General catalog of image processing lenses, illumination systems, and peripherals

Machine Micro Lenses

Illumination Systems For Machine Vision

Peripherals

MORITEX CORPORATION

The best application for more efficient image processing
A total system with products that match any object

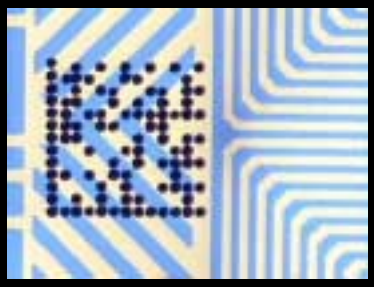
Recognition of fields larger than CCD elements

Effective application to recognize fields larger than CCD elements. To inspect large fields, use CCTV lenses, macro lenses, and LED with a variety of colors.

CCTV macro lens application

CCTV lens P.22 | Macro lens P.17 + LED illumination P.54

Two-dimensional code



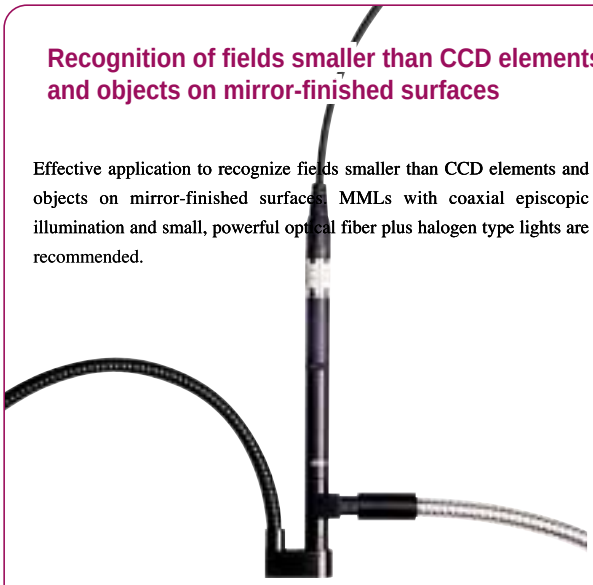
Illumination Simulated coaxial episcopic illumination LED P.57

Recognition of characters written on a battery

Illumination Low angel LED P.55

Recognition of fields smaller than CCD elements and objects on mirror-finished surfaces

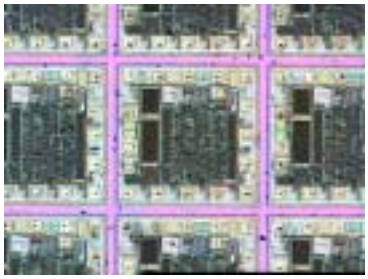
Effective application to recognize fields smaller than CCD elements and objects on mirror-finished surfaces. MMLs with coaxial episcopic illumination and small, powerful optical fiber plus halogen type lights are recommended.



MML application

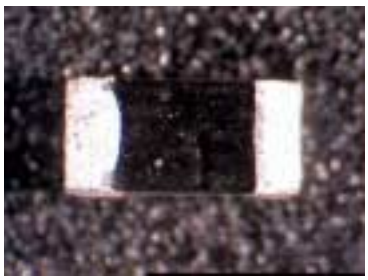
Coaxial episcopic illumination MML series P.5 + Optical fiber P.40 + Halogen type light source P.30

Wafer alignment



Illumination Coaxial episcopic illumination light guide P.25

Resistance visual inspection



Illumination Bifurcated light guide P.43

Lighting Pattern

Character recognition

Printed substrate inspection

Wafer recognition

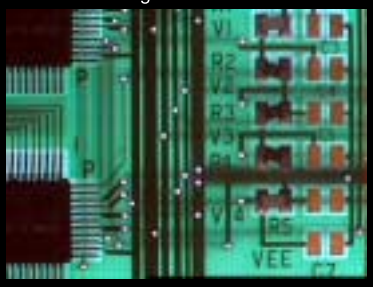
Scratch on a CD

Illumination Shadowless flat ring LED P.55

Mouth of a PET bottle

Illumination Sadowless flat ring LED P.55

Substrate through hole

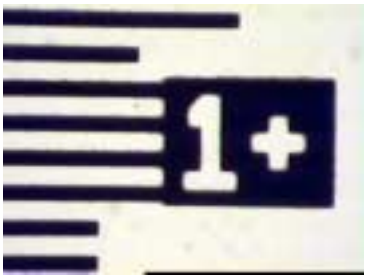


Illumination Edge light bar-type LED P.56

Connector soldering

Illumination Dome light guide P.45

TAB alignment mark

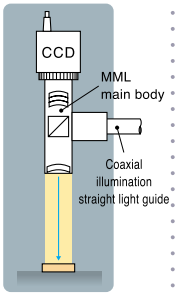


Illumination Bar-type light guide P.44

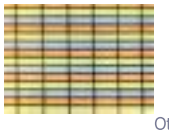
Needle point inspection

Illumination Ring light guide P.40

Coaxial illumination
(Blight field)

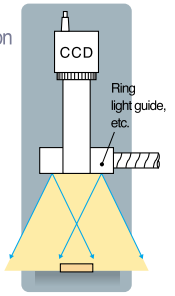


Color filter



IC pattern
Silicon wafer
Hard disk
LCD panel
Color filter
Other mirror finished work

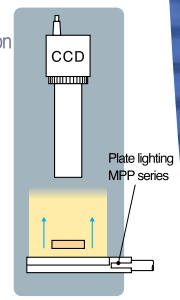
Oblique ray illumination
(Dark field)



Mounting part

Marks on a substrate
Scratch, edge
Convex inspection
Soldering, components
Other non-mirror finished work

Transmitted illumination
(Backlight)



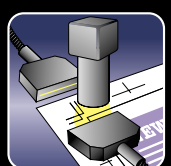
Color filter

IC lead shape
Pitch
Substrate through hole
LCD substrate electrodes
Other transparent bodies

IC bonding

BGA ball inspection

LCD color filter observation



Printing alignment inspection

IC lead inspection

Lighting a drawing

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source
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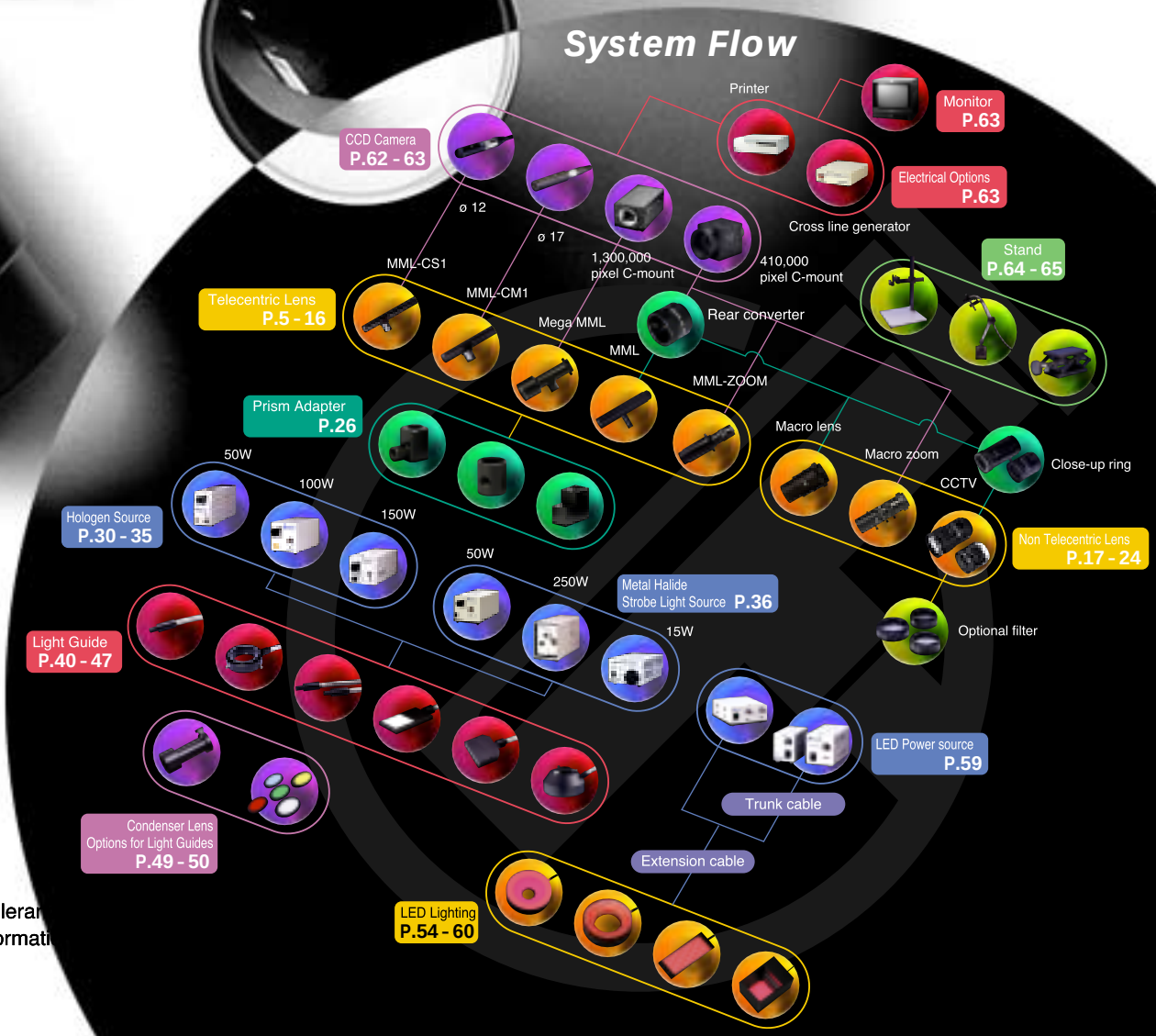
MML

Machine Micro Lenses

Machine Micro Lenses

System Flow



Not all dimensional toleran
For more detailed informati
specifications.

Mega MML Series

Compatible with 1,300,000 pixel

Mega MML Series

Telecentric

Mega MML Series

Mega MML Series lenses are small, telecentric, and coaxial. The products were developed to accurately inspect components and patterns that are becoming smaller and smaller. Former MMLs (for alignment) were designed prioritizing operational functions such as small size, long working distance, and depth of field. Mega MMLs (for inspection) were designed for precision inspections with a priority on resolution. High contrast image recognition is possible during eye inspection and image processing.

Features

- **High NA design for mega pixel CCD (maximum NA=0.11)**

  Mega MML Series was designed at 4.65μm/pix of pixel CCD element size. As a result, NA is very large and aberration is minimal. High resolution is possible when used with regular 410,000 pixel CCDs. Mega MMLs can perform best and higher resolution can be achieved when used with 1,300,000 pixel CCDs.

- **Telecentric optical design**

  Object side telecentric optical method is used for a high telecentric effect.

- **Amazing brightness**

  Effective FNO is at least 6.8. Lenses are twice as bright as conventional MMLs. Image contrast is high even under poor conditions such as when using a high-speed shutter.

- **Less depth**

  Since depth of field is very small, the lenses are hardly influenced by conditions other than the object to be inspected. Therefore, these lenses are perfect for surface observation.

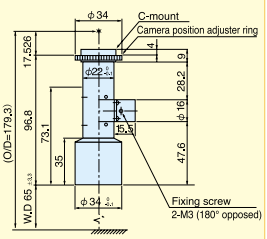
- **All lenses have a uniform coaxial illumination system.**

  The lenses have a coaxial illumination system that is best for recognizing objects with high reflectance such as wafers and glass substrate.

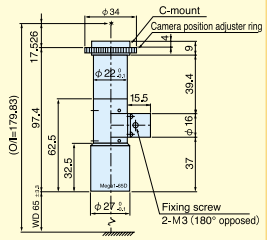
1,300,000 pixel CCD list

Model	Maker	No. of effective pixels	Pixel size	Cell size	H x V	Frame rate (frame/second)	Signal method	
							Digital output	Analog output
XCD-SX900	SONY	1,450,000	1/2"	4.65μm	1392 x 1040	7.5 pieces	IEEE-1394-1995	–
CV-M4	JAI	1,340,000	2/3"	6.7μm	1392 x 1040	24 pieces	EIA-644 LVDS 8bit	–
CS-3910	Tokyo Denshi Kogyo	1,340,000	2/3"	6.7μm	1300 x 1030	24 pieces	EIA-644 10bit	1.0Vp-p/75Ω
TM-1320-15CL	PULNiX	1,300,000	2/3"	6.7μm	1280 x 1024	15 pieces (30 pieces for partial reading)	8bit camera link	1.0Vp-p/75Ω

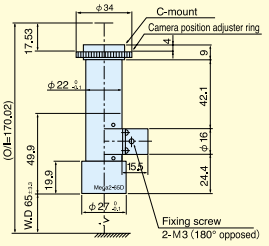
Mega05-65D



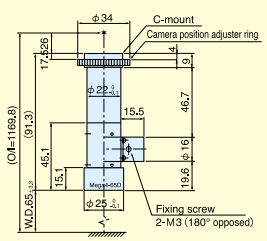
Mega1-65D



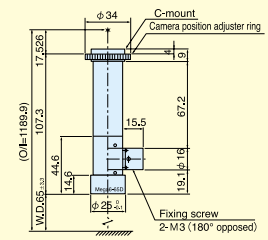
Mega2-65D



Mega4-65D



Mega6-65D



Product name	Magnification	Effective FNO	O/I	WD	Depth of field	Resolution	TV distortion	NA	Weight	Largest compatible CCD	Mount
Mega05-65D	x 0.5	6.8	179.3	65mm	2.2mm	9.2μm	-0.08% or less	0.04	120g	2/3"	C-mount
Mega1-65D	x 1	7.1	179.8	65mm	560μm	4.7μm	-0.08% or less	0.07	115g	2/3"	C-mount
Mega2-65D	x 2	10.1	170	65mm	200μm	3.4μm	-0.04% or less	0.1	100g	2/3"	C-mount
Mega4-65D	x 4	18.7	169.8	65mm	93μm	3.1μm	-0.12% or less	0.11	100g	2/3"	C-mount
Mega6-65D	x 6	26.8	189.9	65mm	59μm	3μm	-0.16% or less	0.11	105g	2/3"	C-mount

*Depth of field is calculated assuming a horizontal 320 TV resolution using a 1/2" CCD camera. (Permissible circle of confusion on the image-formation side: 40μm)
*Resolution indicates a theoretical resolution at a wavelength of 550nm.

