

# TC series – Bi-telecentric lens for matrix detectors up to 2/3"



| Model                            | Mag.  | Image circle<br>Ø | Detector type              |                                |                            |                                |                                     | Optical specifications |      |                                 |                             |                |                   | Dimensions |        |      |
|----------------------------------|-------|-------------------|----------------------------|--------------------------------|----------------------------|--------------------------------|-------------------------------------|------------------------|------|---------------------------------|-----------------------------|----------------|-------------------|------------|--------|------|
|                                  |       |                   | 1/3"<br>w x h<br>4.8 x 3.6 | 1/2.5"<br>w x h<br>5.70 x 4.28 | 1/2"<br>w x h<br>6.4 x 4.8 | 1/1.8"<br>w x h<br>7.13 x 5.37 | 2/3" - 5 MP<br>w x h<br>8.45 x 7.07 | WD                     | wF/# | Telecentricity<br>typical (max) | Distortion<br>typical (max) | Field<br>depth | CTF @<br>70 lp/mm | Mount      | Length | Diam |
|                                  | (x)   | (mm)              | (mm)                       | (mm)                           | (mm)                       | (mm)                           | (mm)                                | (mm)                   |      | (deg)                           | (%)                         | (mm)           | (%)               |            | (mm)   | (mm) |
|                                  |       |                   |                            |                                |                            | 7                              |                                     | 1                      | 2    | 3                               | 4                           | 5              |                   |            | 6      |      |
| Object field of view (mm x mm) 8 |       |                   |                            |                                |                            |                                |                                     |                        |      |                                 |                             |                |                   |            |        |      |
| TC23004                          | 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   |
| TC23007                          | 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   |
| TC23009                          | 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   |
| TC23012                          | 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   |
| TC12016                          | 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 |
| TC23016                          | 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 |
| TC12024                          | 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   |
| TC23024                          | 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   |
| TC13036                          | 0.133 | 6.0               | 36.0 x 27.0                | Ø = 32.0                       | Ø = 36.0                   | Ø = 40.2                       | -                                   | 102.5                  | 8    | < 0.04 (0.08)                   | < 0.03 (0.08)               | 38             | > 50              | C          | 133.0  | 61   |
| TC12036                          | 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   |
| TC23036                          | 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   |
| TC13048                          | 0.098 | 6.0               | 48.8 x 36.6                | Ø = 43.5                       | Ø = 48.8                   | Ø = 54.6                       | -                                   | 133.4                  | 8    | < 0.08 (0.10)                   | < 0.06 (0.10)               | 65             | > 40              | C          | 167.9  | 75   |

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|         |       |                   | 1/3"<br>w x h<br>4.8 x 3.6       | 1/2.5"<br>w x h<br>5.70 x 4.28 | 1/2"<br>w x h<br>6.4 x 4.8 | 1/1.8"<br>w x h<br>7.13 x 5.37 | 2/3" - 5 MP<br>w x h<br>8.45 x 7.07 | WD                     | wF/# | Telecentricity<br>typical (max) | Distortion<br>typical (max) | Field<br>depth | CTF @<br>70 lp/mm | Mount      | Length | Diam |  |
|         | (x)   | (mm)              | (mm)                             | (mm)                           | (mm)                       | (mm)                           | (mm)                                | (mm)                   |      | (deg)                           | (%)                         | (mm)           | (%)               |            | (mm)   | (mm) |  |
|         |       |                   |                                  |                                |                            | 7                              |                                     | 1                      | 2    | 3                               | 4                           | 5              |                   |            | 6      |      |  |
|         |       |                   | Object field of view (mm x mm) 8 |                                |                            |                                |                                     |                        |      |                                 |                             |                |                   |            |        |      |  |
| TC12048 | 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   |  |
| TC23048 | 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   |  |
| TC12056 | 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   |  |
| TC23056 | 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   |  |
| TC13064 | 0.074 | 6.0               | 65.2 x 48.9                      | Ø = 58.1                       | Ø = 65.2                   | Ø = 72.9                       | -                                   | 181.9                  | 8    | < 0.06 (0.08)                   | < 0.03 (0.07)               | 124            | > 40              | C          | 212.3  | 100  |  |
| TC12064 | 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  |  |
| TC23064 | 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  |  |
| TC23072 | 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          | 299.2  | 116  |  |
| TC13080 | 0.059 | 6.0               | 81.2 x 60.9                      | Ø = 72.4                       | Ø = 81.2                   | Ø = 90.9                       | -                                   | 225.9                  | 8    | < 0.05 (0.08)                   | < 0.03 (0.08)               | 192            | > 40              | C          | 259.2  | 116  |  |
| TC12080 | 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  |  |
| TC23080 | 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  |  |
| TC23085 | 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          | 344.5  | 143  |  |
| TC13096 | 0.050 | 6.0               | 96.0 x 72.0                      | Ø = 85.5                       | Ø = 96.0                   | Ø = 107.4                      | -                                   | 279.6                  | 8    | < 0.06 (0.08)                   | < 0.04 (0.10)               | 268            | > 50              | C          | 303.3  | 143  |  |
| TC12096 | 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  |  |
| TC23096 | 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  |  |

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|---------|-------|-------------------|----------------------------------|--------------------------------|----------------------------|--------------------------------|-------------------------------------|------------------------|------|---------------------------------|-----------------------------|----------------|-------------------|------------|--------|------|--|
|         |       |                   | 1/3"<br>w x h<br>4.8 x 3.6       | 1/2.5"<br>w x h<br>5.70 x 4.28 | 1/2"<br>w x h<br>6.4 x 4.8 | 1/1.8"<br>w x h<br>7.13 x 5.37 | 2/3" - 5 MP<br>w x h<br>8.45 x 7.07 | WD                     | wF/# | Telecentricity<br>typical (max) | Distortion<br>typical (max) | Field<br>depth | CTF @<br>70 lp/mm | Mount      | Length | Diam |  |
|         | (x)   | (mm)              | (mm)                             | (mm)                           | (mm)                       | (mm)                           | (mm)                                | (mm)                   |      | (deg)                           | (%)                         | (mm)           | (%)               |            | (mm)   | (mm) |  |
|         |       |                   | Object field of view (mm x mm) 8 |                                |                            |                                |                                     |                        |      |                                 |                             |                |                   |            |        |      |  |
| TC23110 | 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          | 430.4  | 180  |  |
| TC12120 | 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          | 402.7  | 180  |  |
| TC23120 | 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          | 422.4  | 180  |  |
| TC23130 | 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          | 490.0  | 200  |  |
| TC12144 | 0.044 | 8.0               | 107.9 x<br>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          | 462.1  | 200  |  |
| TC23144 | 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          | 481.9  | 200  |  |
| TC23172 | 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          | 630.3  | 260  |  |
| TC12192 | 0.033 | 8.0               | 144.1 x<br>108.0                 | 171.1 x<br>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          | 602.6  | 260  |  |
| TC23192 | 0.046 | 11.0              | 104.9 x<br>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          | 622.3  | 260  |  |
| TC23200 | 0.044 | 11.0              | 110.0 x<br>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          | 792.0  | 322  |  |
| TC23240 | 0.037 | 11.0              | 130.8 x<br>98.1                  | 155.4 x<br>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          | 775.1  | 322  |  |

*Please refer to notes on next page*

## 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 (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 millimetre 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  $\mu\text{m}$ .
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 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 " $\emptyset =$ ", the image of a circular object of such diameter is fully inscribed into the detector.