RICOH Extended Depth of Field Camera (EDoF)

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Updated on July 22, 2013

RICOH EDoF Line Up

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■ GigE Vision Camera （3 models）

Model	Specifications
EV-G030B1	1/3” VGA Monochrome CCD Frame Rate: 90 fps Dimensions: 50(W)x50(H)x53.4(D)mm
EV-G200B1	1/1.8” UXGA(2 megapixel) Monochrome CCD Frame Rate: 15fps Dimensions: 50(W)x50(H)x53.4(D)mm
EV-G200C1	1/1.8” UXGA(2 megapixel) Color CCD Frame Rate: 15fps Dimensions: 50(W)×50(H)×53.4(D)mm

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■Lens （8 models）

Model	Specifications
EL-CC0817B-VG	8.5mm F1.7(fixed iris) VGA Dimensions: Φ42x40mm
EL-CC0833B-VG	8.5mm F3.3(fixed iris) VGA Dimensions: Φ42x40mm
EL-CC0866B-VG	8.5mm F6.6(fixed iris) VGA Dimensions: Φ42x40mm
EL-HC1228-2M	12mm F2.8(fixed iris) VGA or UXGA(2 megapixel) Dimensions: Φ29.5x28.5mm
EL-HC1255-2M	12mm F5.5(fixed iris) VGA or UXGA(2 megapixel) Dimensions: Φ29.5x28.5mm
EL-CC3521-2M	35mm F2.1(fixed iris) VGA or UXGA(2 megapixel) Dimensions: Φ29.5x35.4mm
EL-CC3543-2M	35mm F4.3(fixed iris) VGA or UXGA(2 megapixel) Dimensions: Φ29.5x35.4mm
EL-CC3586-2M	35mm F8.6(fixed iris) VGA or UXGA(2 megapixel) Dimensions: Φ29.5x35.4mm

RICOH EDoF Features

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■ EDoF Features

- **Extend depth of field, 3 times of ordinary VGA cameras, and 5 times of ordinary UXGA(2 megapixel) cameras**
- **Extension rings can be used**

■ Other Features

- Metal removable machined body is robust and efficiently radiates heat
- High precision & first-class CCD
- M4 tapped holes along with CCD center deployed on camera body sides
- Exposure-interval signal output
- Developed based on GigE Vision and GenICam standards
- Compatible to leading companies' libraries
- Lookup table function loaded
- Pre-processing functions loaded
- Strobe signal output deployed
- Various scan mode (Full or AOI)
- Software designer friendly, and various sample codes, C++, VB and C#, are available
- DC iris lens connector
- PoE

RICOH EDoF Cost Performance

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■Reduce time for preparation, image capturing, image processing and image analyzing

■Increase inspection and production efficiency

■Reduce takt time and production cost

■The camera allows users to handle complex scanning tasks with ease and efficiency, and reduce time, labor and costs that may have been spent for everyday system operation in the past. So, by adapting RICOH Extended Depth of Field Camera, the total cost of ownership including the initial cost and running cost may be reduced.

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Steps to select the right EDoF camera lens

1.Select a camera, VGA monochrome, UXGA(2 megapixel) monochrome or UXGA(2 megapixel) color
2.Determine 1) a size of area or an object to inspect , 2) necessary depth of field and 3) an allowable range of working distance, minimal and maximum
3.Based on the selected camera and the determined size to inspect and the working distance, select a lens focal length and F stop using RICOH lens selector

After follow through the above step 1 and 2, contact RICOH or authorized distributor to select the right EDoF camera lens for each application.

Important
Individual algorithm of each EDoF camera ordered is factory applied for the specific EDoF lens ordered together as the set. Do not mix up with other EDoF or ordinary cameras or lenses.

RICOH EDoF Selection Guide (VGA)