Fixed Magnification MMLs for Alignment

MML (Machine Micro Lens) Series models are high-performance fixed magnification lenses for alignment. They are small with a long working distance for mounting on equipment and meet required optical performance conditions for alignment and part recognition.

Features

- Telecentric optical design (object side).
- Equipped with a uniform coaxial illumination system that covers the entire view.
- Small with a long working distance for mounting on equipment.
- A variety of products by WD and camera mount.

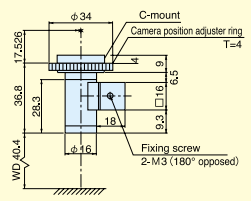
Model explanation

MML □ – □ □ – □

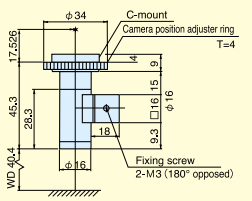
Magnification	WD	Illumination	Mount
		Nothing : None	No : C-mount
		D : Coaxial	CM1 : M15.5 x 0.5
			CS1 : M10.5 x 0.5

WD40 Series Telecentric

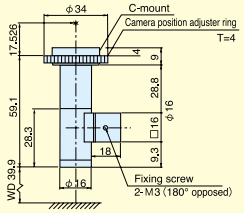
MML2-40D



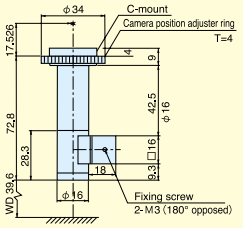
MML4-40D



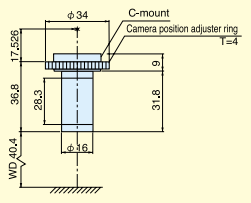
MML6-40D



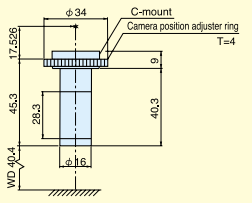
MML8-40D



MML2-40



MML4-40



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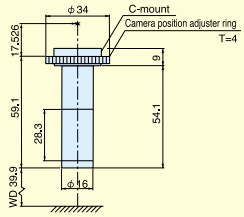
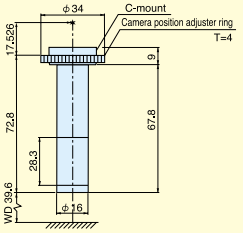


MML8-40



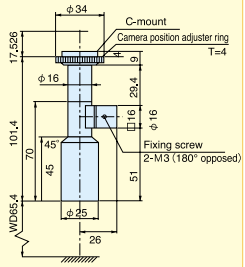
Product name	Magnification	Effective FNO	O/I	WD	Depth of field	Resolution	TV distortion	NA	Weight	Largest compatible CCD	Mount
MML2-40/40D	x 2	14.3	94.8	40.4mm	280μm	4.8μm	0.9% or less	0.07	40g/50g	1/2"	C-mount
MML4-40/40D	x 4	28.6	103.3	40.4mm	140μm	4.8μm	0.6% or less	0.07	40g/50g	1/2"	C-mount
MML6-40/40D	x 6	43	116.5	39.9mm	95μm	4.8μm	0.3% or less	0.07	50g/60g	1/2"	C-mount
MML8-40/40D	x 8	57.3	129.9	39.6mm	71μm	4.8μm	0.2% or less	0.07	53g/63g	1/2"	C-mount

* Depth of field is calculated assuming a horizontal 320 TV resolution using a 1/2" CCD camera. (Permissible circle of confusion on the image-formation side: 40μm)
* Resolution indicates a theoretical resolution at a wavelength of 550nm.

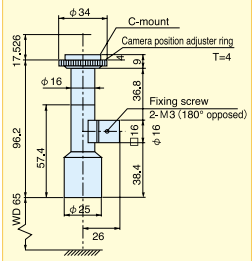
WD65 Series

Telecentric

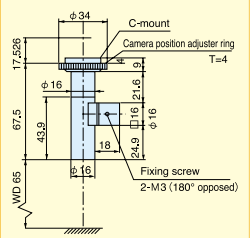
MML08-65D



MML1-65D



MML2-65D



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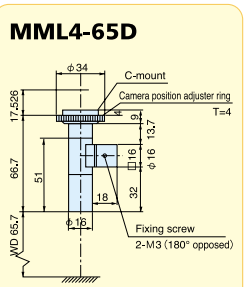
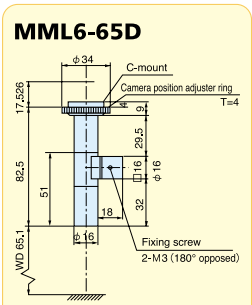
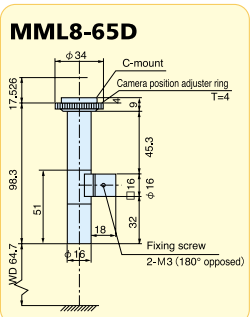


MML6-65D



MML8-65D



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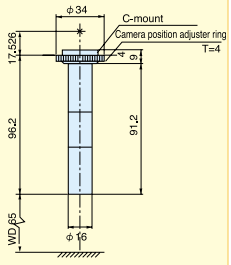

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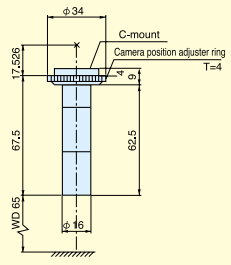

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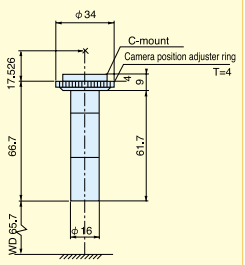

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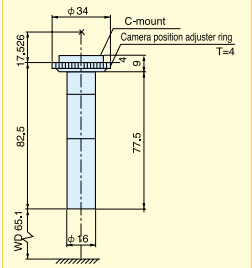
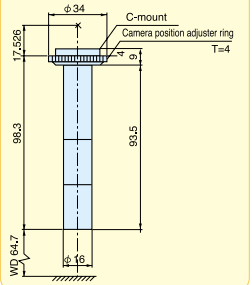


MML8-65



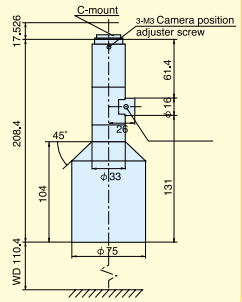
Product name	Magnification	Effective FNO	O/I	WD	Depth of field	Resolution	TV distortion	NA	Weight	Largest compatible CCD	Mount
MML08-65D	x 0.8	14.9	184.4	65.4mm	1.9mm	12μm	0.1% or less	0.03	66g	2/3"	C-mount
MML1-65/65D	x 1	18.6	178.8	65mm	1.5mm	12μm	0.1% or less	0.03	54g/66g	1/2"/ 2/3"	C-mount
MML2-65/65D	x 2	17.4	150.1	65mm	350μm	5.8μm	0.1% or less	0.06	48g/60g	2/3"	C-mount
MML4-65/65D	x 4	27	149.9	65.7mm	130μm	4.5μm	0.4% or less	0.07	50g/62g	1/2"	C-mount
MML6-65/65D	x 6	40.8	165.1	65.1mm	90μm	4.5μm	0.2% or less	0.07	53g/65g	1/2"	C-mount
MML8-65/65D	x 8	54.7	180.5	64.7mm	68μm	4.6μm	0.1% or less	0.07	58g/70g	1/2"	C-mount

* Depth of field is calculated assuming a horizontal 320 TV resolution using a 1/2" CCD camera. (Permissible circle of confusion on the image-formation side: 40μm)
* Resolution indicates a theoretical resolution at a wavelength of 550nm.

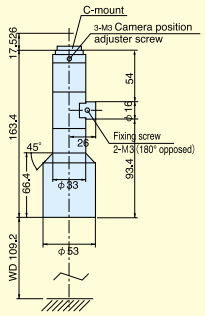
WD110 Series

Telecentric

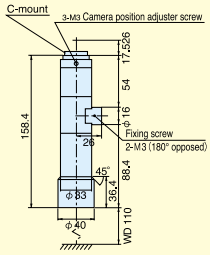
MML018-110D



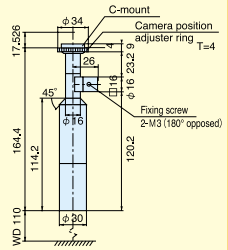
MML03-110D



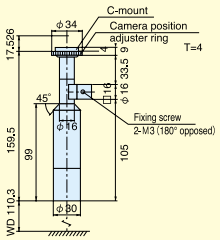
MML05-110D



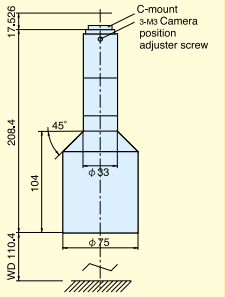
MML08-110D



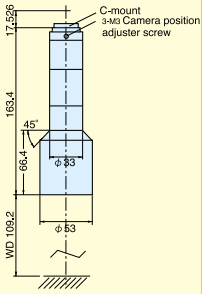
MML1-110D



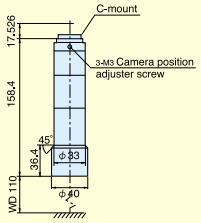
MML018-110



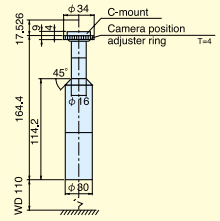
MML03-110



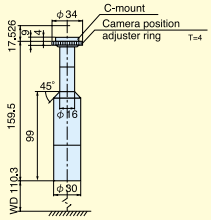
MML05-110



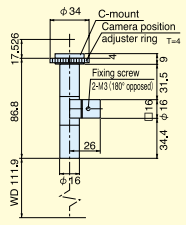
MML08-110



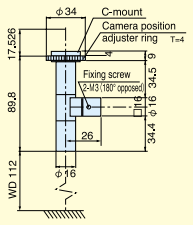
MML1-110



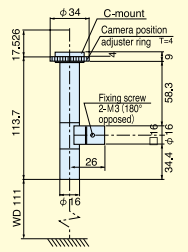
MML2-110D



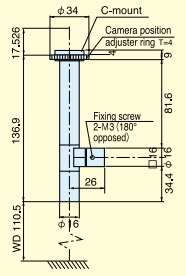
MML4-110D



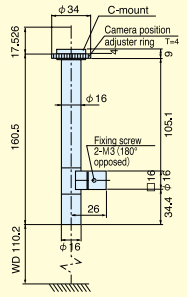
MML6-110D



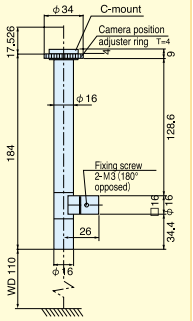
MML8-110D



MML10-110D



MML12-110D



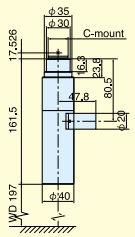
Product name	Magnification	Effective FNO	O/I	WD	Depth of field	Resolution	TV distortion	NA	Weight	Largest compatible CCD	Mount
MML018-110/110D	x 0.18	6.4	336.3	110.4mm	15mm	24μm	0.1% or less	0.01	700g/700g	2/3"	C-Mount
MML03-110/110D	x 0.3	7	290.1	109.2mm	6mm	16μm	0.3% or less	0.02	380g/380g	2/3"	C-Mount
MML05-110/110D	x 0.5	11.6	286	110mm	3.7mm	16μm	0.3% or less	0.02	280g/280g	2/3"	C-Mount
MML08-110/110D	x 0.8	16.1	292	110mm	2mm	14μm	0.3% or less	0.02	150g/150g	2/3"	C-Mount
MMl1-110/110D	x 1	16.7	287.4	110.3mm	1.3mm	11μm	0.2% or less	0.03	140g/140g	2/3"	C-Mount
MML2-110D	x 2	33.2	216.3	111.9mm	670μm	11μm	0.1% or less	0.03	73g	2/3"	C-Mount
MML4-110D	x 4	43.9	219.3	112mm	230μm	7.7μm	0.2% or less	0.04	75g	2/3"	C-Mount
MML6-110D	x 6	66.2	242.2	111mm	170μm *1	7.6μm	0.2% or less	0.04	78g	2/3"	C-Mount
MML8-110D	x 8	88	265	110.5mm	170μm *1	7.6μm	0.1% or less	0.04	80g	2/3"	C-Mount
MML10-110D	x 10	112.7	288.2	110.2mm	180μm *1	8μm *2	0.1% or less	0.04	85g	2/3"	C-Mount
MML12-110D	x 12	135.1	311.6	110mm	220μm *1	10μm *2	0.1% or less	0.04	88g	2/3"	C-Mount

*Depth of field is calculated assuming a horizontal 320 TV resolution using a 1/2" CCD camera. (Permissible circle of confusion on the image-formation side: 40μm) But *1 is calculated based on resolution.
*Resolution indicates a theoretical resolution at a wavelength of 550nm. But *2 indicates a theoretical resolution when a green filter is used.

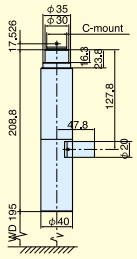
WD195 Series

Telecentric

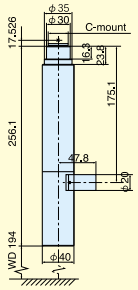
MML4-195D



MML6-195D



MML8-195D



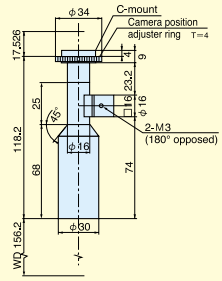
Product name	Magnification	Effective FNO	O/I	WD	Depth of field	Resolution	TV distortion	NA	Weight	Largest compatible CCD	Mount
MML4-195D	x 4	25.3	376	197mm	130μm	4.2μm	0.1% or less	0.08	480g	2/3"	C-mount
MML6-195D	x 6	37.6	421.3	195mm	80μm	4.2μm	0.1% or less	0.0.8	490g	2/3"	C-mount
MML8-195D	x 8	49.9	467.6	194mm	60μm	4.2μm	0.1% or less	0.08	500g	2/3"	C-mount

*Depth of field is calculated assuming a horizontal 320 TV resolution using a 1/2" CCD camera. (Permissible circle of confusion on the image-formation side: 40μm)
*Resolution indicates a theoretical resolution at a wavelength of 550nm.

