Lenses & Peripherals

MV

Machine Vision General Catalog

MORITEX CORPORATION

2008-2

Allowing you to see what was imperceivable

Approaching the three fields of illumination, lens, and peripherals from a comprehensive system point of view and solving problems efficiently to obtain images necessary for customers. This is the total solution by Moritex. When problems arise, what should be improved? Understanding each individual aspect of the problem and considering it as a whole will present a real solution. Contrary to total optimization, the partial optimization of mutually related illumination, lens, and peripheral items may not produce a good overall result. An optimal image makes visible that which you once could not see. That is our total solution to meet various requirements.

TOTAL SOLUTION
for Machine Vision

Results beyond Customers' Imagination

Capturing images or taking photos under complex restrictions, customers expect optimum images as complete results not just lenses or illumination parts. We believe that the results of our careful consideration of customers' needs and the consequent customer satisfaction prove to be our greatest value. Such friendly, capable customer service by our sales personnel and engineers support Moritex's total solution ideal. The pleasure and excitement of producing results beyond customers' imagination motivates us.

Illuminations

Lenses

Image Illumination Systems World Share No. 1

Since our founding in 1973, Moritex has existed as a total manufacturer of lighting and lighting related products. Moritex has continually pursued a spirit of uniqueness and advancement. In particular, our image illumination systems using optical fibers have achieved the No. 1 share in the world. Furthermore, our years of experience in the design and manufacturing of optical lenses enable us to provide machine vision systems, combing illumination and lens systems to manufacturers and suppliers of equipment around the world. We shall conduct further research in order to accurately and precisely respond to the needs of our customers, and shall strive to provide the highest quality machine vision processing systems.

Peripherals

Service & Support

Case Study

Related to Automotive Parts — Company A

We consulted with Moritex regarding illumination for recognizing 2D codes on metal surfaces. Moritex recommended a system with coaxial illumination instead of the conventional reflected illumination. We adopted the proposed image processing system with lenses and illumination, which included image processing software with an established reputation for recognizing algorithms. This system remarkably increased the recognition accuracy and thus improved the reliability of the code recognition line.

Related to Industrial Equipment — Company H

We were looking for a partner who could develop peripherals for our new image processing equipment and chose Moritex based on its capability to provide us with an overall solution. Moritex put great effort into the development of our new product, including customization of lenses, illumination, and peripherals. Despite the difficulty of our request, the required inspection line was completed and put into operation with great satisfaction.

Related to LCD Manufacture — Company K

We were using a system that combined a line CCD camera, lens, and light source for inspection purposes, but had a problem of low accuracy and yield. The lens, line illumination, and light source were purchased from 2 different manufacturers. After consulting with Moritex, we found that it was necessary to match the illumination to the characteristics of the lens. Using the items that were recommended to best match the lens characteristics, we were able to improve the inspection accuracy and raise the yield higher than our expectations.

Related to Food Packaging — Company T

We do business with Moritex because they are the sole maker of FA lenses and illumination that also offers a variety of peripherals. Moritex's products are very convenient because they are easy to set up when installing new products, and there are a large number of items to choose from. When problems occur, Moritex is also quick in solving problems when they occur.

Related to Industrial Products — Company M

We were looking for a lens to check the shape of a mold but other companies only offered objective lenses. Because of their short working distances, objective lenses are not suitable for this inspection where oil may spil. In response to our inquiry, Moritex recommended lenses with a long working distance. The new lenses not only prevented oil spillages but produced images of higher definition than expected. This greatly enhanced our ability of mold inspection.

Related to Industrial Equipment — Company M

Working toward cost reduction, we contacted Moritex to make an estimation on a vision system. The system Moritex proposed contained lenses not of an equivalent level, but higher mega pixel lenses. This system not only reduced our overall costs, but also improved the recognition accuracy achieved by the high resolution of the lens.

Related to Biotechnology Industry — Company T

The standard lenses that were available did not have a large enough depth of field for our special use. Upon consulting with Moritex, they promptly adjusted the depth of field according to our specifications. As a result, we were able to upgrade our system without any problems. We believe that a lens should be purchased from a manufacturer of high quality optical technology that can easily customize lenses.

Test Laboratory

Moritex has 11 demo labs in Japan and 5 others throughout the world where you can bring in actual objects and test our lenses, illumination, and even our image processing software. We have created environments available for experimentation whenever necessary.
From the various Moritex products, you can select the most appropriate items for your application.

★ Convenient in the following cases:

- It is difficult to recognize objects because the color or shape has changed
- You wish to select illumination and lenses with first hand experimentation, and to see images provided by image processing software
- You wish to conduct tests by changing the color (or reflectivity) of LED illumination
- You wish to know the differences that result from changing the angle or method of illumination when your work material often changes
- You are having difficulty viewing objects, the reason for which is unknown

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System Flow

Lenses & Peripherals

Stand

➡P.L69

CCD Cameras

➡P.L68

Rear Converter Lenses

➡P.L63

Close-Up Rings

➡P.L64

Telecentric Lenses

MML-HR Series

➡P.L12

High Magnification Machine Micro Lens SOD-10X

➡P.L16

MML-ST Series

➡P.L18

MML Series

➡P.L25

MML-ST-CM Series

➡P.L27

MML-CS1 Series

➡P.L30

Near-Infrared, MML-NIR Series

➡P.L31

MML Zoom Lens Series

➡P.L39

Zoom Lenses (Navitar)

12X Zoom Lens

➡P.L44

12X Ultra-Zoom Lens

➡P.L46

Non-telecentric Macro Lenses

➡P.L48

Low Magnification Macro Lenses

➡P.L49

Zoom Lenses (Normal)

CCTV Macro Zoom Lens

➡P.L51

High Performance Macro Zoom Lens

➡P.L51

Megapixel Macro Zoom Lens

➡P.L52

10x Zoom Lens

➡P.L52

Line CCD Lenses

NAVITAR Raptar Pro

➡P.L55

ML-L12K5 Series

➡P.L56

Line Scan CCD Lens Series for 57mm sensor

➡P.L57

Line CCD Lens

➡P.L58

CCTV Lenses

CCTV Lens Series

➡P.L59

Megapixel CCTV Lens Series

➡P.L61

Telecentric CCTV Lens

➡P.L62

Varifocal Lens

➡P.L50

Prism Adapters

➡P.L32

Prism Units

➡P.L36

Optional Filters

➡P.L64

Telecentric Lenses VISIONMES®

➡P.L65

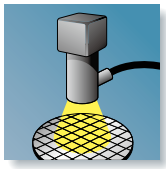
SOD-III Coaxial Illumination Unit for Objective Lenses

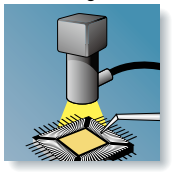
➡P.L53

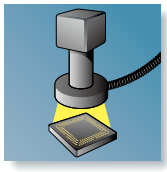
Lighting Pattern

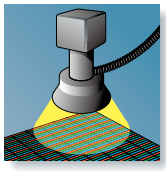
Character Recognition

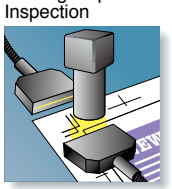

Print Board Inspection


Wafer Inspection


IC Bonding


BGA Ball Inspection


LCD Color Filter Observations


Printing Gap Inspection


IC Lead Inspection

Lighting for Picture

Basics

Color Filter

Mounted Parts

Color Filter

Coaxial Illumination (Bright Field)

IC Pattern
Silicon Wafer
Hard Disk
LCD Panel
Color Filter
Other Mirror Finished Materials

Oblique Illumination (Dark Field)

Marks on a Substrate
Scratch, Edge
Convex Inspection
Soldering Components
Other Mirror Finished Objects

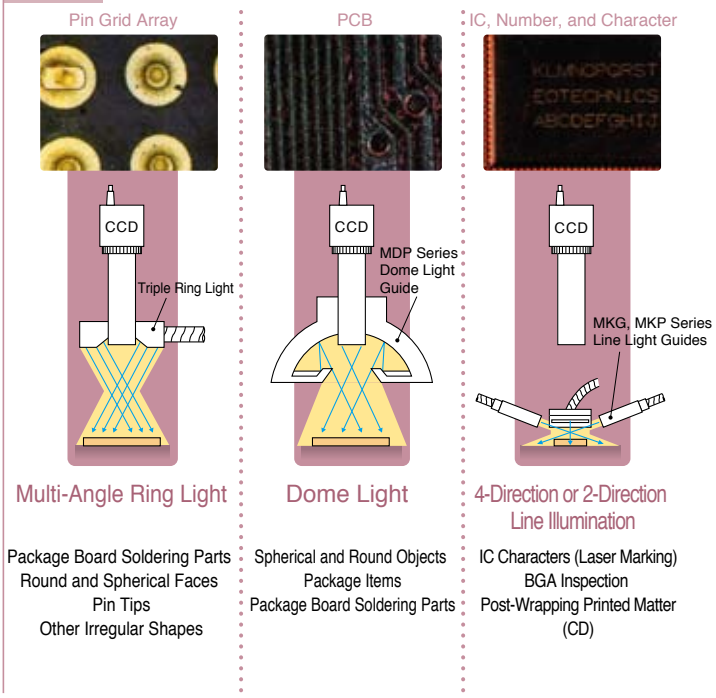
Transmitted Illumination (Backlight)

IC Lead Shape, Pitch
Substrate through Hole
LCD Substrate Electrodes
Other Transparent Bodies

Illumination Related Products

*See MVS General Catalog 'LED Illumination/Light Sources.'

Applied



Multi-Angle Ring Light

Package Board Soldering Parts
Round and Spherical Faces
Pin Tips
Other Irregular Shapes

Dome Light

Spherical and Round Objects
Package Items
Package Board Soldering Parts

4-Direction or 2-Direction Line Illumination

IC Characters (Laser Marking)
BGA Inspection
Post-Wrapping Printed Matter
(CD)

INDEX

Not all dimensions or tolerances are given in this catalog.
For more detailed information, please request product specifications.

Machine Micro Lens

Mega Pixel
Non-Distortion
High Contrast

MML-HR Series

MML-High Resolution

The MML-HR Series supports mega pixel cameras with 410 thousand or more pixels. This series is designed for high resolution in all views of the lens and for high contrast that emphasizes the difference in S/N. The quality of Moritex lenses can be found in the difference in image quality that cannot be compared through catalog specifications alone.

- A lineup offering the long-awaited WD=110 mm in addition to a WD =65 mm.
- Non-distortion design.
- High contrast design.
- An ultra-uniform coaxial illumination function model equipped in all lens types.
- Achievement of thorough cost reductions through revisions of the design and manufacturing processes.

Non-Distortion
Low Cost
Uniform Image Surface Illumination

MML-ST Series

MML-Standard

Through combination with a 410 thousand pixel camera, the MML-ST Series has renewed the design and manufacturing processes to achieve high level optical capabilities.
Furthermore, compact models with a diameter from ϕ16~ and featuring deep depth of field are available for installation into manufacturing equipment. This series is the next generation in machine vision, pursuing the highest level of optical capabilities and ease of use.

- 4 types of WD to match customer needs (WD=65, 100, 150, 300 mm).
- Non-distortion design.
- An ultra-uniform coaxial illumination function model equipped in all lens types.
- Achievement of thorough cost reductions through revisions of the design and manufacturing processes.

MML-ST-CM Series
MML-CS1 Series

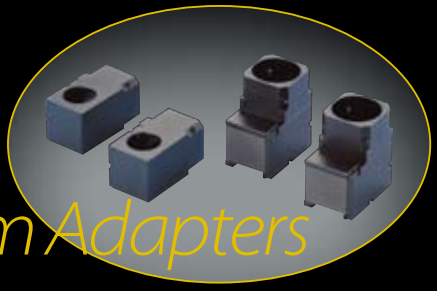
The MML-ST-CM/CS1 Series consists of small diameter, lightweight models which save space and achieve fine pitch due to their micro-head cameras with special mounts.