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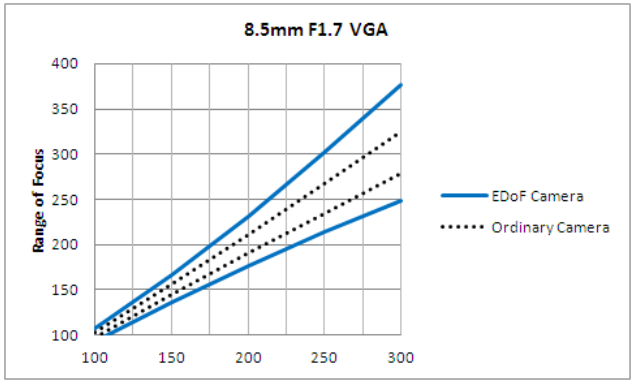
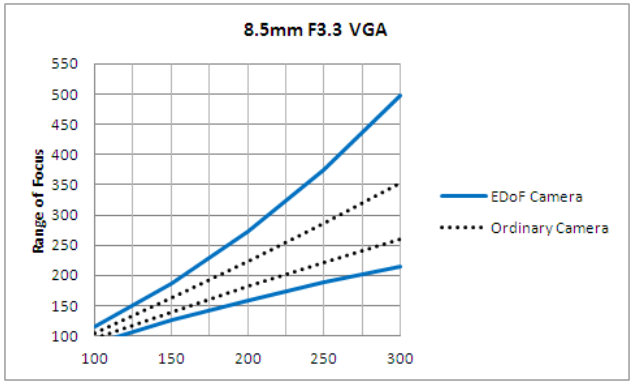
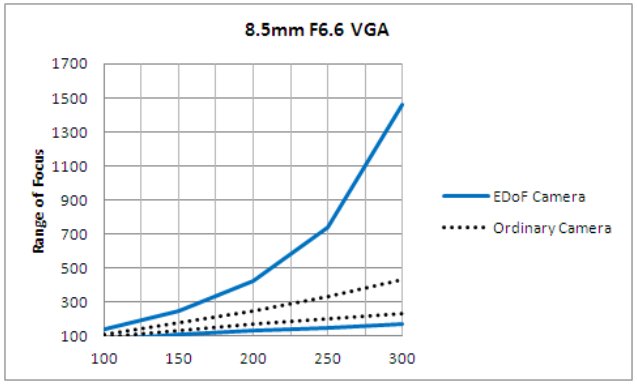
8.5mm F1.7 on VGA		Working Distance				
		100	150	200	250	300
EDoF Camera	Near Point	93.6	136.1	176.0	213.6	249.0
	Far Point	107.3	167.1	231.6	301.4	377.2
	DoF	13.7	31.0	55.6	87.9	128.2
Ordinary Camera	Near Point	97.5	144.4	190.2	234.8	278.4
	Far Point	102.7	156.1	210.9	267.3	325.3
	DoF	5.2	11.7	20.8	32.5	46.9



8.5mm F3.3 on VGA		Working Distance				
		100	150	200	250	300
EDoF Camera	Near Point	88.3	125.1	158.1	187.8	214.7
	Far Point	115.3	187.2	272.1	373.8	497.8
	DoF	27	62.1	114.0	186.0	283.1
Ordinary Camera	Near Point	95.2	139.5	181.7	222.1	260.7
	Far Point	105.3	162.2	222.3	285.9	353.2
	DoF	10.1	22.7	40.6	63.8	92.5

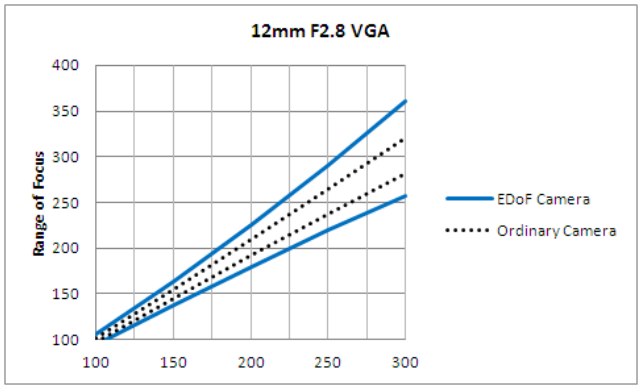


8.5mm F6.6 on VGA		Working Distance				
		100	150	200	250	300
EDoF Camera	Near Point	79.1	107.3	130.7	150.4	167.2
	Far Point	136.0	248.9	425.4	740.3	1461.6
	DoF	57.0	141.6	294.6	589.9	1294.4
Ordinary Camera	Near Point	90.9	130.4	166.5	199.8	230.5
	Far Point	111.2	176.6	250.3	333.9	429.5
	DoF	20.3	46.3	83.8	134.1	199.0

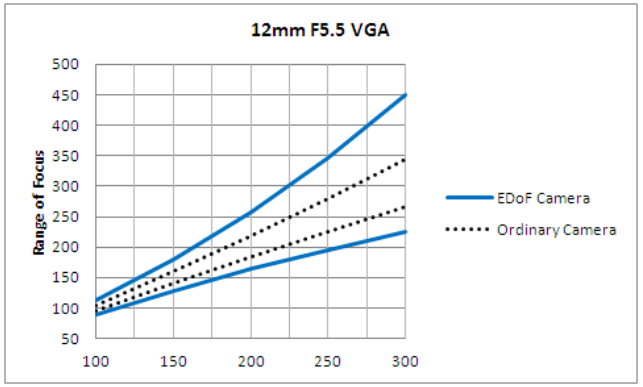


RICOH EDoF Selection Guide (VGA)

12mm F2.8 VGA		Working Distance				
		100	150	200	250	300
EDoF Camera	Near Point	94.7	138.3	179.7	219.1	256.6
	Far Point	106.0	163.9	225.4	291.0	361.1
	DoF	11.3	25.6	45.7	71.9	104.5
Ordinary Camera	Near Point	97.9	145.3	191.8	237.3	281.9
	Far Point	102.2	155.0	208.9	264.1	320.6
	DoF	4.3	9.6	17.1	26.8	38.7



12mm F5.5 VGA		Working Distance				
		100	150	200	250	300
EDoF Camera	Near Point	90.0	128.6	163.7	195.8	225.2
	Far Point	112.5	179.9	256.9	345.7	449.3
	DoF	22.4	51.3	93.2	150.0	224.1
Ordinary Camera	Near Point	96.0	141.1	184.5	226.2	266.4
	Far Point	104.4	160.1	218.3	279.3	343.3
	DoF	8.4	19.0	33.9	53.1	76.8



Note:
The DoF (Depth of Field) has been calculated based on pixel pitch. The practical DoF shall be subject to requirements of each application. Use this RICOH EDoF Selection Guide as reference.

