

# TC23004

Bi-telecentric lens for 2/3" detectors, magnification 2.000 ×, C-mount

## SPECIFICATIONS

Magnification	(×)	2.000
Image circle Ø	(mm)	11.0

### Object field of view(8)

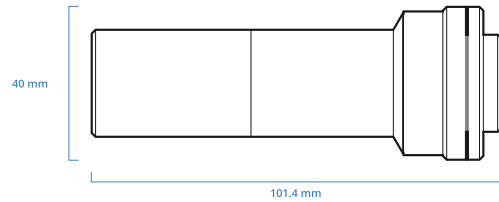
with 1/3" detector (4.8 x 3.6 mm)	(mm × mm)	2.40 x 1.80
with 1/2.5" detector (5.70 x 4.28 mm)	(mm × mm)	2.85 x 2.14
with 1/2" detector (6.4 x 4.8 mm)	(mm × mm)	3.20 x 2.40
with 1/1.8" detector (7.13 x 5.37 mm) (7)	(mm × mm)	3.57 x 2.67
with 2/3" - 5 MP detector (8.45 x 7.07 mm)	(mm × mm)	4.25 x 3.55

### Optical specifications

Working distance (1)	(mm)	56.0
wF/# (2)		11
Telecentricity typical (max) (3)	(deg)	< 0.08 (0.10)
Distortion typical (max) (4)	(%)	< 0.04 (0.08)
Field depth (5)	(mm)	0.23
CTF @ 70 lp/mm	(%)	> 30

### Dimensions

Mount		C
Phase Adjustment (9)		
Length (6)	(mm)	101.4
Diameter	(mm)	28
Mass	(g)	148



## NOTES

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 (higher 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 millirad, 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 very 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" (8.9 mm diagonal) detectors, the FOV of TC12yyy 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).

## COMPATIBLE PRODUCTS

Despite the efforts made to generate an error-free compatibility list, we always recommend to consult the Opto Engineering® technical support department before purchasing a compatible product. Opto Engineering® shall not be liable for any damage or malfunctioning caused by the incorrect selection of a compatible product.



High-performance telecentric illuminators

LTCLHP023-G	Telecentric HP illuminator, beam diameter 16 mm, green
LTCLHP023-B	Telecentric HP illuminator, beam diameter 16 mm, blue
LTCLHP023-W	Telecentric HP illuminator, beam diameter 16 mm, white



#### LTLA series

High-power strobed LED low angle diffused ringlights

LTLAB2-R	Diffusive strobed low angle ring light illuminator - medium size high power red
LTLAB2-G	Diffusive strobed low angle ring light illuminator - medium size high power green
LTLAB2-W	Diffusive strobed low angle ring light illuminator - medium size high power white



#### LTLAIC series (discontinued models)

Continuous LED low angle diffused ringlights

LT2RZF050-60-2-W-24V	LED ringlight, 2 LED rows, 50.8 mm outer diameter, 60°, white, 24V
LT2RZF050-60-2-R-24V	LED ringlight, 2 LED rows, 50.8 mm outer diameter, 60°, red, 24V
LT2RZF050-60-2-G-24V	LED ringlight, 2 LED rows, 50.8 mm outer diameter, 60°, green, 24V
LT2RZF050-60-2-B-24V	LED ringlight, 2 LED rows, 50.8 mm outer diameter, 60°, blue, 24V



#### LTLAIC series

Continuous LED low angle diffused ringlights

LT3RZF050-60-1-W-24V	LED ringlight, 1 LED row, 56.4 mm outer diameter, 60°, white, 24V
LT3RZF050-60-1-R-24V	LED ringlight, 1 LED row, 56.4 mm outer diameter, 60°, red, 24V
LT3RZF050-60-1-G-24V	LED ringlight, 1 LED row, 56.4 mm outer diameter, 60°, green, 24V
LT3RZF050-60-1-B-24V	LED ringlight, 1 LED row, 56.4 mm outer diameter, 60°, blue, 24V