[MML-ST-CM: for use with ϕ17mm (M15.5 P0.5) mount]

[MML-CS1: for use with ϕ12mm (M10.5 P0.5) mount]

MML-Zoom Lens Series

The MML-Zoom Lens Series consists of high resolution zoom lenses with coaxial illumination functions designed with telecentric optics. These lenses support all type of work recognition through the use of a wide zoom range and a long working distance, as well as uniform, coaxial illumination that covers the entire field of view. Zoom models are available with both a manual type and a motor zoom type that includes a stepping motor.



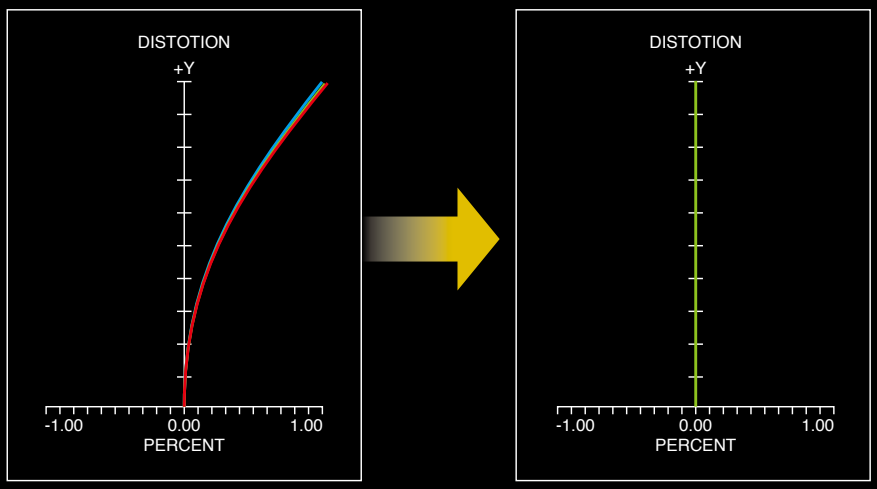
Prism Adapters

These prism adapters are for the MML-ST Series. Prism adapters make it possible to bend the optical axis at a right angle of 90˚, and to perform mark and target recognition for microscopic work by modifying the pitch between 2 MML lenses to a fine pitch.

Machine Micro Lens

Non-Distortion

The pursuit of high resolution with no aberration has resulted in the elimination of image bending. This means that it is no longer necessary to consider distortion offsets.

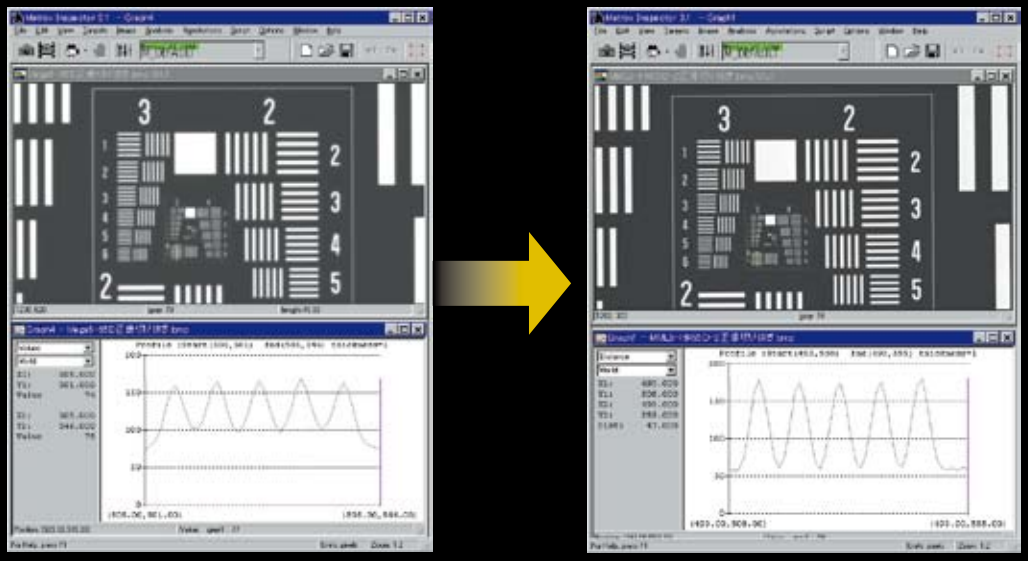


Conventional MML

MML-HR & MML-ST

High Contrast

Improvement of contrast has enabled image recognition with greater emphasis on the shadings of black and white. By converting the resolution chart image to binary form and then graphing and comparing the brightness levels, the MML-HR greatly emphasizes the difference in brightness between black and white when compared to the conventional Mega MML.



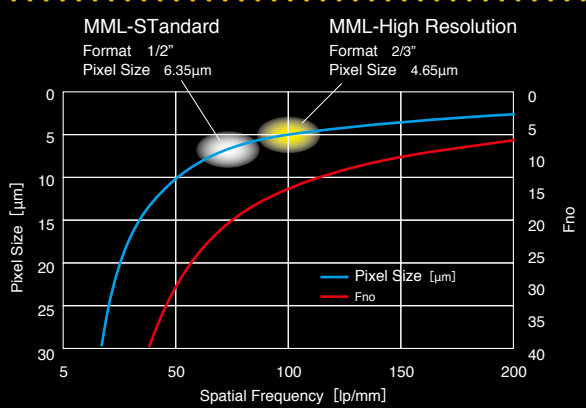
Conventional MML

MML-HR & MML-ST

Design Concept

Pixel size, resolution limitation frequency, Fno relation

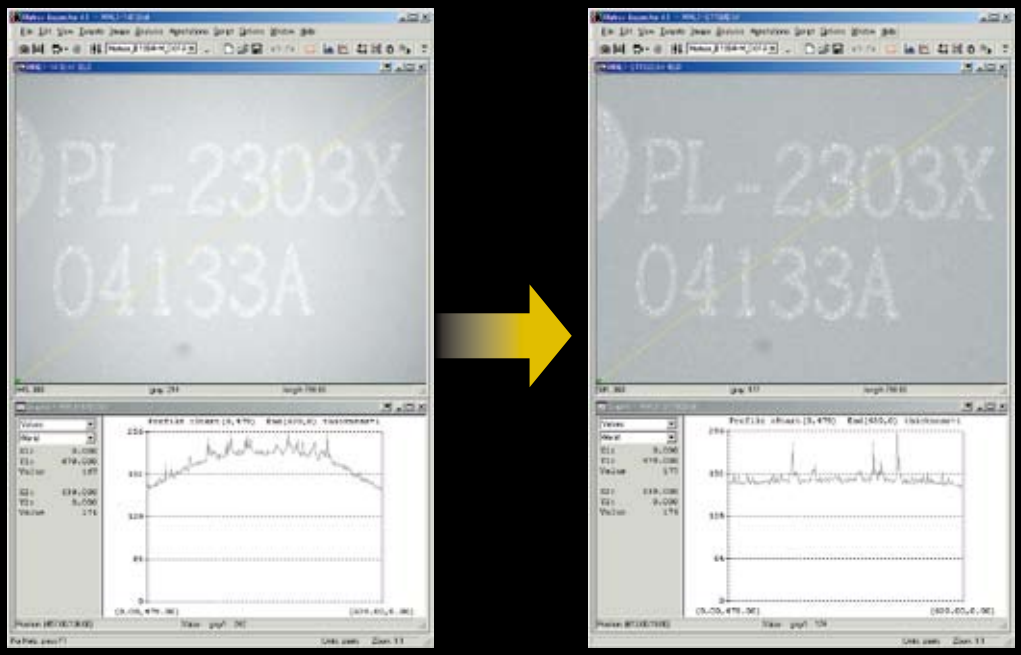
The MML-HR/ST series consists of two types of optical designs combined with CCD cameras.



Illumination Uniformity

When recognizing matt work surface with coaxial illumination, only a small amount of light is reflected from the surface, so the light quantity is often raised when recognizing images.
However, in this type of use, the brightness of the center of the screen is raised due to reflection from the lens of the illumination light. The ST/HR Series solves this problem with a design the vastly reduces reflection from the lens. This improves the uniformity of illumination for even matt work surfaces.

Recognition using coaxial illumination was performed for microcomputer surfaces (rough surfaces). The MML-ST/HR brightness graph shows a reduction in the difference between the brightness in the center and periphery of the screen. The images above the graphs show the removal of the light area from the center.



Conventional MML

MML-HR & MML-ST

C Mount　3 Mounts of Differing Types

ϕ34 Ring Type
MML

ϕ30 Ring Type
MML-ST / HR

Set Screw Type
MML-ST

Moritex provides customized responses to requests for modifications of mounts and special mounts.

MML-HR Series

MML-High Resolution

MML-HR Series

- Supports mega pixel CCD.
- High resolving power throughout the field of view.
- Number of pixels: 410 thousand pixels~mega pixels

  Compatible with 2/3" or smaller CCD element (some only to 1/2").

The MML-HR Series is a high capability model that supports mega pixel cameras with 410 thousand pixels or more (4.65µm/Pix~).

The entire screen features a high resolution and high contrast design that realizes amazing, ultra-high image quality which cannot be compared through numbers alone. This series exerts true power in highly detailed inspections and alignments.

WD65mm

Model	Magnification	WD	Resolution	Depth of Field	NA	Effective Fno	TV Distortion	Largest Compatible CCD	Weight	Mount	Product Code
MML05-HR65D	×0.5	65mm	12.8µm	3.04mm	0.026	9.5	-0.001% or less	2/3"	75g	C Mount	A-3029
MML08-HR65D	×0.8	65mm	8.4µm	1.2mm	0.04	9.9	0.017%	2/3"	64g	C Mount	A-3128
MML1-HR65D	×1.0	65mm	7.5µm	0.88mm	0.045	11	-0.02%	2/3"	58g	C Mount	A-3031
MML1.5-HR65D	×1.5	65mm	5.4µm	0.42mm	0.063	12	-0.036%	1/2"	53g	C Mount	A-3032
MML2-HR65D	×2.0	65mm	4.5µm	0.27mm	0.074	13.5	0.02%	2/3"	52g	C Mount	A-3033
MML4-HR65D	×4.0	65mm	3µm	0.09mm	0.112	17.9	0.018%	2/3"	94g	C Mount	A-3034
MML6-HR65D	×6.0	65mm	3µm	0.06mm	0.112	26.7	0.006%	2/3"	102g	C Mount	A-3035
MML4-HR65D-VI	×4.0	65mm	3~13.3µm	0.09~0.53mm	0.112	17.9~79.2	0.018%	2/3"	95g	C Mount	A-3094
MML6-HR65D-VI	×6.0	65mm	3~13.9µm	0.06~0.58mm	0.112	26.7~124	0.006%	2/3"	102g	C Mount	A-3095

*Resolution values indicate the theoretical resolution at a wavelength of 550nm.
*Depth of field is calculated assuming a horizontal 240TV resolution using a 1/2 CCD camera. (Permissible circle of confusion on the image-formation side: 40µ)

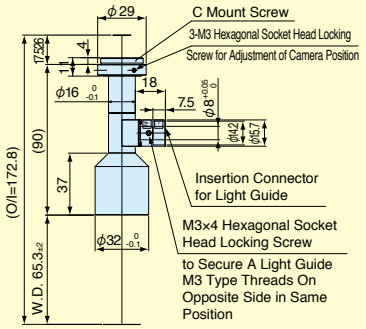
MML-HR Series

Explanation of Model Code

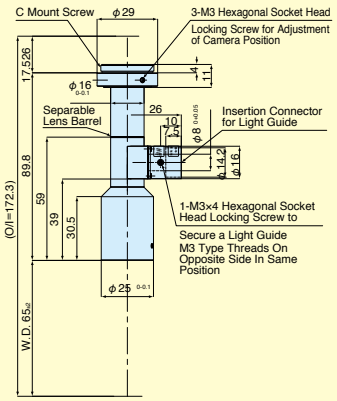
MML □ – □ – □ □ □ – □ – □

Magnification	Series	WD	Illumination	Mounted Parts	Variable Aperture
	HR MML-HR				None
	ST MML-ST		None	None	**VI** Exists
	MML		**D** Coaxial Illumination Type	**S** Short Barrel Model	C Mount
					CM M15.5×0.5
					CS1 M10.5×0.5