RICOH EDoF Selection Guide (VGA)

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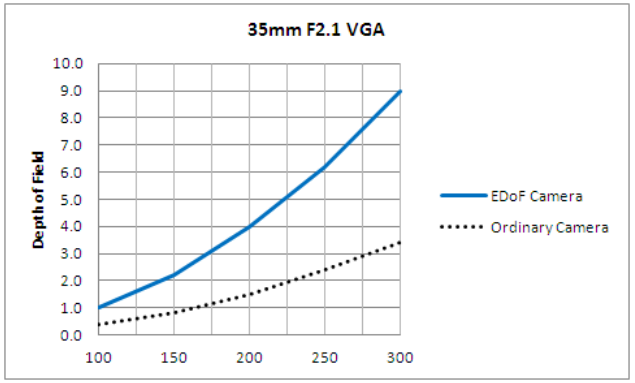
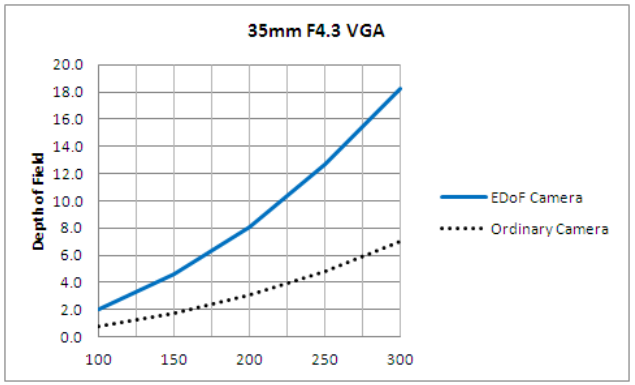
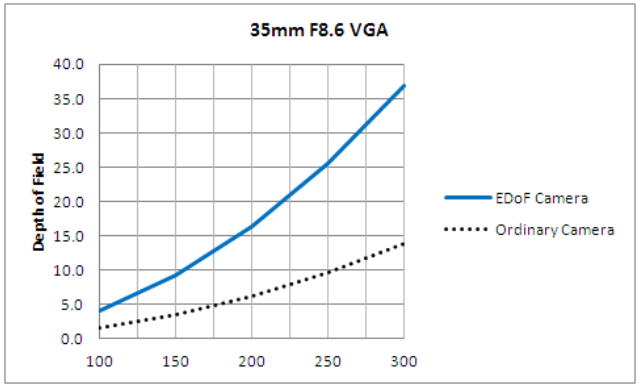
35mm F2.1 on VGA		Working Distance				
		100	150	200	250	300
EDoF Camera	Near Point	99.5	148.9	198.0	246.9	295.6
	Far Point	100.5	151.1	202.0	253.1	304.5
	DoF	1.0	2.2	4.0	6.2	9.0
Ordinary Camera	Near Point	99.8	149.6	199.2	248.8	298.3
	Far Point	100.2	150.4	200.8	251.2	301.7
	DoF	0.4	0.8	1.5	2.4	3.4



35mm F4.3 on VGA		Working Distance				
		100	150	200	250	300
EDoF Camera	Near Point	99.0	147.7	196.0	243.8	291.1
	Far Point	101.0	152.3	204.2	256.5	309.5
	DoF	2.0	4.6	8.1	12.7	18.3
Ordinary Camera	Near Point	99.6	149.1	198.5	247.6	296.6
	Far Point	100.4	150.9	201.6	252.4	303.5
	DoF	0.8	1.7	3.1	4.8	7.0

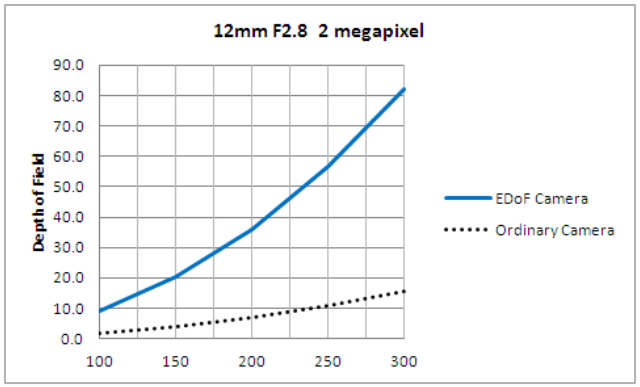


35mm F8.6 on VGA		Working Distance				
		100	150	200	250	300
EDoF Camera	Near Point	98.0	145.6	192.2	237.9	282.7
	Far Point	102.1	154.7	208.5	263.4	319.5
	DoF	4.1	9.2	16.3	25.5	36.8
Ordinary Camera	Near Point	99.2	148.3	197.0	245.3	293.2
	Far Point	100.8	151.8	203.1	254.9	307.1
	DoF	1.5	3.5	6.2	9.7	13.9

