BI-TELECENTRIC LENSES

OPTO ENGINEERING SRL

INDUSTRIAL OPTO-MECHANICAL SYSTEMS

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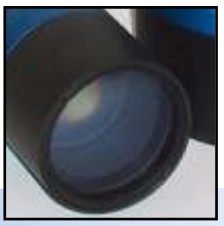
TC SERIES

DOUBLE-SIDED TELECENTRIC



100% QUALITY CONTROLLED

HIGH TELECENTRICITY

VERY LOW DISTORTION

COMPACT AND ROBUST DESIGN

BI-TELECENTRIC LENSES

SHORT FORM CATALOGUE

Each telecentric lens is carefully quality controlled and a precise regulation of telecentricity is made: any lens is delivered with its own quality test report which ensures optical specifications conformity.

Working distance and field depth are scaled to the object size: in our product philosophy lenses are specifically tailored for a particular detector and object size, to reduce lens dimensions and weight.

The lens suiting your application can be easily selected through its code: the second group of digits (13, 12 or 23) says which is the maximum allowable detector size (1/3",1/2" and 2/3" respectively), while the third group of digits says which is the maximum object size: e.g. A TC **12 64** has a field of view of **64** (x 48) mm on a **1/2"** detector.

MATRIX DETECTOR CAMERA TELECENTRIC LENSES

		Object Field (6)									Optical Specifications						Dimensions	
model	magn. (X)	1/3" w 4,8 (mm)	x	h 3,6 (mm)	1/2" w 6,4 (mm)	x	h 4,8 (mm)	2/3" w 8,8 (mm)	x	h 6,6 (mm)	W.D. (1) (mm)	F/N (2)	MTF @ 70 lp/mm %	Field Depth (3) (mm)	Telecen-tricity (4) (deg)	Distortion (%)	Mount	Length (5) (mm)	Diam. (mm)
TC 23 04	2	2,4	x	1,8	3,2	x	2,4	4,4	x	3,3	57,1	11	>30	0,2	< 0,08	< 0,08	C	101,4	28
TC 23 07	1,333	3,6	x	2,7	4,8	x	3,6	6,6	x	5,0	61,2	11	>30	0,5	< 0,08	< 0,08	C	78,5	28
TC 23 09	1	4,8	x	3,6	6,4	x	4,8	8,8	x	6,6	63,3	11	>25	1	< 0,08	< 0,08	C	65	28
TC 12 16	0,4	12,0	x	9,0	16,0	x	12,0	Ø	=	16,5	45,3	8	> 40	4,5	< 0,1	< 0,08	C	92	37,8
TC 23 16	0,55	8,7	x	6,5	11,6	x	8,7	16,0	x	12,0	45,3	8	>30	3	< 0,1	<0,07	C	112	37,8
TC 12 24	0,27	18,0	x	13,5	24,0	x	18,0	Ø	=	24,8	69,2	8	>45	10	< 0,1	< 0,08	C	122,5	44
TC 23 24	0,37	13,1	x	9,8	17,5	x	13,1	24,0	x	18,0	63,4	8	>45	7	< 0,1	< 0,1	C	142	44
TC 13 36	0,13	36,0	x	27,0	Ø	=	36,0	n.a		n.a	103,5	8	>50	38	<0,08	< 0,08	C	133	61
TC 12 36	0,18	27,0	x	20,3	36,0	x	27,0	Ø	=	37,1	103,5	8	> 40	22	<0,08	< 0,1	C	148	61
TC 23 36	0,24	19,6	x	14,7	26,2	x	19,6	36,0	x	27,0	103,5	8	> 40	12	<0,08	< 0,1	C	164,9	61
TC 12 56	0,11	42,0	x	31,5	56,0	x	42,0	Ø	=	57,8	159,3	8	>50	45	<0,08	< 0,08	C	205	80
TC 23 56	0,157	30,5	x	22,9	40,7	x	30,5	56,0	x	42,0	159,3	8	>45	26	<0,08	< 0,08	C	225	80
TC 13 64	0,075	64,0	x	48,0	Ø	=	64,0	n.a		n.a	182,3	8	> 40	130	<0,08	<0,07	C	212	100
TC 12 64	0,1	48,0	x	36,0	64,0	x	48,0	Ø	=	66,0	182,3	8	>50	60	<0,08	<0,07	C	227	100
TC 23 64	0,14	34,9	x	26,2	46,5	x	34,9	64,0	x	48,0	182,3	8	>50	36	<0,08	<0,07	C	245,5	100
TC 23 72	0,12	39,3	x	29,5	52,4	x	39,3	72,0	x	54,0	227,7	8	>40	48	<0,08	<0,07	C	300	120
