



Macro lenses

2014

www.opto-engineering.com

Index

Macro lenses

Macro lenses are Opto Engineering's answer to the need for macro-based accurate imaging. While not suited to measurement applications - due to their non-telecentric nature which allows perspective bias - they can perform close-range inspections very effectively with impressive optical performance in terms of resolution and lack of distortion.

Like all Opto Engineering products, these optics are built to be deployed in a real-world environment: their compact form factor, flexible design, optical capabilities and excellent value make the Macro lenses an optimal component of a wide range of machine vision systems.

ACCESSORIES

Our Macro lenses family is complemented by a full set of accessories:



CLAMPING MECHANICS



RING LED ILLUMINATORS

Please refer to our website www.opto-engineering.com to browse our complete product range.

MC series

Zero distortion macro lenses

4

MC3-03X macro

Zero distortion multi-configuration macro lens

6

MC12K series

Macro lenses for 12 k and 16 k pixel linescan cameras

8

MC series

Zero distortion macro lenses



MC series is a family of macro lenses designed to capture images of small objects when both very good resolution and nearly zero distortion are needed. Small object fields of view are often observed by means of long focal length lenses equipped with an additional spacer, used to adjust the working distance.

Unfortunately, this approach leads to several problems like high image distortion, resolution loss (especially at the corners), poor depth of field and chromatic effects, thus making this method not suitable for good imaging neither compatible with accurate measurement requirements.

All of these problems can be overcome by using MC series, specifically designed for macro imaging. MC series lenses are compact and cost-effective optics providing very high image resolution. A very low optical distortion makes these lenses perfectly suitable for precise dimensional measurement applications.

KEY ADVANTAGES

Zero distortion

MC series are suitable for any measurement application where telecentricity is not required.

High resolution

MC series has been specifically designed to work in macro configuration.

Compactness

MC series small outer diameter (15 mm) fits those applications where only little room for optical components is available.

Example of applications





Part number	Mag. (x)	Image circle (mm)	Detector type					Optical specifications				Mechanical specifications			
			1/3"	1/2.5"	1/2"	1/1.8"	2/3" - 5 Mpx	W.D.	Distortion	F/N	Field depth	Mount	Length	Height	Diam.
			w x h (mm x mm)	w x h (mm x mm)	w x h (mm x mm)	w x h (mm x mm)	w x h (mm x mm)	(mm)	(%)		(mm)		(mm)	(mm)	(mm)
Object field of view (mm x mm)															
MC300X	3	11.0	1.60 x 1.20	1.90 x 1.43	2.13 x 1.60	2.38 x 1.79	2.82 x 2.36	29	< 0.01	20	0.15	C	106.5	30.0	15
MC200X	2	11.0	2.40 x 1.80	2.85 x 2.14	3.20 x 2.40	3.56 x 2.68	4.22 x 3.53	33	< 0.01	16	0.25	C	78.1	30.0	15
MC150X	1.5	11.0	3.20 x 2.40	3.80 x 2.85	4.27 x 3.20	4.75 x 3.58	5.63 x 4.71	38	< 0.01	13	0.35	C	63.9	30.0	15
MC100X	1	11.0	4.80 x 3.60	5.70 x 4.28	6.40 x 4.80	7.13 x 5.37	8.45 x 7.07	47	< 0.01	10	0.6	C	49.9	30.0	15
MC075X	0.75	11.0	6.40 x 4.80	7.60 x 5.70	8.53 x 6.40	9.50 x 7.16	11.3 x 9.42	58	< 0.02	9	1.1	C	42.8	30.0	15
MC050X	0.50	11.0	9.60 x 7.20	11.4 x 8.55	12.8 x 9.60	14.3 x 10.7	16.9 x 14.1	75	< 0.02	8	2.1	C	35.7	30.0	15
MC033X	0.333	11.0	14.4 x 10.8	17.1 x 12.8	19.2 x 14.4	21.4 x 16.1	25.4 x 21.2	102	< 0.05	7	3.7	C	31.0	30.0	15

MC3-03X macro

Zero distortion multi-configuration macro lens



KEY ADVANTAGES

Wide range of magnifications

MC3-03X is suitable for the inspection of many different object sizes with different detector options.

Nearly zero distortion

Less than 0.05% distortion, at any magnification, makes this lens a perfect choice for measurement applications.

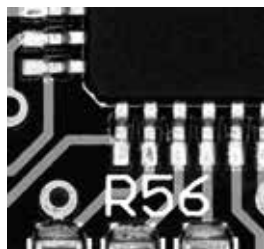
Perfect optical parameters mix

Changing the magnification also changes the lens working F-number in such a way that resolution and distortion remain properly combined.