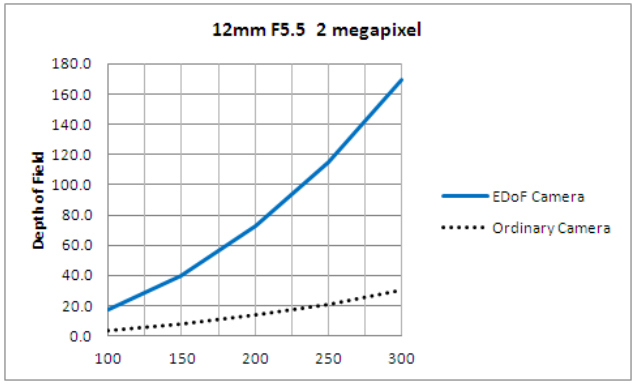


RICOH EDoF Selection Guide (UXGA/2 Megapixel)

12mm F2.8 on 2 megapixel		Working Distance				
		100	150	200	250	300
EDoF Camera	Near Point	95.7	140.6	183.6	224.9	264.5
	Far Point	104.7	160.8	219.6	281.5	346.5
	DoF	9.0	20.2	36.1	56.6	82.0
Ordinary Camera	Near Point	99.2	148.1	196.6	244.8	292.5
	Far Point	100.9	152.0	203.5	255.5	307.9
	DoF	1.7	3.9	6.8	10.7	15.4



12mm F5.5 on 2 megapixel		Working Distance				
		100	150	200	250	300
EDoF Camera	Near Point	91.9	132.5	170.1	205.0	237.4
	Far Point	109.6	172.8	242.6	320.4	407.4
	DoF	17.7	40.2	72.5	115.4	169.9
Ordinary Camera	Near Point	98.3	146.3	193.5	239.9	285.6
	Far Point	101.7	153.9	207.0	261.0	315.9
	DoF	3.4	7.6	13.5	21.0	30.3



RICOH EDoF Selection Guide (UXGA/2 Megapixel)

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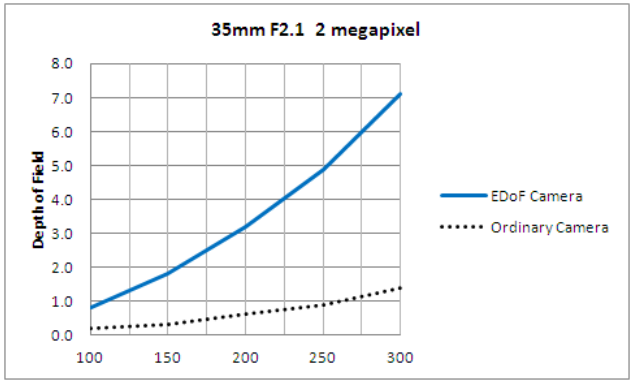
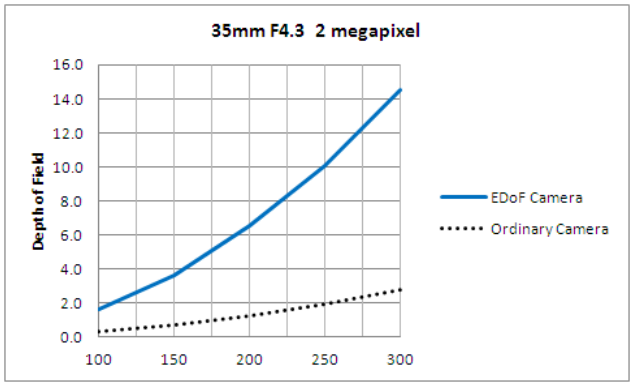
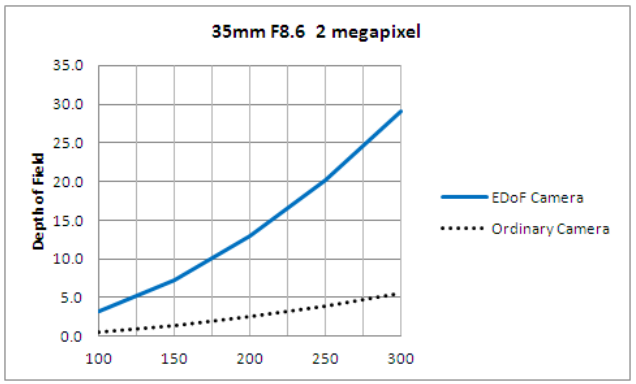
35mm F2.1 on 2 megapixel		Working Distance				
		100	150	200	250	300
EDoF Camera	Near Point	99.6	149.1	198.4	247.6	296.5
	Far Point	100.4	150.9	201.6	252.5	303.6
	DoF	0.8	1.8	3.2	4.9	7.1
Ordinary Camera	Near Point	99.9	149.8	199.7	249.5	299.3
	Far Point	100.1	150.2	200.3	250.5	300.7
	DoF	0.2	0.3	0.6	0.9	1.4