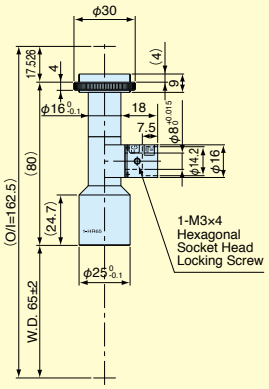
MML05-HR65D



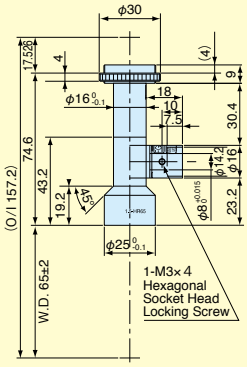
MML08-HR65D



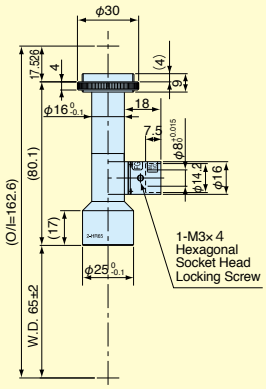
MML1-HR65D



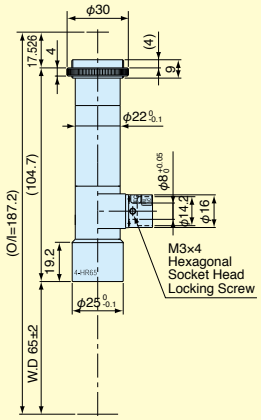
MML1.5-HR65D



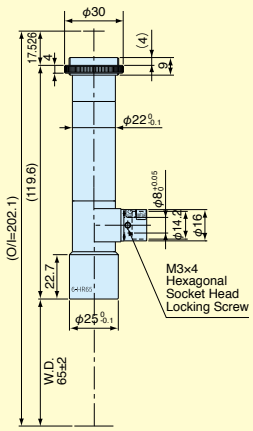
MML2-HR65D



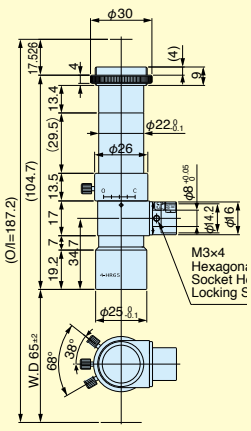
MML4-HR65D



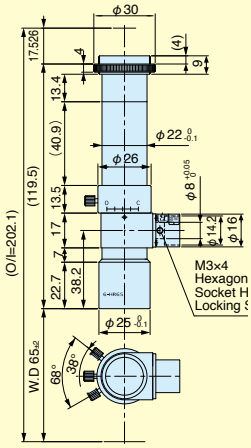
MML6-HR65D



MML4-HR65D-VI

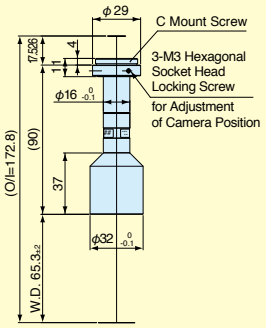


MML6-HR65D-VI



MML-HR Series

MML05-HR65



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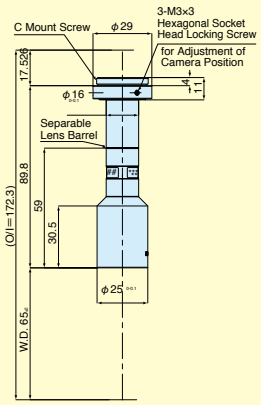
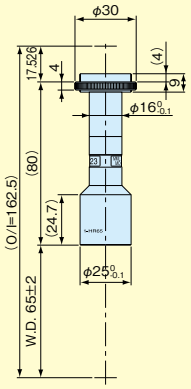
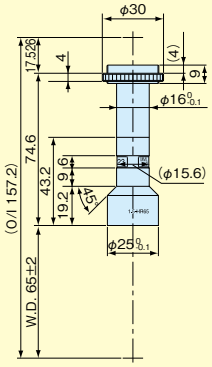


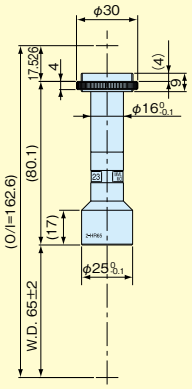
MML1-HR65



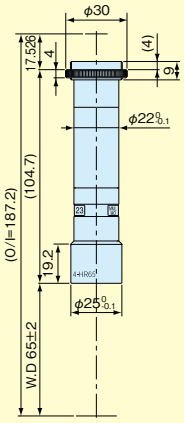
MML1.5-HR65



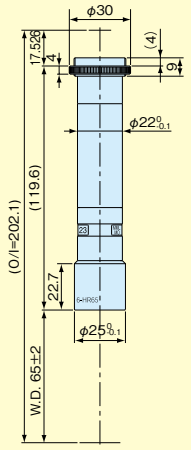
MML2-HR65



MML4-HR65



MML6-HR65



Model	Magnification	WD	Resolution	Depth of Field	NA	Effective Fno	TV Distortion	Largest Compatible CCD	Weight	Mount	Product Code
MML05-HR65	×0.5	65mm	12.8μm	3.04mm	0.026	9.5	-0.001%	2/3"	70g	C Mount	A-3044
MML08-HR65	×0.8	65mm	8.4μm	1.2mm	0.04	9.9	0.017%	2/3"	60g	C Mount	A-3129
MML1-HR65	×1.0	65mm	7.5μm	0.88mm	0.045	11	-0.02%	2/3"	50g	C Mount	A-3045
MML1.5-HR65	×1.5	65mm	5.4μm	0.42mm	0.063	12	-0.036%	1/2"	46g	C Mount	A-3046
MML2-HR65	×2.0	65mm	4.5μm	0.27mm	0.074	13.5	0.02%	2/3"	46g	C Mount	A-3047
MML4-HR65	×4.0	65mm	3μm	0.09mm	0.112	17.9	0.018%	2/3"	86g	C Mount	A-3048
MML6-HR65	×6.0	65mm	3μm	0.06mm	0.112	26.7	0.006%	2/3"	94g	C Mount	A-3049

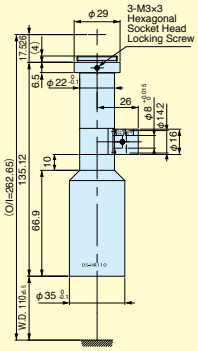
*Resolution values indicate the theoretical resolution at a wavelength of 550nm.
*Depth of field is calculated assuming a horizontal 240TV resolution using a 1/2" CCD camera. (Permissible circle of confusion on the image-formation side: 40μ)

Newly Released
MML-PL25HR
Dedicated 90° prism for MML-HR See page L-38 for details

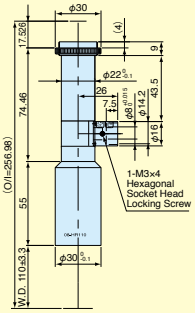
MML-HR Series

WD110mm

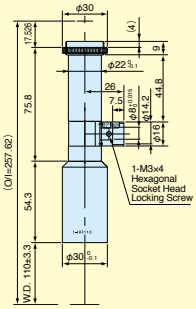
MML05-HR110D



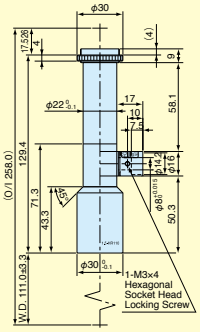
MML08-HR110D



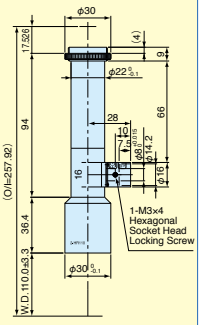
MML1-HR110D



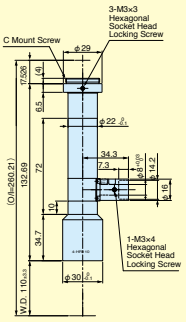
MML1.5-HR110D



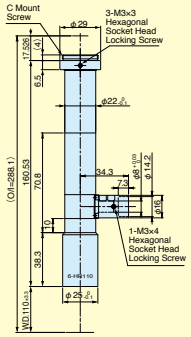
MML2-HR110D



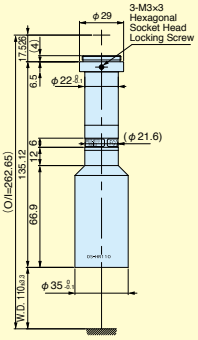
MML4-HR110D



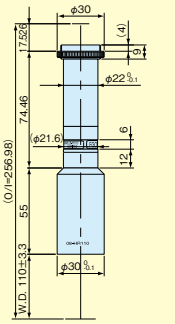
MML6-HR110D



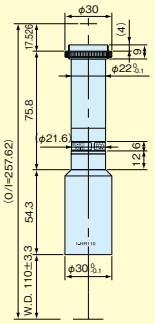
MML05-HR110



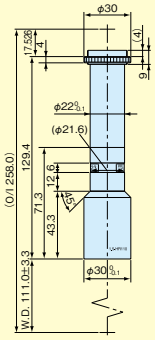
MML08-HR110



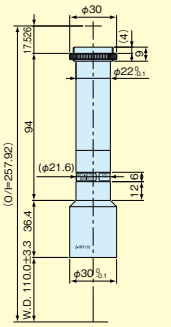
MML1-HR110



MML1.5-HR110



MML2-HR110



Model	Magnification	WD	Resolution	Depth of Field	NA	Effective Fno	TV Distortion	Largest Compatible CCD	Weight	Mount	Product Code
MML05-HR110D	×0.5	110.0mm	12.8μm	3.0mm	0.026	9.5	0.018%	2/3"	142g	C Mount	A-3037
MML08-HR110D	×0.8	110.0mm	9.3μm	1.4mm	0.036	11	0.009%	2/3"	112g	C Mount	A-3038
MML1-HR110D	×1.0	110.0mm	7.4μm	0.88mm	0.045	11	0.003%	2/3"	120g	C Mount	A-3039
MML1.5-HR110D	×1.5	111.0mm	5.4μm	0.42mm	0.063	12	0.025%	2/3"	110g	C Mount	A-3040
MML2-HR110D	×2.0	110.0mm	4.5μm	0.27mm	0.074	13.5	0.014%	2/3"	110g	C Mount	A-3041
MML4-HR110D	×4.0	110.0mm	3.7μm	0.11mm	0.09	22.2	-0.001%	2/3"	125g	C Mount	A-3042
MML6-HR110D	×6.0	110.0mm	4.5μm	0.088mm	0.075	39.9	0.022%	2/3"	140g	C Mount	A-3043
MML05-HR110	×0.5	110.0mm	12.8μm	3.0mm	0.026	9.5	0.018%	2/3"	137g	C Mount	A-3051
MML08-HR110	×0.8	110.0mm	9.3μm	1.4mm	0.036	11	0.009%	2/3"	109g	C Mount	A-3052
MML1-HR110	×1.0	110.0mm	7.4μm	0.88mm	0.045	11	0.003%	2/3"	116g	C Mount	A-3053
MML1.5-HR110	×1.5	111.0mm	5.4μm	0.42mm	0.063	12	0.025%	2/3"	98g	C Mount	A-3054
MML2-HR110	×2.0	110.0mm	4.5μm	0.27mm	0.074	13.5	0.014%	2/3"	100g	C Mount	A-3055

*Resolution values indicate the theoretical resolution at a wavelength of 550nm.
*Depth of field is calculated assuming a horizontal 240TV resolution using a 1/2" CCD camera. (Permissible circle of confusion on the image-formation side: 40μ)

High Magnification Machine Micro Lens
SOD-10×

- 10× optical magnification. 15×, 20× possible.
- Long working distance of 55mm.
- High resolution of 0.23 NA.
- Compact design.

