

PRECISE EYE FIXED LENS SYSTEM

High Magnification for Fixed Inspection Applications

Navitar's Precise Eye series of lenses is designed to provide superior optical performance over standard C-mount video lenses.

- High resolution, f/4.5 optical quality for high precision measurement and inspection
- Long working distance makes lighting and handling easier
- Coaxial lighting available for shadow-free illumination
- Compatible with high-magnification infinity corrected objectives
- Mechanically stable for the most demanding vibration environments
- Modular design for flexibility
- Optics attach to any C-mount camera
- Short tube length (~4 inches/101.6mm) and small diameter (1.25 inches/31.8mm)
- Allows for coaxial illumination and/or 3 mm fine focus
- High transmission (>70%) over the visible to near IR spectrum



Precise Eye Field of View Matrix (mm at nominal working distance)

Lens Attachment	W.D. (mm)	Camera Format & Parameters	0.5X Adapter 1-62088 H x V	0.67X Adapter 1-61453 H x V	1.0X Adapter 1-61445 H x V	1.33X Adapter 1-61448 H x V	2.0X Adapter 1-61450 H x V
0.25X 0.018 NA DOF 1.59 mm 1-6044	310 (nominal)	Mag.	0.23X	0.30X	0.45X	0.60X	0.90X
		1/4" Sensor	14.2 x 10.7	10.6 x 8.0	7.1 x 5.3	5.3 x 4.0	3.6 x 2.7
		1/3" Sensor	21.3 x 16.0	15.9 x 11.9	10.7 x 8.0	8.0 x 6.0	5.3 x 4.0
	282-351 (1) W.D. Range	1/2" Sensor	28.4 x 21.3	21.2 x 15.9	14.2 x 10.7	10.7 x 8.0	7.1 x 5.3
		2/3" Sensor	39.1 x 29.3	29.2 x 21.9	19.6 x 14.7	14.7 x 11.0	9.8 x 7.3
0.5X 0.035 NA DOF 0.40 mm 1-60110	175 (nominal)	Mag.	0.45X	0.60X	0.90X	1.20X	1.80X
		1/4" Sensor	7.1 x 5.3	5.3 x 4.0	3.6 x 2.7	2.7 x 2.0	1.8 x 1.3
