



TCST Series (WD: 400mm)

	Mag.	WD	Res. (Obj.)	NA	F No.	D.O.F. (μm)	Telecentricity (<degree)	Optical Distort. (%)	CCD size (max.)	Mount
TCST-05-400 / C	0.5X	402	12.9	0.026	9.6	3.07mm	0.03	0.05	1/2"	C

I = Manual Iris, C = Coaxial, IC = Both / D.O.F Calculation: Permissible of circle of confusion : 40μm

Telecentric Lenses

Telecentric Zoom Lenses

Features

- Telecentricity at any magnification
- Suitable for high resolution megapixel cameras
- Magnification can be converted from 0.25x to 2.6x by using front converter
- Less shading and keeps uniformity of intensity
- TV distortion less than 0.01%



	Mag.	WD	Depth of Field	Resolution	NA	CCD	Mount
TZ0510	0.5x-1.0x	174mm-114mm	1.20mm-0.47mm	12.5μm-9.8μm	0.066-0.085	2/3"	C
TZ0513	0.5x-1.3x	173mm-97mm	1.84mm-0.52mm	8μm-6.4μm	0.044-0.059	2/3"	C

Values when the converter is attached to TZ0513:

	Mag.	WD	Application
FC02510	0.25x-1.0x	323.2mm-115.6mm	Front converter for TZ0513
FC1426	1.4x-2.6x	56.2mm-42.6mm	Front converter for TZ0513

Depth of field is calculated assuming a horizontal 320 TV resolution using 1/2" CCD camera (permissible circle of confusion, 40μ)

TL4K Series 4K Line CCD's Telecentric Lens

- We have several telecentric lenses for 4K line CCD camera.(7μm/Pixel)
- High accuracy lens for 4K line CCD camera.
- Very good telecentricity and high contrast image.
- Low distortion over the whole field of view.
- IRIS diaphragm for adjusting D.O.F.
- Object-side telecentric lens



	Mag.	WD	Res. (Obj.)	NA	F No.	D.O.F. (μm)	Telecentricity (<degree)	Optical Distort. (%)	CCD size (max.)	Mount
TL4K-05-237I	0.5X	237	8.4	0.04	6.25	700	0.02	0.08	4K(7μm)	F
TL4K-07-130I	0.7X	130	5.1	0.066	5.3	303	0.04	0.05	4K(7μm)	F
TL4K-077-140I	0.77X	140	7	0.0477	8	544	0.03	0.06	4K(10μm)	M72
TL4K-092-170I	0.92X	170	5.2	0.064	7.14	250	0.01	0.03	4K(7μm)	F
TL4K-10-138I	1.0X	138	6.1	0.055	9.1	364	0.04	0.02	4K(10μm)	F
TL4K-20-102	2.0X	102	3.7	0.09	11.1	111	0.03	0.07	4K(10μm)	F

I = Manual Iris, C = Coaxial, IC = Both / Possible to change mount

Telecentric Linescan Lenses

TL8K Series 8K Line CCD's Telecentric Lens

- High accuracy lens for 8K line CCD camera.
- Very good telecentricity and high contrast image.
- Low distortion over the whole field of view.
- Uniform coaxial illumination with LED coaxial guide.
 - Provides easy alignment with CCD camera and illumination.
 - Inner coaxial illumination, not external coaxial illumination.
- Good for 8K TDI & general line CCD



	Mag.	WD	Res. (Obj.)	NA	F No.	D.O.F. (μm)	Telecentricity (<degree)	Optical Distort. (%)	CCD size (max.)	Mount
TL8K-0467-278 / C	0.467X	278	12	0.028	8	1000	0.04	0.03	8K(7μm)	M72

TL12K Series 12K Line CCD's Telecentric Lenses



- High resolution & High contrast optical design.
- Can be applied from 8K to 12K line CCD.
- Almost perfect telecentric design. (telecentricity: < 0.04 degree)
- Low distortion over the whole field of view.
- Support upto 5μm/pixel (12K Line CCD)
- Uniform coaxial illumination with LED coaxial guide.
 - Provides easy alignment with CCD camera and illumination.
 - Inner coaxial illumination, not external coaxial illumination.

	Mag.	WD	Res. (Obj.)	NA	F No.	D.O.F. (μm)	Telecentricity (<degree)	Optical Distort. (%)	CCD size (max.)	Mount
TL12K-064-170I	0.64X	170	8.4	0.04	8	390	0.04	0.06	12K(5μm)	M72
TL12K-07-117I	0.7X	117	7.7	0.044	8	326	0.04	0.07	12K(5μm)	M72
TL12K-07-145 / C	0.7X	145	10.16	0.033	10.6	450	0.04	0.03	12K(5μm)	M72
TL12K-087-137I	0.87X	137	6.5	0.052	8.3	219	0.04	0.07	12K(5μm)	M72
TL12K-10-122 / C	1.0X	122	6.7	0.05	10	200	0.04	0.02	12K(5μm)	M72
TL12K-20-107I	2.0X	107	3.9	0.085	11.8	59	0.04	0.03	12K(5μm)	M72
TL12K-35-78 / C	3.5X	78	3.05	0.11	15.9	25.9	0.04	0.05	12K(5μm)	M72
TL12K-50-78/C	5.0X	78	2.58	0.13	19.2	15.2	0.04	0.08	12K(5μm)	M72
TL12K-70-15 / C	7.0X	15	1.5	0.23	15.2	62	0.03	0.32	12K(5μm)	M72
TL12K-100-13/C	10.0X	13.5	1.68	0.2	25	5	0.04	0.02	12K(5μm)	M72

Linescan Lenses

Line Scan Lenses for Wide Field of View

Our large format lens series has been specifically designed for the line-scan and large area sensor market. Covering up to 62mm sensors, these low distortion lenses are ready for challenging applications.