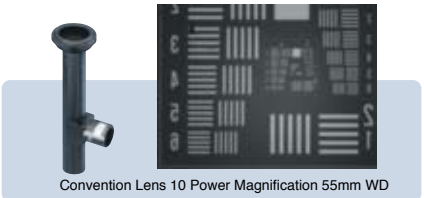
The high magnification MML is a new introduction to the industry that uses machine vision to realize high magnification and high resolution of the microscopic range.
Enlarged observation with 15× or 20× is possible when using a high capability rear converter.
The MML provides a solution for machine vision users who wish to install a microscopic vision system in their machines.

Model	CCD Size	Magnification	WD	Effective Fno	NA	Resolution	Depth of Field	Mount	Product Code
SOD-10X	2/3"	10×	55.2mm	22	0.23	1.5µm	17µm	C-Mount	A-0174
Dedicated Rear Converter Lens									
SOD-1.5X	2/3"	15×	55.2mm	33	0.23	1.5µm	12µm	C-Mount	A-0175
SOD-2X	2/3"	20×	55.2mm	44	0.23	1.5µm	9µm	C-Mount	A-0176

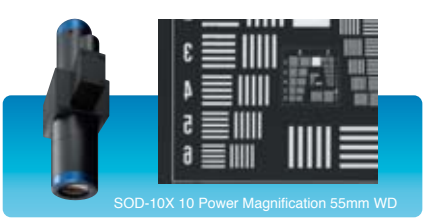
1 Even Better Images

High Resolution The World of 0.23 NA

Achievement of high resolution that is beyond comparison with conventional machine vision lenses.



Convention Lens 10 Power Magnification 55mm WD

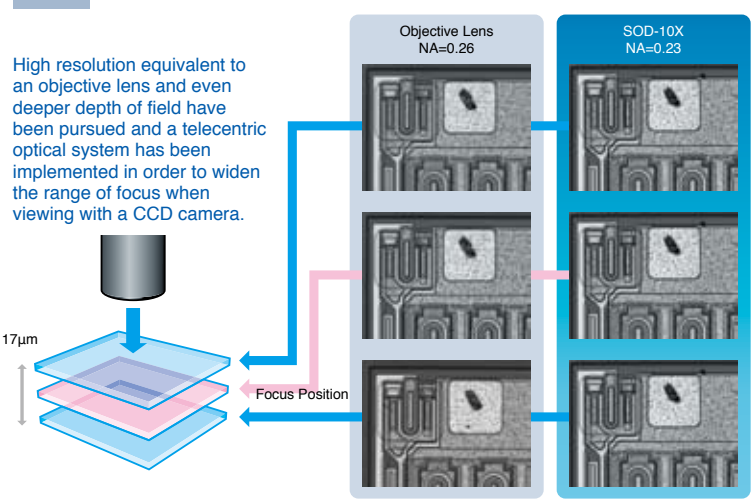


SOD-10X 10 Power Magnification 55mm WD

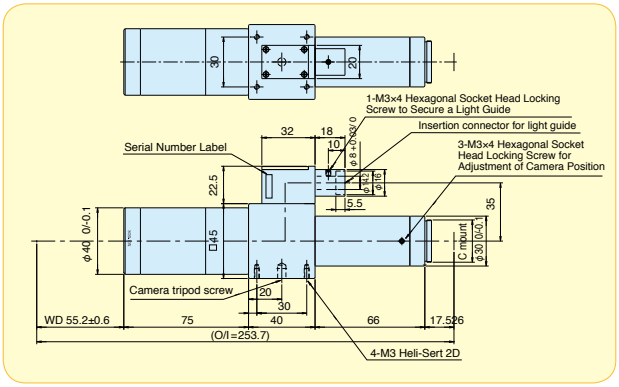
2 Wide Focus Range

Deep Depth of Field 17µm Telecentric Optical System

High resolution equivalent to an objective lens and even deeper depth of field have been pursued and a telecentric optical system has been implemented in order to widen the range of focus when viewing with a CCD camera.

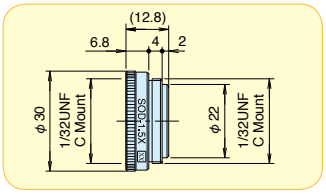


SOD-10X

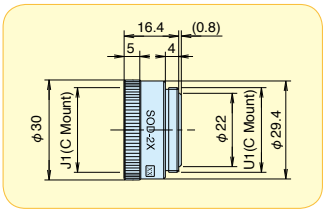


■Rear Converter Lens (Option)

SOD-1.5X



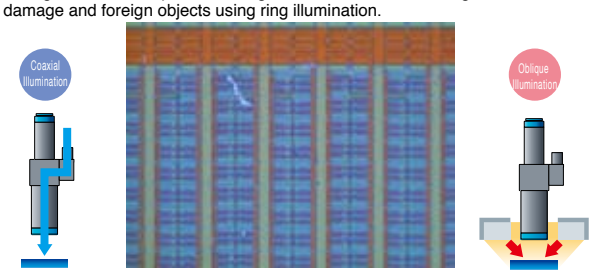
SOD-2X



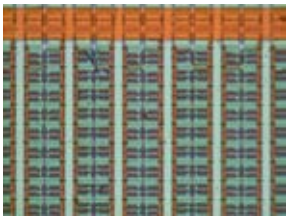
Application Sample

Silicon Wafers

Recognition of wafer patterns using coaxial illumination. Recognition of damage and foreign objects using ring illumination.



■ Coaxial Illumination



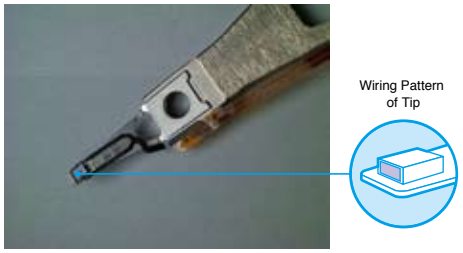
Wafer (Pattern)

■ Ring Illumination

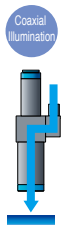
Wafer (Damage)

Hard Disk Reading Head

Highly uneven objects are covered by using a wide focus range.



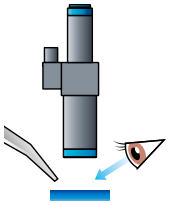
■ Coaxial Illumination



3 Ease of Use **Long WD of 55mm**

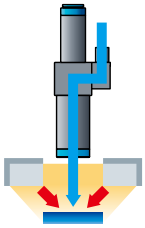
Improved ease of use through longer WD (working distance) while maintaining high resolution.

Sufficient space for tools and picking has been secured, allowing the performance of operations thought to be impossible with conventional models. Operating position and work status can be confirmed by eye, resulting in a reduction of operating mistakes.



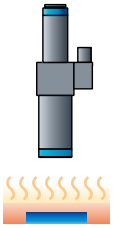
Establishment of operating space
Confirmation of operation status and position possible by eye

Possibility not only of coaxial lighting but ring illumination and various other illumination. The increase in illumination options make it easier to see objects which were previously difficult to see.



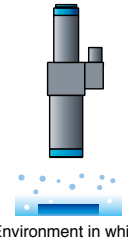
Oblique illumination is possible

Recognition is possible at a location separated from the heat source. Alignment and inspection are also possible during thermo compression bonding.



Separation from heat source

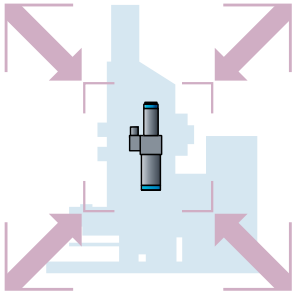
Observation can be performed without effects from water, oil, or foreign objects generated during processing.



Environment in which substances such as water and oil are spilled

4 Compact

Compact design makes it possible to downsize peripheral parts and machinery.



MML-ST Series

MML-Standard

MML-ST Series

- Compact design with a lens barrel diameter of ϕ16~
- Deep Depth of Field
- Number of pixels: ~410 thousand Element size: 1/2” or less

Through combination with a 410 thousand pixel camera, the renewed design of the MML-ST Series realizes high level optical capabilities. Furthermore, compact models, with a diameter from ϕ16 featuring a deep depth of field, are available to install in manufacturing equipment.

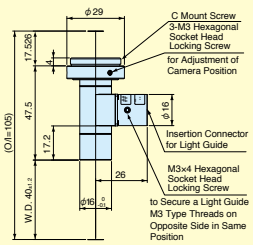
MML-ST Series

WD40mm

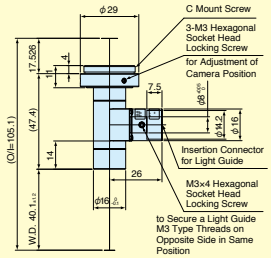
Model	Magnification	WD	Resolution	Depth of Field	NA	Effective Fno	TV Distortion	Largest Compatible CCD	Weight	Mount	Product Code
MML1-ST40D	×1.0	40.0mm	7.2μm	0.88mm	0.046	11.0	-0.013% or less	1/2"	31g	C Mount	A-3086
MML1.5-ST40D	×1.5	40.1mm	5.6μm	0.44mm	0.060	12.5	0.011% or less	1/2"	31g	C Mount	A-3088
MML2-ST40D	×2.0	40.1mm	4.8μm	0.29mm	0.070	14.3	0.006% or less	1/2"	34g	C Mount	A-3090
MML3-ST40D	×3.0	37.9mm	4.8μm	0.19mm	0.070	21.3	-0.049% or less	1/2"	33g	C Mount	A-3092
MML4-ST40D	×4.0	40.9mm	4.8μm	0.14mm	0.070	28.5	0.005% or less	1/2"	36g	C Mount	A-3077
MML6-ST40D	×6.0	40.3mm	4.8μm	0.10mm	0.070	42.8	-0.012% or less	1/2"	39g	C Mount	A-3079
MML8-ST40D	×8.0	40.0mm	4.8μm	0.07mm	0.070	57.0	-0.011% or less	1/2"	42g	C Mount	A-3081
MML1-ST40	×1.0	40.0mm	7.2μm	0.88mm	0.046	11.0	-0.013% or less	1/2"	26g	C Mount	A-3087
MML1.5-ST40	×1.5	40.1mm	5.6μm	0.44mm	0.060	12.5	0.011% or less	1/2"	26g	C Mount	A-3089
MML2-ST40	×2.0	40.1mm	4.8μm	0.29mm	0.070	14.3	0.006% or less	1/2"	29g	C Mount	A-3091
MML3-ST40	×3.0	37.9mm	4.8μm	0.19mm	0.070	21.3	-0.049% or less	1/2"	28g	C Mount	A-3093
MML4-ST40	×4.0	40.9mm	4.8μm	0.14mm	0.070	28.5	0.005% or less	1/2"	31g	C Mount	A-3078
MML6-ST40	×6.0	40.3mm	4.8μm	0.10mm	0.070	42.8	-0.012% or less	1/2"	35g	C Mount	A-3080
MML8-ST40	×8.0	40.0mm	4.8μm	0.07mm	0.070	57.0	-0.011% or less	1/2"	37g	C Mount	A-3082

*Depth of field is calculated assuming a horizontal 240TV resolution using a 1/2" CCD camera. (Permissible circle of confusion on the image-formation side: 40μ)
*Resolution values indicate the theoretical resolution at a wavelength of 550nm.
Caution: The WD 40mm series cannot be used with all prism adapter options.