MC3-03X is a multi-configuration macro lens suitable for the inspection of objects whose size varies from a few millimeters to some centimeters. Magnification and focus can be tuned by adjusting a lockable rotating knob. The lens magnification range can be selected by means of a set of extension tubes, included in the product package; this feature makes this component ideal for

prototyping purposes and for machine vision applications requiring flexibility. Since the working F-number increases with magnification, the optimum combination of field depth, image resolution and brightness is maintained in any lens configuration. Moreover, the optical distortion approaches zero at any magnification, making this lens perfectly suitable for measurement applications.

Example of applications





MC3 - 03X macro FOV and W.D. selection chart

Number of spacers	Mag. (x)	Image circle (mm)	W.D. (mm)	Working F/N	Field depth (mm)	Detector type					Dimensions		
						1/3"	1/2.5"	1/2"	1/1.8"	2/3" - 5 Mpx	Mount	Length (mm)	Diam. (mm)
						w x h (mm x mm)	w x h (mm x mm)	w x h (mm x mm)	w x h (mm x mm)	w x h (mm x mm)			
						Object field of view (mm x mm)							
0	0.1	11.0	275	6	19	48.0 x 36.0	57.0 x 42.8	64.0 x 48.0	71.3 x 53.7	84.5 x 70.7	C	50.5	28
	0.2	11.0	136	6	5	24.0 x 18.0	28.5 x 21.4	32.0 x 24.0	35.6 x 26.8	42.2 x 35.3			
	0.3	11.0	92	7	2.5	16.0 x 12.0	19.0 x 14.3	21.3 x 16.0	23.8 x 17.9	28.2 x 23.6			
	0.4	11.0	71	7	1.5	12.0 x 9.00	14.3 x 10.7	16.0 x 12.0	17.8 x 13.4	21.1 x 17.7			
	0.5	11.0	60	8	1.1	9.60 x 7.20	11.4 x 8.55	12.8 x 9.60	14.3 x 10.7	16.9 x 14.1			
	0.6	11.0	54	9	0.8	8.00 x 6.00	9.50 x 7.13	10.7 x 8.00	11.9 x 8.95	14.1 x 11.8			
	0.7	11.0	50	9	0.6	6.86 x 5.14	8.15 x 6.11	9.14 x 6.86	10.2 x 7.67	12.1 x 10.1			
	0.8	11.0	47	10	0.5	6.00 x 4.50	7.13 x 5.35	8.00 x 6.00	8.91 x 6.71	10.6 x 8.83			
	0.9	11.0	46	10	0.4	5.33 x 4.00	6.34 x 4.75	7.11 x 5.33	7.92 x 5.96	9.38 x 7.85			
	1.0	11.0	46	11	0.4	4.80 x 3.60	5.70 x 4.28	6.40 x 4.80	7.13 x 5.37	8.45 x 7.07			
1	0.7	11.0	31	9	0.6	6.86 x 5.14	8.15 x 6.11	9.14 x 6.86	10.2 x 7.67	12.1 x 10.1	C	69.0	28
	0.8	11.0	29	10	0.5	6.00 x 4.50	7.13 x 5.35	8.00 x 6.00	8.91 x 6.71	10.6 x 8.83			
	0.9	11.0	28	10	0.4	5.33 x 4.00	6.34 x 4.75	7.11 x 5.33	7.92 x 5.96	9.38 x 7.85			