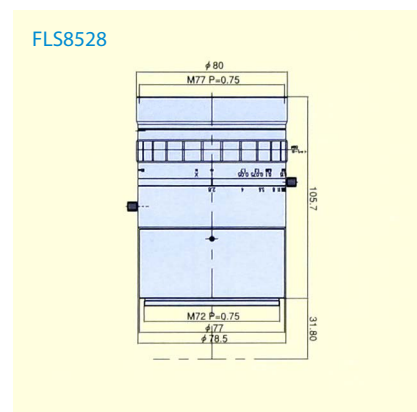
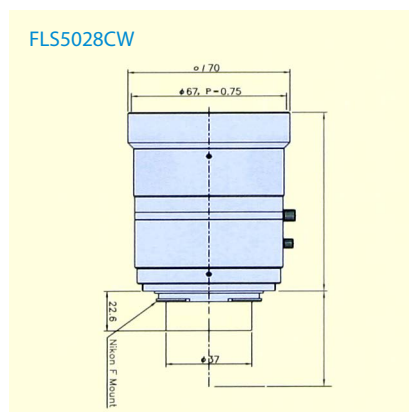
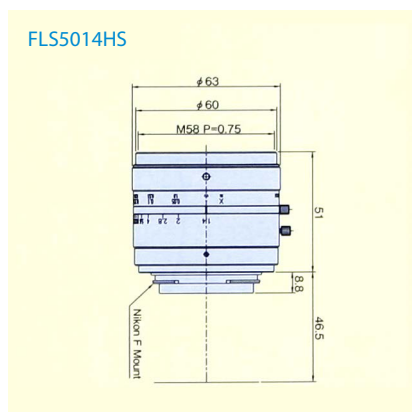
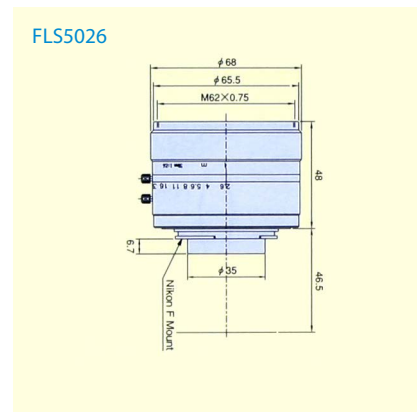
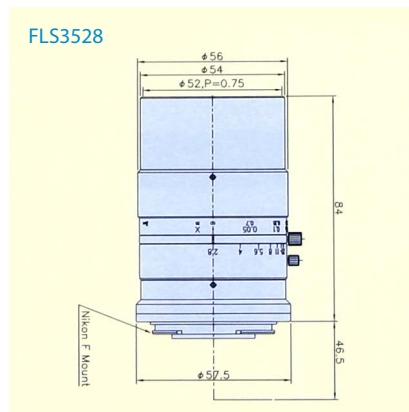
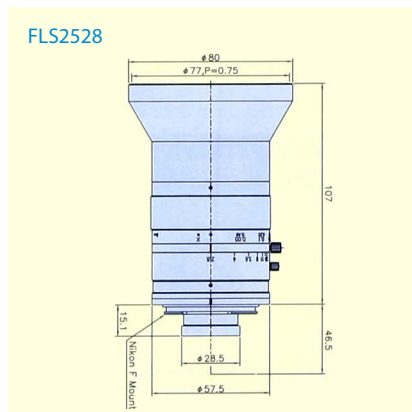
Features:

- Working distance and magnification are adjustable
- Suitable for long working distance
- Designed for machine vision application
- FLS8528 is compatible with M72 mount
- Suitable for various applications such as printing, PC, glass, textile etc..



	F No.	Focal length	Range of WD	Magnification	Distortion	Max. comp. CCD	Mount
FLS2528	2.8	25mm	140mm ~ ∞	0.15x	0.66%	Ø 44mm	F
FLS3528	2.8	35mm	230mm ~ ∞	0.15x	-0.31%	Ø 44mm	F
FLS5026	2.6	50mm	0.32m ~ ∞	0.18x	0.23%	Ø 45mm	F
FLS5014HS	1.4	50mm	0.27m ~ ∞	0.2x	0.17%	Ø 45mm	F
FLS5028CW	2.8	50mm	190mm ~ ∞	0.3x	-0.40%	Ø 44mm	F
FLS8528	2.8	85mm	0.46m ~ ∞	0.2x	0.04%	Ø 62mm	F or M72