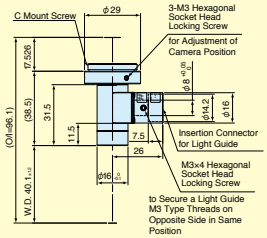
MML1-ST40D



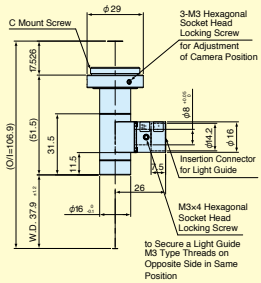
MML1.5-ST40D



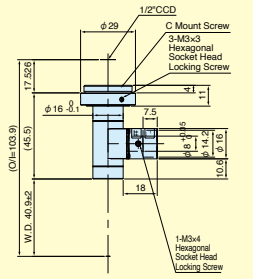
MML2-ST40D



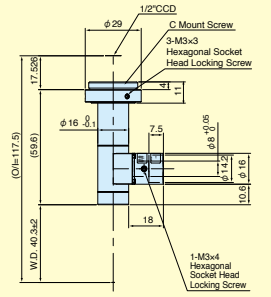
MML3-ST40D



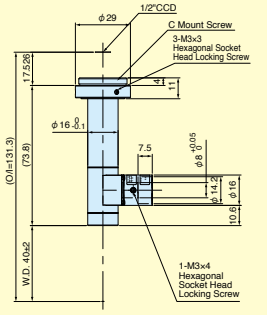
MML4-ST40D



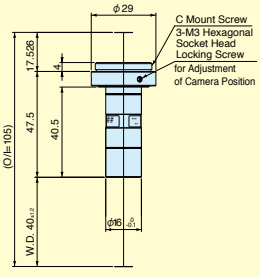
MML6-ST40D



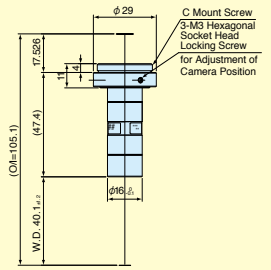
MML8-ST40D



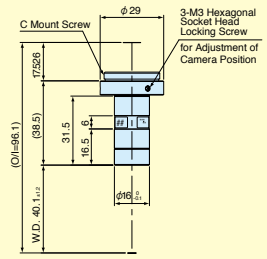
MML1-ST40



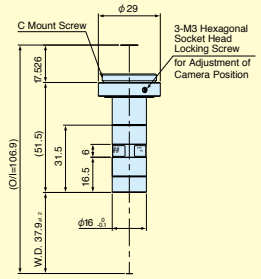
MML1.5-ST40



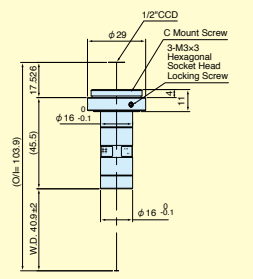
MML2-ST40



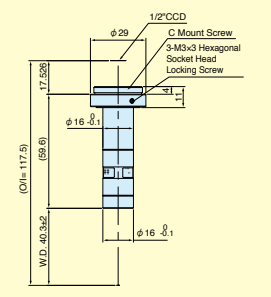
MML3-ST40



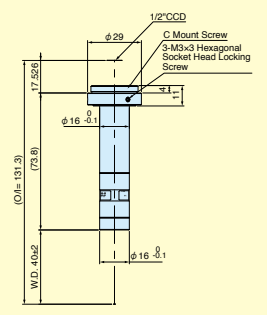
MML4-ST40



MML6-ST40



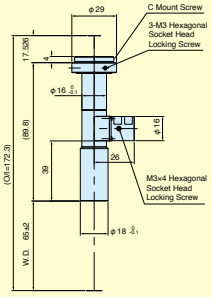
MML8-ST40



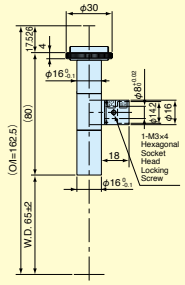
WD65mm

MML-ST Series

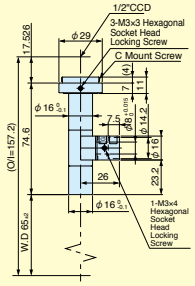
MML08-ST65D



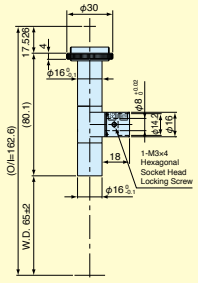
MML1-ST65D



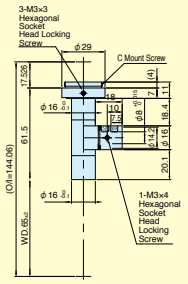
MML1.5-ST65D



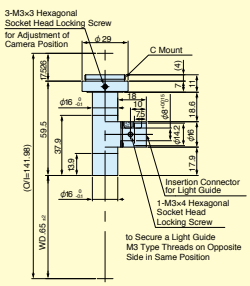
MML2-ST65D



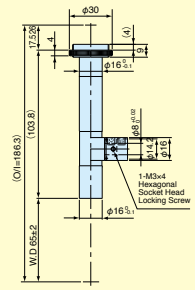
MML2-ST65DS



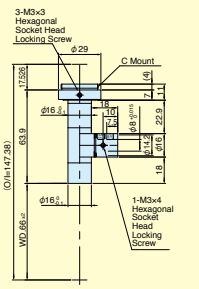
MML3-ST65DS



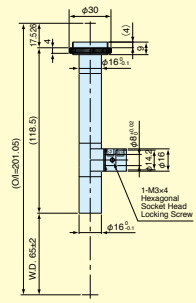
MML4-ST65D



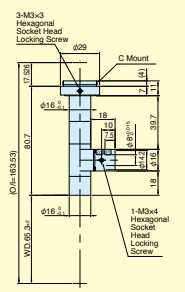
MML4-ST65DS



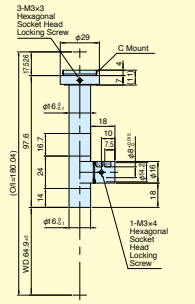
MML6-ST65D



MML6-ST65DS



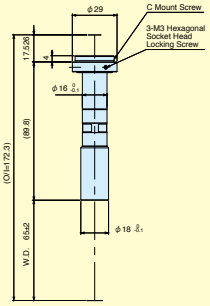
MML8-ST65DS



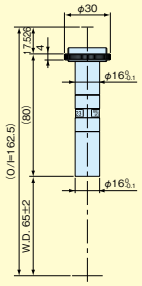
Model	Magnification	WD	Resolution	Depth of Field	NA	Effective Fno	TV Distortion	Largest Compatible CCD	Weight	Mount	Product Code
MML08-ST65D	×0.8	65mm	12.4μm	1.86mm	0.027	14.9	0.0003%	1/2"	49g	C Mount	A-3011
MML1-ST65D	×1	65mm	12.5μm	1.49mm	0.027	18.6	0.002%	1/2"	44g	C Mount	A-3012
MML1.5-ST65D	×1.5	65mm	7μm	0.56mm	0.048	15.5	-0.036%	1/2"	43g	C Mount	A-3062
MML2-ST65D	×2	65mm	5.8μm	0.35mm	0.057	17.3	0.011%	1/2"	44g	C Mount	A-3013
MML2-ST65DS	×2	65mm	5.6μm	0.35mm	0.06	17.3	0.004%	1/2"	37g	C Mount	A-3101
MML3-ST65DS	×3	65mm	4.7μm	0.19mm	0.069	21.9	0.003%	1/2"	35g	C Mount	A-3102
MML4-ST65D	×4	65mm	4.6μm	0.135mm	0.073	27	0.0017%	1/2"	55g	C Mount	A-3014
MML4-ST65DS	×4	66mm	4.4μm	0.13mm	0.076	25.9	0.011%	1/2"	41g	C Mount	A-3103
MML6-ST65D	×6	65mm	4.6μm	0.091mm	0.073	40.9	0.0023%	1/2"	60g	C Mount	A-3015
MML6-ST65DS	×6	65.3mm	4.4μm	0.09mm	0.076	39.3	0.002%	1/2"	43g	C Mount	A-3104
MML8-ST65DS	×8	64.9mm	4.4μm	0.07mm	0.076	50	-0.003%	1/2"	46g	C Mount	A-3081

*Depth of field is calculated assuming a horizontal 240TV resolution using a 1/2" CCD camera. (Permissible circle of confusion on the image-formation side: 40μ)
*Resolution values indicate the theoretical resolution at a wavelength of 550nm.

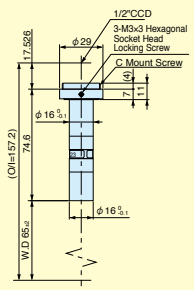
MML08-ST65



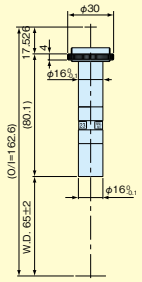
MML1-ST65



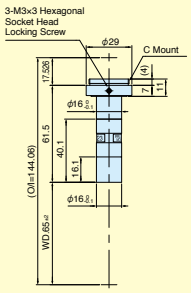
MML1.5-ST65



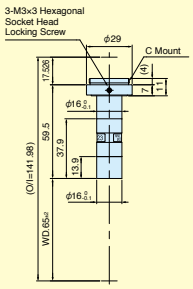
MML2-ST65



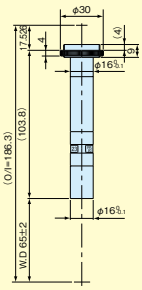
MML2-ST65S



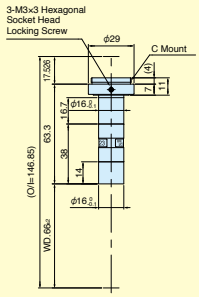
MML3-ST65S



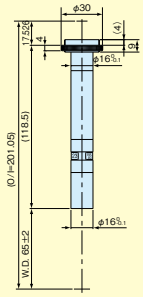
MML4-ST65



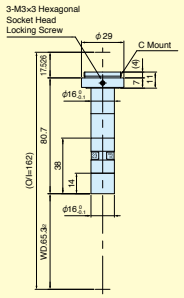
MML4-ST65S



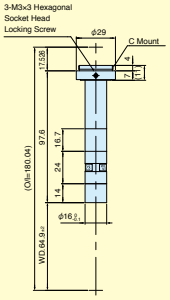
MML6-ST65



MML6-ST65S



MML8-ST65S



Optical Specifications for Machine Types Recommended for Combination with The Rear Converter

Caution: If combinations other than those recommended are used, dirt and scratches on the rear converter may be noticeable in the images that result. For this reason, do not use any setups other than the recommended types.

Model	Converter Lenses	Magnification	Resolution	Depth of Field	Effective Fno
MML1-ST65D/65	**SOD-1.5X**	1.5 X	12.5µm	0.99mm	27.9
	SOD-2X	2.0 X	12.5µm	0.74mm	37.2
MML1.5-ST65D/65	**SOD-1.5X**	2.25X	7µm	370µm	23.4
	SOD-2X	3X	7µm	280µm	31.3
MML2-ST65D/65	**SOD-1.5X**	3 X	5.8µm	230µm	26
	SOD-2X	4 X	5.8µm	170µm	34.6

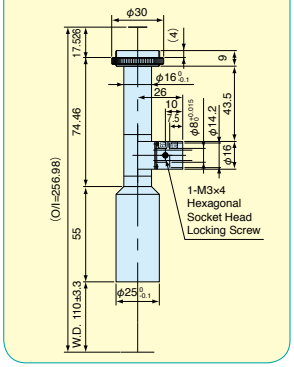
Model	Magnification	WD	Resolution	Depth of Field	NA	Effective Fno	TV Distortion	Largest Compatible CCD	Weight	Mount	Product Code
MML08-ST65	×0.8	65mm	12.4µm	1.86mm	0.027	14.9	0.0003%	1/2"	44g	C Mount	A-3085
MML1-ST65	×1	65mm	12.5µm	1.49mm	0.027	18.6	0.002%	1/2"	38g	C Mount	A-3025
MML1.5-ST65	×1.5	65mm	7µm	0.56mm	0.048	15.5	-0.036%	1/2"	36g	C Mount	A-3063
MML2-ST65	×2	65mm	5.8µm	0.35mm	0.057	17.3	0,011%	1/2"	38g	C Mount	A-3026
MML2-ST65S	×2	65mm	5.6µm	0.35mm	0.06	17.3	0.004%	1/2"	32g	C Mount	A-3105
MML3-ST65S	×3	65mm	4.7µm	0.19mm	0.069	21.9	0.003%	1/2"	30g	C Mount	A-3106
MML4-ST65	×4	65mm	4.6µm	0.135mm	0.073	27	0.0017%	1/2"	50g	C Mount	A-3056
MML4-ST65S	×4	66mm	4.4µm	0.13mm	0.076	25.9	0.011%	1/2"	36g	C Mount	A-3107
MML6-ST65	×6	65mm	4.6µm	0.091mm	0.073	40.9	0.0023%	1/2"	55g	C Mount	A-3057
MML6-ST65S	×6	65.3mm	4.4µm	0.09mm	0.076	39.3	0.002%	1/2"	38g	C Mount	A-3108
MML8-ST65S	×8	64.9mm	4.4µm	0.07mm	0.076	50	-0.003%	1/2"	42g	C Mount	A-3081

*Depth of field is calculated assuming a horizontal 240TV resolution using a 1/2" CCD camera. (Permissible circle of confusion on the image-formation side: 40µ)
*Resolution values indicate the theoretical resolution at a wavelength of 550nm.