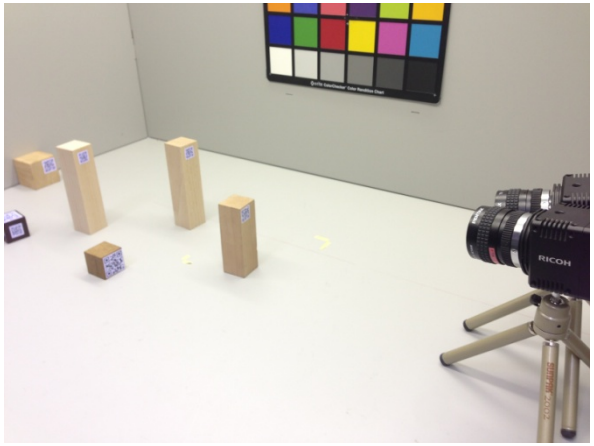
35mm F4.3 on 2 megapixel		Working Distance				
		100	150	200	250	300
EDoF Camera	Near Point	99.2	148.2	196.8	245.1	292.9
	Far Point	100.8	151.8	203.3	255.1	307.4
	DoF	1.6	3.6	6.5	10.1	14.5
Ordinary Camera	Near Point	99.8	149.7	199.4	249.0	298.6
	Far Point	100.2	150.3	200.6	251.0	301.4
	DoF	0.3	0.7	1.2	1.9	2.8

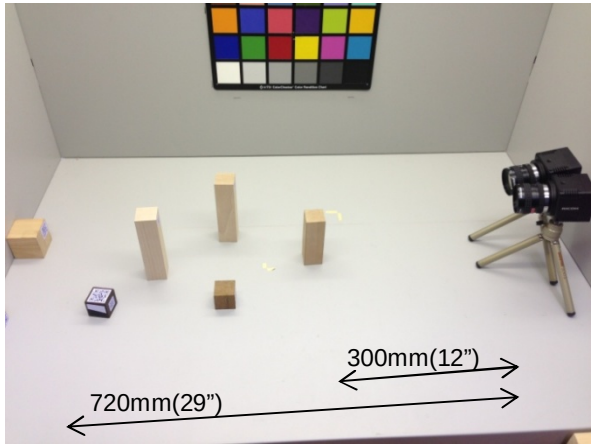


35mm F8.6 on 2 megapixel		Working Distance				
		100	150	200	250	300
EDoF Camera	Near Point	98.4	146.5	193.7	240.3	286.1
	Far Point	101.6	153.7	206.7	260.5	315.3
	DoF	3.2	7.3	12.9	20.2	29.1
Ordinary Camera	Near Point	99.7	149.3	198.8	248.1	297.2
	Far Point	100.3	150.7	201.2	251.9	302.8
	DoF	0.6	1.4	2.5	3.9	5.6