Indicated specifications are design values



Linescan Lenses

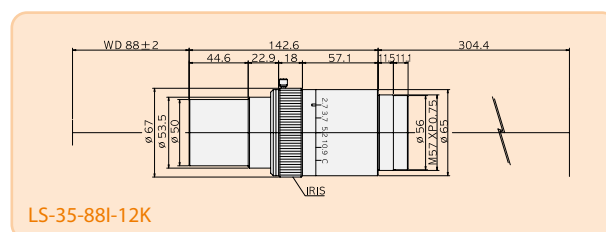
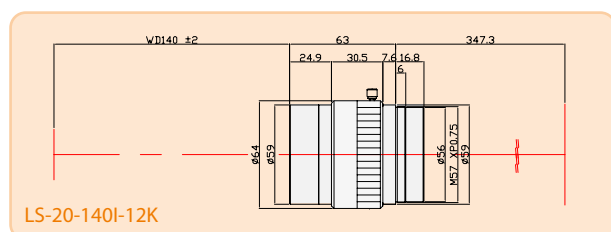
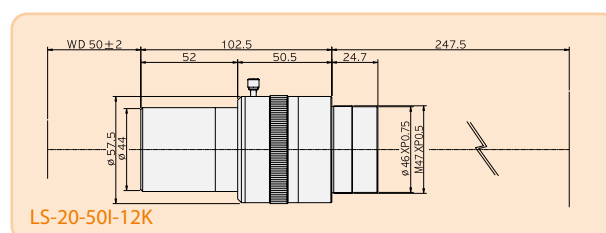
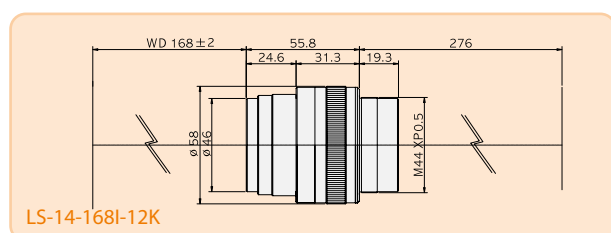
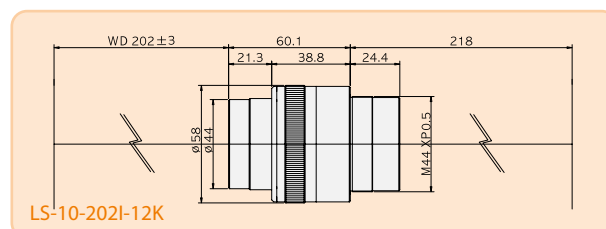
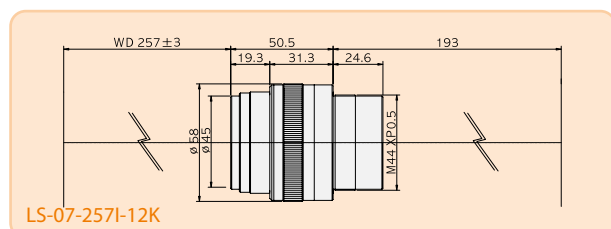
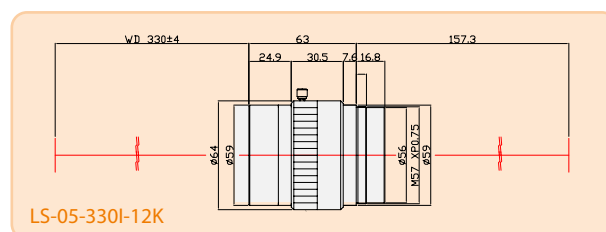
LS-12K Series: Line Scan Lenses for 8K to 12K line CCD

WD 50 mm - 320 mm

	Mag.	WD	D.O.F	Res. (Obj.)	NA	CCD size	F No.	Optical Distortion (%)	Mount
LS-05-330I-12K	0.5X	330 mm	512	8.6 μm	0.039	12k (5u)	6.4	0.08	M57
LS-07-257I-12K	0.7X	257 mm	408	9.6 μm	0.035	12k (5u)	10	0.01	M47
LS-10-202I-12K	1.0X	202 mm	100	6.7 μm	0.05	12k (5u)	10	0.04	M47
LS-14-168I-12K	1.4X	168 mm	113	5.4 μm	0.063	12k (5u)	11.1	0.02	M47
LS-20-50I-12K	2.0X	50 mm	45	3.1 μm	0.11	12k (5u)	9.1	0.03	M47
LS-20-140I-12K	2.0X	140 mm	64	4.3 μm	0.078	12k (5u)	12.8	0.03	M57
LS-35-88I-12K	3.5X	88 mm	41	2.4 μm	0.14	12k (5u)	12.5	0.05	M47

Possible to change mount

- High resolution & high contrast optical design
- Can be applied from 8K to 12K line CCD
- Low distortion for excellent image quality
- Large image circle up to 61.4mm(12K @ 5um)
- Magnification varies from 0.5X to 3.5X