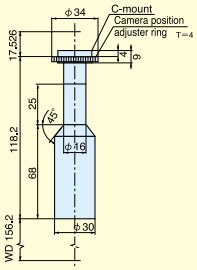
Long WD Series

Telecentric Made to order

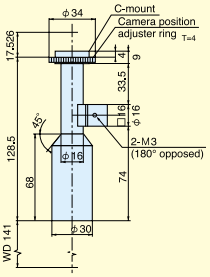
MML08-156D



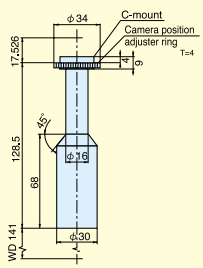
MML08-156



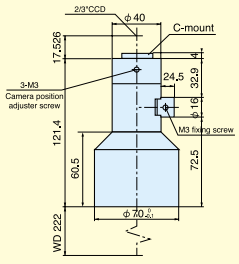
MML1-141D



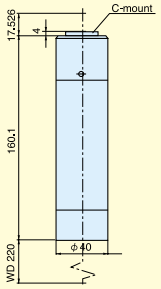
MML1-141



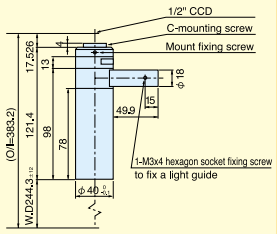
MML02-220D



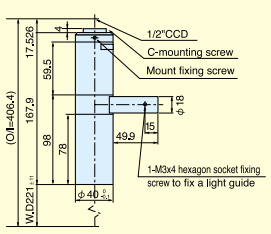
MML2-220



MML1-244D



MML2-221D



Product name	Magnification	Effective FNO	O/I	WD	Depth of field	Resolution	TV distortion	NA	Weight	Largest compatible CCD	Mount
MML08-156/156D	x 0.8	16.1	292	156.2mm	2mm	14μm	0.3% or less	0.02	125g/130g	2/3"	C-mount
ML1-141/141D	x 1	16.7	287.4	141.3mm	1.3mm	11μm	0.2% or less	0.03	115g/120g	2/3"	C-mount
MML02-220D	x 0.2	5	360.9	222mm	10mm	16.7μm	0.1% or less	0.02	450g	2/3"	C-mount
MML2-220	x 2	18	397.6	220mm	370μm	6.2μm	0.2% or less	0.05	400g	2/3"	C-mount
MML1-244D	x 1	11	383.2	244.3mm	880μm	7.4μm	0.1% or less	0.05	260g	1/2"	C-mount
MML2-221D	x 2	21.9	406.4	221mm	220μm	7.4μm	0.1% or less	0.05	320g	1/2"	C-mount

*Depth of field is calculated assuming a horizontal 320 TV resolution using a 1/2" CCD camera. (Permissible circle of confusion on the image-formation side: 40μm)
*Resolution indicates a theoretical resolution at a wavelength of 550nm.

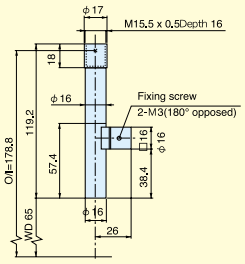
MML-CM1/CS1 Series Fixed Magnification

MML-CM1/CS1 Series models are thin, space-saving, and light-weight so they can be mounted on micro-head cameras.
MML-CM1 Series models are mounted on 17mm ø (M15.5x0.5) and MML-CS1 Series models are mounted on 12mm ø (M10.5x0.5).

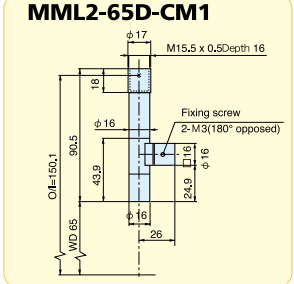
WD65-CM1 Series

Telecentric

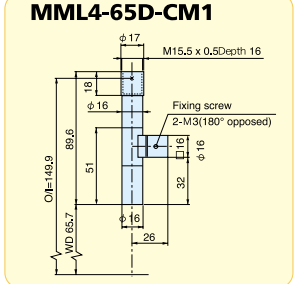
MML1-65D-CM1



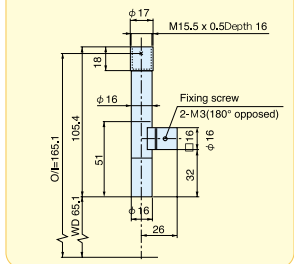
MML2-65D-CM1



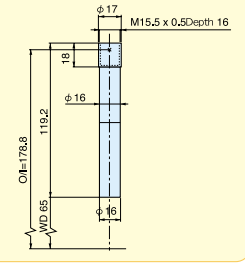
MML4-65D-CM1



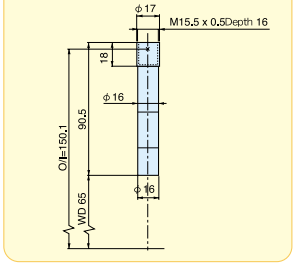
MML6-65D-CM1



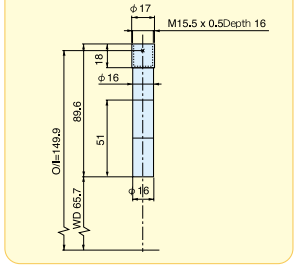
MML1-65-CM1



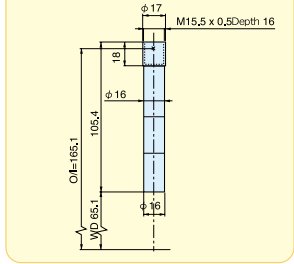
MML2-65-CM1



MML4-65-CM1



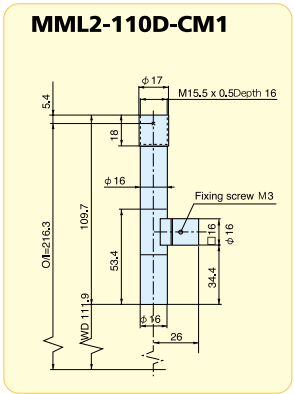
MML6-65-CM1



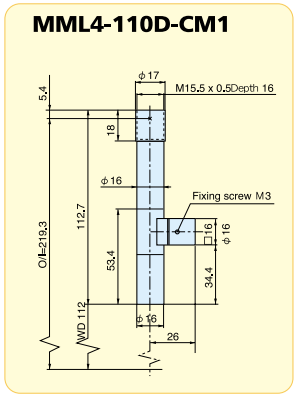
WD110-CM1 Series

Telecentric

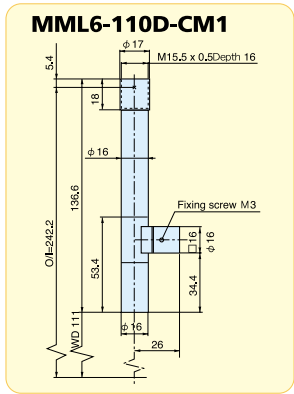
MML2-110D-CM1



MML4-110D-CM1

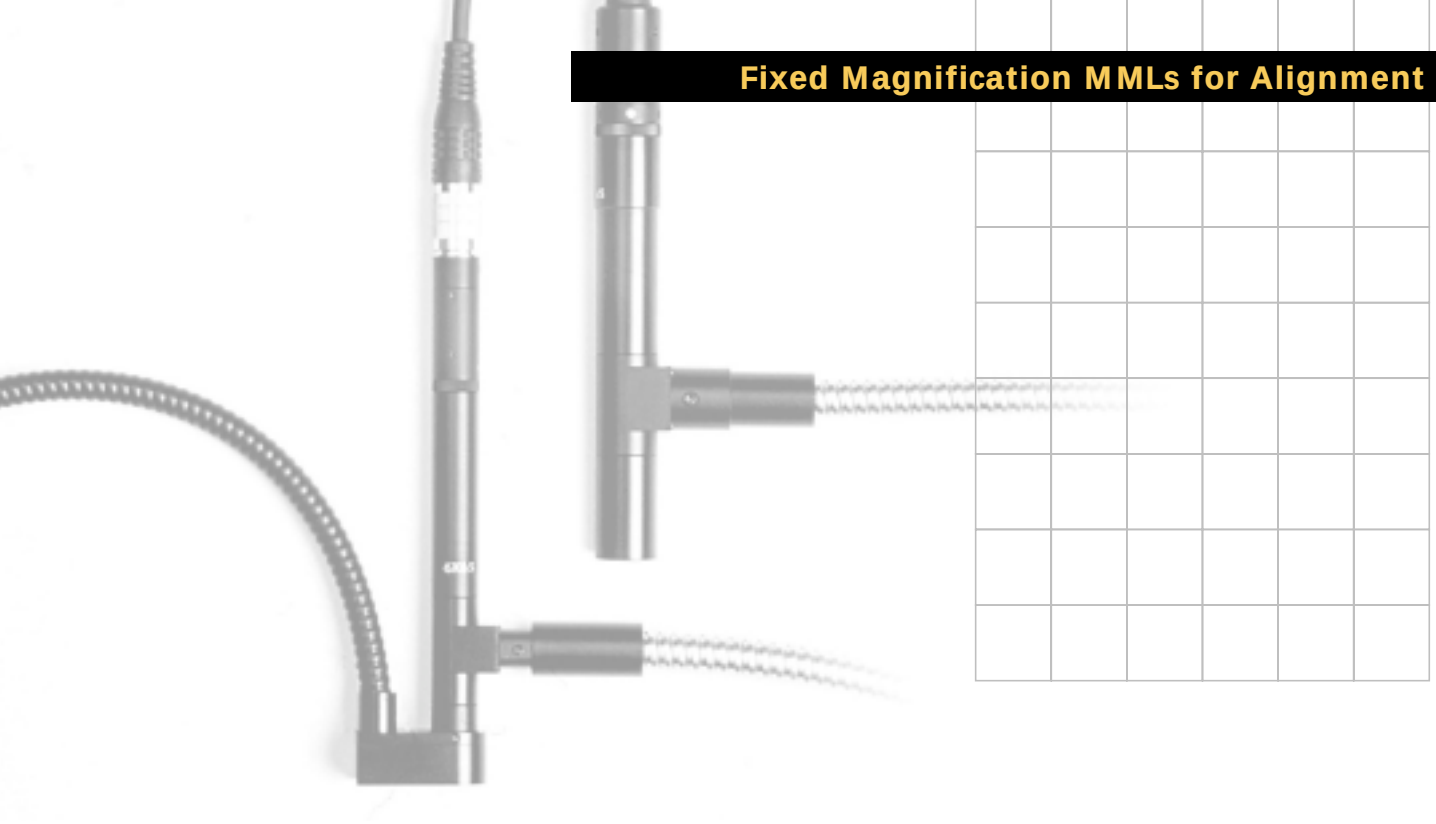


MML6-110D-CM1



Product name	Magnification	Effective FNO	O/I	WD	Depth of field	Resolution	TV distortion	NA	Weight	Largest compatible CCD	Mount
MML1-65-CM1/D-CM1	x 1	18.6	178.8	65mm	1.5mm	12μm	0.1% or less	0.03	55g/62g	1/2"	M15.5 P0.5
MML2-65-CM1/D-CM1	x 2	17.4	150.1	65mm	350μm	5.8μm	0.1% or less	0.06	48g/55g	1/2"	M15.5 P0.5
MML4-65-CM1/D-CM1	x 4	27	149.9	65.7mm	130μm	4.5μm	0.4% or less	0.07	50g/57g	1/2"	M15.5 P0.5
MML6-65-CM1/D-CM1	x 6	40.8	165.1	65.1mm	90μm	4.5μm	0.2% or less	0.07	53g/60g	1/2"	M15.5 P0.5
MML2-110D-CM1	x 2	33.2	216.3	111.9mm	670μm	11μm	0.1% or less	0.03	68g	1/2"	M15.5 P0.5
MML4-110D-CM1	x 4	43.9	219.3	112mm	230μm	7.7μm	0.2% or less	0.04	70g	1/2"	M15.5 P0.5
MML6-110D-CM1	x 6	66.2	242.2	111mm	170μm *1	7.6μm	0.2% or less	0.04	73g	1/2"	M15.5 P0.5

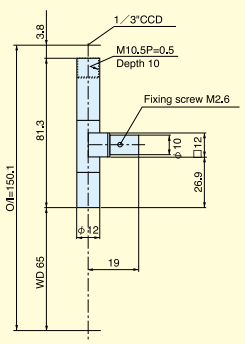
*Depth of field is calculated assuming a horizontal 320 TV resolution using a 1/2" CCD camera. (Permissible circle of confusion on the image-formation side: 40μm) But *1 is calculated based on resolution.
*Resolution indicates a theoretical resolution at a wavelength of 550nm.



