

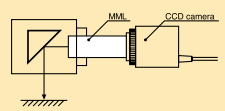
Prism Adapter

90° slide-looking rectangular mirror type

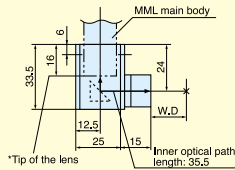


Optical axis can be bent 90 degrees.
Effective when there is no space above the object.
Monitored image is a mirror image.

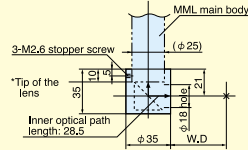
MML-P1
MML-P3
MML-P4



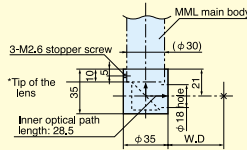
MML-P1



MML-P3



MML-P4



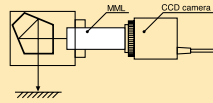
* Working distances in the drawings are that of the lenses', inner optical path length.

90° slide-looking pent prism type

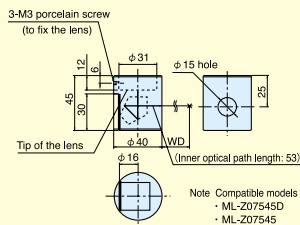
Monitored image is an electing image because of pent prism.



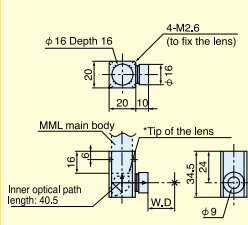
MML-P5 Made to order
MML-P6
MML-P8 Made to order



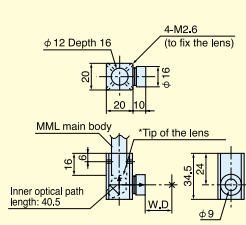
MML-P5



MML-P6



MML-P8



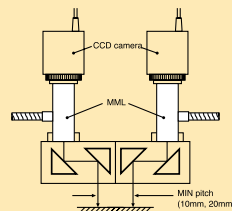
* Working distances in the drawings are that of the lenses', inner optical path length.

Optical axis pitch conversion type

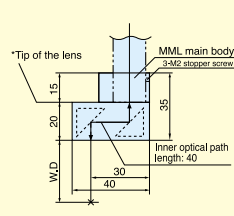
Narrow pitch marks between two points on a micro object can be recognized.



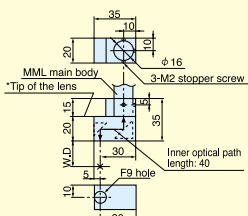
MML-P2
MML-P7
MML-P9



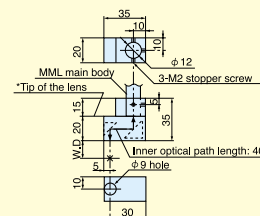
MML-P2



MML-P7



MML-P9



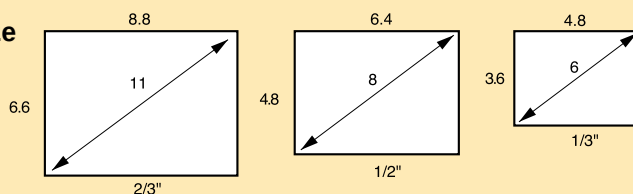
* Working distances in the drawings are that of the lenses', inner optical path length.

Compatible models

MML-P1	MML1-65D-CM1	MML4-110D
MML-P2	MML1-65-CM1	MML4-110D-CM1
MML-P6	MML1-65	MML6-65D
MML-P7	MML2-65D	MML6-65
	MML2-65	MML6-65D-CM1
	MML2-65D-CM1	MML6-65-CM1
	MML2-65-CM1	MML6-110D
	MML2-110D	MML6-110D-CM1
	MML2-110D-CM1	MML8-65D
	MML4-65D	MML8-65
	MML4-65	MML8-110D
	MML4-65D-CM1	MML10-110D
	MML4-65-CM1	MML12-110D
MML-P3	MML08-65D, MML1-65D	
MML-P4	MML08-110D, MML1-110D	
	MML08-110, MML1-110	
MML-P5	ML-Z07545D, ML-Z07545	
MML-P8	MML2-65D-CS1	
MML-P9	MML4-65D-CS1	
	MML6-65D-CS1	
	MML2-110D-CS1	
	MML4-110D-CS1	
	MML6-110D-CS1	