		1/3" Sensor	10.7 x 8.0	8.0 x 6.0	5.3 x 4.0	4.0 x 3.0	2.7 x 2.0
	170-190 (1) W.D. Range	1/2" Sensor	14.2 x 10.7	10.6 x 8.0	7.1 x 5.3	5.3 x 4.0	3.6 x 2.7
		2/3" Sensor	19.6 x 14.7	14.6 x 10.9	9.8 x 7.3	7.4 x 5.5	4.9 x 3.7
0.75X 0.054 NA DOF 0.18 mm 1-60111	113 (nominal)	Mag.	0.68X	0.90X	1.35X	1.80X	2.70X
		1/4" Sensor	4.7 x 3.6	3.5 x 2.7	2.4 x 1.8	1.8 x 1.3	1.2 x 0.9
		1/3" Sensor	7.1 x 5.3	5.3 x 4.0	3.6 x 2.7	2.7 x 2.0	1.8 x 1.3
	110-120 (1) W.D. Range	1/2" Sensor	9.5 x 7.1	7.1 x 5.3	4.7 x 3.6	3.6 x 2.7	2.4 x 1.8
		2/3" Sensor	13.0 x 9.8	9.7 x 7.3	6.5 x 4.9	4.9 x 3.7	3.3 x 2.4
None 0.070 NA DOF 0.10 mm	92 (nominal)	Mag.	0.90X	1.21X	1.80X	2.39X	3.60X
		1/4" Sensor	3.6 x 2.7	2.7 x 2.0	1.8 x 1.3	1.3 x 1.0	0.9 x 0.7
		1/3" Sensor	5.3 x 4.0	4.0 x 3.0	2.7 x 2.0	2.0 x 1.5	1.3 x 1.0
	90-93 (1) W.D. Range	1/2" Sensor	7.1 x 5.3	5.3 x 4.0	3.6 x 2.7	2.7 x 2.0	1.8 x 1.3
		2/3" Sensor	9.8 x 7.3	7.3 x 5.5	4.9 x 3.7	3.7 x 2.8	2.4 x 1.8
1.5X 0.106 NA DOF 0.04 mm 1-60112	51 (nominal)	Mag.	1.35X	1.81X	2.70X	3.59X	5.40X
		1/4" Sensor	2.4 x 1.8	1.8 x 1.3	1.2 x 0.9	0.9 x 0.7	0.6 x 0.4
		1/3" Sensor	3.6 x 2.7	2.7 x 2.0	1.8 x 1.3	1.3 x 1.0	0.9 x 0.7
	49-51 (1) W.D. Range	1/2" Sensor	4.7 x 3.6	3.5 x 2.7	2.4 x 1.8	1.8 x 1.3	1.2 x 0.9
		2/3" Sensor	6.5 x 4.9	4.9 x 3.6	3.3 x 2.4	2.4 x 1.8	1.6 x 1.2
2.0X 0.142 NA DOF 0.02 mm 1-60113	36 (nominal)	Mag.	1.80X	2.41X	3.60X	4.79X	7.20X
		1/4" Sensor	1.8 x 1.3	1.3 x 1.0	0.9 x 0.7	0.7 x 0.5	0.4 x 0.3
		1/3" Sensor	2.7 x 2.0	2.0 x 1.5	1.3 x 1.0	1.0 x 0.8	0.7 x 0.5
	35-36 (1) W.D. Range	1/2" Sensor	3.6 x 2.7	2.7 x 2.0	1.8 x 1.3	1.3 x 1.0	0.9 x 0.7
		2/3" Sensor	4.9 x 3.7	3.6 x 2.7	2.4 x 1.8	1.8 x 1.4	1.2 x 0.9