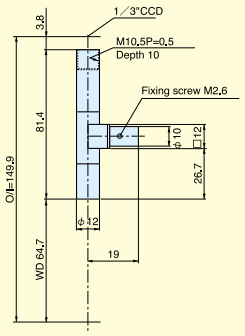
WD65-CS1 Series

Telecentric

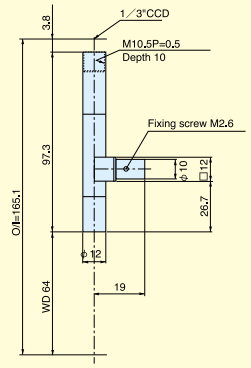
MML2-65D-CS1



MML4-65D-CS1



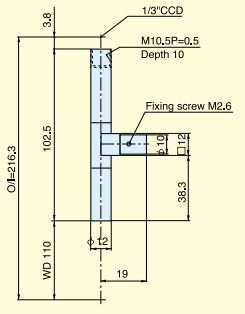
MML6-65D-CS1



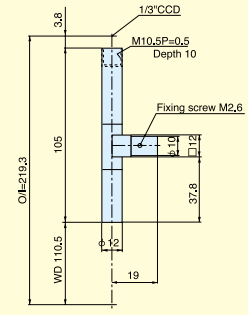
WD110-CS1 Series

Telecentric

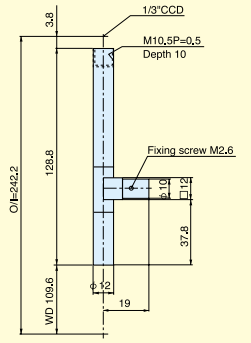
MML2-110D-CS1



MML4-110D-CS1



MML6-110D-CS1



Product name	Magnification	Effective FNO	O/I	WD	Depth of field	Resolution	TV distortion	NA	Weight	Largest compatible CCD	Mount
MML2-65D-CS1	x 2	17.4	150.1	65mm	260μm	5.8μm	0.1% or less	0.06	45g	1/3"	M10.5 P0.5
MML4-65D-CS1	x 4	29.8	149.9	64.7mm	110μm	5μm	0.2% or less	0.07	47g	1/3"	M10.5 P0.5
MML6-65D-CS1	x 6	44.2	165.1	64mm	74μm	5μm	0.1% or less	0.07	50g	1/3"	M10.5 P0.5
MML2-110D-CS1	x 2	33.2	216.3	110mm	500μm	11μm	0.1% or less	0.03	60g	1/3"	M10.5 P0.5
MML4-110D-CS1	x 4	51.1	219.3	110.5mm	220μm	8.6μm	0.1% or less	0.04	60g	1/3"	M10.5 P0.5
MML6-110D-CS1	x 6	76.3	242.2	109.6mm	220μm *1	8.5μm	0.1% or less	0.04	63g	1/3"	M10.5 P0.5

*Depth of field is calculated assuming a horizontal 320 TV resolution using a 1/3" CCD camera. (Permissible circle of confusion on the image-formation side: 30μm) But *1 is calculated based on resolution.
*Resolution indicates a theoretical resolution at a wavelength of 550nm.

MML Zoom Lens Series

MML Zoom Lenses are high-performance lenses with integrated coaxial episcopic illumination designed based on telecentric optics. Multiple zooming, long working distance, and an integrated coaxial episcopic illumination system that covers the entire view allow for recognition of all types of objects. Manual type products and electric zoom type ones with a stepping motor are available.

Model explanation

ML-Z □ — □ — □

Magnification	Illumination	Zooming method
	Nothing: None D: Coaxial	Nothing : Manual M : Electric motorized

High-resolution super low magnification motor zoom lens

ML-Z01515DM

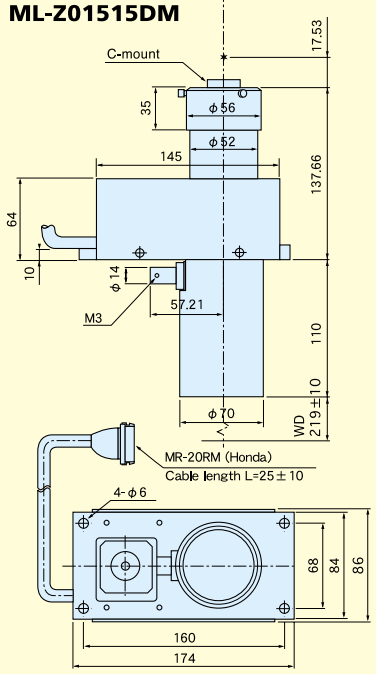
Made to order

Telecentric

Features

- Magnification range: 0.15X to 1.5X (zoom ratio of 10:1)
- WD=219mm
- Includes integrated coaxial episcopic illumination system that covers the entire view.

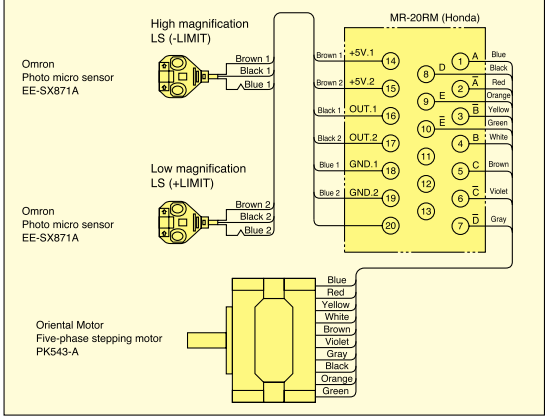
ML-Z01515DM



Item/model	ML-Z01515DM		
Optical magnification	0.15X to 1.5X (zoom ratio of 10:1)		
WD	219± 10mm		
	at 0.15X	at 0.47X	at 1.5X
Effective FNO	6	9.9	16
Depth of field	21.3mm	3.5mm	0.6mm
Resolution	27μm	14μm	7.5μm
NA	0.01	0.02	0.05
TV distortion	-0.15% or less	-0.02% or less	+0.06% or less
Operation method	Electric motorized (pulse control) zoom		
Weight	About 1,900g		
Largest compatible camera	1/2"		
Mount	C-mount		

* Depth of field is calculated assuming a horizontal 320 TV resolution using a 1/2" CCD camera. (Permissible circle of confusion on the image-formation side: 40μm)
* Resolution indicates a theoretical resolution at a wavelength of 550nm.

ML-Z01515DM harness



High-resolution low magnification zoom lens Telecentric

Manual type

ML-Z0220D

Electric motorized type

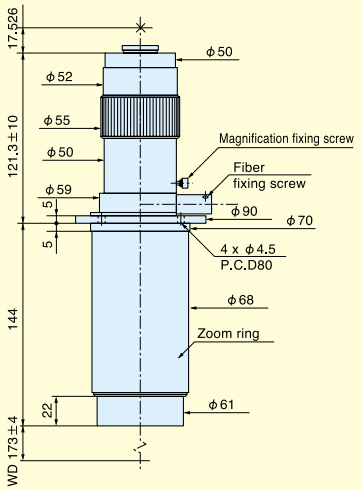
ML-Z0220DM

Features

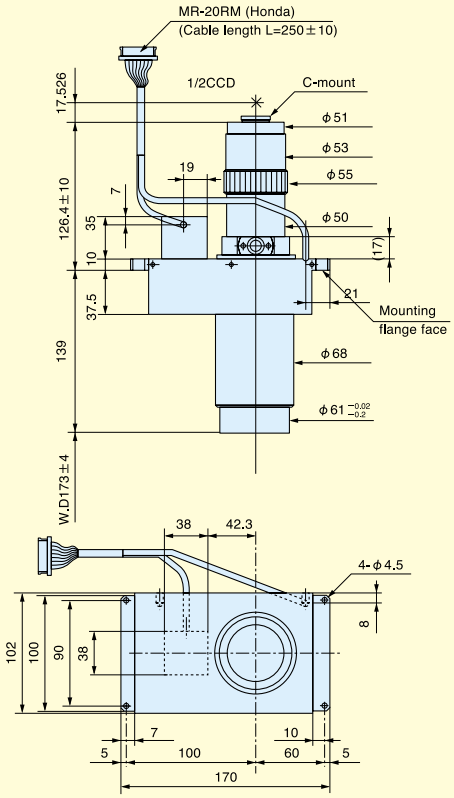
- Magnification range: 0.2X to 2X (zoom ratio of 10:1)
- WD=173mm
- Includes integrated coaxial episcopic illumination system that covers the entire view.
- A special light is attached.

  Coaxial light guide (super random specification) L=800mm
  Color filters (red, green) are attached.

ML-Z0220D



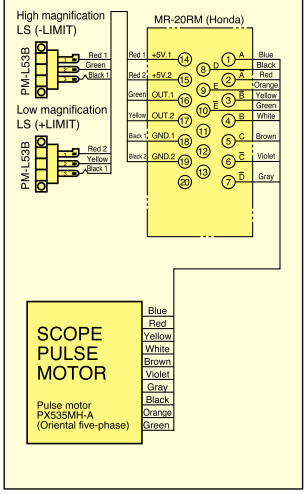
ML-Z0220DM



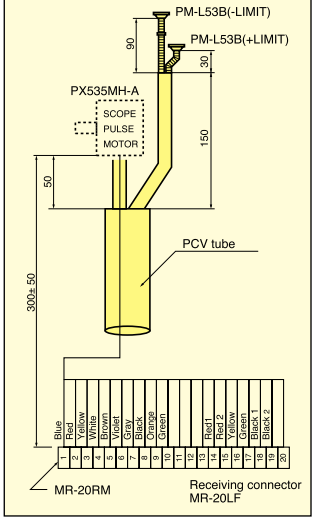
Item/model	ML-Z0220D		ML-Z0220DM
Optical magnification	0.2X to 2X (zoom ratio of 10:1)		
WD	173± 4mm		
	at 0.2X	at 1X	at 2X
Effective FNO	3.6	11.5	20
Depth of field	7mm	0.9mm	0.4mm
Resolution	12μm	7.8μm	7μm
NA	0.03	0.04	0.05
TV distortion	0.03% or less	0.15% or less	0.13% or less
Operation method	Manual zoom		Electric motorized (pulse control) zoom
Weight	About 1,100g		About 1,900g
Largest compatible camera	1/2"		
Mount	C-mount		

* Depth of field is calculated assuming a horizontal 320 TV resolution using a 1/2" CCD camera. (Permissible circle of confusion on the image-formation side: 40μm)
* Resolution indicates a theoretical resolution at a wavelength of 550nm.

ML-Z0220DM Wiring arrangement



ML-Z0220DM harness



* Contact us if you need a motor drive or controller.

ML-Z07545 Series

Telecentric

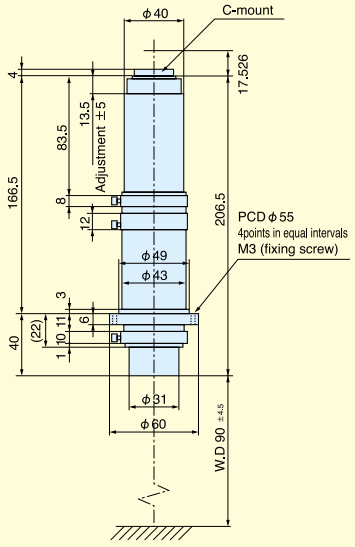
Functional, standard zoom lenses. Using optional adapter lenses can change the magnification range and working distance.

Features

- Magnification range: 0.75X to 4.5X (zoom ratio of 6:1)
- WD=90mm
- Integrated coaxial episcopic illumination system that covers the entire view.
- Focus adjustment function is mounted. (WD can be changed to -6mm.)

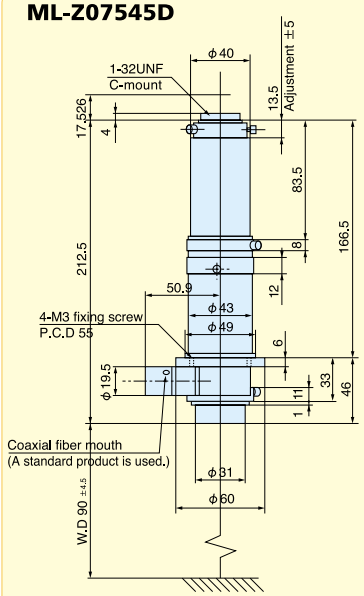
Manual zoom lens

ML-Z07545



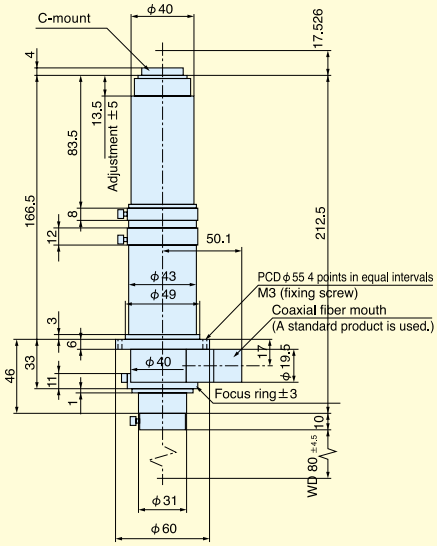
Coaxial episcopic zoom lens

ML-Z07545D



Coaxial episcopic zoom lens with polarizing function

ML-Z07545D-PL

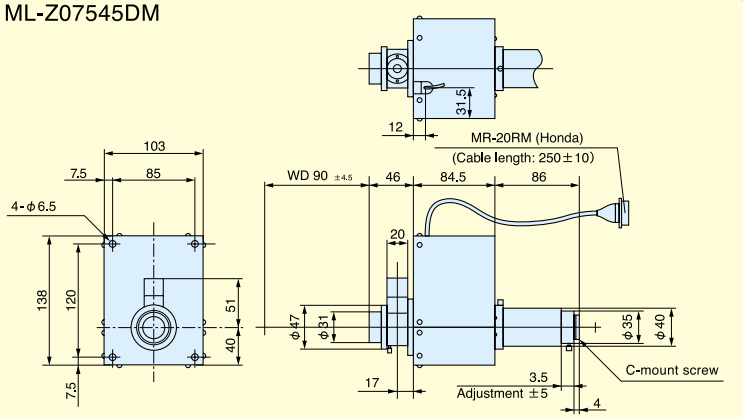


Item/model	ML-Z07545	ML-Z07545D	ML-Z07545D-PL	ML-Z07545DM
Optical magnification	0.75X to 4.5X (zoom ratio of 6:1)			
WD	90± 4.5mm		80± 4.5mm	90± 4.5mm
Focus adjustment	0 to −6mm			
	x 0.75	x 2		x 4.5
Effective FNO	11	16		28
Depth of field	1.6mm	0.3mm		0.1mm
Resolution	9.9μm	5.4μm		4.2μm
NA	0.03	0.06		0.08
TV distortion	0.02% or less	0.01% or less		−0.02% or less
Operation method	All models have focus, iris, and zoom. ML-Z07545D-PL contains an internal polarizing filter. ML-07545DM has an electric motorized zoom (pulse control).			
Weight	About 440g	About 470g	About 490g	About 1100g
Largest compatible camera	1/2"			
Mount	C-mount			

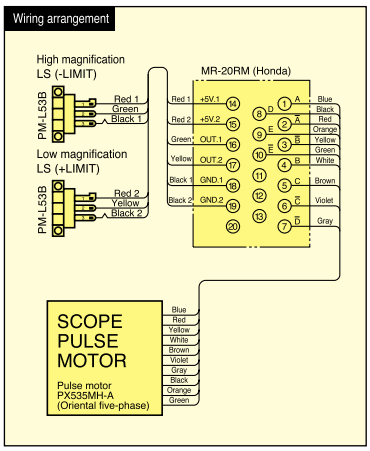
* Depth of field is calculated assuming a horizontal 320 TV resolution using a 1/2" CCD camera. (Permissible circle of confusion on the image-formation side: 40μm)
* Resolution indicates a theoretical resolution at a wavelength of 550nm.
* Effective FNO indicates a value when the iris is open.