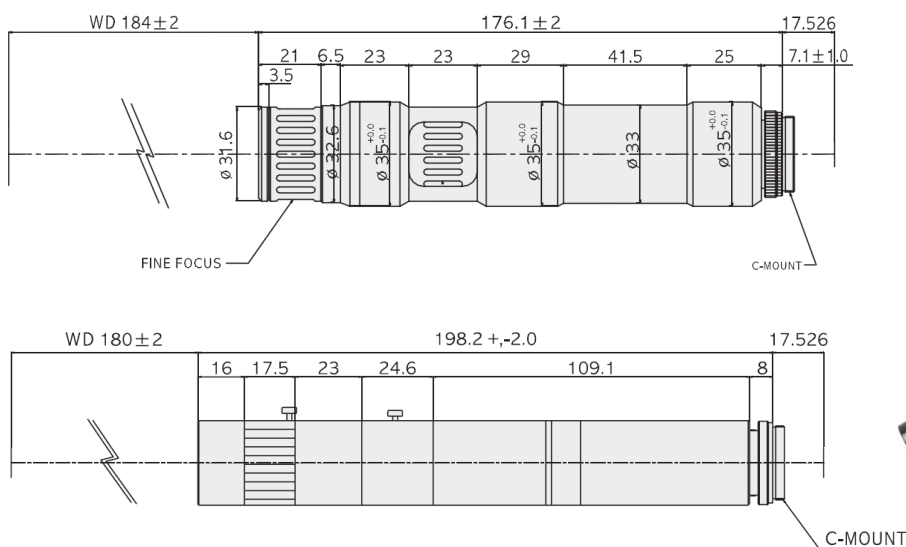


Macro Zoom Lenses

Macro Zoom Lenses

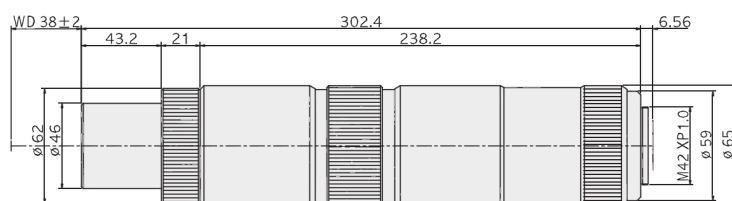
	Mag.	WD	Resolution (μm)	NA	F/#	D.O.F. (μm)	Optical Distort. (%)	CCD size (max.)	Mount
MZC0515	0.5X	184	11.25	0.0298	8.3	2600	0.2	1/2"	C
	1.5X	184	6.7	0.05	15	533	0.15	1/2"	
MZC0530S12	0.5X	180	21	0.016	15.6	4990	0.6	1/2"	C
	3.0X	180	7.8	0.043	34.9	310	0.2	1/2"	
MZC0530S13	0.5X	180	18.6	0.018	13.9	4450	0.25	1/3"	C
	3.0X	180	7	0.048	31.3	278	0.14	1/3"	

- This zoom lens has high resolution to get high contrast image compared to the general zoom lens.
- Magnification ranges: 0.5 ~ 1.5X, 0.5X ~ 3.0X
- W.D: 184mm, 180mm. Support upto 1/2" or 1/3" CCD camera
- Fine focus adjustment



	Mag.	WD	Resolution (μm)	NA	F/#	D.O.F. (μm)	Optical Distort. (%)	CCD size (max.)	Mount
MZ3050	3.0X	38	3.6	0.093	16.1	93.6	0.046	2K(13u)	M42
	4.0X	38	2.92	0.115	17.4	56.5	0.032	2K(13u)	
	5.1X	38	2.6	0.13	19.6	39.1	0.044	2K(13u)	

- This zoom lens is designed specially for large CCD cameras like 2K Line CCD, 4M CCD cameras, etc
- This lens also has the high resolution and low distortion for over full range of magnification
- IRIS diaphragm adapted 26mm diagonal



Macro Zoom Lenses

Macro Lenses

These series are non-telecentric lenses for machine vision applications like factory automation.

For many types of CCD cameras like 1/2", 2/3", 2M, 4M, 5M, 8M, 12M & 15M, with high resolution and low distortion quality.

Features:

- Various working distance and magnification
- Fixed magnification (can be modified to another magnification)
- Mount: C-mount, F-mount & M48-P0.75
- IRIS diaphragm adapted (some lenses)



Standard

	Mag.	WD	Res. (Obj.)	NA	F No.	D.O.F. (μm)	Optical Distort. (%)	CCD size (max.)	Mount
MCST-034-120	0.34X	120	15.80	0.0212	8.00	5500	0.07	1/2"	C
MCST-053-110	0.53X	110	11.18	0.0300	9.00	2560	0.06	1/2"	C
MCST-06-117	0.6X	117	9.30	0.0360	8.30	1800	0.02	1/2"	C
MCST-06-120	0.6X	120	9.30	0.0360	8.30	1800	0.04	1/2"	C
MCST-08-100	0.8X	100	8.20	0.0410	9.70	1200	0.03	1/2"	C
MCST-12-100	1.2X	100	7.80	0.0430	13.90	772	0.03	1/2"	C
MCST-20-100	2.0X	100	7.10	0.0470	21.20	424	0.04	1/2"	C
MCST-40-92	4.0X	92	6.10	0.0550	36.40	180	0.01	1/2"	C
MCHR-019-240	0.19X	240	28.00	0.0120	7.77	17 mm	0.13	2/3"	C
MCHR-03-240	0.3X	240	17.66	0.0190	7.80	6900	0.135	2/3"	C
MCHR-057-200	0.57X	200	11.57	0.0290	10.00	2460	0.04	2/3"	C