NOTE: (1) Working distance range when using 3 mm fine focus. Field of view will change with shorter or longer working distances.

PRECISE EYE FIXED LENS SYSTEM

Precise Eye Performance Specifications

Precise Eye Combinations Lens Attachment + Precise Eye + Adapter	W.D. (mm)	Magnification	NA Object Side	Resolve Limits (μm)	Depth of Field (mm)	Required Matching Pixel Size (μm)
0.25x + Precise Eye + 0.5x	310	0.23x	0.018	18.8	1.59	2.1
0.25x + Precise Eye + 0.67x	310	0.30x	0.018	18.8	1.59	2.8
0.25x + Precise Eye + 1.0x	310	0.45x	0.018	18.8	1.59	4.2
0.25x + Precise Eye + 1.33x	310	0.60x	0.018	18.8	1.59	5.6
0.25x + Precise Eye + 2.0x	310	0.90x	0.018	18.8	1.59	8.4
0.5x + Precise Eye + 0.5x	175	0.45x	0.035	9.4	0.40	2.1
0.5x + Precise Eye + 0.67x	175	0.60x	0.035	9.4	0.40	2.8
0.5x + Precise Eye + 1.0x	175	0.90x	0.035	9.4	0.40	4.2
0.5x + Precise Eye + 1.33x	175	1.20x	0.035	9.4	0.40	5.6
0.5x + Precise Eye + 2.0x	175	1.80x	0.035	9.4	0.40	8.4
0.75x + Precise Eye + 0.5x	113	0.68x	0.054	6.2	0.18	2.1
0.75x + Precise Eye + 0.67x	113	0.90x	0.054	6.2	0.18	2.8
0.75x + Precise Eye + 1.0x	113	1.35x	0.054	6.2	0.18	4.2
0.75x + Precise Eye + 1.33x	113	1.80x	0.054	6.2	0.18	5.6
0.75x + Precise Eye + 2.0x	113	2.70x	0.054	6.2	0.18	8.4
None + Precise Eye + 0.5x	92	0.90x	0.071	4.6	0.10	2.1
None + Precise Eye + 0.67x	92	1.21x	0.071	4.6	0.10	2.8
None + Precise Eye + 1.0x	92	1.80x	0.071	4.6	0.10	4.2
None + Precise Eye + 1.33x	92	2.39x	0.071	4.6	0.10	5.6
None + Precise Eye + 2.0x	92	3.60x	0.071	4.6	0.10	8.4
1.5x + Precise Eye + 0.5x	51	1.35x	0.106	3.2	0.04	2.1
1.5x + Precise Eye + 0.67x	51	1.81x	0.106	3.2	0.04	3.0
1.5x + Precise Eye + 1.0x	51	2.70x	0.106	3.2	0.04	4.4
1.5x + Precise Eye + 1.33x	51	3.59x	0.106	3.2	0.04	5.8
1.5x + Precise Eye + 2.0x	51	5.40x	0.106	3.2	0.04	8.6
2.0x + Precise Eye + 0.5x	36	1.80x	0.142	2.4	0.02	2.1
2.0x + Precise Eye + 0.67x	36	2.41x	0.142	2.4	0.02	2.8
2.0x + Precise Eye + 1.0x	36	3.60x	0.142	2.4	0.02	4.2
2.0x + Precise Eye + 1.33x	36	4.79x	0.142	2.4	0.02	5.6
2.0x + Precise Eye + 2.0x	36	7.20x	0.142	2.4	0.02	8.4