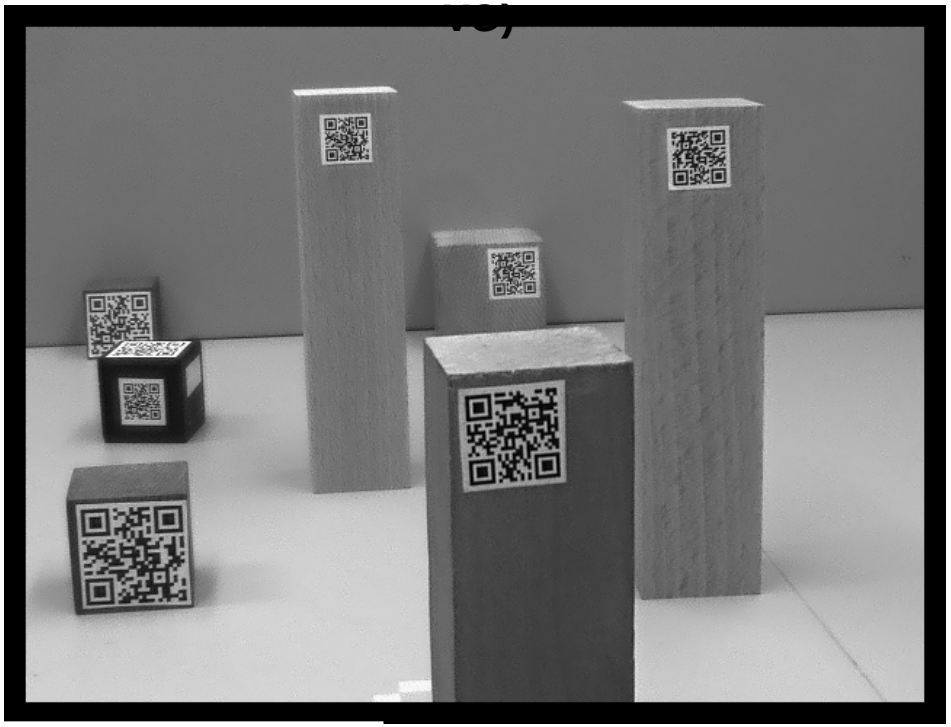


RICOH EDoF Camera Image

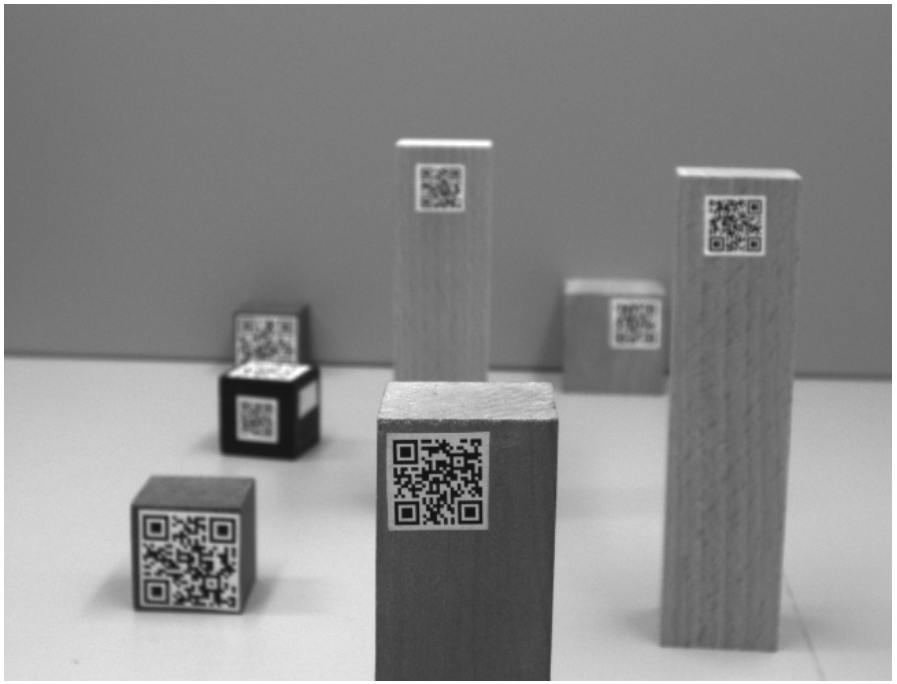




EDoF Camera (EV-G030B1 & EL-CC0833B-



Ordinary Camera



RICOH EDoF Applications (Inspection)

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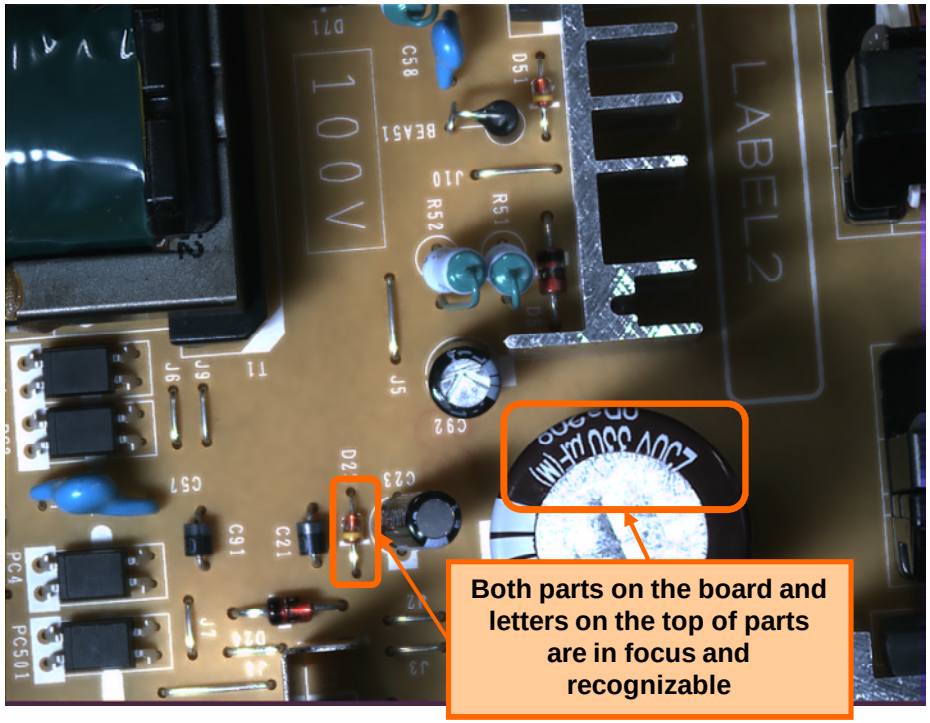
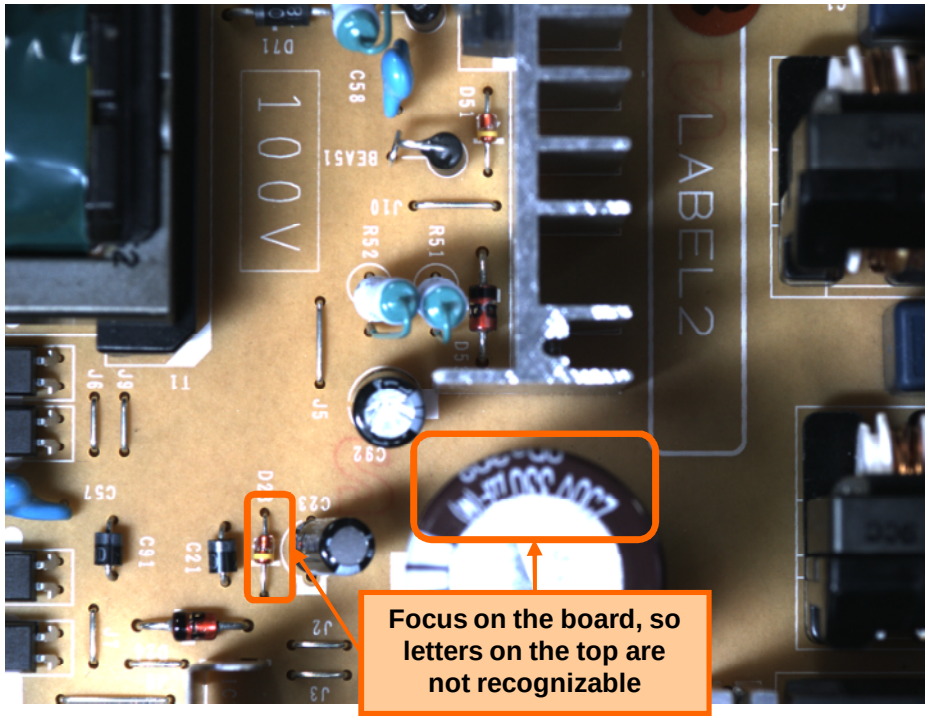
- PC board
- Various bottles and their labels & barcodes
- OCR applications
- Package
- Other many