TC 12 80	0,08	60,0	x	45,0	80,0	x	60,0	Ø	=	82,5	227,7	8	>50	90	<0,08	<0,1	C	272	120
TC 23 80	0,11	43,6	x	32,7	58,2	x	43,6	80,0	x	60,0	227,7	8	>50	57	<0,08	<0,1	C	272	120
TC 23 85	0,10	46,4	x	34,8	61,8	x	46,4	85,0	x	63,8	280,6	8	>45	60	<0,08	<0,08	C	346	146
TC 13 96	0,050	96,0	x	72,0	Ø	=	96,0	n.a	n.a	n.a	280,6	8	>50	240	<0,08	<0,1	C	302	146
TC 12 96	0,067	72,0	x	54,0	96,0	x	72,0	Ø	=	99,0	279,6	8	>45	120	<0,08	<0,08	C	318	146
TC 23 96	0,092	52,4	x	39,3	69,8	x	52,4	96,0	x	72,0	279,6	8	> 40	70	<0,08	<0,08	C	338	146
TC 23 110	0,080	60,0	x	45,0	80,0	x	60,0	110,0	x	82,5	336,5	8	> 40	90	<0,08	<0,07	C	431	185
TC 12 120	0,053	90,0	x	67,5	120,0	x	90,0	Ø	=	123,8	336,5	8	>45	180	<0,08	<0,1	C	402	185
TC 23 120	0,073	65,5	x	49,1	87,3	x	65,5	120,0	x	90,0	336,5	8	>35	105	<0,08	<0,1	C	422	185
TC 23 130	0,068	70,9	x	53,2	94,5	x	70,9	130,0	x	97,5	398	8	> 40	150	<0,08	<0,1	C	490	200
TC 12 144	0,044	108,0	x	81,0	144,0	x	108,0	Ø	=	148,5	398	8	>35	260	<0,08	<0,08	C	483	200
TC 23 144	0,061	78,5	x	58,9	104,7	x	78,5	144,0	x	108,0	398	8	> 40	160	<0,08	<0,08	C	628	200
TC 23 172	0,051	93,8	x	70,4	125,1	x	93,8	172,0	x	129,0	531	8	> 40	240	<0,08	<0,1	C	628	260
TC 12 192	0,033	144,0	x	108,0	192,0	x	144,0	Ø	=	198,0	531	8	>45	360	<0,08	<0,08	C	600	260
TC 23 192	0,046	104,7	x	78,5	139,6	x	104,7	192,0	x	144,0	531	8	>35	240	<0,08	<0,08	C	618	260
TC 23 200	0,044	109,1	x	81,8	145,5	x	109,1	200,0	x	150,0	500	8	> 40	310	<0,08	<0,1	C	785	330
TC 23 240	0,037	130,9	x	98,2	174,5	x	130,9	240,0	x	180,0	500	8	>45	380	<0,08	<0,08	C	778	330

LINEAR DETECTOR CAMERA TELECENTRIC LENSES

		LINE Detector/Object Field (6)									Optical Specifications						Dimensions	
model	magn. (X)	4k l =	x 29	7µm mm	2k l =	x 21	10µm mm	2k l =	x 14	7µm mm	W.D. (1) (mm)	F/N (2) 0	MTF @ 70 lp/mm %	Field Depth (3) (mm)	Telecen-tricity (4) (deg)	Distortion (%)	Mount	Length (5) (mm)	Diam. (mm)
TCL 060	0,478	60			43			30			230	9	>30	4	<0,08	<0,08	custom	460	100
TCL 080	0,3588	80			57			40			243	9	>30	7	<0,1	<0,10	custom	460	120
TCL 120	0,2391	120			86			60			250	9	>30	15	<0,1	<0,15	custom	460	146

(1) Working distance: best focus front lens to object distance. Set this distance within +/- 3% of the nominal value to optimize distortion
(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) Out of this interval the MTF contrast falls below 50% of the nominal value; the field depth can be increased by a smaller diapragm, available on request
(4) Maximum slope of principal rays inside the lens: turned in millirad. tells which is the maximum measurement error for any millimiter of object displacement
(5) Measured from the end of the mechanics to the camera flange
(6) For the fields with the indication "Ø =" the image of a circular object is inscribed inside the short detector side

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Telecentric lenses are mandatory to develop imaging systems for dimensional measurement.