Assumptions:

1. Minimum resolvable feature size is half of the threshold line pair limit. Calculation = $1/(3000 \times \text{Lens NA})$
2. Matching pixel size is that which will permit the minimum feature size to overlap two pixels. Calculation = $1/2(\text{Feature Size} \times \text{System Magnification})$
3. If the matching pixel size is greater than the camera pixel size, the system is "lens limited.", if it's less than the camera pixel size, the system is "camera limited."

ULTRA PRECISE EYE

Ultra Precise Eye System Greater Resolution and Magnification

Navitar offers a variety of Ultra Precise Eye systems ideal for high magnification applications. The advanced design produces outstanding contrast and precision, while providing higher resolution and magnification than the standard Precise Eye. These systems incorporate infinity corrected objectives to provide long working distances and excellent edge flatness and clarity. The Ultra Precise Eye is also available with fine focus (1-61521) or with fine focus and coaxial illumination (1-61522).



Ultra Precise Eye Magnification Matrix

Infinity Corrected Objective	W.D. (mm)	Camera Format & Parameters	0.5X Adapter 1-62088 H x V	0.67X Adapter 1-61453 H x V	1.0X Adapter 1-61445 H x V	1.33X Adapter 1-61448 H x V	2.0X Adapter 1-61450 H x V
4X 0.20 NA 1-55341	20	Mag.	1.78X	2.39X	3.56X	4.73X	7.12X
		1/4" Sensor	1.80 x 1.35	1.34 x 1.01	0.90 x 0.67	0.68 x 0.51	0.45 x 0.34
		1/3" Sensor	2.70 x 2.02	2.01 x 1.51	1.35 x 1.01	1.01 x 0.76	0.67 x 0.51
		1/2" Sensor	3.60 x 2.70	2.68 x 2.01	1.80 x 1.35	1.35 x 1.01	0.90 x 0.67
		2/3" Sensor	-	-	2.47 x 1.85	1.86 x 1.39	1.24 x 0.93
5X 0.14 NA 1-60226	34	Mag.	2.23X	2.98X	4.45X	5.92X	8.90X
		1/4" Sensor	1.44 x 1.08	1.07 x 0.80	0.72 x 0.54	0.54 x 0.41	0.36 x 0.27
		1/3" Sensor	2.16 x 1.62	1.61 x 1.21	1.08 x 0.81	0.81 x 0.61	0.54 x 0.40
		1/2" Sensor	2.88 x 2.16	2.15 x 1.61	1.44 x 1.08	1.08 x 0.81	0.72 x 0.54
		2/3" Sensor	-	-	1.98 x 1.48	1.49 x 1.12	0.99 x 0.74
10X 0.28 NA 1-60227	33	Mag.	4.45X	5.96X	8.90X	11.80X	17.80X
		1/4" Sensor	0.72 x 0.54	0.54 x 0.40	0.36 x 0.27	0.27 x 0.20	0.18 x 0.13
		1/3" Sensor	1.08 x 0.81	0.80 x 0.60	0.54 x 0.40	0.41 x 0.30	0.27 x 0.20
		1/2" Sensor	1.44 x 1.08	1.07 x 0.80	0.72 x 0.54	0.54 x 0.41	0.36 x 0.27
		2/3" Sensor	-	-	0.99 x 0.74	0.74 x 0.56	0.49 x 0.37
20X 0.42 NA 1-60228	20	Mag.	8.90X	11.90X	17.80X	23.70X	35.60X
		1/4" Sensor	0.36 x 0.27	0.27 x 0.20	0.18 x 0.13	0.14 x 0.10	0.09 x 0.07
		1/3" Sensor	0.54 x 0.40	0.40 x 0.30	0.27 x 0.20	0.20 x 0.15	0.13 x 0.10
		1/2" Sensor	0.72 x 0.54	0.54 x 0.40	0.36 x 0.27	0.27 x 0.20	0.18 x 0.13
		2/3" Sensor	-	-	0.49 x 0.37	0.37 x 0.28	0.25 x 0.19
50X 0.55 NA 1-60229	13	Mag.	22.30X	29.80X	44.50X	59.20X	89.00X
		1/4" Sensor	0.14 x 0.11	0.11 x 0.08	0.07 x 0.05	0.05 x 0.04	0.04 x 0.03
		1/3" Sensor	0.22 x 0.16	0.16 x 0.12	0.11 x 0.08	0.08 x 0.06	0.05 x 0.04
		1/2" Sensor	0.29 x 0.22	0.21 x 0.16	0.14 x 0.11	0.11 x 0.08	0.07 x 0.05
		2/3" Sensor	-	-	0.20 x 0.15	0.15 x 0.11	0.10 x 0.07

NOTE: The O-I remains constant for each body tube (main assembly) regardless of which infinity corrected objective and adapter are selected:

1-61517 I-O = 219 mm,

1-61521 I-O = 243 mm, 1-61522 I-O = 263 mm. NA varies with zoom setting.