RICOH EDoF Camera PCB Inspection



RICOH EDoF Camera

UXGA(2 megapixel) color & 35mm
Resolving power=35μm/pixel



Ordinary Camera

RICOH EDoF Camera Stainless Bottle Inspection

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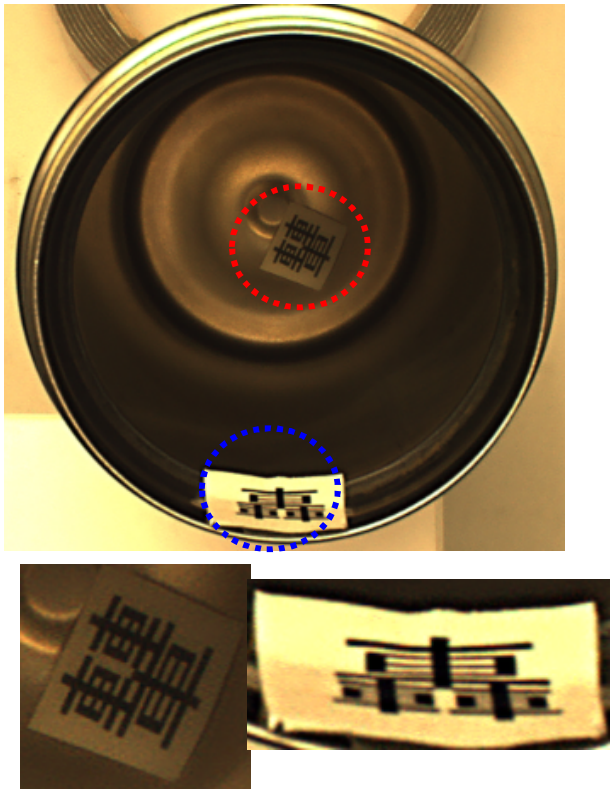
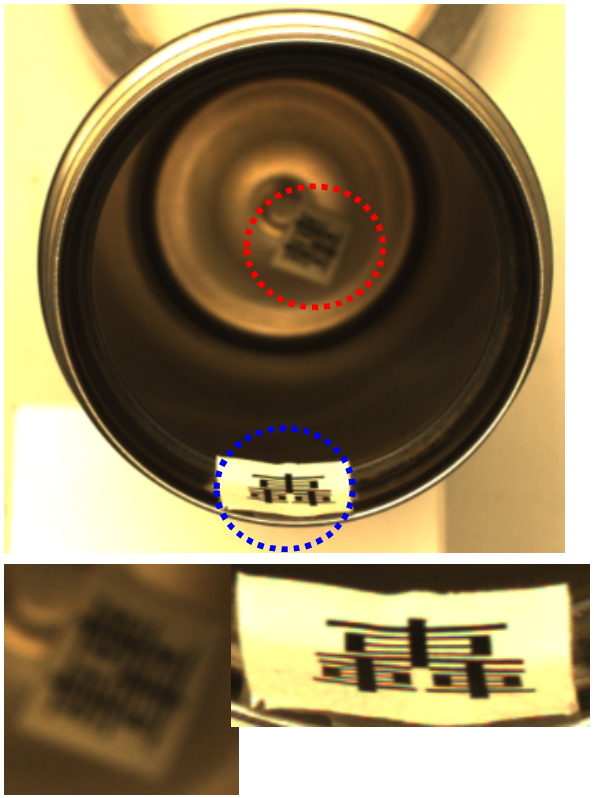
RICOH EDoF Camera
UXGA(2 megapixel)
Color & 12mm F5.5