D.O.F Calculation: Permissible of circle of confusion : 40μm

For 2 Megapixel sensors

	Mag.	WD	Res. (Obj.)	NA	F No.	D.O.F. (μm)	Opt. Distort. (%)	CCD size (max.)	Mount
MCHR-0198-185	0.198X	185	21.20	0.0158	6.25	9570	0.06	1/1.8"	C
MC2M-025-194I	0.25X	194	8.50	0.0395	3.16	3030	0.01	2M	C
MC2M-047-176	0.47X	176	10.17	0.0330	7.14	1900	0.28	2M	C
MC2M-055-164	0.55X	164	9.80	0.0342	8.10	2100	0.06	2M	C
MC2M-05-253	0.5X	253	11.18	0.0300	8.33	2000	0.06	2M	C
MC2M-075-164	0.75X	164	8.90	0.0376	10.00	1070	0.06	2M	C

D.O.F Calculation: Permissible of circle of confusion : 30μm

Macro Lenses



For 4 Megapixel sensors

	Mag.	WD	Res. (Obj.)	NA	F No.	D.O.F. (μm)	Opt. Distort. (%)	CCD size (max.)	Mount
MC4M-0185-225I	0.185X	225	18.10	0.0185	5.00	8770	0.01	4M	C
MC4M-0215-226I	0.215X	226	20.00	0.0170	6.25	8120	0.01	4M	C
MF4M-0247-267	0.247X	267	13.60	0.0247	5.00	4900	0.01	4M	F
MC4M-025-194I	0.25X	194	14.80	0.0230	5.50	5280	0.01	4M	C
MF4M-037-261	0.37X	261	9.10	0.0370	5.00	2190	0.01	4M	F
MF4M-055-210	0.55X	210	10.20	0.0330	8.30	1650	0.04	4M	F
MF4M-075-193	0.75X	193	8.90	0.0376	10.00	1060	0.06	4M	F
MC4M-015-255I	0.15X	255	29.8	0.01125	6.7	17.87mm	0.08	4M	C
MF4M-0296-267	0.296X	267	12	0.028	5.3	3600	0.01	4M	F
MC4M-03-170I	0.3X	170	17.2	0.02	7.7	5130	0.06	4M	C
MF4M-043-261	0.43X	261	7.8	0.043	5	1620	0.01	4M	F
MF4M-063-310I	0.63X	310	6.9	0.0485	6.5	983	0.08	4M	F
MF4M-074-247	0.74X	247	6.5	0.0518	7.1	778	0.06	4M	F

D.O.F. Calculation: Permissible of circle of confusion : 30μm

For 5 Megapixel sensors

	Mag.	WD	Res. (Obj.)	NA	F No.	D.O.F. (μm)	Opt. Distort. (%)	CCD size (max.)	Mount
MC5M-019-240	0.19X	240	17.70	0.0190	5.00	5500	0.03	2/3"	C
MC5M-0257-185	0.257X	185	16.80	0.0200	6.25	3800	0.01	2/3"	C

D.O.F. Calculation: Permissible of circle of confusion : 20μm

For 8 Megapixel sensors

	Mag.	WD	Res. (Obj.)	NA	F No.	D.O.F. (μm)	Opt. Distort. (%)	CCD size (max.)	Mount
MF8M-0247-267	0.247X	267	13.6	0.0247	5.0	3600	0.01	8M (23mm)	F
MF8M-0296-267	0.296X	267	12	0.028	5.3	2700	0.01	8M (23mm)	F
MF8M-035-300	0.35X	300	9.6	0.035	5.0	1800	0.08	8M (23mm)	F
MF8M-037-261	0.37X	261	9.1	0.037	5.0	1600	0.01	8M (23mm)	F
MF8M-043-261	0.43X	261	7.8	0.043	5.0	1200	0.01	8M (23mm)	F
MF8M-05-300	0.5X	300	6.7	0.05	5.0	880	0.08	8M (23mm)	F
MF8M-055-210	0.55X	210	10.2	0.033	8.3	1200	0.04	8M (23mm)	F
MF8M-063-310I	0.63X	310	6.9	0.0485	6.5	720	0.08	8M (23mm)	F
MF8M-074-247	0.74X	247	6.5	0.0518	7.1	574	0.06	8M (23mm)	F
MF8M-075-193	0.75X	193	8.9	0.0376	10	780	0.005	8M (23mm)	F
MF8M-08-260	0.8X	260	5.9	0.0568	7.0	484	0.05	8M (23mm)	F

D.O.F. Calculation: Permissible of circle of confusion : 20μm

For 12 Megapixel sensors

	Mag.	WD	Res. (Obj.)	NA	F No.	D.O.F. (μm)	Opt. Distort. (%)	CCD size (max.)	Mount
MD12M-054-235I	0.54X	235	7.80	0.0430	6.25	1280	0.05	12M	M48

D.O.F. Calculation: Permissible of circle of confusion : 30μm

For 15 Megapixel sensors

	Mag.	WD	Res. (Obj.)	NA	F No.	D.O.F. (μm)	Opt. Distort. (%)	CCD size (max.)	Mount
MF15M-042-300	0.42X	300	8.6	0.039	5.37	1200	0.08	15M	F
MF15M-0789-260	0.789X	260	5.95	0.056	7	674	0.06	15M	F