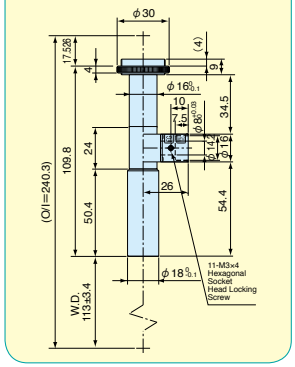
WD110mm

MML-ST Series

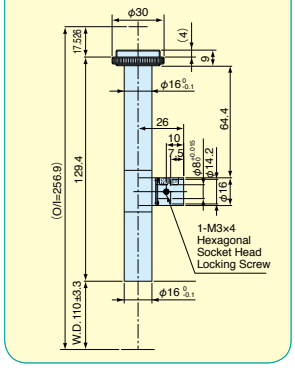
MML08-ST110D



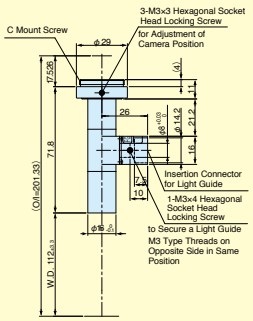
MML1-ST110D



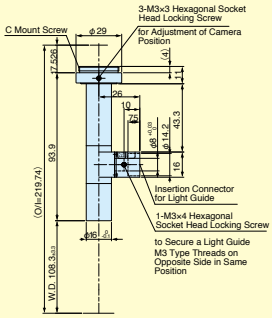
MML2-ST110D



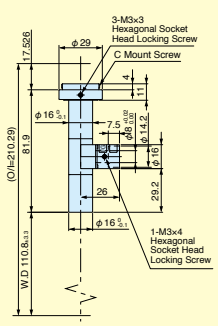
MML2-ST110DS



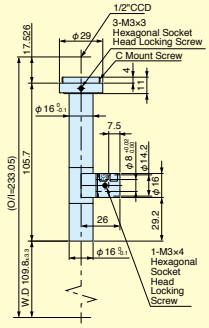
MML3-ST110DS



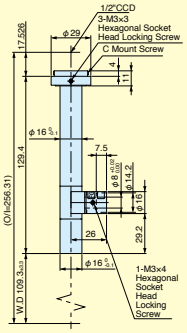
MML4-ST110D



MML6-ST110D

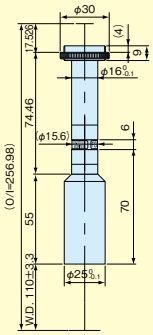


MML8-ST110D

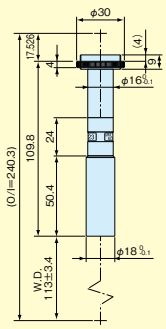


Model	Magnification	WD	Resolution	Depth of Field	NA	Effective fno	TV Distortion	Largest Compatible CCD	Weight	Mount	Product Code
MML08-ST110D	×0.8	110.0mm	13.5μm	2.00mm	0.024	16.1	0.002%	1/2"	85g	C Mount	A-3002
MML1-ST110D	×1	113.0mm	14μm	1.68mm	0.024	20.9	0.05%	1/2"	58g	C Mount	A-3003
MML2-ST110D	×2	110.0mm	11μm	0.66mm	0.03	33.2	0.006%	1/2"	55g	C Mount	A-3004
MML2-ST110DS	×2	112.0mm	11.2μm	0.66mm	0.03	33.2	0.008%	2/3"	39g	C Mount	A-3109
MML3-ST110DS	×3	108.3mm	11.2μm	0.44mm	0.03	49.7	0.008%	2/3"	43g	C Mount	A-3110
MML4-ST110D	×4	110.8mm	7μm	0.22mm	0.045	44.4	0.021%	1/2"	43g	C Mount	A-3005
MML6-ST110D	×6	109.8mm	7μm	0.17mm	0.045	66.4	-0.005%	1/2"	48g	C Mount	A-3006
MML8-ST110D	×8	109.3mm	7μm	0.17mm	0.045	88.4	-0.007%	1/2"	54g	C Mount	A-3007

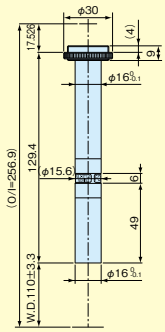
MML08-ST110



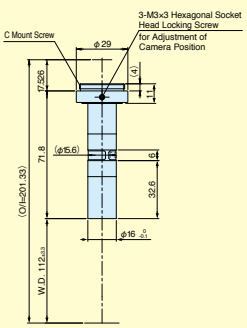
MML1-ST110



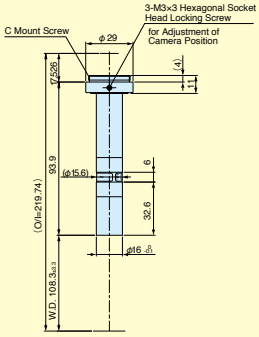
MML2-ST110



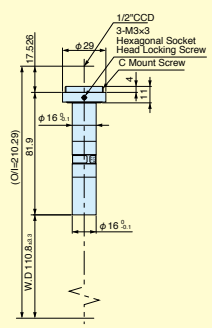
MML2-ST110S



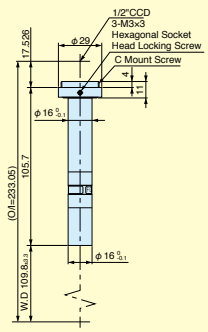
MML3-ST110S



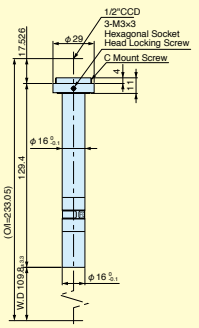
MML4-ST110



MML6-ST110



MML8-ST110



Model	Magnification	WD	Resolution	Depth of Field	NA	Effective Fno	TV Distortion	Largest Compatible CCD	Weight	Mount	Product Code
MML08-ST110	×0.8	110.0mm	13.5μm	2.00mm	0.024	16.1	0.002%	1/2"	78.5g	C Mount	A-3019
MML1-ST110	×1	113.0mm	14μm	1.68mm	0.024	20.9	0.05%	1/2"	50g	C Mount	A-3020
MML2-ST110	×2	110.0mm	11μm	0.66mm	0.03	33.2	0.006%	1/2"	50g	C Mount	A-3021
MML2-ST110S	×2	112.0mm	11.2μm	0.66mm	0.03	33.2	0.008%	2/3"	34g	C Mount	A-3111
MML3-ST110S	×3	108.3mm	11.2μm	0.44mm	0.03	49.7	0.008%	2/3"	37g	C Mount	A-3112
MML4-ST110	×4	110.8mm	7μm	0.22mm	0.045	44.4	0.021%	1/2"	38g	C Mount	A-3064
MML6-ST110	×6	109.8mm	7μm	0.17mm	0.045	66.4	-0.005%	1/2"	43g	C Mount	A-3065
MML8-ST110	×8	109.3mm	7μm	0.17mm	0.045	88.4	-0.007%	1/2"	49g	C Mount	A-3066

Optical Specifications for Machine Types Recommended for Combination with the Rear Converter

Model	Converter Lenses	Magnification	Resolution	Depth of Field	Effective Fno
MML08-ST110D/110	**SOD-1.5X**	1.2 X	13.5μm	1.34mm	24.2
	SOD-2X	1.6 X	13.5μm	1.00mm	32.2
MML1-ST110D/110	**SOD-1.5X**	1.5 X	14μm	1.11mm	31.4
	SOD-2X	2.0 X	14μm	0.84mm	41.8
MML2-ST110D/110	**SOD-1.5X**	3 X	11μm	0.44mm	49.8

* Depth of field is calculated assuming a horizontal 240TV resolution using a 1/2" CCD camera. (Permissible circle of confusion on the image-formation side: 40μ)

* Resolution values indicate the theoretical resolution at a wavelength of 550nm.

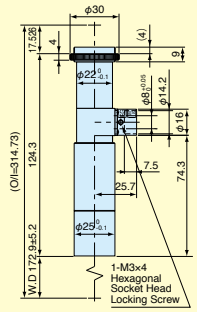
Caution: If combinations other than those recommended are used, dirt and scratches on the rear converter may be noticeable in the images that result. For this reason, do not use any setups other than the recommended types.

Long WD Series

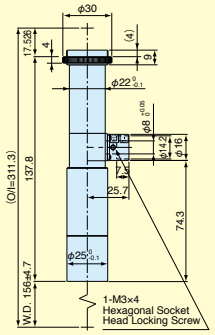
WD150mm

MML-ST Series

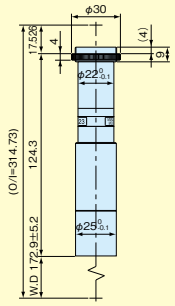
MML08-ST170D



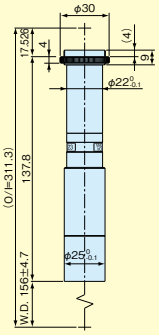
MML1-ST150D



MML08-ST170



MML1-ST150



Model	Magnification	WD	Resolution	Depth of Field	NA	Effective Fno	TV Distortion	Largest Compatible CCD	Weight	Mount	Product Code
MML08-ST170D	×0.8	172.9	12μm	1.79mm	0.028	14	0.022%	1/2"	80g	C Mount	A-3008
MML1-ST150D	×1	156.0	8.8μm	1.05mm	0.038	13	0.021%	1/2"	90g	C Mount	A-3009
MML08-ST170	×0.8	172.9	12μm	1.79mm	0.028	14	0.022%	1/2"	76g	C Mount	A-3022
MML1-ST150	×1	156.0	8.8μm	1.05mm	0.038	13	0.021%	1/2"	84g	C Mount	A-3023

* Resolution values indicate the theoretical resolution at a wavelength of 550nm.
* Depth of field is calculated assuming a horizontal 240TV resolution using a 1/2" CCD camera. (Permissible circle of confusion on the image-formation side: 40μ)

Optical Specifications for Machine Types Recommended for Combination with Rear Converter

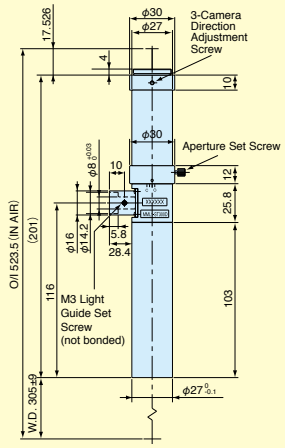
Model	Converter Lenses	Magnification	Resolution	Depth of Field	Effective Fno
MML08-ST170D/170	**SOD-1.5X**	1.2X	12μm	1.17mm	21
	SOD-2X	1.6 X	12μm	0.88mm	28
MML1-ST150D/150	**SOD-1.5X**	1.5 X	8.8μm	0.69mm	19.5
	SOD-2X	2.0 X	8.8μm	0.52mm	26

Caution: If combinations other than those recommended are used, dirt and scratches on the rear converter may be noticeable in the images that result. For this reason, do not use any setups other than the recommended types.