Among the most important features peculiar to TELECENTRIC lenses, making them radically different from common MACRO lenses:

A) NO PARALLAX error: the lens captures only the image of surfaces that are orthogonal to the main optical axis

b) NO CHANGE OF MAGNIFICATION within the depth of field: moving back and forth the object from the best focus distance, the object's image size doesn't change

c) INCREASED DEPTH OF FIELD: in comparison with a common macro lens with the same magnification and working F/#, a telecentric lens exhibits a larger depth of focus

Our special telecentric lens design in addition meets the following specifications:

1)Bi-Telecentric Design: the lens is telecentric both in the object and in the image space, allowing a telecentricity of less than 0,1° within the field depth

2)Distortion < 0,1% or less at the field corners

3)VIS + NIR design and coating optimisation

4)MTF > 40% @ 130 lines/mm

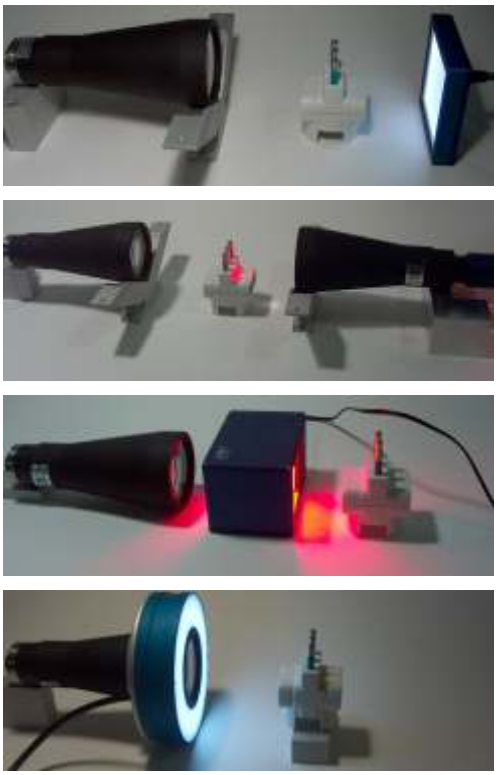
5)Optical and mechanical full compatibility with our family of LED illuminators specifically designed to suit any illumination need.

6)Even detector illumination: due to the bi-telecentric design, these lenses don’t show the typical “cosine to the fourth” illumination decay at the image corners and are therefore suitable also for radiometric applications

BI-TELECENTRIC LENSES

ILLUMINATORS & ACCESSORIES

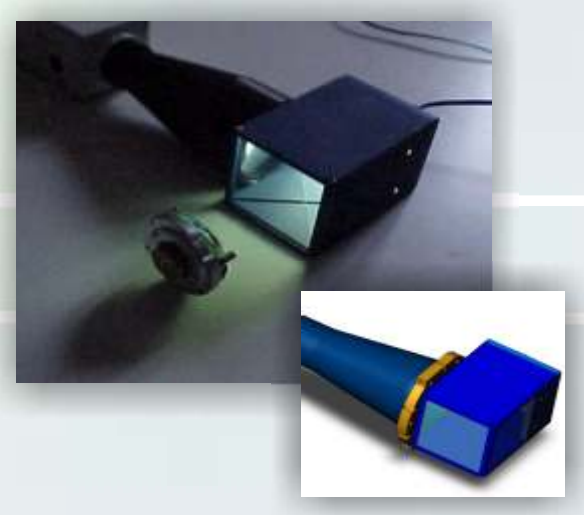
Our LED illuminators are mechanically and optically compatible with the TC series. The illuminator model can be easily found by simply checking that the product code suffix for the illuminator is the same as that of the telecentric lens: e.g. a TC..XX should be coupled with an LT.. XX illuminator.



Example of integration with lighting devices: a TC 12 **36** lens combined with a back light (LT BK **36**), collimated (LT CL **36**), coaxial (LT CX **36**) and ring (LT RN **36**) LED illuminator.

Opto Engineering designs lenses and accessories to meet specific customer's needs. We can supply mechanical interfaces specifically designed to suite your device and application.

We can also provide interchangeable protective windows for TC lenses, additional filters, special lens-to-camera interfaces or mounts, etc...



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