D.O.F. Calculation: Permissible of circle of confusion : 20μm

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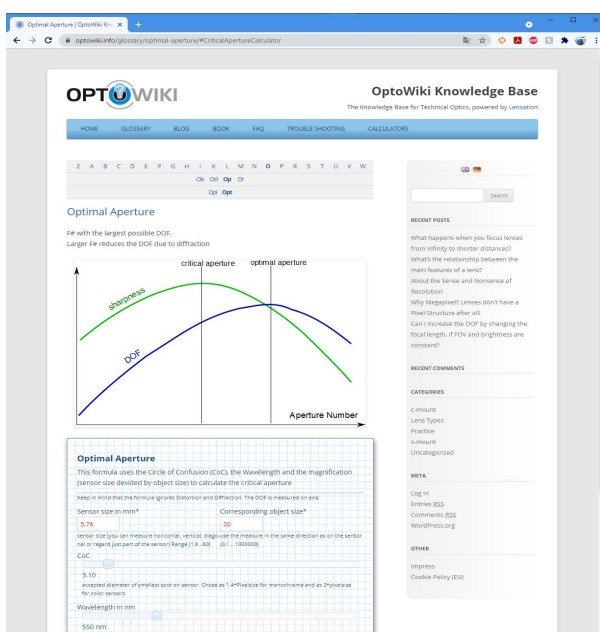
E-Mail: info@piezolution.com



- Linear Motors
- Driver Boards
- Linear Stages
- OEM Design
- Consulting

Did you already know optowiki.info?

You will find many interesting questions about optics ...and surprising answers!



Q: Can s-mount lenses be as good as c-mount lenses?

A: *Even better!*
Although there is a natural limit on the quality of s-mount lenses, some of them provide a quality not found in the c-mount area, or only for dramatically higher prices.

Q: Why is the camera image totally blurred!?

A: ...not just 'something' out of focus!? It could be that you are using a CS-mount lens on a C-mount camera. At cs-mount cameras it is about 5mm less from the leading edge of the

• Interactive graphics

• Online calculators

• Optics glossary

• Trouble shooting

Coaxial LED Illumination

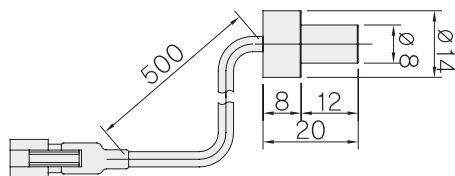
LED illumination is more popular in machine vision application instead of Halogen source by means of the life time and compact size. The brightness of LED is increasing so fast. Therefore most of application in machine vision illumination can be covered by LED illumination.

- Ultra high bright spot illumination
- Enough for coaxial illumination of most of the telecentric lens
- High contrast compared to halogen source
- Long lifetime and low power consumption
- Several illumination colors(R, G, B, White)
- 4 type's coaxial LED guide(5mm dia, 1W, 3W, 5W)

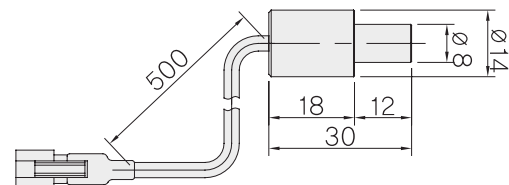
	Color	Power Consumption
LED-CX-5D	W,R,G,B	-
LED-CX-1W	W,R,G,B	1W
LED-CX-3W	W,R,G,B	3W
LED-CX-5W	W,R,G,B	5W
LED-SP-1W	W,R,G,B	1W
LED-SP-3W	W,R,G,B	3W



LED-CX-5D

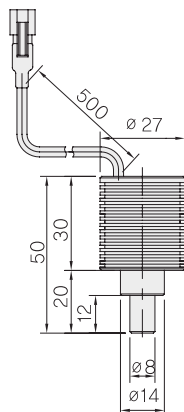


A type

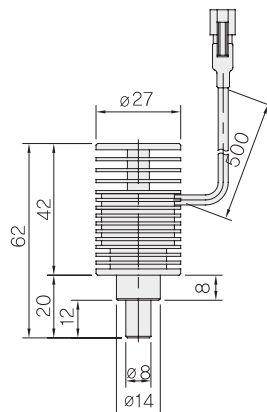


B type

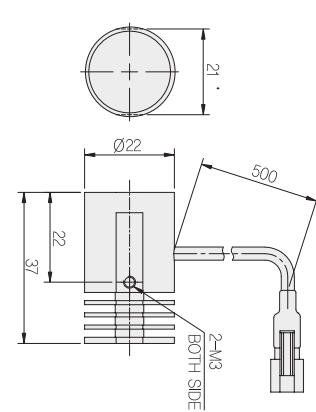
LED-CX-1W



LED-CX-3W/5W



LED-SP-1W/3W



Analog LED Controller

It can control the LED guide which is commonly used in machine vision.
It is constant current control type instead of voltage control.

- Basic channel: 2 up to 9channel
- Constant current control type optimized for LED lamp
- External 0~5 voltage to control the volume
- On/Off control by DC voltage (Ex, Off@ 5V)



	Channel	Output	Volume Control	Input Voltage	RC Connector
LED-CONT-2CA	2	700mA@5V or12V (max : 24W)	Volume control by front knob	AC 100 ~240V/50/60Hz	D-Sub. 15-pin (male)
LED-CONT-4CA	4	700mA@5V or12V (max : 50W)	Volume control by front knob	AC 100 ~240V/50/60Hz	D-Sub. 15-pin (male)
LED-CONT-9CA	9	1.2A @40V (max : 500W)	Volume control by front knob	AC 220V±15%	D-Sub. 15-pin (male)

Digital LED Controller

This controller is digital control type instead of analog via RS-232 communication to give customers convenient.