PRECISE EYE FIXED LENS SYSTEM

Precise Eye with Co-axial Illumination

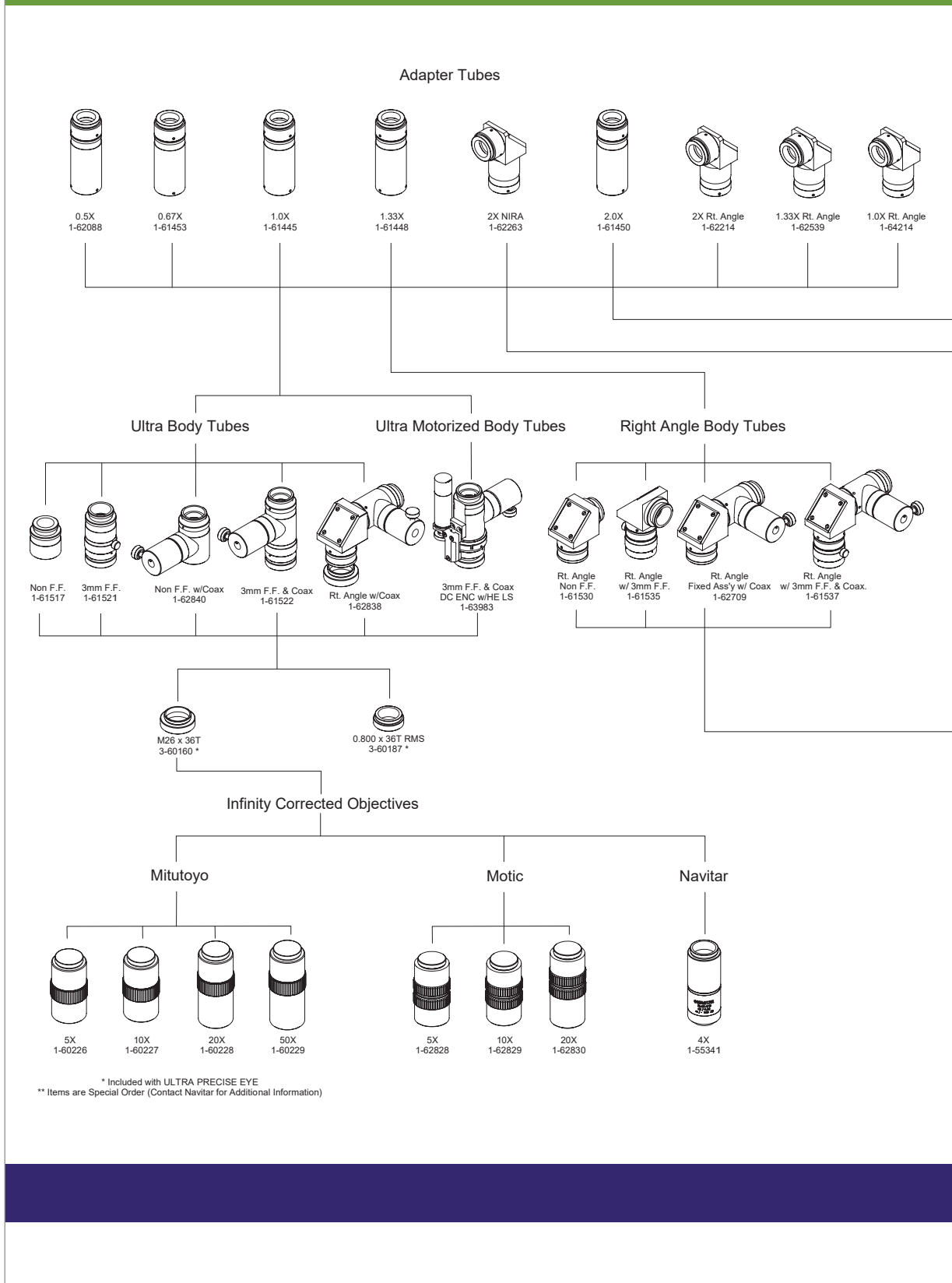
Navitar's Precise Eye with Internal Co-axial Illumination (1-61446) is an ideal solution for applications involving highly reflective surfaces, such as wafers, polished samples, and fluids. Designed to provide even illumination for higher magnification applications, coaxial illumination provides extremely detailed resolution, particularly when a high resolution camera is used.

Precise Eye Field of View Matrix for Co-axial Illumination (mm at nominal working distance)