Motor zoom lens

ML-Z07545DM



Wiring arrangement



Options Sold separately

Proxar lens

ML-Z Series

Attach on the tip of a lens to change magnification and working distance.

Model	Focus position	ML-Z07545 MIN Magnification	MAX	WD	Matching	ML-Z07545D/DM MIN Magnification	MAX	WD	Matching
ML-Z03	Near	x 0.24	x 1.43	255mm	○	x 0.23	x 1.4	263mm	▲ Coaxial illumination cannot cover the entire view.
	Middle	x 0.23	x 1.36	283mm		x 0.22	x 1.33	292mm	
	Far	x 0.21	x 1.28	315mm		x 0.21	x 1.25	325mm	
ML-Z04	Near	x 0.31	x 1.87	195mm	○	x 0.31	x 1.84	200mm	▲ Coaxial illumination cannot cover the entire view.
	Middle	x 0.3	x 1.81	211mm		x 0.3	x 1.81	216mm	
	Far	x 0.29	x 1.72	229mm		x 0.29	x 1.72	234mm	
ML-Z05	Near	x 0.38	x 2.27	160mm	○	x 0.37	x 2.25	163mm	▲ Coaxial illumination cannot cover the entire view.
	Middle	x 0.37	x 2.24	170mm		x 0.37	x 2.21	174mm	
	Far	x 0.36	x 2.2	181mm		x 0.36	x 2.17	185mm	
ML-Z07	Near	x 0.52	x 3.17	114mm	○	x 0.52	x 3.16	115mm	▲ Coaxial illumination cannot cover the entire view.
	Middle	x 0.53	x 3.16	119mm		x 0.52	x 3.16	121mm	
	Far	x 0.53	x 3.17	125mm		x 0.52	x 3.16	126mm	
ML-Z14	Near	x 1.03	x 6.21	53.4mm	○	x 1.03	x 6.21	53.8mm	○
	Middle	x 1.05	x 6.33	54.7mm		x 1.06	x 6.37	55.1mm	
	Far	x 1.08	x 6.49	56.1mm		x 1.08	x 6.49	56.5mm	
ML-Z20	Near	x 1.45	x 8.77	32.1mm	○	x 1.46	x 8.77	32.3mm	○
	Middle	x 1.49	x 9.01	32.7mm		x 1.5	x 9.09	32.9mm	
	Far	x 1.54	x 9.26	33.4mm		x 1.54	x 9.35	33.6mm	

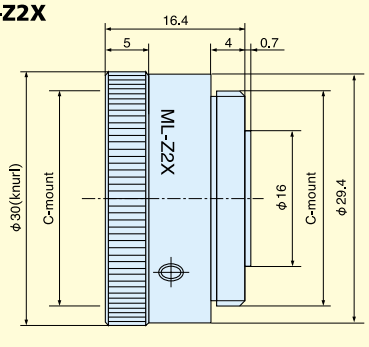
*Magnification and working distance can be slightly changed by turning the focus adjuster ring (N←→F)
Indicated values are based on calculation formulas. Actual measurement may be different because of tolerance.
They cannot be mounted on ML-Z07545D-PL.

Rear converter lens

ML-Z2X

A specially designed 2X rear converter. Mounting this between a lens and CCD camera can double the magnification without changing working distance. *May decrease the resolution.

ML-Z2X



Manual click zoom lens

Telecentric

ML-Z0315D

A manual click system allows for ± 0.5% magnification repeatability.
Magnification can be adjusted between five different levels.

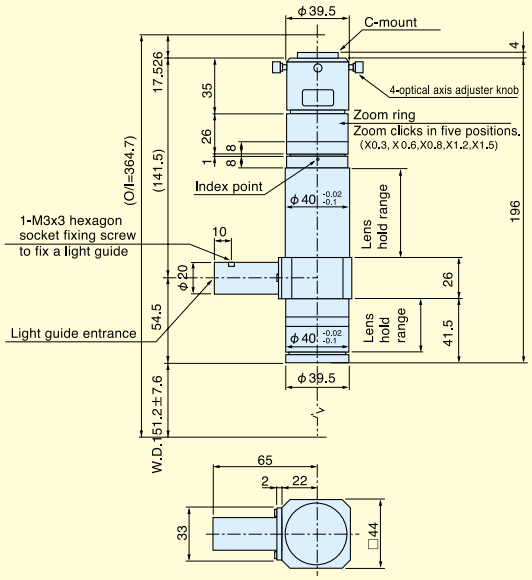
Features

- Magnification range: 0.3X to 1.5X (click one of five levels)
- WD=151.2mm
- Integrated coaxial episcopic illumination system that covers the entire view.

Item/model	ML-Z0315D				
Optical magnification	0.3X to 1.5X (zoom ratio of 5:1)				
WD	151.2 ± 7.6mm				
Zoom click position	x 0.3	x 0.6	x 0.8	x 1.2	x 1.5
Effective FNO	9.3	11.1	12.4	14.7	16.5
Depth of field	8.2mm	2.4mm	1.5mm	0.8mm	0.6mm
Resolution	20.8μm	12.4μm	10.4μm	8.2μm	7.4μm
NA	0.02	0.03	0.03	0.04	0.05
TV distortion	-0.09%	-0.05%	-0.02%	+0.03%	+0.06%
Operation method	Manual click zoom				
Zoom click accuracy	Magnification repeatability ± 0.5%				
Weight	About 520g				
Largest compatible camera	1/2"				
Mount	C-mount				

* Depth of field is calculated assuming a horizontal 320 TV resolution using a 1/2" CCD camera. (Permissible circle of confusion on the image-formation side: 40μm)
* Resolution indicates a theoretical resolution at a wavelength of 550nm.

ML-Z0315D



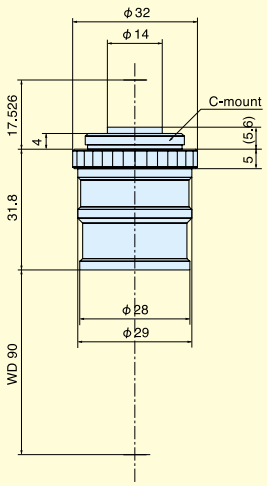
Low magnification macro lenses

Made to order

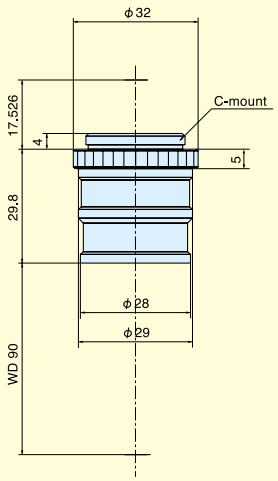
Small, high-resolution macro lenses to be mounted on a machine. Working distance of all models is 90mm.

ML-15014 ·····Magnification 0.14X
ML-24030 ·····Magnification 0.3X
ML-3505 ·····Magnification 0.5X
ML-5010 ·····Magnification1X

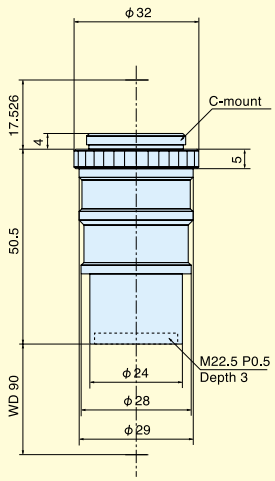
ML-15014



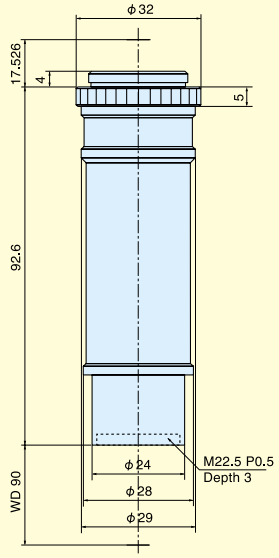
ML-24030



ML-3505



ML-5010



Product name	Magnification	Effective FNO	O/I	WD	Depth of field	Resolution	TV distortion	Weight	Lagest compatible CCD	Mount
ML-15014	x 0.14	4.6	139.3	90mm	18mm	36μm	0.1% or less	28g	2/3"	C-mount
ML-24030	x 0.3	7.3	137.3	90mm	6.5mm	21μm	0.1% or less	39g	2/3"	C-mount
ML-3505	x 0.5	8.4	158	90mm	2.7mm	13μm	0.1% or less	55g	2/3"	C-mount
ML-5010	x 1	8	200.1	90mm	0.6mm	6.3μm	0.1% or less	68g	2/3"	C-mount

* Depth of field is calculated assuming a horizontal 320 TV resolution using a 1/2" CCD camera. (Permissible circle of confusion on the image-formation side: 40μm)

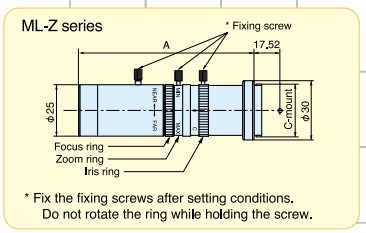
Macro Zoom Lenses

TV macro zoom lens

CCTV simplified zoom models. Various types of images can be taken because the products are small, light weight, and very functional.

Features

- Zoom ratio of 4:1. (0.02X to 2.4X) Eight models are available.
- Iris, focus, and zoom are adjustable.
- Include screws to lock movable parts.
- Maximum outside diameter: 25mm



Product name	A dimensions (mm)
ML-Z002	80.4 to 90.83
ML-Z004	87.15 to 97.8
ML-Z007	80.7 to 87.25
ML-Z014	87.45 to 94.15
ML-Z020	88.82 to 99.34
ML-Z026	89.12 to 95.69
ML-Z040	95.7 to 106.2
ML-Z052	96.0 to 102.57

TV macro zoom lens series

Item/model	ML-Z002	ML-Z004	ML-Z007	ML-Z014
WD (mm)	Max750 to 300 Min	Max750 to 300 Min	Max210 to 150 Min	Max210 to 150 Min
Magnification	x 0.02 to x 0.08 x 0.06 to x 0.22	x 0.043 to x 0.16 x 0.12 to x 0.43	x 0.07 to x 0.27 x 0.11 to x 0.4	x 0.14 to x 0.51 x 0.21 to x 0.78
Depth of field (mm)	± 387 to ± 30 ± 51 to ± 3.9	± 202 to ± 15 ± 28 to ± 2.1	± 37 to ± 2.7 ± 16 to ± 1.2	± 19 to ± 1.5 ± 8.3 to ± 0.6
Effective FNO	4.6 to 22	9.2 to 44	4.6 to 22	9.2 to 44
Weight (g)	94	101	94	102

Item/model	ML-Z020	ML-Z026	ML-Z040	ML-Z052
WD (mm)	Max69 to 55 Min	Max49 to 44 Min	Max69 to 55 Min	Max49 to 44 Min
Magnification	x 0.21 to x 0.78 x 0.3 to x 1.1	x 0.27 to x 0.98 x 0.33 to x 1.21	x 0.42 to x 1.52 x 0.58 to x 2.13	x 0.54 to x 1.94 x 0.66 to x 2.37
Depth of field (mm)	± 4.2 to ± 0.3 ± 2.1 to ± 0.17	± 2.7 to ± 0.2 ± 1.8 to ± 0.13	± 2.2 to ± 0.17 ± 1.1 to ± 0.08	± 1.3 to ± 0.1 ± 1.2 to ± 0.07
Effective FNO	4.6 to 22	4.6 to 22	9.2 to 44	9.2 to 44
Weight (g)	103	103	110	111

High-resolution macro zoom lens

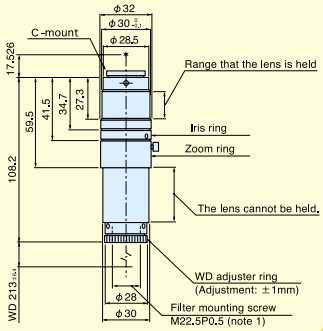
ML-Z0108

High-resolution macro lens with 8:1 magnification ratio and long working distance. By using the focus ring on the tip, working distance can be changed within a range of 20mm.

Features

- Zoom ratio of 8:1. Magnification range: 0.1X to 0.8X
- WD=213mm
- Focus adjustment ± 20mm (magnification variation ± 13%)
- Iris, focus, and zoom are adjustable. Comes with locking screws.

ML-Z0108



Item/model	ML-Z0108		
Optical magnification	0.1X to 0.8X (zoom ratio of 8:1)		
WD	213mm		
Focus adjustment	± 20mm (amount the lens comes out ± 1mm, magnification variation ± 13%)		
	at 0.1X	at 0.4X	at 0.8X
Effective FNO	8.2	8.2	9.3
Depth of field	32.8mm	2.1mm	0.6mm
Resolution	55μm	14μm	8μm
TV distortion	-0.02% or less	+0.18% or less	+0.17% or less
Operation method	Manual: Adjusting iris, zoom, and focus		
Weight	About 140g		
Largest compatible camera	1/2"		
Mount	C-mount		

* Depth of field is calculated assuming a horizontal 320 TV resolution using a 1/2" CCD camera. (Permissible circle of confusion on the image-formation side: 40μm)
* Effective FNO indicates a value when the iris is open.

10X zoom

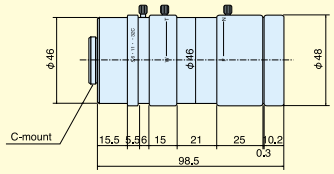
MLH-10X

A wide range zoom lens developed for wide field. Zoom ratio can be 10:1 at a working distance of 150mm to 450mm by adjusting the focus. This lens can be used for FA, laboratory work, weak eyesight correction, and environment-related projects.