DATA List

CCD camera element size



MML field of view list

Optical magnification	2/3" (length x width x angle)	Monitor magnification		1/2" (length x width x angle)	Monitor magnification		1/3" (length x width x angle)	Monitor magnification	
		9"	14"		9"	14"		9"	14"
x 0.1	66 x 88 x 110	2.1	3.2	48 x 64 x 80	2.9	4.5	36 x 48 x 60	3.8	5.9
x 0.14	47 x 63 x 79	2.9	4.5	34 x 46 x 57	4.0	6.2	26 x 34 x 43	5.3	8.3
x 0.16	41 x 55 x 69	3.4	5.2	30 x 40 x 50	4.6	7.1	23 x 30 x 38	6.1	9.5
x 0.18	37 x 49 x 61	3.8	5.8	27 x 36 x 44	5.1	8.0	20 x 27 x 33	6.9	10.7
x 0.2	33 x 44 x 55	4.2	6.5	24 x 32 x 40	5.7	8.9	18 x 24 x 30	7.6	11.9
x 0.3	22 x 29 x 37	6.3	9.7	16 x 21 x 27	8.6	13.4	12 x 16 x 20	11.4	17.8
x 0.4	17 x 22 x 28	8.4	12.9	12 x 16 x 20	11.4	17.8	9 x 12 x 15	15.2	23.7
x 0.5	13 x 18 x 22	10.5	16.2	9.6 x 12.8 x 16	14.3	22.3	7.2 x 9.6 x 12	19.1	29.7
x 0.6	11 x 15 x 18	12.6	19.4	8.0 x 10.7 x 13	17.2	26.7	6 x 8 x 10	22.9	35.6
x 0.7	9 x 13 x 16	14.7	22.6	6.9 x 9.1 x 11	20.0	31.2	5.1 x 6.9 x 8.6	26.7	41.5
x 0.75	9 x 12 x 15	15.8	24.2	6.4 x 8.5 x 11	21.5	33.4	4.8 x 6.4 x 8.0	28.6	44.5
x 0.8	8 x 11 x 14	16.8	25.8	6.0 x 8.0 x 10	22.9	35.6	4.5 x 6.0 x 7.5	30.5	47.4
x 0.9	7.3 x 9.8 x 12.2	18.9	29.1	5.3 x 7.1 x 8.9	25.7	40.1	4.0 x 5.3 x 6.7	34.3	53.4
x 1	6.6 x 8.8 x 11.0	21.0	32.3	4.8 x 6.4 x 8.0	28.6	44.5	3.6 x 4.8 x 6.0	38.1	59.3
x 1.5	4.4 x 5.9 x 7.3	31.5	48.5	3.2 x 4.3 x 5.3	42.9	66.8	2.4 x 3.2 x 4.0	57.2	89.0
x 2	3.3 x 4.4 x 5.5	42.0	64.6	2.4 x 3.2 x 4.0	57.2	89.0	1.8 x 2.4 x 3.0	76.2	119
x 2.5	2.6 x 3.5 x 4.4	52.5	80.8	1.9 x 2.6 x 3.2	71.5	111	1.4 x 1.9 x 2.4	95.3	148
x 3	2.2 x 2.9 x 3.7	63.0	96.9	1.6 x 2.1 x 2.7	85.8	134	1.2 x 1.6 x 2.0	114	178
x 3.5	1.9 x 2.5 x 3.1	73.5	113	1.4 x 1.8 x 2.3	100	156	1.0 x 1.4 x 1.7	133	208
x 4	1.7 x 2.2 x 2.8	84.0	129	1.2 x 1.6 x 2.0	114	178	0.9 x 1.2 x 1.5	152	237
x 4.5	1.5 x 2.0 x 2.4	94.5	145	1.1 x 1.4 x 1.8	129	200	0.8 x 1.1 x 1.3	171	267
x 5	1.3 x 1.8 x 2.2	105	162	1.0 x 1.3 x 1.6	143	223	0.7 x 1.0 x 1.2	191	297
x 6	1.1 x 1.5 x 1.8	126	194	0.8 x 1.1 x 1.3	172	267	0.6 x 0.8 x 1.0	229	356
x 7	0.94 x 1.26 x 1.57	147	226	0.69 x 0.91 x 1.14	200	312	0.51 x 0.69 x 0.86	267	415
x 8	0.83 x 1.10 x 1.38	168	258	0.60 x 0.80 x 1.00	229	356	0.45 x 0.60 x 0.75	305	474
x 9	0.73 x 0.98 x 1.22	189	291	0.53 x 0.71 x 0.89	257	401	0.40 x 0.53 x 0.67	343	534
x 10	0.66 x 0.88 x 1.10	210	323	0.48 x 0.64 x 0.80	286	445	0.36 x 0.48 x 0.60	381	593
x 11	0.60 x 0.80 x 1.00	231	355	0.44 x 0.58 x 0.73	315	490	0.33 x 0.44 x 0.55	419	652
x 12	0.55 x 0.73 x 0.92	252	388	0.40 x 0.53 x 0.67	343	534	0.30 x 0.40 x 0.50	457	712

Formula

Resolution (mm) = $0.61 \text{ (fixed number)} \times 0.55 \text{ (design wavelength)} / \text{NA}$

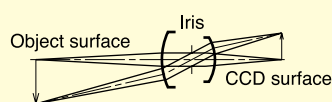
Effective FNO = $\text{magnification} / 2\text{NA}$

Depth of field (mm) = $2 \text{ (permissible circle of confusion)} \times \text{effective FNO} / \text{magnification}^2$

Luminous flux diameter = $2\text{NA} \times \text{height from a object} + \text{field size (angle)}$

Telecentric optical system's features

Non-telecentric lens



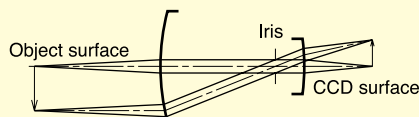
Pros

- Smaller size.
- Cost-saving because the number of lenses is fewer.

Cons

- Object size or position varies as the object surface goes up and down.

Object side telecentric lens



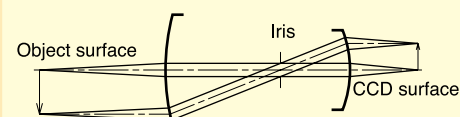
Pros

- Object size does not change even when the object surface goes up and down.
- Smaller size is possible because coaxial episcopic illumination is used.

Cons

- The lens is larger than regular lenses if coaxial episcopic illumination is not used.

Double-sided telecentric lens



Pros

- Similar to MMLs, accuracy is high when the size of the back of the camera flange differs greatly.

Cons

- Same as MMLs. More expensive than MMLs.