Lens Attachment	W.D. (mm)	Camera Format & Parameters	0.5X Adapter 1-62088 H x V	0.67X Adapter 1-61453 H x V	1.0X Adapter 1-61445 H x V	1.33X Adapter 1-61448 H x V	2.0X Adapter 1-61450 H x V
0.5X 0.035 NA DOF 0.40 mm 1-60110	175 (nominal)	Mag.	0.45X	0.60X	0.90X	1.20X	1.80X
		1/4" Sensor	7.1 x 5.3	5.3 x 4.0	3.6 x 2.7	2.7 x 2.0	1.8 x 1.3
		1/3" Sensor	10.7 x 8.0*	8.0 x 6.0	5.3 x 4.0	4.0 x 3.0	2.7 x 2.0
	170-190 (1) W.D. Range	1/2" Sensor	14.2 x 10.7*	10.6 x 8.0*	7.1 x 5.3	5.3 x 4.0	3.6 x 2.7
		2/3" Sensor	19.6 x 14.7*	14.6 x 10.9*	9.8 x 7.3*	7.4 x 5.5	4.9 x 3.7*
0.75X 0.054 NA DOF 0.17 mm 1-60111	113 (nominal)	Mag.	0.68X	0.90X	1.35X	1.80X	2.70X
		1/4" Sensor	4.7 x 3.6	3.5 x 2.7	2.4 x 1.8	1.8 x 1.3	1.2 x 0.9
		1/3" Sensor	7.1 x 5.3	5.3 x 4.0	3.6 x 2.7	2.7 x 2.0	1.8 x 1.3
	110-120 (1) W.D. Range	1/2" Sensor	9.5 x 7.1*	7.1 x 5.3	4.7 x 3.6	3.6 x 2.7	2.4 x 1.8
		2/3" Sensor	13.0 x 9.8*	9.7 x 7.3*	6.5 x 4.9	4.9 x 3.7	3.3 x 2.4*
None 0.070 NA DOF 0.10 mm	92 (nominal)	Mag.	0.90X	1.21X	1.80X	2.39X	3.60X
		1/4" Sensor	3.6 x 2.7	2.7 x 2.0	1.8 x 1.3	1.3 x 1.0	0.9 x 0.7
		1/3" Sensor	5.3 x 4.0	4.0 x 3.0	2.7 x 2.0	2.0 x 1.5	1.3 x 1.0
	90-93 (1) W.D. Range	1/2" Sensor	7.1 x 5.3	5.3 x 4.0	3.6 x 2.7	2.7 x 2.0	1.8 x 1.3
		2/3" Sensor	9.8 x 7.3*	7.3 x 5.5*	4.9 x 3.7	3.7 x 2.8	2.4 x 1.8*
1.5X 0.106 NA DOF 0.046 mm 1-60112	51 (nominal)	Mag.	1.35X	1.81X	2.70X	3.59X	5.40X
		1/4" Sensor	2.4 x 1.8	1.8 x 1.3	1.2 x 0.9	0.9 x 0.7	0.6 x 0.4
		1/3" Sensor	3.6 x 2.7	2.7 x 2.0	1.8 x 1.3	1.3 x 1.0	0.9 x 0.7
	49-51 (1) W.D. Range	1/2" Sensor	4.7 x 3.6	3.5 x 2.7	2.4 x 1.8	1.8 x 1.3	1.2 x 0.9
		2/3" Sensor	6.5 x 4.9	4.9 x 3.6*	3.3 x 2.4	2.5 x 1.8	1.6 x 1.2*
2.0X 0.142 NA DOF 0.025 mm 1-60113	36 (nominal)	Mag.	1.80X	2.41X	3.60X	4.79X	7.20X
		1/4" Sensor	1.8 x 1.3	1.3 x 1.0	0.9 x 0.7	0.7 x 0.5	0.4 x 0.3
		1/3" Sensor	2.7 x 2.0	2.0 x 1.5	1.3 x 1.0	1.0 x 0.8	0.7 x 0.5
	35-36 (1) W.D. Range	1/2" Sensor	3.6 x 2.7	2.7 x 2.0	1.8 x 1.3	1.3 x 1.0	0.9 x 0.7
		2/3" Sensor	4.9 x 3.7	3.6 x 2.7*	2.4 x 1.8	1.8 x 1.4	1.2 x 0.9*

NOTE: *The internal coax will illuminate a circular area of about 11 mm in diameter. Any field of view larger than 11 mm will have darkened corners.
(1) Working distance range when using 3 mm fine focus. Field of view will change with shorter or longer working distance.

PRECISE EYE SYSTEM DIAGRAM



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