Features

- Zoom ratio of 10:1. (Magnification range: Min. 0.023X to Max. 0.84X)
- WD=Min. 450mm to Max. 150mm
- Iris, focus, and zoom are adjustable. Comes with locking screws.

MLH-10X



Field of view chart

WD	Magnification	Field of view	
		1/2" (length mm x width mm)	1/3" (length mm x width mm)
150mm	x 0.086 to x 0.84	55.8 x 74.4 to 5.7 x 7.6	42 x 56 to 4.3 x 5.7
200mm	x 0.06 to x 0.58	80 x 107 to 8.3 x 11.0	60 x 80 to 6.2 x 8.3
250mm	x 0.045 to x 0.44	107 x 142 to 10.9 x 14.5	80 x 107 to 8.2 x 10.9
300mm	x 0.037 to x 0.36	130 x 173 to 13.3 x 17.8	97 x 130 to 10.0 x 13.3
350mm	x 0.031 to x 0.3	155 x 206 to 16.0 x 21.3	116 x 155 to 12.0 x 16.0
400mm	x 0.026 to x 0.25	185 x 246 to 19.2 x 25.6	138 x 185 to 14.4 x 19.2
450mm	x 0.023 to x 0.22	209 x 278 to 21.8 x 29.1	157 x 209 to 16.4 x 21.8

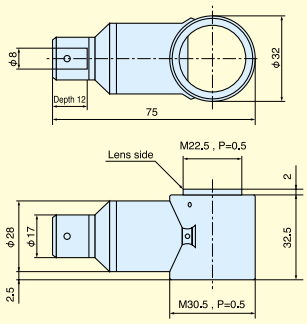
Item/model	MLH-10X
Max. magnification	0.084 x to 0.84 x
WD (mm)	150mm to 450mm
Iris	F5.6 to Close
Compatible camera mount	C-mount
Compatible camera size	1/2". 1/3". 1/4"
Filter size	M46 P=0.75
Weight	233g

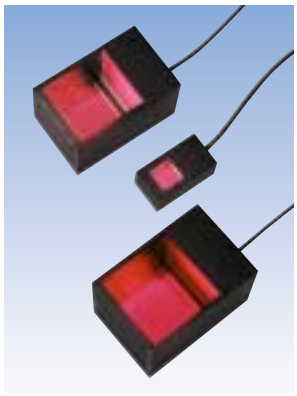
Simulated coaxial episcopic illumination unit

For detailed information about simulated coaxial LED, see P.57.

■Coaxial episcopic illumination unit appearance

MLZ-HM (For ML-Z040, ML-Z052)





Macro zoom field of view chart

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 x110	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	32 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	10 x 13 x 16	14.3	22.3	7 x 10 x 12	19.1	29.7
x 0.6	11 x 15 x 18	12.6	19.4	8 x 11 x 13	17.2	26.7	6 x 8 x 10	22.9	35.6
x 0.7	9.4 x 13 x 16	14.7	22.6	6.9 x 9.1 x11.4	20.0	31.2	5.1 x 6.9 x 8.6	26.7	41.5
x 0.75	8.8 x 12 x 15	15.8	24.2	6.4 x 8.5 x10.7	21.5	33.4	4.8 x 6.4 x 8.0	28.6	44.5
x 0.8	8.3 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 x12.2	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	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

Macro Lenses for Line CCDs

ML-L Series

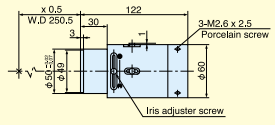
Features Best for high-speed processing of large field of view.

- Low TV distortion, all models less than 0.1%
- Low marginal rays difference
- High resolution, high contrast
- Suitable for long WD applications

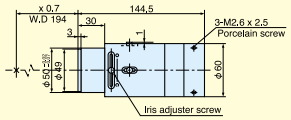
Applications

- Defective wafer inspection
- Lead frame inspection
- Printed substrate inspection
- Defective film inspection

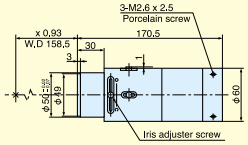
ML-L05



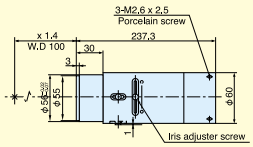
ML-L07



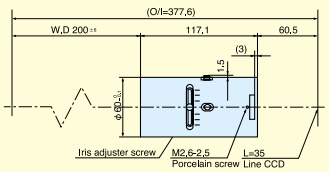
ML-L09



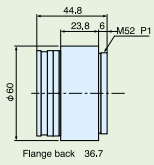
ML-L14



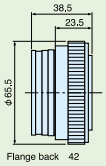
ML-L047-200 Made to order



MMT

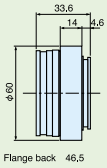


FDMT



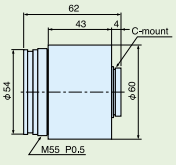
Canon mount

FMT



Nikon mount

CMT

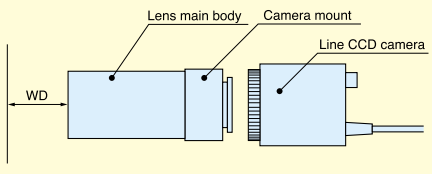


C-mount

A super high resolution lens for resolution of camera elements (4.7μm) in large field of view. You can observe areas twice as large as our conventional lenses allow at equal resolution.

Line CCD camera element list

Product name
14μm x 1024 bit
11μm x 2048 bit
11μm x 2592 bit
7μm x 5000 bit
4.7μm x 5000 bit
4.7μm x 7500 bit



ML-L series

Product name	Magnification	Effective FNO	O/I	WD	Depth of field	Resolution	TV distortion	Weight	Monitor size	Mount
ML-L05	x 0.5	5.9 to 28	433	250.5mm	470μm	20μm	0.1% or less	700g	ø 35	Sold separately
ML-L07	x 0.7	6.7 to 32	399	194mm	270μm	14μm	0.1% or less	800g	ø 35	Sold separately
ML-L09	x 0.933	7.7 to 37	389.5	158.5mm	160μm	10μm	0.1% or less	800g	ø 35	Sold separately
ML-L14	x 1.4	9.5 to 45	397.8	100mm	95μm	7μm	0.1% or less	800g	ø 35	Sold separately
ML-L047-200	x 0.47	5.9 to 32	377.6	200mm	300μm	12μm	0.01% or less	720g	ø 35	Sold separately

* Depth of field is calculated based on resolution.

SOD-III Series

Metallographic microscope coaxial unit

SOD-III Series For mounting a machine

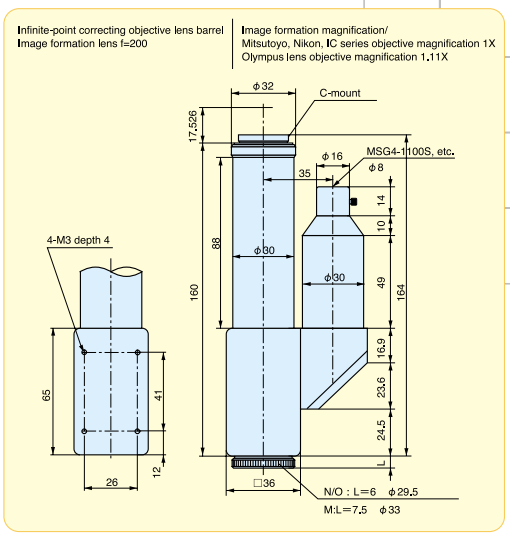
Features

- Compact design
- Compatible with various makers' bright field lenses
- Mount in many different ways such as horizontal setting

Applications

- Fiber end inspection
- Liquid crystal defective inspection and alignment
- Wafer defective inspection and alignment

SOD-III

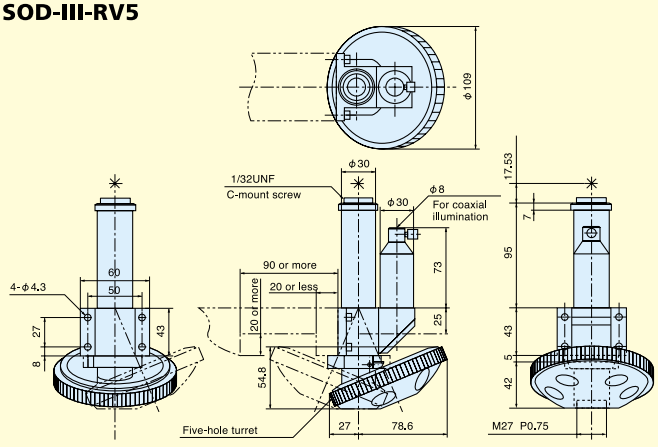


* Lens barrel designed for infinite-point correcting objectives
* Image formation lens f=200 - Please use an infinite-point correcting objective lens (bright field). When using an Olympus lens, optical magnification at the image formation plane is the objective lens's magnification times 1.11.

SOD-III RV5 Five-hole manual revolver type Made to order

SOD-III RV5M Five-hole electric revolver type Made to order

SOD-III-RV5



OLYMPUS

Product name	NA	WD(mm)	Price
M SPlan 1.5 x	0.04	2	126,500
M SPlan 2.5 x	0.07	5	93,500
M SPlan 5 x	0.13	21.1	44,000
M SPlan 10 x	0.3	9	58,300
ULWDMSPlan 20 x	0.4	11	127,600
ULWDMSPlan 50 x	0.55	8.1	145,200
ULWDMSPlan 80 x	0.75	4.1	229,900
ULWDMSPlan 100 x	0.8	3.18	308,000

Mitsutoyo

Product name	NA	WD(mm)	Price
M Plan Apo 1 x	0.025	11	200,000
M Plan Apo 2 x	0.055	34	66,000
M Plan Apo 5 x	0.14	34	40,000
M Plan Apo 10 x	0.28	33.5	55,000
M Plan Apo SL 20 x	0.28	30.5	145,000
M Plan Apo SL 50 x	0.42	20.5	220,000
M Plan Apo SL 80 x	0.5	15	270,000
M Plan Apo SL 100 x	0.55	13	300,000

Nikon

Product name	NA	WD(mm)	Price
CF IC EPI Plan 1.5 x	0.045	3.6	190,000
CF IC EPI Plan 2.5 x	0.075	8.8	79,000
CF IC EPI Plan 5 x	0.13	22.5	40,000
CF IC EPI SLWDPlan 10 x	0.21	20.3	90,000
CF IC EPI SLWDPlan 20 x	0.35	20.5	135,000
CF IC EPI SLWDPlan 50 x	0.45	13.8	170,000
CF IC EPI SLWDPlan 100 x	0.73	4.7	320,000

CCTV lenses

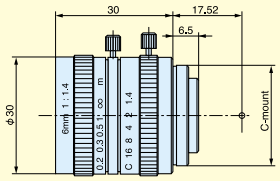
CCTV (Closed Circuit Television) lenses were developed to recognize images in a wide area. All models' iris and focus are adjustable and you can set them as you like. *1 (They come with locking screws.) Using optional close-up ring and converter allows for macro photographing. *2

*1 Not designed to be vibration proof.
*2 Tolerances of lenses may increase and image quality may worsen as a result.

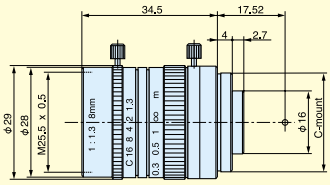
Features

- A wide range of products from f=6mm to 100mm.
- Focus and iris are adjustable using attached locking screws.

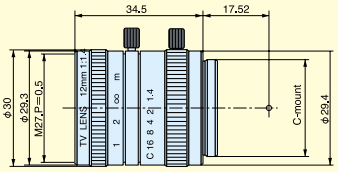
ML-0614



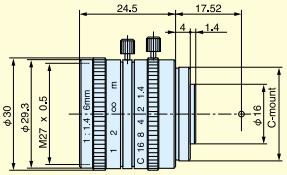
ML-0813



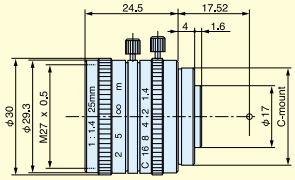
ML-1214



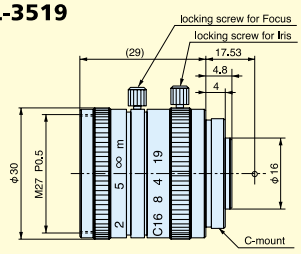
ML-1614



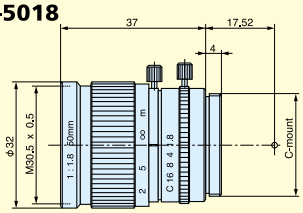
ML-2514



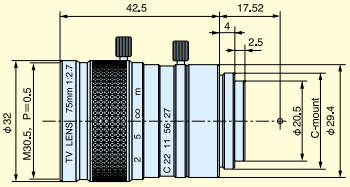
ML-3519



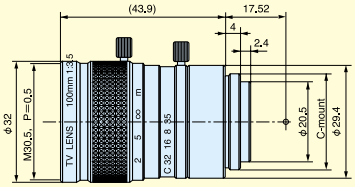
ML-5018



ML-7527



ML-10035



CCTV specifications

Model / item	Focal distance	Focus (F No.)	Field of view (VxH)	Closest distance	Filter screw	Weight (g)	Maximum compatible camera size	Mount
ML-0614	6mm	F1.4 to close	42.3° x 54.6°	0.2m	M27 P0.5	60	1/2"	C-mount
ML-0813	8mm	F1.3 to close	45.0° x 57.8°	0.2m	M25.5 P0.5	60	2/3"	C-mount
ML-1214	12mm	F1.4 to close	21.9° x 29.0°	0.3m	M27 P0.5	60	1/2"	C-mount
ML-1614	16mm	F1.4 to close	23.0° x 30.4°	0.4m	M27 P0.5	40	2/3"	C-mount
ML-2514	25mm	F1.4 to close	21.6° x 28.5°	0.5m	M27 P0.5	45	1"	C-mount
ML-3519	35mm	F1.9 to close	10.8° x 14.4°	0.5m	M27 P0.5	50	2/3"	C-mount
ML-5018	50mm	F1.8 to close	7.9° x 10.5°	1m	M30.5 P0.5	60	2/3"	C-mount
ML-7527	75mm	F2.7 to close	4.9° x 6.5°	1m	M30.5 P0.5	65	2/3"	C-mount
ML-10035	100mm	F3.5 to close	3.8° x 5.1°	1m	M30.5 P0.5	65	2/3"	C-mount

