TC series

Bi-telecentric lenses for matrix detectors up to 2/3"

TC series bi-telecentric lenses represent the key component of any measurement system powered by machine vision: these lenses can truly take advantage of high-resolution detectors such as 5 Mpix - 2/3", acquiring images with exceptional fidelity and precision.

The Opto Engineering® bi-telecentric design makes these optics truly telecentric: no magnification change occurs when an object is moved closer to or away from the lens, making TC series ideal for measurement applications of mechanical parts ranging from extruded aluminium profiles to tiny clock gears.

No other lenses can offer the same optical performance in terms of telecentricity and distortion: additionally you can further enhance depth of field and optical accuracy by pairing our TC lenses with LTCLHP telecentric illuminators.
All of our TC lenses are rigorously tested and supplied with a detailed Test Report: We guarantee that 100% of our TC lenses meet or exceed our written specifications.

Opto Engineering® TC series offers the best performance to price ratio available today and is the ideal choice when no compromise can be accepted in terms of reliability and ease of use.
Additionally we supply useful accessories including CMHO clamping mechanics and CMPT mounting plates: mechanical support systems for easy integration in industrial environments, where a solid and secure assembly is mandatory.

NEW

Camera phase adjustment available on selected models for easy and hassle-free integration.

KEY ADVANTAGES

High telecentricity for thick object imaging.

Nearly zero distortion for accurate measurements.

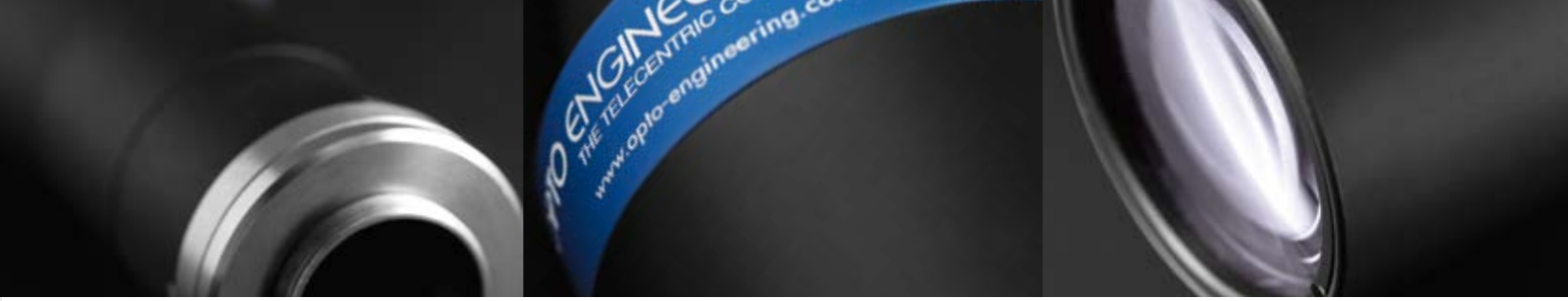
Excellent resolution for high resolution cameras.

Simple and robust design for industrial environments.

Easy filter insertion.

Detailed test report with measured optical parameters.

FOR HIGHER MAGNIFICATION LENSES SEE ALSO		
	TCHM series	p. 30
FULL RANGE OF COMPATIBLE ILLUMINATORS		
	LTCLHP CORE series	p. 110
FULL RANGE OF COMPATIBLE ACCESSORIES		
	Mounting mechanics CMHO and CMPT	p. 200-202