- Basic channel: 2 up to 8channel
- Constant current control type optimized for LED lamp
- Rs-232 communication control for volume
- I/O control for On/Off function
- Volume display on the front panel of thecontroller



	Channel	Output	Volume Control	Input Voltage	RC Connector
LED-CONT-2CD	2	700mA@5V or12V (max : 50W)	0-255 level by Jog Dial	AC 100 ~240V/50/60Hz	RS-232 D-Sub 15pin (male)
LED-CONT-4CD	4	700mA@5V or12V (max : 50W)	0-255 level by Jog Dial	AC 100 ~240V/50/60Hz	RS-232 D-Sub 15pin (male)
LED-CONT-8CD	8	700mA@5V or12V (max : 100W)	0-255 level by Jog Dial	AC 220V±15%	RS-232 D-Sub 15pin (male)

Optical Glossary

Resolution(μm)

Resolution is a measure of how closely spaced two points may be before they cannot be distinguished. For example, $1\mu\text{m}$ resolution means that two points that are $1\mu\text{m}$ 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) $\text{Wavelength } 0.61 \times \text{NA}$

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.

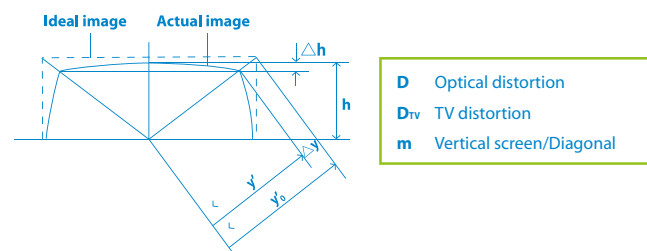
For example, 100 line/mm means that black and white pitch $1/100\text{mm}(10\mu)$ can be distinguished. The width of both the black and white lines is $1/200\text{mm}(5\mu)$.

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; $50 \times 6.4(\text{CCD width}) \times 2 = 640\text{TV}$

Distortion



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.

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

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. $F \text{ No} = f/D$

Effective F No

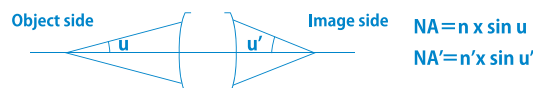
The value indicates a lens's brightness. It is calculated by dividing the lens's focal length by the lens's effective diameter(entrance pupil D mm) looking from object side. It can be also calculated by NA and Lens's optical magnification(). The smaller the number, the brighter the lens is. $\text{Effective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

Numerical aperture

The higher the NA, the greater the resolution and brightness are.

When the half angle from an image makes on exit pupil is u' and refractive index is n' , $n' \times \sin u'$ is called image side numerical aperture, NA' .

NAs in this catalog indicate object side numerical apertures.



$NA = M/2xF$, $NA' = 1/2xF$.
Relation of NA and NA' is $NA = NA' \times \text{Optical magnification}$ or $NA' = NA / \text{optical magnification}$.

MTF

It provides a graph analyzing a lens's 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 forth from the best focal point. Depth range of the object side is called depth of field.

$\text{Depth of field} = 2(\text{Permissible circle of confusion} \times \text{Effective F No} / \text{Magnification}^2)$

Depth of focus

Depth is the distance between the nearest and farthest points that appear in acceptably sharp focus when a CCD is shifted back and forth 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.

$\text{Angle of view} = 2 \times \tan^{-1} D / \text{Image size} = 2f / \text{Focal length}$

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.

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"

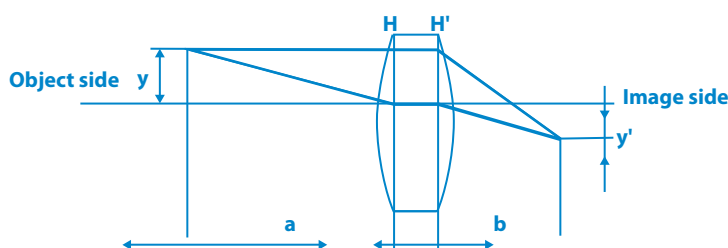
Vertical FOV $4.8 \div 0.5$ 9.6mm Horizontal FOV $6.4 \div 0.5$ 12.8mm

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 $15 \times 25.4 \div 8$ 47.6x

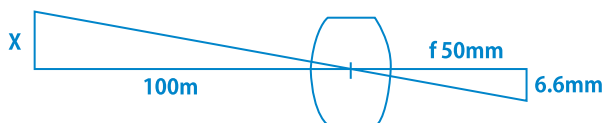
Monitor magnification 0.5×47.65 23.8x

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



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

Formula of Focal length

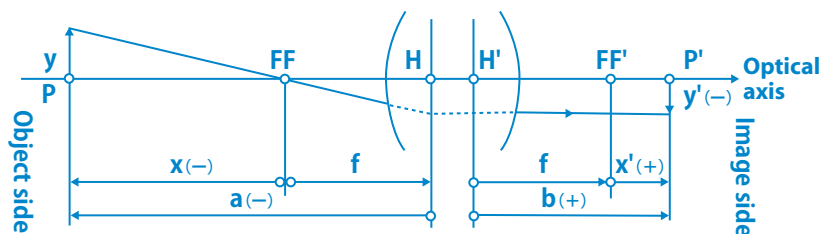
$$f = \frac{\text{Distance from lens to object} \times \text{Image size}}{\text{Height}}$$