#### LTLADC series

Continuous LED low angle direct ringlights

LTZZO130-75-3-W-24V	LED low angle ringlight, 3 LED rows, outer diameter 131 mm, 75°, white, 24V
LTZZO130-75-3-R-24V	LED low angle ringlight, 3 LED rows, outer diameter 131 mm, 75°, red, 24V
LTZZO130-75-3-G-24V	LED low angle ringlight, 3 LED rows, outer diameter 131 mm, 75°, green, 24V
LTZZO130-75-3-B-24V	LED low angle ringlight, 3 LED rows, outer diameter 131 mm, 75°, blue, 24V



#### LTRNST series

LED ring illuminators - straight type

LTRN023RD	Ring LED illuminator, inner diameter 28 mm, straight type, red 630 nm
LTRN023GR	Ring LED illuminator, inner diameter 28 mm, straight type, green 525 nm
LTRN023BL	Ring LED illuminator, inner diameter 28 mm, straight type, blue 470 nm
LTRN023NW	Ring LED illuminator, inner diameter 28 mm, straight type, white



#### LTRNOB series

LED ring illuminators - oblique type

LTRN075R45	Ring LED illuminator, inner diameter 28 mm, oblique type, red 630 nm
LTRN075G45	Ring LED illuminator, inner diameter 28 mm, oblique type, green 525 nm
LTRN075B45	Ring LED illuminator, inner diameter 28 mm, oblique type, blue 470 nm
LTRN075W45	Ring LED illuminator, inner diameter 28 mm, oblique type, white



#### LTRNOBHP series

High power LED ring illuminators, oblique type

LTRNHP075R45	High power LED ring illuminators, oblique type, inner diam. 28mm, red, 625 nm
LTRNHP075G45	High power LED ring illuminators, oblique type, inner diam. 28mm, green, 525 nm
LTRNHP075B45	High power LED ring illuminators, oblique type, inner diam. 28mm, blue, 475 nm
LTRNHP075W45	High power LED ring illuminators, oblique type, inner diam. 28mm, white, 6200 k



#### LTRNDC series

Continuous LED direct ringlights

<a href="#">LTZGK050-15-2-W-24V</a>	LED ringlight, 2 LED rows, outer diameter 50 mm, 15°, white, 24V
<a href="#">LTZGK050-15-2-R-24V</a>	LED ringlight, 2 LED rows, outer diameter 50 mm, 15°, red, 24V
<a href="#">LTZGK050-15-2-G-24V</a>	LED ringlight, 2 LED rows, outer diameter 50 mm, 15°, green, 24V
<a href="#">LTZGK050-15-2-B-24V</a>	LED ringlight, 2 LED rows, outer diameter 50 mm, 15°, blue, 24V
<a href="#">LTZGK070-45-3-W-24V</a>	LED ringlight, 3 LED rows, outer diameter 70 mm, 45°, white, 24V
<a href="#">LTZGK070-45-3-R-24V</a>	LED ringlight, 3 LED rows, outer diameter 70 mm, 45°, red, 24V
<a href="#">LTZGK070-45-3-G-24V</a>	LED ringlight, 3 LED rows, outer diameter 70 mm, 45°, green, 24V
<a href="#">LTZGK070-45-3-B-24V</a>	LED ringlight, 3 LED rows, outer diameter 70 mm, 45°, blue, 24V



LTBC series

Continuous LED backlight

<a href="#">LTBC054054-W</a>	Continuous LED backlight, 54x54 illumination area, white
<a href="#">LTBC054054-G</a>	Continuous LED backlight, 54x54 illumination area, green



LTBF series

Continuous flat side-emitting LED backlights

<a href="#">LTPVRG25X36-00-1-W-24V</a>	Flat side-emitting LED backlight, thin borders, 25X36 mm illumination area, white, 24V
<a href="#">LTPVRG25X36-00-1-R-24V</a>	Flat side-emitting LED backlight, thin borders, 25X36 mm illumination area, red, 24V
<a href="#">LTPVRG25X36-00-1-G-24V</a>	Flat side-emitting LED backlight, thin borders, 25X36 mm illumination area, green, 24V
<a href="#">LTPVRG25X36-00-1-B-24V</a>	Flat side-emitting LED backlight, thin borders, 25X36 mm illumination area, blue, 24V