WD300mm

MML-ST Series

MML1-ST300D



- Magnification 1×
- WD=300 mm
- With variable aperture of 22.7-C32
- Slim body with external diameter of φ27.

A super-long working distance lens which realizes a working distance of 300mm with an optical magnification of 1×.
Improved ease of use with variable aperture.

Optical Specifications for Machine Types Recommended for Combination with Rear Converter

Model	Converter Lenses	Magnification	Resolution	Depth of Field	Effective Fno
MML1-ST300D	**SOD-1.5X**	1.5 X	15μm	1.21mm	34.1
	SOD-2X	2.0 X	15μm	0.91mm	45.4

Caution: If combinations other than those recommended are used, dirt and scratches on the rear converter may be noticeable in the images that result. For this reason, do not use any setups other than the recommended types.

Model	Magnification	WD	Resolution	Depth of Field	NA	Effective Fno	TV Distortion	Largest Compatible CCD	Weight	Mount	Product Code
MML1-ST300D	×1	305mm	15μm	1.82mm	0.022	22.7-C32	0.05%	1/2"	150g	C Mount	A-3061

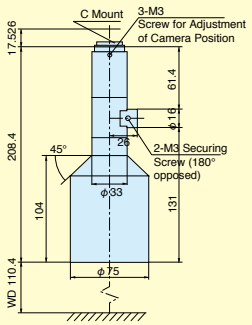
* Resolution values indicate the theoretical resolution at a wavelength of 550nm.
* Depth of field is calculated assuming a horizontal 240TV resolution using a 1/2" CCD camera. (Permissible circle of confusion on the image-formation side: 40μ)

MML Series

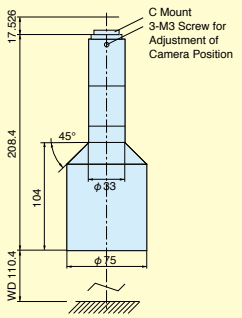
WD110mm

MML Series

MML018-110D



MML018-110



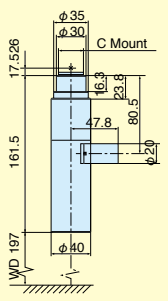
Model	Magnification	WD	Resolution	Depth of Field	NA	Effective Fno	TV Distortion	Largest Compatible CCD	Weight	Mount	Product Code
MML018-110D	×0.18	110.4mm	24μm	15mm	0.01	6.4	0.1% or less	2/3"	700g	C Mount	A-0041
MML018-110	×0.18	110.4mm	24μm	15mm	0.01	6.4	0.1% or less	2/3"	700g	C Mount	A-0040

* Depth of field is calculated assuming a horizontal 240TV resolution using a 1/2" CCD camera. (Permissible circle of confusion on the image-formation side: 40μ)
* Resolution values indicate the theoretical resolution at a wavelength of 550nm.

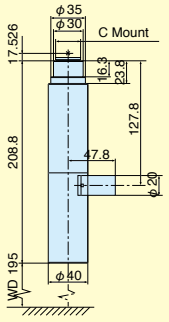
WD195mm

MML Series

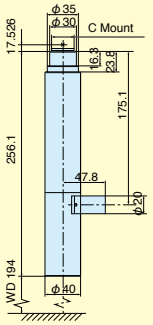
MML4-195D



MML6-195D



MML8-195D



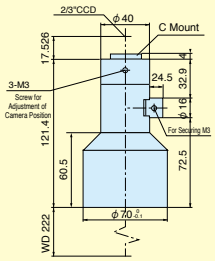
Model	Magnification	WD	Resolution	Depth of Field	NA	Effective Fno	TV Distortion	Largest Compatible CCD	Weight	Mount	Product Code
MML4-195D	×4	197mm	4.2μm	130μm	0.08	25.3	0.1% or less	2/3"	480g	C Mount	A-0061
MML6-195D	×6	195mm	4.2μm	80μm	0.08	37.6	0.1% or less	2/3"	490g	C Mount	A-0062
MML8-195D	×8	194mm	4.2μm	60μm	0.08	49.9	0.1% or less	2/3"	500g	C Mount	A-0063

* Resolution values indicate the theoretical resolution at a wavelength of 550nm.
* Depth of field is calculated assuming a horizontal 240TV resolution using a 1/2" CCD camera. (Permissible circle of confusion on the image-formation side: 40μ)

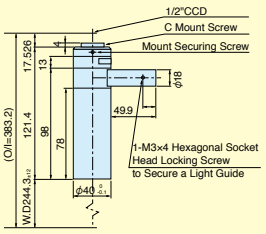
WD200mm~

MML Series

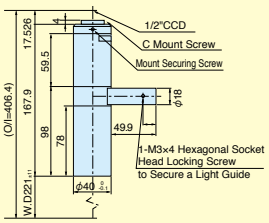
MML02-220D



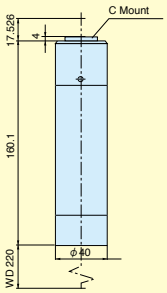
MML1-244D



MML2-221D



MML2-220



Model	Magnification	WD	Resolution	Depth of Field	NA	Effective Fno	TV Distortion	Largest Compatible CCD	Weight	Mount	Product Code
MML02-220D	×0.2	222	16.7μm	10mm	0.02	5	0.1% or less	2/3"	450g	C Mount	A-0073
MML1-244D	×1	244.3	7.4μm	880μm	0.05	11	0.1% or less	2/3"	260g	C Mount	A-0075
MML2-221D	×2	221	7.4μm	440μm	0.05	21.9	0.1% or less	2/3"	320g	C Mount	A-0076
MML2-220	×2	220	6.2μm	370μm	0.05	18	0.2% or less	2/3"	400g	C Mount	A-0074

* Resolution values indicate the theoretical resolution at a wavelength of 550nm.
* Depth of field is calculated assuming a horizontal 240TV resolution using a 1/2" CCD camera. (Permissible circle of confusion on the image-formation side: 40μ)

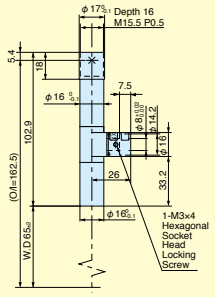
For Use with Compact Camera (ϕ17mm)

MML-ST-CM Series

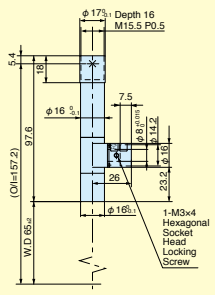
The MML-ST-CM Series consists of small diameter, lightweight models which save space and achieve fine pitch due to their micro-head cameras with special mounts.
The series is intended for use with ϕ17mm (M15.5 P0.5) mounts.

WD65mm

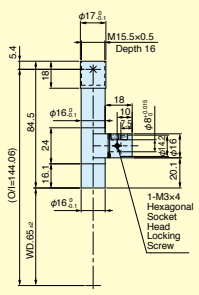
MML1-ST65D-CM



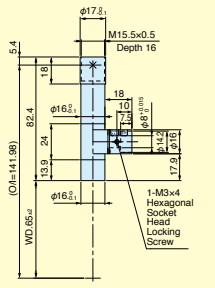
MML1.5-ST65D-CM



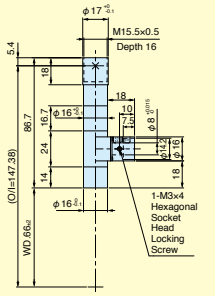
MML2-ST65DS-CM



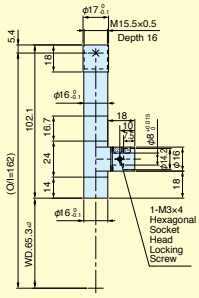
MML3-ST65DS-CM



MML4-ST65DS-CM



MML6-ST65DS-CM

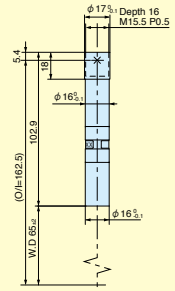


Model	Magnification	WD	Resolution	Depth of Field	NA	Effective Fno	TV Distortion	Largest Compatible CCD	Weight	Mount	Product Code
MML1-ST65D-CM	×1	65.0mm	12.5μm	1.49mm	0.027	18.6	0.002%	1/2"	44g	M15.5 P0.5	A-3073
MML1.5-ST65D-CM	×1.5	65.0mm	7.0μm	0.56mm	0.048	15.5	-0.036%	1/2"	43g	M15.5 P0.5	A-3074
MML2-ST65DS-CM	×2	65.0mm	5.6μm	0.35mm	0.06	17.3	0.004%	1/2"	34g	M15.5 P0.5	A-3113
MML3-ST65DS-CM	×3	65.0mm	4.7μm	0.19mm	0.069	21.9	0.003%	1/2"	32g	M15.5 P0.5	A-3114
MML4-ST65DS-CM	×4	66.0mm	4.4μm	0.13mm	0.076	25.9	0.011%	1/2"	38g	M15.5 P0.5	A-3115
MML6-ST65DS-CM	×6	65.3mm	4.4μm	0.09mm	0.076	39.3	0.002%	1/2"	40g	M15.5 P0.5	A-3116

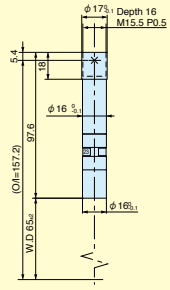
* Depth of field is calculated assuming a horizontal 240TV resolution using a 1/2" CCD camera. (Permissible circle of confusion on the image-formation side: 40μ)
* Resolution values indicate the theoretical resolution at a wavelength of 550nm.

WD65mm

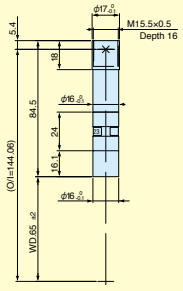
MML1-ST65-CM



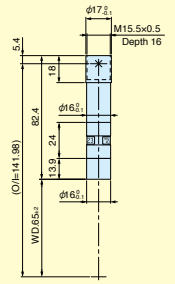
MML1.5-ST65-CM



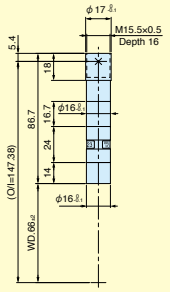
MML2-ST65S-CM



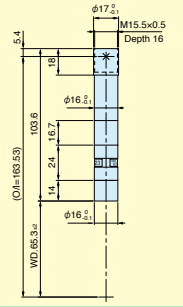
MML3-ST65S-CM



MML4-ST65S-CM



MML6-ST65S-CM

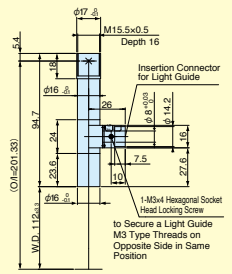


Model	Magnification	WD	Resolution	Depth of Field	NA	Effective Fno	TV Distortion	Largest Compatible CCD	Weight	Mount	Product Code
MML1-ST65-CM	×1	65.0mm	12.5µm	1.49mm	0.027	18.6	0.002%	1/2"	38g	M15.5 P0.5	A-3075
MML1.5-ST65-CM	×1.5	65.0mm	7.0µm	0.56mm	0.048	15.5	-0.036%	1/2"	36g	M15.5 P0.5	A-3076
MML2-ST65S-CM	×2	65.0mm	5.6µm	0.35mm	0.06	17.3	0.004%	1/2"	29g	M15.5 P0.5	A-3117
MML3-ST65S-CM	×3	65.0mm	4.7µm	0.19mm	0.069	21.9	0.003%	1/2"	27g	M15.5 P0.5	A-3118
MML4-ST65S-CM	×4	66.0mm	4.4µm	0.13mm	0.076	25.9	0.011%	1/2"	33g	M15.5 P0.5	A-3119
MML6-ST65S-CM	×6	65.3mm	4.4µm	0.09mm	0.076	39.3	0.002%	1/2"	35g	M15.5 P0.5	A-3120

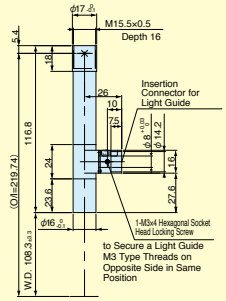
* Depth of field is calculated assuming a horizontal 240TV resolution using a 1/2" CCD camera. (Permissible circle of confusion on the image-formation side: 40µ)
* Resolution values indicate the theoretical resolution at a wavelength of 550nm.