			Detector type					Optical specifications							Mechanical specs			
Part number	Mag. (x)	Image circle Ø (mm)	1/3'' w x h 4.80 x 3.60 (mm x mm)	1/2.5'' w x h 5.70 x 4.28 (mm x mm)	1/2'' w x h 6.40 x 4.80 (mm x mm)	1/1.8'' w x h 7.13 x 5.37 (mm x mm) 7	2/3" - 5 Mpx w x h 8.45 x 7.07 (mm x mm)	WD (mm) 1	wF/# 2	Telecentricity typical (max) (deg) 3	Distortion typical (max) (%) 4	Field depth (mm) 5	CTF @70lp/mm (%)	Mount	Phase adj. 9	Length (mm) 6	Diam. (mm)
			Object field of view (mm x mm) 8															
TC 23 004	2.000	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 3.55	56.0	11	< 0.08 (0.10)	< 0.04 (0.08)	0.23	> 30	C		101.4	28
TC 23 007	1.333	11.0	3.60 x 2.70	4.28 x 3.21	4.80 x 3.60	5.35 x 4.03	6.34 x 5.30	60.1	11	< 0.08 (0.10)	< 0.03 (0.08)	0.5	> 30	C		78.5	28
TC 23 009	1.000	11.0	4.80 x 3.60	5.70 x 4.28	6.40 x 4.80	7.13 x 5.37	8.44 x 7.06	62.2	11	< 0.08 (0.10)	< 0.04 (0.08)	0.9	> 25	C		65.0	28
TC 23 012	0.735	11.0	6.54 x 4.90	7.77 x 5.82	8.72 x 6.54	9.71 x 7.31	11.5 x 9.62	53.9	14	< 0.04 (0.10)	< 0.04 (0.10)	1.2	> 25	C		60.3	28
TC 13 016	0.290	6.0	16.6 x 12.4	Ø = 14.8	Ø = 16.6	Ø = 18.5	n.a.	43.1	8	< 0.04 (0.10)	< 0.04 (0.08)	8	> 40	C		80.9	37.7
TC 12 016	0.385	8.0	12.5 x 9.36	14.8 x 11.1	16.6 x 12.5	18.5 x 14.0	Ø = 18.4	43.1	8	< 0.04 (0.10)	< 0.04 (0.08)	5	> 40	C		93.0	37.7
TC 23 016	0.528	11.0	9.09 x 6.82	10.8 x 8.10	12.1 x 9.09	13.5 x 10.2	16.0 x 13.4	43.1	8	< 0.06 (0.10)	< 0.04 (0.07)	2	> 30	C		112.7	37.7
TC 13 024	0.192	6.0	25.0 x 18.7	Ø = 22.3	Ø = 25	Ø = 28	n.a.	67.2	8	< 0.08 (0.10)	< 0.04 (0.08)	19	> 45	C		105.6	44
TC 12 024	0.255	8.0	18.8 x 14.1	22.4 x 16.8	25.1 x 18.8	28.0 x 21.1	Ø = 27.7	67.2	8	< 0.08 (0.10)	< 0.04 (0.08)	10	> 45	C		117.8	44
TC 23 024	0.350	11.0	13.7 x 10.3	16.3 x 12.2	18.3 x 13.7	20.4 x 15.3	24.1 x 20.2	67.2	8	< 0.08 (0.10)	< 0.04 (0.10)	5	> 45	C		137.5	44
TC 13 036	0.133	6.0	36.0 x 27.0	Ø = 32.0	Ø = 36.0	Ø = 40.2	n.a.	102.5	8	< 0.04 (0.08)	< 0.03 (0.08)	38	> 50	C		133.0	61
TC 12 036	0.177	8.0	27.1 x 20.3	32.2 x 24.1	36.1 x 27.1	40.2 x 30.3	Ø = 39.9	102.5	8	< 0.03 (0.08)	< 0.04 (0.10)	21	> 40	C		145.2	61
TC 23 036	0.243	11.0	19.7 x 14.8	23.4 x 17.6	26.3 x 19.7	29.3 x 22.1	34.7 x 29.0	102.5	8	< 0.04 (0.08)	< 0.04 (0.10)	11	> 40	C		164.9	61
TC 13 048	0.098	6.0	48.8 x 36.6	Ø = 43.5	Ø = 48.8	Ø = 54.6	n.a.	133.4	8	< 0.08 (0.10)	< 0.06 (0.10)	65	> 40	C		167.9	75
TC 12 048	0.134	8.0	35.9 x 26.9	42.5 x 31.9	47.8 x 35.9	53.3 x 40.1	Ø = 52.8	132.9	8	< 0.07 (0.10)	< 0.06 (0.10)	37	> 40	C		181.5	75
TC 23 048	0.184	11.0	26.1 x 19.6	31.0 x 23.3	34.8 x 26.1	38.8 x 29.2	46.0 x 38.4	132.9	8	< 0.08 (0.10)	< 0.05 (0.10)	20	> 40	C		201.0	75
TC 13 056	0.084	6.0	57.1 x 42.8	Ø = 50.9	Ø = 57.1	Ø = 63.9	n.a.	157.8	8	< 0.04 (0.08)	< 0.04 (0.08)	93	> 50	C		191.5	80
TC 12 056	0.114	8.0	42.0 x 31.5	49.9 x 37.4	56.0 x 42.0	62.3 x 46.9	Ø = 61.8	157.8	8	< 0.04 (0.08)	< 0.04 (0.08)	51	> 50	C		205.0	80
TC 23 056	0.157	11.0	30.6 x 22.9	36.3 x 27.2	40.7 x 30.6	45.4 x 34.2	53.8 x 45.0	157.8	8	< 0.05 (0.08)	< 0.03 (0.08)	27	> 45	C		225.0	80
TC 13 064	0.074	6.0	65.2 x 48.9	Ø = 58.1	Ø = 65.2	Ø = 72.9	n.a.	181.9	8	< 0.06 (0.08)	< 0.03 (0.07)	124	> 40	C		212.3	100
TC 12 064	0.100	8.0	48.0 x 36.0	57.0 x 42.7	64.0 x 48.0	71.2 x 53.6	Ø = 70.6	181.8	8	< 0.05 (0.08)	< 0.04 (0.07)	67	> 50	C		225.9	100