	1.0	11.0	27	11	0.4	4.80 x 3.60	5.70 x 4.28	6.40 x 4.80	7.13 x 5.37	8.45 x 7.07			
	1.1	11.0	28	11	0.3	4.36 x 3.27	5.18 x 3.89	5.82 x 4.36	6.48 x 4.88	7.68 x 6.42			
	1.2	11.0	28	12	0.3	4.00 x 3.00	4.75 x 3.56	5.33 x 4.00	5.94 x 4.47	7.04 x 5.89			
	1.3	11.0	29	12	0.24	3.69 x 2.77	4.39 x 3.29	4.92 x 3.69	5.48 x 4.13	6.50 x 5.44			
	1.4	11.0	31	13	0.2	3.43 x 2.57	4.07 x 3.05	4.57 x 3.43	5.09 x 3.83	6.03 x 5.05			
	1.5	11.0	32	13	0.19	3.20 x 2.40	3.80 x 2.85	4.27 x 3.20	4.75 x 3.58	5.63 x 4.71			
	1.6	11.0	34	14	0.2	3.00 x 2.25	3.56 x 2.67	4.00 x 3.00	4.46 x 3.36	5.28 x 4.42			
2	1.4	11.0	12	13	0.21	3.43 x 2.57	4.07 x 3.05	4.57 x 3.43	5.09 x 3.83	6.03 x 5.05	C	87.5	28
	1.5	11.0	14	13	0.19	3.20 x 2.40	3.80 x 2.85	4.27 x 3.20	4.75 x 3.58	5.63 x 4.71			
	1.6	11.0	15	14	0.18	3.00 x 2.25	3.56 x 2.67	4.00 x 3.00	4.46 x 3.36	5.28 x 4.42			
	1.7	11.0	17	14	0.16	2.82 x 2.12	3.35 x 2.52	3.76 x 2.82	4.19 x 3.16	4.97 x 4.16			
	1.8	11.0	19	15	0.15	2.67 x 2.00	3.17 x 2.38	3.56 x 2.67	3.96 x 2.98	4.69 x 3.93			
	1.9	11.0	21	15	0.14	2.53 x 1.89	3.00 x 2.25	3.37 x 2.53	3.75 x 2.83	4.45 x 3.72			
	2.0	11.0	23	16	0.13	2.40 x 1.80	2.85 x 2.14	3.20 x 2.40	3.56 x 2.68	4.22 x 3.53			
	2.1	11.0	25	16	0.12	2.29 x 1.71	2.72 x 2.04	3.05 x 2.29	3.39 x 2.56	4.02 x 3.36			
	2.2	11.0	27	17	0.12	2.18 x 1.64	2.59 x 1.94	2.91 x 2.18	3.24 x 2.44	3.84 x 3.21			
	2.3	11.0	30	18	0.11	2.09 x 1.57	2.48 x 1.86	2.78 x 2.09	3.10 x 2.33	3.67 x 3.07			
3	2.1	11.0	7	16	0.12	2.29 x 1.71	2.72 x 2.04	3.05 x 2.29	3.39 x 2.56	4.02 x 3.36	C	106.0	28
	2.2	11.0	9	17	0.12	2.18 x 1.64	2.59 x 1.94	2.91 x 2.18	3.24 x 2.44	3.84 x 3.21			
	2.3	11.0	11	18	0.11	2.09 x 1.57	2.48 x 1.86	2.78 x 2.09	3.10 x 2.33	3.67 x 3.07			
	2.4	11.0	14	18	0.10	2.00 x 1.50	2.38 x 1.78	2.67 x 2.00	2.97 x 2.24	3.52 x 2.94			
	2.5	11.0	16	19	0.10	1.92 x 1.44	2.28 x 1.71	2.56 x 1.92	2.85 x 2.15	3.38 x 2.83			
	2.6	11.0	18	19	0.09	1.85 x 1.38	2.19 x 1.64	2.46 x 1.85	2.74 x 2.06	3.25 x 2.72			
	2.7	11.0	21	20	0.09	1.78 x 1.33	2.11 x 1.58	2.37 x 1.78	2.64 x 1.99	3.13 x 2.62			
	2.8	11.0	23	20	0.09	1.71 x 1.29	2.04 x 1.53	2.29 x 1.71	2.55 x 1.92	3.02 x 2.52			
	2.9	11.0	26	21	0.08	1.66 x 1.24	1.97 x 1.47	2.21 x 1.66	2.46 x 1.85	2.91 x 2.44			
	3.0	11.0	28	21	0.08	1.60 x 1.20	1.90 x 1.43	2.13 x 1.60	2.38 x 1.79	2.82 x 2.36			