LTBRDC series

Continuous LED bar lights

<a href="#">LTZPFL040-00-6-W-24V</a>	LED bar light, 6 LED rows, 40X26.3 illumination area, white, 24V
<a href="#">LTZPFL040-00-6-R-24V</a>	LED bar light, 6 LED rows, 40X26.3 illumination area, red, 24V
<a href="#">LTZPFL040-00-6-G-24V</a>	LED bar light, 6 LED rows, 40X26.3 illumination area, green, 24V
<a href="#">LTZPFL040-00-6-B-24V</a>	LED bar light, 6 LED rows, 40X26.3 illumination area, blue, 24V



LED Illuminators

Advanced lighting solutions.

LTCXC series	Continuous LED coaxial lights
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LTCXC series

Continuous LED coaxial lights

<a href="#">LT2QOG025-00-X-W-24V</a>	LED coaxial light, 25x25.6 mm light emitting area, white, 24V
<a href="#">LT2QOG025-00-X-R-24V</a>	LED coaxial light, 25x25.6 mm light emitting area, red, 24V
<a href="#">LT2QOG025-00-X-G-24V</a>	LED coaxial light, 25x25.6 mm light emitting area, green, 24V
<a href="#">LT2QOG025-00-X-B-24V</a>	LED coaxial light, 25x25.6 mm light emitting area, blue, 24V



CMHO series

Clamping mechanics

CMHO023	Clamping mechanics for TCxx004, 007, 009, 012 and LTCLHP023-X
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PTTC, PTCP series

Accurate calibration patterns for machine vision systems

PT004-009	Calibration pattern
PT004-009-C	Calibration pattern for telecentric lenses with a certificate of conformity



LTPR series

## LED patterns projectors

LTPRHP3W-W	LED pattern projector 3W, HP, white
LTPRHP3W-R	LED pattern projector 3W, HP, red
LTPRHP3W-G	LED pattern projector 3W, HP, green
LTPRHP3W-B	LED pattern projector 3W, HP, blue
LTPRUP-W	90W strobed LED pattern projector white
LTPRUP-R	90W strobed LED pattern projector red
LTPRUP-G	90W strobed LED pattern projector green
LTPRUP-B	90W strobed LED pattern projector blue