TC 23 064	0.138	11.0	34.9 x 26.2	41.5 x 31.1	46.6 x 34.9	51.9 x 39.0	61.4 x 51.4	181.8	8	< 0.05 (0.08)	< 0.03 (0.07)	35	> 50	C		245.5	100
TC 23 072	0.122	11.0	39.2 x 29.4	46.6 x 35.0	52.3 x 39.2	58.3 x 43.9	69.1 x 57.8	226.7	8	< 0.04 (0.08)	< 0.03 (0.07)	45	> 40	C	Yes	299.2	116
TC 13 080	0.059	6.0	81.2 x 60.9	Ø = 72.4	Ø = 81.2	Ø = 90.9	n.a.	225.9	8	< 0.05 (0.08)	< 0.03 (0.08)	192	> 40	C		259.2	116
TC 12 080	0.080	8.0	59.8 x 44.8	71.0 x 53.2	79.7 x 59.8	88.7 x 66.8	Ø = 88.0	226.7	8	< 0.03 (0.08)	< 0.04 (0.10)	104	> 50	C		271.5	116
TC 23 080	0.110	11.0	43.5 x 32.6	51.7 x 38.8	58.0 x 43.5	64.6 x 48.7	76.5 x 64.0	226.7	8	< 0.04 (0.08)	< 0.02 (0.10)	55	> 50	C		291.2	116
TC 23 085	0.104	11.0	46.3 x 34.8	55.1 x 41.3	61.8 x 46.3	68.8 x 51.8	81.5 x 68.2	279.7	8	< 0.04 (0.08)	< 0.02 (0.08)	62	> 45	C	Yes	344.5	143
TC 13 096	0.050	6.0	96.0 x 72.0	Ø = 85.5	Ø = 96.0	Ø = 107.4	n.a.	279.6	8	< 0.06 (0.08)	< 0.04 (0.10)	268	> 50	C		303.3	143
TC 12 096	0.068	8.0	70.6 x 52.9	83.8 x 62.9	94.1 x 70.6	104.8 x 78.9	Ø = 103.9	278.6	8	< 0.06 (0.08)	< 0.03 (0.08)	145	> 45	C		317.0	143
TC 23 096	0.093	11.0	51.4 x 38.5	61.0 x 45.8	68.5 x 51.4	76.3 x 57.5	90.4 x 75.6	278.6	8	< 0.06 (0.08)	< 0.04 (0.08)	77	> 40	C		336.6	143
TC 23 110	0.079	11.0	60.5 x 45.4	71.8 x 53.9	80.6 x 60.5	89.8 x 67.6	106.4 x 89.0	334.5	8	< 0.06 (0.08)	< 0.03 (0.07)	106	> 40	C	Yes	430.4	180
TC 13 120	0.038	6.0	125 x 93.9	Ø = 111.6	Ø = 125.2	Ø = 140	n.a.	334.5	8	< 0.06 (0.08)	< 0.04 (0.10)	450	> 45	C	Yes	398.1	180
TC 12 120	0.052	8.0	92.1 x 69.1	109.4 x 82.0	122.8 x 92.1	136.7 x 103.0	Ø = 135.5	334.5	8	< 0.06 (0.08)	< 0.04 (0.10)	247	> 45	C	Yes	402.7	180
TC 23 120	0.072	11.0	67.0 x 50.3	79.6 x 59.7	89.4 x 67.0	99.5 x 75.0	117.9 x 98.7	334.5	8	< 0.07 (0.08)	< 0.04 (0.10)	131	> 35	C	Yes	422.4	180
TC 23 130	0.068	11.0	70.9 x 53.2	84.2 x 63.2	94.5 x 70.9	105.3 x 79.3	124.7 x 104.3	396.0	8	< 0.05 (0.08)	< 0.04 (0.10)	146	> 40	C	Yes	490.0	200
TC 13 144	0.033	6.0	146.7 x 110.1	Ø = 130.8	Ø = 146.7	Ø = 164.2	n.a.	396.0	8	< 0.05 (0.08)	< 0.04 (0.10)	606	> 45	C	Yes	448.8	200
TC 12 144	0.044	8.0	107.9 x 80.9	128.2 x 96.2	143.9 x 107.9	160.3 x 120.7	Ø = 158.9	396.0	8	< 0.05 (0.08)	< 0.05 (0.08)	339	> 35	C	Yes	462.1	200
TC 23 144	0.061	11.0	78.6 x 58.9	93.3 x 70.0	104.8 x 78.6	116.7 x 87.9	138.3 x 115.7	396.0	8	< 0.05 (0.08)	< 0.04 (0.08)	180	> 40	C	Yes	481.9	200
TC 23 172	0.051	11.0	94.6 x 71.0	112.4 x 84.3	126.1 x 94.6	140.5 x 105.8	166.5 x 139.3	526.9	8	< 0.05 (0.08)	< 0.04 (0.10)	260	> 40	C	Yes	630.3	260
TC 13 192	0.025	6.0	195.8 x 146.9	Ø = 174.6	Ø = 195.8	Ø = 219.1	n.a.	527.0	8	< 0.06 (0.08)	< 0.04 (0.10)	1050	> 45	C	Yes	589.2	260
TC 12 192	0.033	8.0	144.1 x 108.0	171.1 x 128.3	192.1 x 144.1	213.9 x 161.1	Ø = 212.0	526.9	8	< 0.06 (0.08)	< 0.04 (0.08)	603	> 45	C	Yes	602.6	260
TC 23 192	0.046	11.0	104.9 x 78.6	124.6 x 93.4	139.8 x 104.9	155.7 x 117.3	184.5 x 154.4	526.9	8	< 0.06 (0.08)	< 0.05 (0.08)	320	> 35	C	Yes	622.3	260
TC 23 200	0.044	11.0	110.0 x 82.5	130.7 x 98.0	146.7 x 110.0	163.3 x 123.0	193.5 x 161.9	492.8	8	< 0.06 (0.08)	< 0.05 (0.10)	352	> 40	C	Yes	792.0	322
TC 23 240	0.037	11.0	130.8 x 98.1	155.4 x 116.6	174.4 x 130.8	194.3 x 146.3	230.2 x 192.6	492.8	8	< 0.03 (0.08)	< 0.04 (0.08)	498	> 45	C	Yes	775.1	322