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



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

Formula of conjugation relationship



Basics formula

$$-\frac{1}{a} + \frac{1}{b} = \frac{1}{f}$$

Object point distance

$$-a = \left(1 - \frac{1}{M}\right) \times f$$

Horizontal magnification

$$M = \frac{y'}{y} = \frac{b}{a}$$

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.

$$NA' = \frac{1}{2Fe}$$

$$NA' = \frac{1}{2(1-M)F}$$

$$NA = \frac{M}{2Fe}$$

$$NA = \frac{M}{2(1-M)F}$$

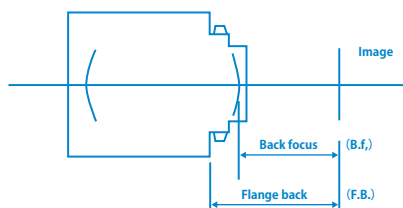
Camera mount and flange back

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

Field of View Table

M.M. = Monitor Magnification (14" monitor)

	1"		2/3"		1/2"		1/3"		1/4"	
	HxWxD	M.M.	HxWxD	M.M.	HxWxD	M.M.	HxWxD	M.M.	HxWxD	M.M.
0.1x	96x128x160	2.3x	66x88x110	3.3x	48x64x80	4.5x	36x48x60	6x	27x36x45	7.9x
0.2x	48x64x80	4.6x	33x44x55	6.6x	24x32x40	9x	18x24x30	12x	13.5x18x22.5	15.8x
0.3x	32x42.67x53.33	6.9x	22x29.33x36.67	9.9x	16x21.33x26.67	13.5x	12x16x20	18x	9x12x15	23.7x
0.4x	24x32x40	9.2x	16.5x22x27.5	13.2x	12x16x20	18x	9x12x15	24x	6.75x9x11.25	31.6x
0.5x	19.2x25.6x32	11.5x	13.2x17.6x22	16.5x	9.6x12.8x16	22.5x	7.2x9.6x12	30x	5.4x7.2x9	39.5x
0.6x	16x21.33x26.67	13.8x	11x14.67x18.33	19.8x	8x10.67x13.33	27x	6x8x10	36x	4.5x6x7.5	47.4x
0.7x	13.71x18.29x22.86	16.1x	9.43x12.57x15.71	23.1x	6.86x9.14x11.43	31.5x	5.14x6.86x8.57	42x	3.86x5.14x6.43	55.3x
0.8x	12x16x20	18.4x	8.25x11x13.75	26.4x	6x8x10	36x	4.5x6x7.5	48x	3.38x4.5x5.63	63.2x
0.9x	10.67x14.22x17.78	20.7x	7.33x9.78x12.22	29.7x	5.33x7.11x8.89	40.5x	4x5.33x6.67	54x	3x4x5	71.1x
1x	9.6x12.8x16.0	23x	6.6x8.8x11	33x	4.8x6.4x8.0	45x	3.6x4.8x6.0	60x	2.7x3.6x4.5	79x
2x	4.8x6.4x8.0	46x	3.3x4.4x5.5	66x	2.4x3.2x4.0	90x	1.8x2.4x3.0	120x	1.35x1.8x2.25	158x
3x	3.2x4.27x5.33	69x	2.2x2.93x3.67	99x	1.6x2.3x2.67	135x	1.2x1.6x2.0	180x	0.9x1.2x1.5	237x
4x	2.4x3.2x4.0	92x	1.65x2.2x2.75	132x	1.2x1.6x2.0	18x	0.9x1.2x1.5	240x	0.68x0.9x1.13	316x
5x	1.92x2.56x3.2	115x	1.32x1.76x2.2	165x	0.96x1.28x1.6	225x	0.72x0.96x1.2	300x	0.54x0.72x0.9	395x
6x	1.6x2.13x2.67	138x	1.1x1.47x1.83	198x	0.8x1.07x1.33	27x	0.6x0.8x1.0	360x	0.45x0.6x0.75	474x
7x	1.37x1.83x2.29	161x	0.94x1.26x1.57	231x	0.69x0.91x1.14	315x	0.51x0.69x0.86	420x	0.39x0.51x0.64	553x
8x	1.2x1.6x2.0	184x	0.83x1.1x1.38	264x	0.6x0.8x1.0	36x	0.45x0.6x0.75	480x	0.34x0.45x0.56	632x
9x	1.07x1.42x1.78	207x	0.73x0.98x1.22	297x	0.53x0.71x0.89	405x	0.4x0.53x0.67	540x	0.3x0.4x0.5	711x
10x	0.96x1.28x1.6	230x	0.66x0.88x1.1	330x	0.48x0.64x0.8	450x	0.36x0.48x0.6	600x	0.27x0.36x0.45	790x