MC12K series

Macro lenses for 12 k and 16 k pixel linescan cameras



MC12K series are a family of linescan camera lenses specifically designed to work with line detectors as large as 62 mm in macro configuration.

This optical setup is critical since a lens with its focal planes placed at infinity - like a photographic lens - cannot perform close-up observations properly.

MC12K series are tailored for industrial applications where maximum image resolution is required for inspecting solar cells and printed sheets or for sorting products at high speed.

In addition to the standard M72x0.75 mount, these lenses can be easily equipped with any other type of camera mount at no extra cost.

KEY ADVANTAGES

Low distortion

Perform measurements with a high degree of accuracy and reliability.

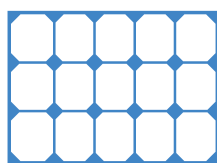
Wide image circle

Up to 62.4 mm, optimal for large detectors.

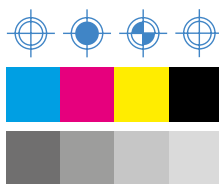
Macro by design

Enabling unique optical performances.

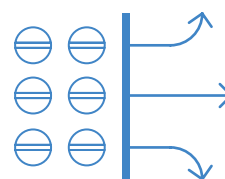
Example of applications



Solar cell inspection



Print and web inspection



High speed sorting of tablets



Part number	Focusing	Mag. (x)	Detector type				Optical specifications							Dimensions			
			35 mm w x h (mm x mm)	Line - 16 kpx 16k x 3.5 µm (mm)	Line - 12 kpx 12k x 5 µm (mm)	Line - 12 kpx 12 k x 5.2 µm (mm)	W.D. (mm)	F/N	Distortion typical (max) (%)	Field depth (mm)	CTF @50lp/mm (%)	Image side N.A	Object side N.A	Mount	Length (mm)	Diam. (mm)	
			Object field of view (mm x mm)						2	3	4				5		
	near	2.017	17.8 x 11.9	28.7	30.5	30.7	93.6										
MC12K 200X	nominal	2.000	18.0 x 12.0	28.7	30.7	31.2	94.0	18	< 0.01 (0.02)	0.15	> 30	0.028	0.056	M72 x 0.75	281.8	76	
	far	1.983	18.2 x 12.1	29.2	31.0	31.3	94.4										
MC12K 150X	near	1.517	23.7 x 15.8	38.2	40.5	40.9	109.3										
	nominal	1.500	24.0 x 16.0	38.2	41.0	41.6	110.0	15	< 0.01 (0.02)	0.2	> 40	0.033	0.050	M72 x 0.75	242.5	76	
	far	1.484	24.3 x 16.2	39.0	41.4	41.8	110.7										
MC12K 100X	near	1.018	35.4 x 23.6	56.9	60.4	61.0	134.0										
	nominal	1.000	36.0 x 24.0	57.3	61.4	62.4	135.5	12	< 0.01 (0.02)	0.3	> 50	0.042	0.042	M72 x 0.75	195.0	76	
	far	0.984	36.6 x 24.4	58.9	62.5	63.1	137.0										
MC12K 067X	near	0.684	52.7 x 35.1	84.7	89.9	90.7	179.7										
	nominal	0.667	54.0 x 36.0	86.0	92.2	93.6	183.0	10	< 0.01 (0.02)	0.6	> 60	0.050	0.033	M72 x 0.75	169.6	76	
	far	0.667	55.4 x 36.9	86.8	92.2	93.0	186.4										
MC12K 050X	near	0.517	69.6 x 46.4	111.9	118.8	119.9	217.1										
	nominal	0.500	72.0 x 48.0	114.7	122.9	124.8	223.0	9	< 0.01 (0.02)	0.9	> 50	0.056	0.028	M72 x 0.75	153.3	76	
	far	0.483	74.5 x 49.6	119.7	127.1	128.3	229.1										
MC12K 025X	near	0.266	135.3 x 90.2	217.6	231.1	233.2	393.6										
	nominal	0.250	144.0 x 96.0	229.4	245.8	249.6	415.5	8	< 0.05 (0.1)	3.2	> 50	0.063	0.016	M72 x 0.75	138.9	76	
	far	0.234	154.2 x 102.8	247.9	263.2	265.6	393.6										
MC12K 012X	near	0.142	254.4 x 169.6	409.1	434.4	438.3	678.5										
	nominal	0.125	287.0 x 192.0	458.4	491.1	498.8	762.0	7	< 0.05 (0.1)	11	> 50	0.071	0.009	M72 x 0.75	125.3	76	
	far	0.108	332.5 x 221.7	534.5	567.5	572.6	873.2										
MC12K 008X	near	0.100	359.2 x 239.5	577.7	613.5	619.1	924.1										
	nominal	0.083	432.0 x 288.0	687.3	736.4	747.9	1102.5	7	< 0.05 (0.1)	15	> 50	0.071	0.006	M72 x 0.75	121.0	76	
	far	0.067	541.1 x 360.7	869.9	923.6	932.0	1370.9										

- 1 Maximum and minimum acceptable focusing change.
- 2 Working F-number: the real F-number of a lens when used as a macro. Lenses with smaller apertures can be supplied on request.
- 3 Percent deviation of the real image compared to an ideal, undistorted image: typical (average production) values and maximum (guaranteed) values are listed.

- 4 At the borders of the field depth the image can be still used for measurement but to get a perfectly sharp image only half of the nominal field depth should be taken into account.
- 5 Measured from the front end of the mechanics to the camera flange; take into account a +/- 2.5 mm tolerance due to the focussing mechanism.





Contact us

EUROPE

**Opto Engineering
Europe headquarters**
Circonvallazione Sud, 15
46100 Mantova, IT
phone: +39 0376 699111
contact@opto-engineering.com

**Opto Engineering
Germany**
Agnes-Pockels-Bogen, 1
80992 München, DE
phone: +49 0 89 18930918
de@opto-engineering.com

UNITED STATES

**Opto Engineering
USA**
11261 Richmond Ave
Ste G-108 - Houston, TX 77082
phone: +1 832 2129391
us@opto-engineering.com

ASIA

**Opto Engineering
China**
Room 2405, n°885, Renmin RD
Huangpu District 200010
Shanghai, China
phone: +86 21 61356711
info@deepview.cn

**Opto Engineering
India**
contact@opto-engineering.com

**Opto Engineering
Korea**
kr@opto-engineering.com