1 Working distance: distance between the front end of the mechanics and the object. Set this distance within +/- 3% of the nominal value for maximum resolution and minimum distortion.
2 Working F-number (wF/#): the real F-number of a lens when used as a macro. Lenses with smaller apertures can be supplied on request.
3 Maximum slope of chief rays inside the lens: when converted to milliradians, it gives the maximum measurement error for any millimeter of object displacement. Typical (average production) values and maximum (guaranteed) values are listed.
4 Percent deviation of the real image compared to an ideal, undistorted image: typical (average production) values and maximum (guaranteed) values are listed.
5 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 considered. Pixel size used for calculation is 5.5 µm.
6 Measured from the front end of the mechanics to the camera flange.
7 With 1/1.8" (9 mm diagonal) detectors, the FOV of TC 12 yyy lenses may show some vignetting at the image corners, as these lenses are optimized for 1/2" detectors (8 mm diagonal).
8 For the fields with the indication "Ø =", the image of a circular object of such diameter is fully inscribed into the detector.
9 Indicates the availability of an integrated camera phase adjustment feature. If missing, it can be supplied upon request (except for TC23004, TC23007, TC23009, TC23012).

Ordering information

It's easy to select the right lens for your application: our part numbers are coded as **TC xx yyy**, where **xx** defines the camera sensor size (13 = 1/3", 12 = 1/2", 23 = 2/3") and **yyy** refers to the width dimension of the object field of view (FOV), in millimeters. For instance, a TC 12 064 features a field of view of 64 (x 48) mm with a 1/2" camera sensor.