Field, WD, and magnification when a close-up ring is used

Close-up ring (mm)	ML-0614				ML-0813				ML-1214			
	Field of view(length x width) 1/2"	Field of view(length x width) 1/3"	WD (mm)	Magni-fication	Field of view(length x width) 1/2"	Field of view(length x width) 1/3"	WD (mm)	Magni-fication	Field of view(length x width) 1/2"	Field of view(length x width) 1/3"	WD (mm)	Magni-fication
0	165 x 221	124 x 165	200	0.03	96 x 128	72 x 96	148	0.05	103 x 137	77 x 103	248	0.05
0.5	44 x 58	33 x 44	43	0.11	43 x 57	32 x 43	59	0.11	55 x 73	41 x 55	125	0.09
	60 x 79	45 x 60	63	0.08	77 x 102	57 x 77	115	0.06	119 x 159	89 x 119	289	0.04
1	25 x 34	19 x 25	19	0.19	27 x 37	21 x 27	34	0.18	38 x 50	28 x 38	80	0.13
	30 x 40	22 x 30	25	0.16	38 x 51	29 x 38	52	0.13	59 x 79	45 x 59	136	0.08
1.5					20 x 27	15 x 20	22	0.24	29 x 38	21 x 29	57	0.17
					26 x 34	19 x 26	31	0.19	40 x 53	30 x 40	85	0.12
2									23 x 31	17 x 23	42	0.21
									30 x 40	22 x 30	59	0.16

Close-up ring (mm)	ML-1614				ML-2514				ML-3519			
	Field of view(length x width) 1/2"	Field of view(length x width) 1/3"	WD (mm)	Magni-fication	Field of view(length x width) 1/2"	Field of view(length x width) 1/3"	WD (mm)	Magni-fication	Field of view(length x width) 1/2"	Field of view(length x width) 1/3"	WD (mm)	Magni-fication
0	109 x 145	82 x 109	358	x 0.04	87 x 115	65 x 87	458	x 0.06	66 x 87	49 x 66	500	x 0.07
0.5	64 x 86	48 x 64	206	x 0.07	64 x 85	48 x 64	338	x 0.08	55 x 73	41 x 55	422	x 0.09
	156 x 208	117 x 156	515	x 0.03	242 x 322	181 x 242	1270	x 0.02	335 x 447	251 x 335	2459	x 0.01
1	45 x 61	34 x 45	143	x 0.11	50 x 67	38 x 50	269	x 0.10	47 x 63	35 x 47	366	x 0.10
	78 x 104	58 x 78	252	x 0.06	121 x 161	91 x 121	637	x 0.04	168 x 223	126 x 168	1240	x 0.03
1.5	35 x 47	26 x 35	108	x 0.14	42 x 56	31 x 42	223	x 0.12	41 x 55	31 x 41	324	x 0.12
	52 x 69	39 x 52	164	x 0.09	81 x 107	60 x 81	425	x 0.06	112 x 149	84 x 112	834	x 0.04
2	29 x 38	22 x 29	86	x 0.17	36 x 47	27 x 36	191	x 0.13	37 x 49	28 x 37	291	x 0.13
	39 x 52	29 x 39	120	x 0.12	60 x 81	45 x 60	320	x 0.08	84 x 112	63 x 84	631	x 0.06
5	14 x 18	10 x 14	35	x 0.35	19 x 25	14 x 19	103	x 0.25	22 x 30	17 x 22	185	x 0.22
	16 x 21	12 x 16	42	x 0.31	24 x 32	18 x 24	130	x 0.20	34 x 45	25 x 34	265	x 0.14
10	7.3 x 9.7	5.4 x 7.3	14	x 0.66	11 x 14	8.0 x 11	60	x 0.45	13 x 18	10 x 13	121	x 0.36
	7.8 x 10	5.8 x 7.8	15	x 0.62	12 x 16	9.1 x 12	66	x 0.40	17 x 22	13 x 17	143	x 0.29
15					7.4 x 9.8	5.5 x 7.4	43	x 0.65	9.5 x 13	7.2 x 9.5	93	x 0.50
					8.1 x 11	6.0 x 8.1	45	x 0.60	11 x 15	8.4 x 11	103	x 0.43
20					5.6 x 7.5	4.2 x 5.6	34	x 0.85	7.4 x 9.9	5.6 x 7.4	78	x 0.65
					6.0 x 8.1	4.5 x 6.0	35	x 0.79	8.4 x 11	6.3 x 8.4	82	x 0.57
25									6.1 x 8.1	4.6 x 6.1	68	x 0.79
									6.7 x 8.9	5.0 x 6.7	70	x 0.72

Close-up ring (mm)	ML-5018				ML-7527				ML-10035			
	Field of view(length x width) 1/2"	Field of view(length x width) 1/3"	WD (mm)	Magni-fication	Field of view(length x width) 1/2"	Field of view(length x width) 1/3"	WD (mm)	Magni-fication	Field of view(length x width) 1/2"	Field of view(length x width) 1/3"	WD (mm)	Magni-fication
0	90 x 120	68 x 90	943	x 0.05	60 x 80	45 x 60	1000	x 0.08	46 x 62	35 x 46	1000	x 0.10
1.5	57 x 76	43 x 57	610	x 0.08								
	154 x 205	115 x 154	1577	x 0.03								
2	51 x 67	38 x 51	548	x 0.10	43 x 57	32 x 43	776	x 0.11				
	115 x 154	86 x 115	1193	x 0.04	184 x 246	138 x 184	3189	x 0.03				
5	31 x 41	23 x 31	347	x 0.16	30 x 40	23 x 30	607	x 0.16	27 x 37	21 x 27	724	x 0.18
	46 x 61	35 x 46	503	x 0.10	74 x 98	55 x 74	1422	x 0.07	95 x 127	71 x 95	2413	x 0.05
10	18 x 25	14 x 18	226	x 0.26	20 x 27	15 x 20	475	x 0.24	19 x 26	15 x 19	609	x 0.25
	23 x 31	17 x 23	273	x 0.21	37 x 49	28 x 37	833	x 0.13	48 x 63	36 x 48	1432	x 0.10
15	13 x 18	10 x 13	174	x 0.37	15 x 20	11 x 15	408	x 0.32	15 x 20	11 x 15	546	x 0.32
	15 x 21	12 x 15	196	x 0.31	25 x 33	18 x 25	636	x 0.20	32 x 42	24 x 32	1105	x 0.15
20	10 x 14	7.7 x 10	145	x 0.47	12 x 16	9 x 12	369	x 0.40	12 x 16	9 x 12	505	x 0.39
	12 x 15	8.6 x 12	158	x 0.42	18 x 25	14 x 18	538	x 0.26	24 x 32	18 x 24	941	x 0.20
25	8.4 x 11	6.3 x 8.4	126	x 0.57	10 x 14	7.6 x 10	342	x 0.47	10 x 14	8 x 10	478	x 0.46
	9.2 x 12	6.9 x 9.2	134	x 0.52	15 x 20	11 x 15	479	x 0.33	19 x 25	14 x 19	843	x 0.25
30	7.1 x 9.4	5.3 x 7.1	113	x 0.68	8.7 x 12	6.5 x 8.7	323	x 0.55	9.0 x 12	6.7 x 9.0	458	x 0.54
	7.7 x 10	5.8 x 7.7	119	x 0.63	12 x 16	9.2 x 12	440	x 0.39	16 x 21	12 x 16	778	x 0.30
35	6.1 x 8.2	4.6 x 6.1	104	x 0.78	7.6 x 10	5.7 x 7.6	309	x 0.63	7.9 x 11	5.9 x 7.9	443	x 0.61
	6.6 x 8.8	4.9 x 6.6	108	x 0.73	11 x 14	7.9 x 11	412	x 0.46	14 x 18	10 x 14	731	x 0.35
40	5.4 x 7.2	4.1 x 5.4	97	x 0.89	6.7 x 9.0	5.1 x 6.7	297	x 0.71	7.1 x 9.4	5.3 x 7.1	430	x 0.68
	5.8 x 7.7	4.3 x 5.8	100	x 0.83	9.2 x 12	6.9 x 9.2	391	x 0.52	12 x 16	8.9 x 12	696	x 0.40
45					6.1 x 8.1	4.6 x 6.1	289	x 0.79	6.4 x 8.5	4.8 x 6.4	421	x 0.75
					8.2 x 11	6.1 x 8.2	375	x 0.59	11 x 14	7.9 x 11	669	x 0.45
50					5.5 x 7.4	4.1 x 5.5	281	x 0.87	5.8 x 7.8	4.4 x 5.8	412	x 0.82
					7.4 x 9.8	5.5 x 7.4	361	x 0.65	9.5 x 13	7.1 x 9.5	647	x 0.50
60									5.0 x 6.6	3.7 x 5.0	400	x 0.97
									7.9 x 11	5.9 x 7.9	614	x 0.61

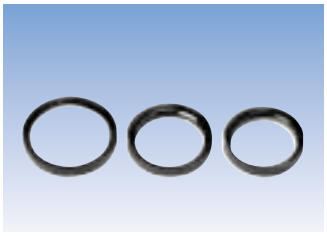
- Indicated values are based on calculations and actual measurements may be different. Use the values as a reference.
- Products' accuracy is guaranteed only when themselves use them. Please note that WD, distortion, and image quality may vary when a close-up ring or other equipment is used because tolerances of lenses increase.

Filters and adapters for CCTV lenses

Close-up ring

- **ML-EXR** 7-piece set (0.5, 1, 2, 5, 10, 20, 40)
- **ML-EXR** □
- **ML-EXR1520** Adjustable type (15 to 20mm)
- **ML-EXR3042** Adjustable type (30 to 42mm)

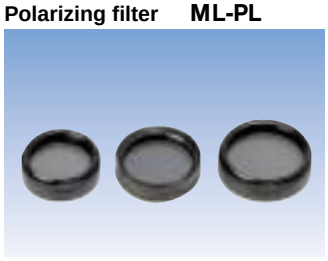
Glass cover ML-GA



Glass lens protection cover prevents lens from getting dirty and damage from dust and airborne particles.

CCTV model	Glass cover model
ML-0614	ML-GA270
ML-0813	ML-GA255
ML-1214	ML-GA270
ML-1614	ML-GA270
ML-2514	ML-GA270
ML-3519	ML-GA270
ML-5018	ML-GA305
ML-7527	ML-GA305
ML-10035	ML-GA305

Polarizing filter ML-PL



Polarizing filter that can be rotated. Using the filter with a polarizing light reduces the grainy look of objects and localized halation.

CCTV model	Polarizing filter model
ML-0614	ML-PL270
ML-0813	ML-PL255
ML-1214	ML-PL270
ML-1614	ML-PL270
ML-2514	ML-PL270
ML-3519	ML-PL270
ML-5018	ML-PL305
ML-7527	ML-PL305
ML-10035	ML-PL305

Ring light mounting adapter ML-FL

Adapters to mount a ring light of inner diameter of 31.
Fiber optic ring light MRG31 series: P.40
LED light MRL series: P.54

CCTV model	Ring light mounting adapter model
ML-0614	ML-FL270
ML-0813	ML-FL255
ML-1214	ML-FL270
ML-1614	ML-FL270
ML-2514	ML-FL270
ML-3519	ML-FL270
ML-5018	ML-FL305
ML-7527	ML-FL305
ML-10035	ML-FL305

Telecentric system CCTV lens

MTE-55

MTE-55 lens uses F2.8, f=55mm telecentric optical system that reduces angle and magnification errors when observing objects. Accurate telecentric performance is achieved when the magnification combined with the optional lens MTE2 is 0.4X to 0.9X. Although there is no telecentric effect at the magnification of infinite to 0.4X, aberrations are corrected well as compared to regular lenses.

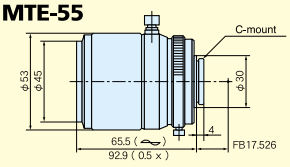
Applications

Medical purposes:Eyeball inspection,
physical and chemical research
FA-related: Large-size substrate recognition
Other: Laboratories

Model / item	MTE-55
Magnification	Infinite to 0.5X (when a special converter is used: 1.0X at max)
Focal distance	F=55mm
FNO	2.8 to close
Photographing distance	Infinite to 140mm
Distortion	0.6% at max
Marginal ray amount	78.50%
Maximum outside diameter	53mm
Length	65.5mm (infinite) to 92.9mm (when the lens is fully-extended)
Mount	C-mount
Filter size	M43 P=0.5
Maximum compatible camera size	2/3"
Weight (g)	320g

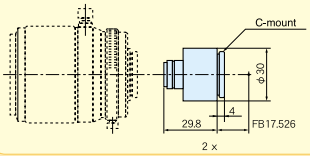
Field of view by CCD camera size

MTE-55



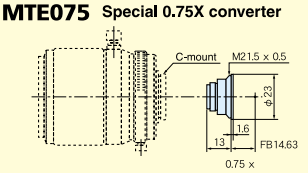
WD (mm)	MTE-55			
	2/3" (length x width)	1/2" (length x width)	1/3" (length x width)	Optical magnification
5000	550 x 733	415 x 550	300 x 400	x 0.012
3000	330 x 440	240 x 320	170 x 220	x 0.02
1000	132 x 176	90 x 120	61 x 82	x 0.05
500	55 x 73	40 x 53	30 x 40	x 0.12
300	31 x 41	24 x 32	17 x 22	x 0.21
200	22 x 29	15 x 20	11 x 15	x 0.3
140	13 x 18	10 x 13	7 x 10	x 0.48