### COE-G series

#### GeniCam® PoE cameras

COE-050-M-POE-023-IR-C	Area Scan camera MT9P031, CMOS, Rolling shutter, 2592 x 1944, 5 MP, 2.2 pix, 1/2.5", Gray, 14 fps, GigE, POE, C - mount, Glass filter
COE-013-M-POE-030-IR-C	Area Scan camera PYTHON 1300, CMOS, Global shutter, 1280 x 1024, 1.3 MP, 4.8 pix, 1/2", Gray, 90 fps, GigE, POE, C - mount, Glass filter
COE-013-C-POE-030-IR-C	Area Scan camera PYTHON 1300, CMOS, Global shutter, 1280 x 1024, 1.3 MP, 4.8 pix, 1/2", Color, 90 fps, GigE, POE, C - mount, Infrared cut filter
COE-106-M-POE-031-IR-C-2	Area Scan camera MT9J003, CMOS, Rolling shutter, 3840 x 2748, 10.6 MP, 1.67 pix, 1/2.3", Gray, 11 fps, GigE, POE, C - mount, Glass filter
COE-106-C-POE-031-IR-C	Area Scan camera MT9J003, CMOS, Global shutter, 3840 x 2748, 10.6 MP, 1.67 pix, 1/2.3", Color, 7 fps, GigE, POE, C - mount, Infrared cut filter
COE-032-M-POE-040-IR-C	Area Scan camera IMX265, CMOS, Global shutter, 2048 x 1536, 3.1 MP, 3.45 pix, 1/1.8", Gray, 37.5 fps, GigE, POE, C - mount, Glass filter
COE-032-C-POE-040-IR-C	Area Scan camera IMX265, CMOS, Global shutter, 2048 x 1536, 3.1 MP, 3.45 pix, 1/1.8", Color, 37.5 fps, GigE, POE, C - mount, Infrared cut filter
COE-063-M-POE-040-IR-C-B	Area Scan camera IMX178, CMOS, Rolling shutter, 3072 x 2048, 6.3 MP, 2.4 pix, 1/1.8", Gray, 17 fps, GigE, POE, C - mount, Glass filter
COE-063-C-POE-040-IR-C	Area Scan camera IMX178, CMOS, Rolling shutter, 3072 x 2048, 6.3 MP, 2.4 pix, 1/1.8", Color, 17 fps, GigE, POE, C - mount, Infrared cut filter
COE-122-M-POE-041-IR-C	Area Scan camera IMX226, CMOS, Rolling shutter, 4024 x 3036, 12.2 MP, 1.85 pix, 1/1.7", Gray, 9.6 fps, GigE, POE, C - mount, Glass filter
COE-122-C-POE-041-IR-C	Area Scan camera IMX226, CMOS, Rolling shutter, 4024 x 3036, 12.2 MP, 1.85 pix, 1/1.7", Color, 9.6 fps, GigE, POE, C - mount, Infrared cut filter
COE-023-M-POE-050-IR-C	Area Scan camera PYTHON 2000, CMOS, Global shutter, 1920 x 1200, 2.3 MP, 4.8 pix, 2/3", Gray, 51 fps, GigE, POE, C - mount, Glass filter
COE-023-C-POE-050-IR-C	Area Scan camera PYTHON 2000, CMOS, Global shutter, 1920 x 1200, 2.3 MP, 4.8 pix, 2/3", Color, 51 fps, GigE, POE, C - mount, Infrared cut filter
COE-050-M-POE-050-IR-C	Area Scan camera IMX264, CMOS, Global shutter, 2448 x 2048, 5 MP, 3.45 pix, 2/3", Gray, 23.5 fps, GigE, POE, C - mount, Glass filter
COE-050-C-POE-050-IR-C	Area Scan camera IMX264, CMOS, Global shutter, 2448 x 2048, 5 MP, 3.45 pix, 2/3", Color, 23.5 fps, GigE, POE, C - mount, Infrared cut filter



### COE-U series

#### USB 3.0 GeniCam® cameras

COE-016-M-USB-021-IR-C	Area Scan camera IMX273, CMOS, Global shutter, 1440 x 1080, 1.6 MP, 3.45 pix, 1/2.9", Gray, 165 fps, USB 3.0, C - mount, Glass filter
COE-016-C-USB-021-IR-C	Area Scan camera IMX273, CMOS, Global shutter, 1440 x 1080, 1.6 MP, 3.45 pix, 1/2.9", Color, 165 fps, USB 3.0, C - mount, Infrared cut filter
COE-050-C-USB-023-IR-C	Area Scan camera AR0521, CMOS, Rolling shutter, 2592 x 1944, 5 MP, 2.2 pix, 1/2.5", Color, 31 fps, USB 3.0, C - mount, Infrared cut filter
COE-013-M-USB-030-IR-C	Area Scan camera PYTHON 1300, CMOS, Global shutter, 1280 x 1024, 1.3 MP, 4.8 pix, 1/2", Gray, 170 fps, USB 3.0, C - mount, Glass filter
COE-013-C-USB-030-IR-C	Area Scan camera PYTHON 1300, CMOS, Global shutter, 1280 x 1024, 1.3 MP, 4.8 pix, 1/2", Color, 90 fps, USB 3.0, C - mount, Infrared cut filter
COE-063-M-USB-040-IR-C	Area Scan camera IMX178, CMOS, Rolling shutter, 3072 x 2048, 6.3 MP, 2.4 pix, 1/1.8", Gray, 42 fps, USB 3.0, C - mount, Glass filter
COE-063-C-USB-040-IR-C	Area Scan camera IMX178, CMOS, Rolling shutter, 3072 x 2048, 6.3 MP, 2.4 pix, 1/1.8", Color, 42 fps, USB 3.0, C - mount, Infrared cut filter
COE-050-M-USB-050-IR-C	Area Scan camera IMX264, CMOS, Global shutter, 2448 x 2048, 5 MP, 3.45 pix, 2/3", Gray, 35 fps, USB 3.0, C - mount, Glass filter