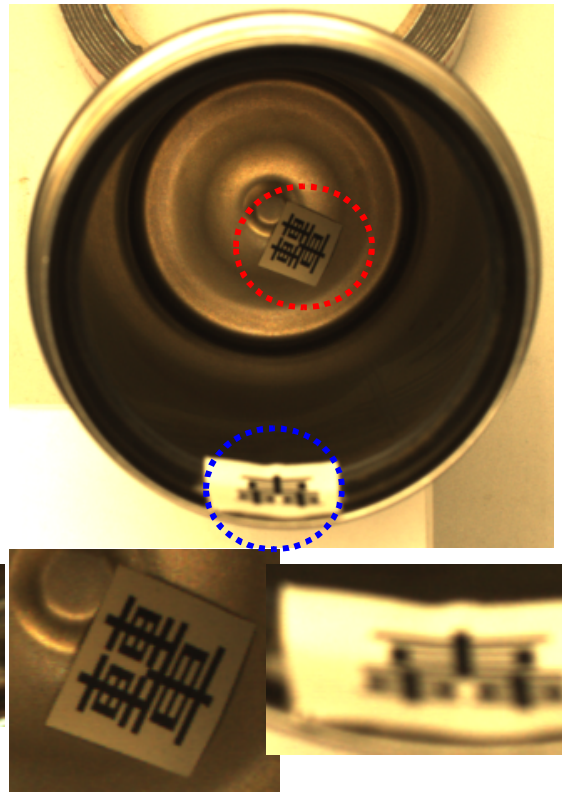


Ordinary Camera

Focused on the top



Focused on the bottom



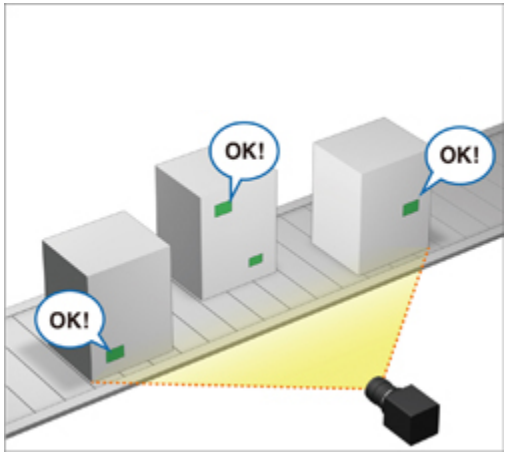
WD: 200mm to the top, and 400mm to the bottom

RICOH EDoF Camera Applications

Example application 1: foreground and background imaging

While capturing objects in both the foreground and the background previously involved multiple lenses and cameras or changing the camera position, it is now possible with our lens & camera to keep both the foreground and the background in focus without re-focus adjustment. Our lenses & cameras are ideal for QR code recognition and objects such as bottles or packages inspection on moving production lines, for example.

Capturing objects at different depths



Extended depth of field for sharpness near & far

Comparing traditional and extended depth-of-field lens & camera

**Imaging result from ordinary lens & camera.
Front QR code is unreadable.**

**Imaging result from extended depth-of-field lens & camera.
Both front and rear QR codes are readable.**

RICOH EDoF Camera Applications

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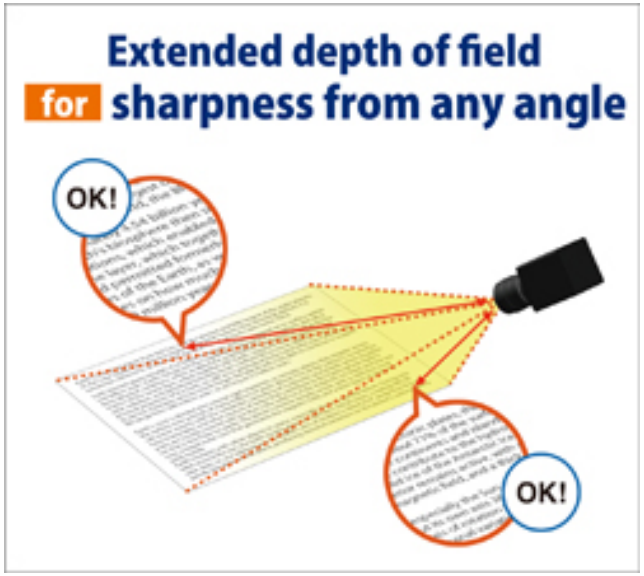
Example application 2: capturing oblique objects

While capturing oblique objects previously required multiple lenses and cameras or that the lenses need to be re-focused, it is now possible to keep an oblique object entirely in focus without readjustment. As a result, multiple images no longer need to be stitched together after separately capturing near and distant portions of the object. Instead, by means of our lenses and cameras, information on the entire subject can be captured in a single shot. Applications include OCR , PCB and substrate inspection.

Capturing an oblique object



RICOH EDoF Camera Applications

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Example application 3: capturing objects at different heights

While capturing objects at different heights previously involved multiple lenses and cameras or changing the vertical position of the camera, it is now possible to keep multiple objects at different heights in focus without readjustment. Potential applications include object recognition of products on moving production lines of different heights, and image recognition in cases where printed matters are progressively stacked higher.

Capturing objects at different heights