MTE2 Special 2X converter



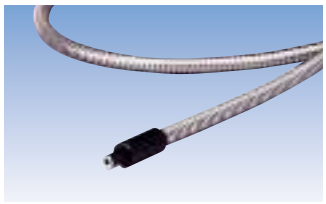
WD (mm)	MTE-55 +Special 2X converter (MTE2)			
	2/3" (length x width)	1/2" (length x width)	1/3" (length x width)	Optical magnification
5000	275 x 366	207 x 275	150 x 200	x 0.024
3000	165 x 220	120 x 160	85 x 110	x 0.04
1000	66 x 88	45 x 60	30 x 41	x 0.1
500	27 x 36	20 x 26	15 x 20	x 0.24
300	15 x 20	12 x 16	8 x 11	x 0.42
200	11 x 14	7 x 10	5 x 7	x 0.6
140	6 x 9	5 x 6	3 x 5	x 0.9

MTE075 Special 0.75X converter



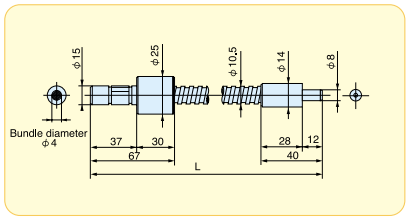
WD (mm)	MTE-55+Special 0.75X converter (MTE075)			
	2/3" (length x width)	1/2" (length x width)	1/3" (length x width)	Optical magnification
5000	733 x 977	553 x 733	400 x 533	x 0.009
3000	440 x 586	320 x 426	226 x 293	x 0.015
1000	176 x 234	120 x 160	81 x 109	x 0.03
500	73 x 97	53 x 70	40 x 53	x 0.09
300	41 x 54	32 x 42	22 x 29	x 0.15
200	29 x 38	20 x 26	14 x 20	x 0.22
140	17 x 24	13 x 17	9 x 13	x 0.36

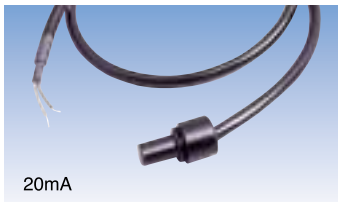
Coaxial episcopic illumination
(Halogen, tungsten, LED)



MSG series ➡ P42

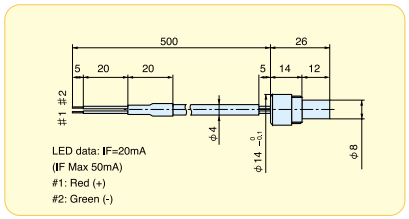
Combination with halogen type light source creates powerful lighting in a wide visible range. Multiple-purpose light suitable for all types of objects.

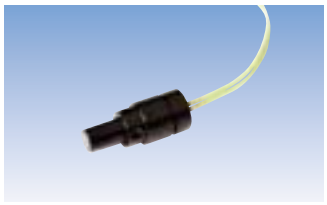




MML-AD-LED

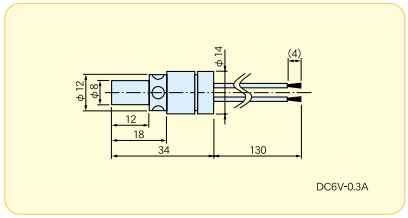
Blight red LED illumination. Highly responsive and long life. The cable end is not processed. Supply IF=20mA (Max 50mA) externally.





MML-AD-TL

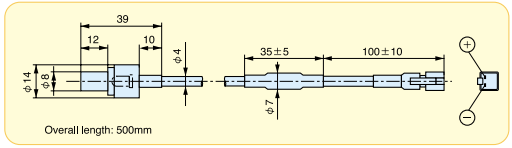
A small, lightweight tungsten lamp is used. The cable end is not processed. Supply DC6V-0.3A externally.



MML-AD-LED-CR12

Terminal connector that can be connected to a special LED light source. Colors can be selected according to objects.

		Power consumption
MML-AD-LED-CR-12	Red	0.26W
MML-AD-LED-W-CR12	White	0.21W
MML-AD-LED-B-CR12	Blue	0.21W
MML-AD-LED-G-CR12	Green	0.22W

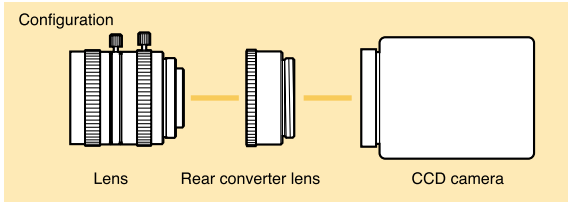


*1. Refer to P.59 for power source and trunk cable.
*2. Cannot be used when adjusting the light or under low light.

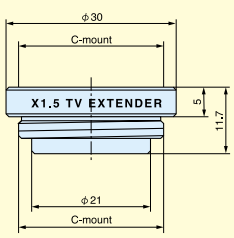
Rear converter lens

Attach between the lens and CCD camera. They allow for magnification adjustment without changing the working distance of the lens.

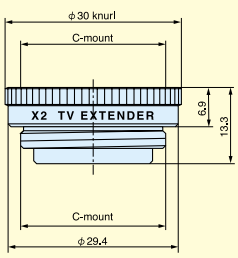
* Note that using them lowers the resolution.



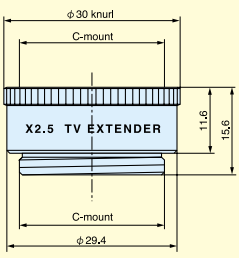
ML-1.5X



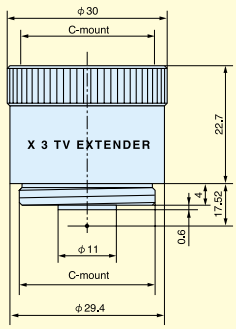
ML-2X



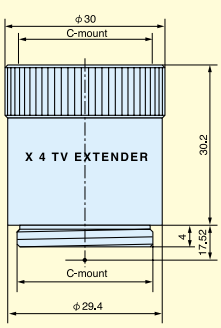
ML-2.5X



ML-3X

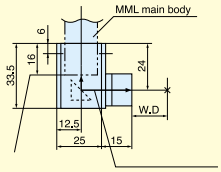


ML-4X

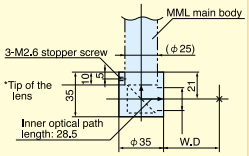


90° slide-looking rectangular mirror type

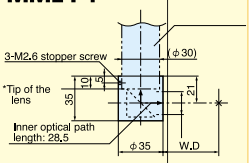
MML-P1



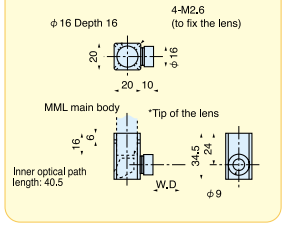
MML-P3

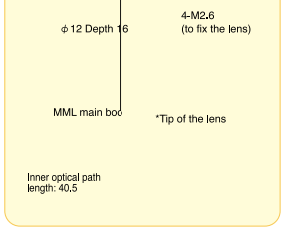


MML-P4



90°slide-looking pent prism type

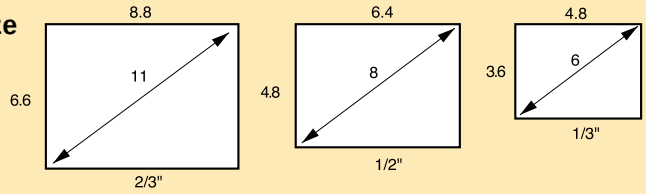




Optical axis pitch conversion type

DATA List

CCD camera element size



MML field of view list

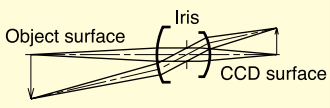
Optical magnification	2/3" (length x width x angle)	Monitor magnification 9"	Monitor magnification 14"	1/2" (length x width x angle)	Monitor magnification 9"	Monitor magnification 14"	1/3" (length x width x angle)	Monitor magnification 9"	Monitor magnification 14"
x 0.1	66 x 88 x 110	2.1	3.2	48 x 64 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 (fixed number) x 0.55 (design wavelength) / NA
Effective FNO	=	magnification / 2NA
Depth of field (mm)	=	2 (permissible circle of confusion x effective FNO / magnification^2)
Luminous flux diameter	=	2NA x height from a object + field size (angle)

Telecentric optical system's features

Non-telecentric lens



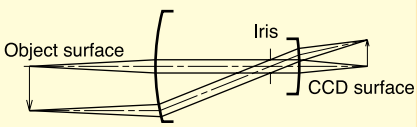
Pros

- 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



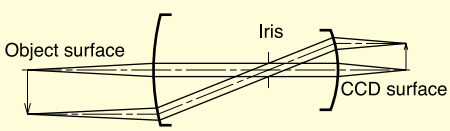
Pros

- 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

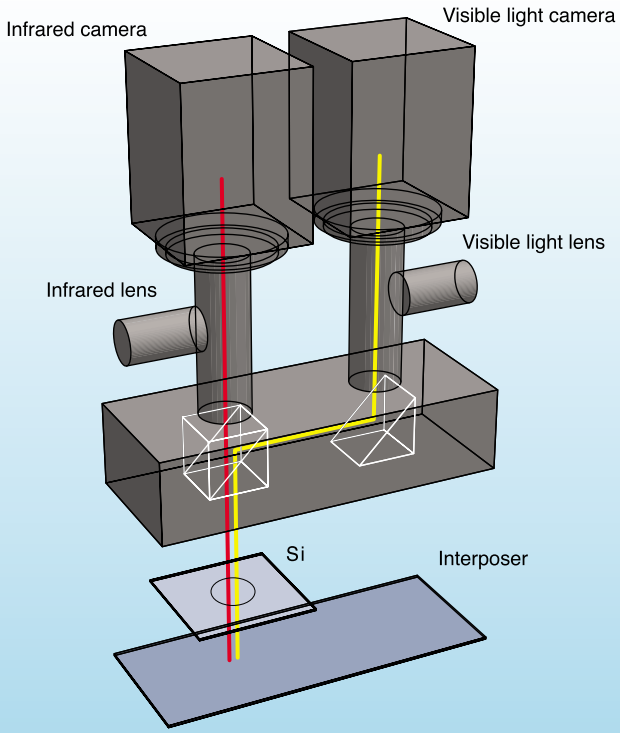
- Similar to MMLs, accuracy is high when the size of the back of the camera flange differs greatly.

Cons

- Same as MMLs. More expensive than MMLs.

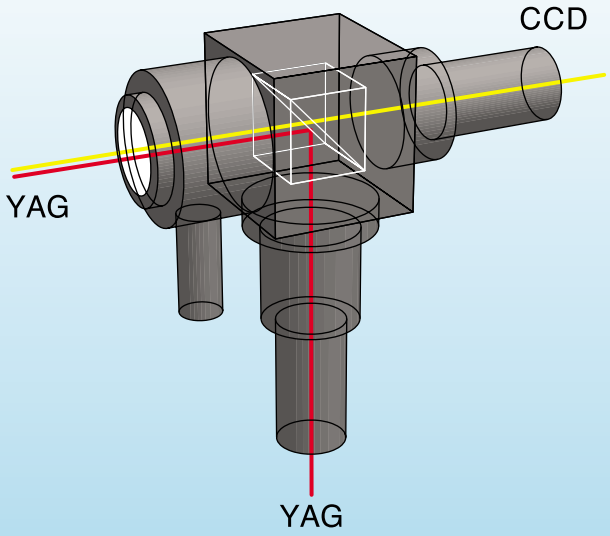
Total optical illumination system

Infrared ray transmitting system



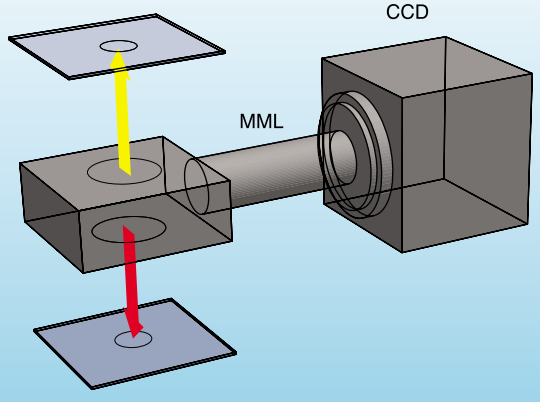
A total lens and light system that uses infrared ray to transmit Si, GaAS, or Ge substrate and recognize patterns on their backsides.

YAG laser optical system



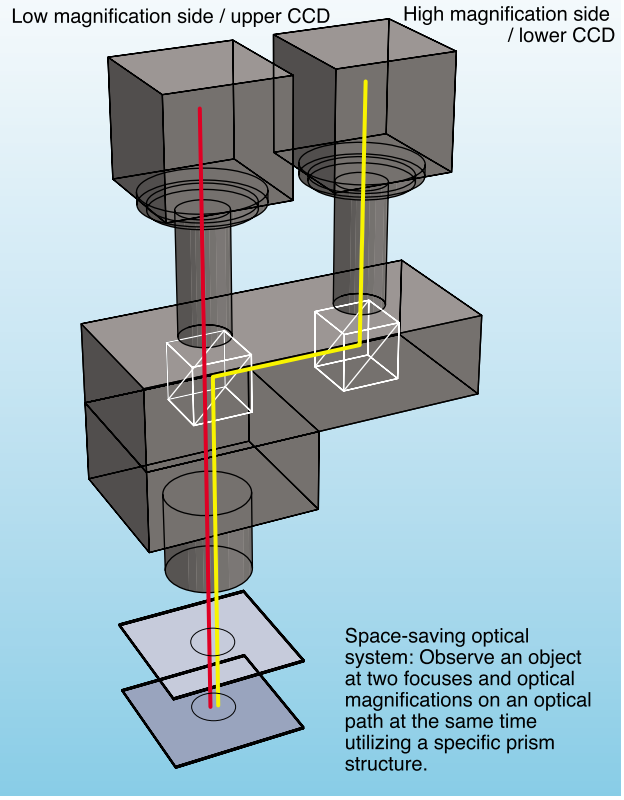
Space-saving optical system to check YAG laser welding and assemble on an optical path using a CCD.

Top and bottom double field optical system (1CCD method) (2CCD method)



Space-saving optical system to stick together two things that are facing each other.

Twin-lens 2X magnification / twin-lens bifocal optical system



Space-saving optical system: Observe an object at two focuses and optical magnifications on an optical path at the same time utilizing a specific prism structure.

Various OEM applications are available with combinations of more than 100 standard products and lights. Please contact us if you are interested.