### mvBlueFOX3-2 series

#### USB3 vision camera with Sony Pregius CMOS sensors

<a href="#">RT-mvBF3-2004</a>	Usb3 vision camera with sony pregius cmos sensor imx287
<a href="#">RT-mvBF3-2016</a>	Usb3 vision camera with sony pregius cmos sensor imx273
<a href="#">RT-mvBF3-2032a</a>	USB3 Vision camera with Sony Pregius CMOS sensor IMX265
<a href="#">RT-mvBF3-2032</a>	USB3 Vision camera with Sony Pregius CMOS sensor IMX252
<a href="#">RT-mvBF3-2064</a>	Usb3 vision camera with sony pregius cmos sensor imx178
<a href="#">RT-mvBF3-2051a</a>	USB3 Vision camera with Sony Pregius CMOS sensor IMX264
<a href="#">RT-mvBF3-2051</a>	USB3 Vision camera with Sony Pregius CMOS sensor IMX250



#### mvBlueCOUGAR series

GigE & Dual GigE Vision cameras

<a href="#">RT-mvBC-X100w</a>	Camera with interface GigE (1GB/s), sensor size 1/3", mpixel 0.36, resolution 752 x 480, sensor name MT9V034, sensor type CMOS
<a href="#">RT-mvBC-X100f</a>	Camera with interface GigE (1GB/s), sensor size 1/2.9", mpixel 0.4, resolution 728 x 544, sensor name IMX287, sensor type CMOS
<a href="#">RT-mvBC-X102f</a>	Camera with interface GigE (1GB/s), sensor size 1/2.9", mpixel 1.58, resolution 1456 x 1088, sensor name IMX273, sensor type CMOS
<a href="#">RT-mvBC-XD102f</a>	Camera with interface Dual GigE (2GB/s), sensor size 1/2.9", mpixel 1.58, resolution 1456 x 1088, sensor name IMX273, sensor type CMOS
<a href="#">RT-mvBC-X105</a>	Camera with interface GigE (1GB/s), sensor size 1/2.5", mpixel 5.04, resolution 2592 x 1944, sensor name MT9P031, sensor type CMOS
<a href="#">RT-mvBC-X1010</a>	Camera with interface GigE (1GB/s), sensor size 1/2.3", mpixel 10.66, resolution 3856 x 2764, sensor name MT9J003, sensor type CMOS
<a href="#">RT-mvBC-X104i</a>	Camera with interface GigE (1GB/s), sensor size 1/1.8", mpixel 3.19, resolution 2064 x 1544, sensor name IMX265, sensor type CMOS
<a href="#">RT-mvBC-XD104h</a>	Camera with interface Dual GigE (2GB/s), sensor size 1/1.8", mpixel 3.19, resolution 2064 x 1544, sensor name IMX252, sensor type CMOS
<a href="#">RT-mvBC-X105b</a>	Camera with interface GigE (1GB/s), sensor size 2/3", mpixel 5.07, resolution 2464 x 2056, sensor name IMX264, sensor type CMOS
<a href="#">RT-mvBC-XD105a</a>	Camera with interface Dual GigE (2GB/s), sensor size 2/3", mpixel 5.01, resolution 2448 x 2048, sensor name IMX250, sensor type CMOS



#### Accessories

Accessories and add-ons to make the most of Opto Engineering lenses.

<a href="#">RT-mvBC-X104iC</a>	CMOS camera GIGE, 2064 x 1544 color, 1/1.8", 37 Hz, IR cut, C-mount, I/O
<a href="#">RT-mvBC-X105bC</a>	CMOS camera GIGE, 2464 x 2056 Colour sensor, 2/3", 23.5 Hz, IR cut, C-mount, I/O