PCCD series

Catadioptric lenses for 360° top and lateral view with just one camera

KEY ADVANTAGES

360° imaging of small objects
Parts down to 7.5 mm in diameter can be imaged.

Extra wide lateral view angle
Object sides are viewed at an angle approaching 45°.

Compactness
The lens can be easily integrated in any system.

Perfect chromatic correction
For RGB camera applications and color inspection.

ACCESSORY

PCCDLFAT Field of view extender for inspection of objects with diameter > 25 mm.

PCCD series are catadioptric lenses exclusively developed and manufactured by Opto Engineering® to enable the 360° side view of small objects. Their innovative optical design, based on a catadioptric system, makes it possible to image objects with diameters as small as 7 mm.
The sides of the object are imaged through the catadioptric system, while the top surface is directly imaged onto the center of the detector.

The compactness and high resolution of these lenses make them ideal to inspect components like pharmaceutical containers, plastic caps, pre-forms, bottlenecks, screws and other threaded objects.
PCCD series can work either with 1/2", 1/3" and 2/3" detectors. The sides of the object being inspected are observed over a wide view angle, approaching 45° at its maximum; this feature makes it possible to inspect complex object geometries from a convenient perspective.

Part number		PCCD 013	PCCD 012	PCCD 023
Detector type		**1/3"**	**1/2"**	**2/3"**
Image circle	Ø (mm)	3.6	4.8	6.6
Field of view	**(diam x height)**			
Min	(mm x mm)	7.5 x 5	7.5 x 5	7.5 x 5
Typical	(mm x mm)	15 x 10	15 x 10	15 x 10
Max	(mm x mm)	25 x 17	25 x 17	25 x 17
Extended with PCCDLFAT	(mm x mm)	35 x 26	35 x 26	35 x 25
Optical specifications				
Wavelength range	(nm)	450 .. 650	450 .. 650	450 .. 650
Working distance	(mm)	28 .. 53	28 .. 53	24 .. 47
Working distance with PCCDLFAT	(mm)	5 .. 11	5 .. 11	5 .. 11
CTF @ 50 lp/mm	(%)	> 35	> 30	> 30
F/#		6 - 24	8 - 32	8 - 24
Mechanical specifications				
Diameter	(mm)	143	143	143
Length	(mm)	110.5	110.5	110.5
Weight	(g)	980	990	990
Mount		C	C	C

Sample images taken with PCCD optics

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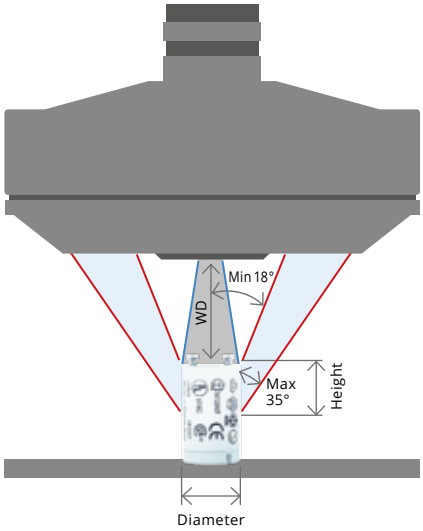

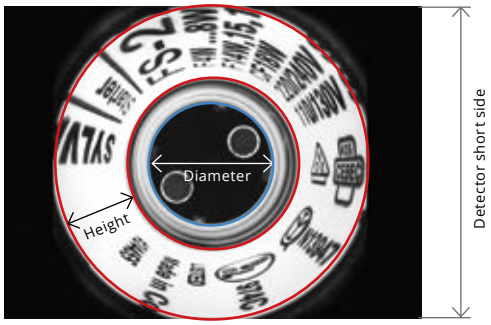

$$\mathbf{c}\ (\%) = \frac{\text{Top view diameter (px)}}{\text{Detector short side (px)}} * 100$$

Unwrapped image.

DEDICATED COMPATIBLE RINGLIGHTS		
	LTRN165x45, LTRN245x35	p. 124
DEDICATED CLAMPING MECHANICS		
	CMHO PCCD	p. 200
FIELD OF VIEW EXTENDER ACCESSORY		
	PCCDLFAT	p. 215

The image of the external walls of the object, captured through the catadioptric system, is inscribed into the short side of the camera detector within a circular crown. On the other hand, the top of the object is directly imaged onto the central part of the detector area: both the lateral and top view of the object are in perfect focus at the same time.

The tables show possible combinations of object diameters and heights along with the appropriate working distance and recommended F-number; the "c" parameter for each configuration is also listed.

The "c" parameter describes the dimension of the top view image: it is calculated as the ratio between the central top view diameter and the short side of the detector. The typical ratio between the object height and its diameter is 2/3 which means that, for a given object diameter (i.e. 15 mm), the recommended inspection height will be around 67% of the diameter (10 mm). However, this parameter can be modified to accommodate for different aspect ratios (up to 100%) by adjusting the lens working distance, focus and F-number.

Field of view selection chart

PCCD 013 field of view

Diameter (mm)	Height (mm)	WD (mm)	F/#	c (%)
7.5	5.0	53	24	11
10	6.7	49	16	15
15	10.0	42	12	22
20	13.3	35	8	30
25	16.7	28	6	37
Extended FOV with PCCDLFAT				
30	22	11	8	36
35	26	5	8	37

PCCD 012 field of view

Diameter (mm)	Height (mm)	WD (mm)	F/#	c (%)
7.5	5.0	53	32	13
10	6.7	49	24	17
15	10.0	42	16	25
20	13.3	34	12	33
25	16.7	28	8	42
Extended FOV with PCCDLFAT				
30	22	11	8	37
35	26	5	8	37

PCCD 023 field of view

Diameter (mm)	Height (mm)	WD (mm)	F/#	c (%)
7.5	5.0	47	24	12
10	6.7	45	24	16
15	10.0	38	16	24
20	13.3	30	12	32
25	16.7	24	8	40
Extended FOV with PCCDLFAT				
30	22	14	8	37
35	25	10	8	45

PCCD accessories

PCCDLFAT is an accessory designed to extend the FOV of PCCD optics and inspect objects with even larger diameters (beyond 25 mm).
This accessory can be easily mounted on PCCD optics by the user: simply remove the pre-assembled protective window and replace it with PCCDLFAT.

PCCD optics are complemented by a full set of accessories, including **CMHO PCCD**: dedicated clamping mechanics designed to securely hold catadioptric lenses.
LTRN series: specific LED ring illuminators.