WD110mm

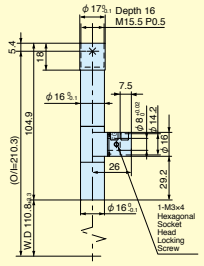
MML2-ST110DS-CM



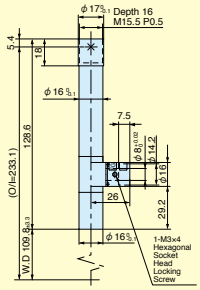
MML3-ST110DS-CM



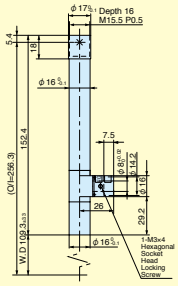
MML4-ST110D-CM



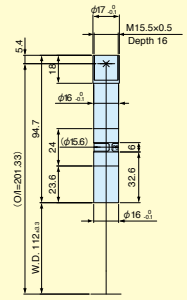
MML6-ST110D-CM



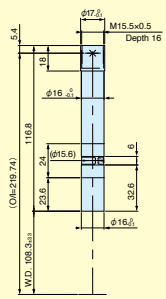
MML8-ST110D-CM



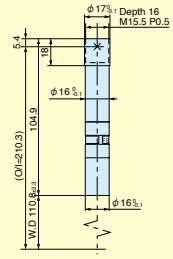
MML2-ST110S-CM



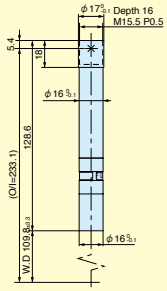
MML3-ST110S-CM



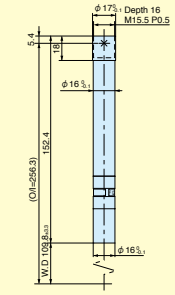
MML4-ST110-CM



MML6-ST110-CM



MML8-ST110-CM



Model	Magnification	WD	Resolution	Depth of Field	NA	Effective Fno	TV Distortion	Largest Compatible CCD	Weight	Mount	Product Code
MML2-ST110DS-CM	×2	112.0mm	11.2μm	0.66mm	0.030	33.2	0.008%	1/2"	36g	M15.5 P0.5	A-3121
MML3-ST110DS-CM	×3	108.3mm	11.2μm	0.44mm	0.030	49.7	0.008%	1/2"	40g	M15.5 P0.5	A-3122
MML4-ST110D-CM	×4	110.8mm	7.5μm	0.22mm	0.045	44.4	0.021%	1/2"	40g	M15.5 P0.5	A-3067
MML6-ST110D-CM	×6	109.8mm	7.5μm	0.17mm	0.045	66.4	-0.005%	1/2"	45g	M15.5 P0.5	A-3068
MML8-ST110D-CM	×8	109.3mm	7.5μm	0.17mm	0.045	88.4	-0.007%	1/2"	51g	M15.5 P0.5	A-3069
MML2-ST110S-CM	×2	112.0mm	11.2μm	0.66mm	0.030	33.2	0.008%	1/2"	31g	M15.5 P0.5	A-3123
MML3-ST110S-CM	×3	108.3mm	11.2μm	0.44mm	0.030	49.7	0.008%	1/2"	34g	M15.5 P0.5	A-3124
MML4-ST110-CM★	×4	110.8mm	7.5μm	0.22mm	0.045	44.4	0.021%	1/2"	35g	M15.5 P0.5	A-3070
MML6-ST110-CM★	×6	109.8mm	7.5μm	0.17mm	0.045	66.4	-0.005%	1/2"	40g	M15.5 P0.5	A-3071
MML8-ST110-CM★	×8	109.3mm	7.5μm	0.17mm	0.045	88.4	-0.007%	1/2"	46g	M15.5 P0.5	A-3072

★Made-to-order product

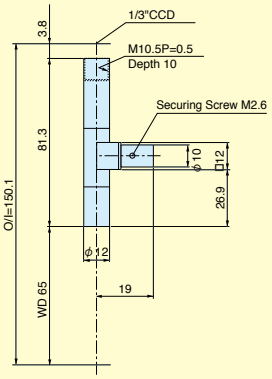
* Depth of field is calculated assuming a horizontal 240TV resolution using a 1/2" CCD camera. (Permissible circle of confusion on the image-formation side: 40μ)
* Resolution values indicate the theoretical resolution at a wavelength of 550nm.

For Use with Compact Camera (φ12mm)
MML-CS1 Series

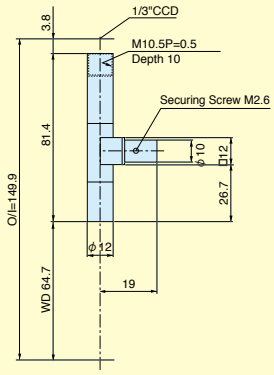
The MML- CS1 Series consists of small diameter, lightweight models which save space and achieve fine pitch due to their micro-head cameras with special mounts.
MML-CS1 Series models are mounted on φ12mm (M10.5 P0.5).

WD65mm

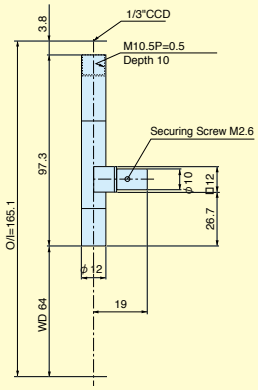
MML2-65D-CS1



MML4-65D-CS1

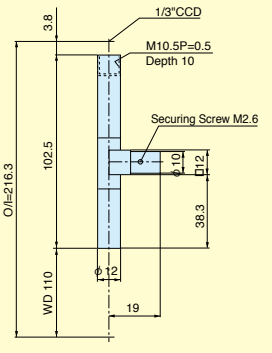


MML6-65D-CS1

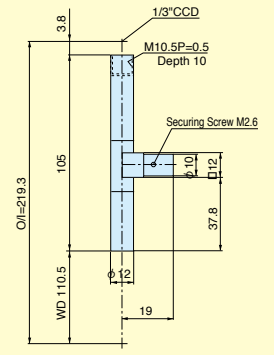


WD110mm

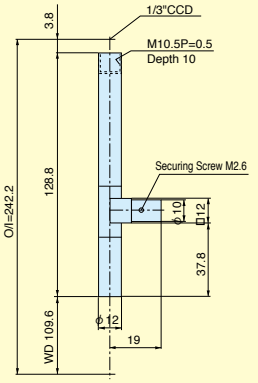
MML2-110D-CS1



MML4-110D-CS1



MML6-110D-CS1



Model	Magnification	WD	Resolution	Depth of Field	NA	Effective Fno	TV Distortion	Largest Compatible CCD	Weight	Mount	Product Code
MML2-65D-CS1	×2	65mm	5.8μm	260μm	0.06	17.4	0.1% or less	1/3"	45g	M10.5 P0.5	A-0098
MML4-65D-CS1	×4	64.7mm	5μm	110μm	0.07	29.8	0.2% or less	1/3"	47g	M10.5 P0.5	A-0099
MML6-65D-CS1	×6	64mm	5μm	74μm	0.07	44.2	0.1% or less	1/3"	50g	M10.5 P0.5	A-0100
MML2-110D-CS1	×2	110mm	11μm	500μm	0.03	33.2	0.1% or less	1/3"	60g	M10.5 P0.5	A-0101
MML4-110D-CS1	×4	110.5mm	8.6μm	220μm*1	0.04	51.1	0.1% or less	1/3"	60g	M10.5 P0.5	A-0102
MML6-110D-CS1	×6	109.6mm	8.5μm	220μm*1	0.04	76.3	0.1% or less	1/3"	63g	M10.5 P0.5	A-0103

* Depth of field is calculated assuming a horizontal 240TV resolution using a 1/2" CCD camera. (Permissible circle of confusion on the image-formation side: 40μm)
However, design values for resolution are used for *1.
* Resolution values indicate the theoretical resolution at a wavelength of 550nm.

Main Uses: Invisible Image Inspection | Void Inspection | SAW Filter (LiNb03 LiTa03) Inspection | MEMS Inspection | Wafer Positioning | FCB positioning | Image Recognition Through Film | Wire Recognition on TAB Board | Wafer Surface Inspection and OCR | Illumination for Infrared Microscope

For Use with Near-Infrared (770nm~1200nm)

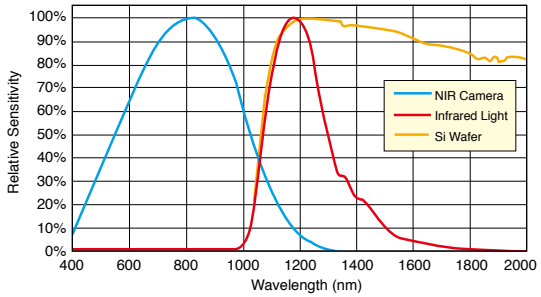
MML-NIR Series

The MML-NIR Series is designed for a wavelength band of 770 to 1200nm.
This series provides special MML-use lenses that allow the observation of in-wafer defects and rear patterns when combined with an infrared camera and illumination.

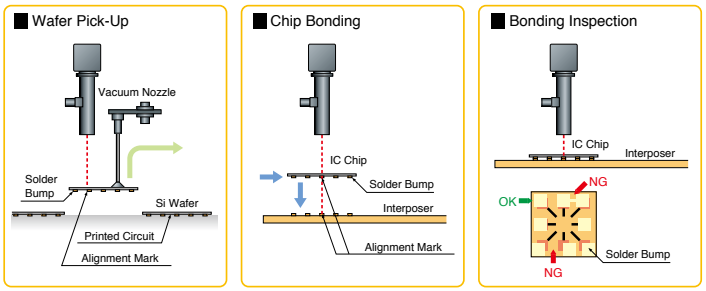
Model	MML4-80D-IR	MML6-80D-IR	MML8-80D-IR
Magnification	×4	×6	×8
WD	82.4mm	81.5mm	81mm
Resolution	4.0µm		
Depth of Field	50µm	33µm	27µm
NA	0.15		
Effective Fno	13.3	20.1	26.9
TV Distortion	0.01% or less		
Largest Compatible CCD	2/3"		
Weight	90g	100g	110g
Mount	C Mount		
Product Code	A-0235	A-0236	A-0237

* Depth of field is calculated assuming a horizontal 435TV resolution using a 2/3" CCD camera. (Permissible circle of confusion on the image-formation side: 30µ)
* Resolution values indicate the theoretical resolution at a wavelength of 985nm.

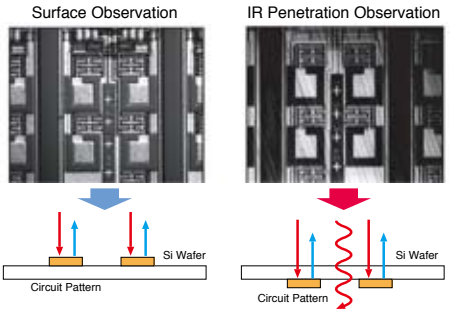
Spectral Characteristics



Example Application



Infrared Coaxial Transmission Observation



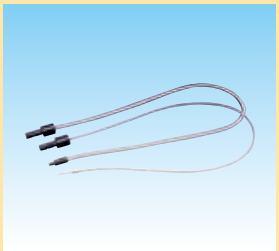
Consumables and Related Products

● Infrared Halogen Light Source

Model	MHAB-100W-IR
Specification	Emission of 1100nm or More
Product Code	A-0524

● Spare Lamp

Model	LM-100-IR
Specification	IR Reflection Coating for 100W
Product Code	A-8216



● Heat Resistant Light Guide (HR Type)

Model	MSG4-1100S-HR
Specification	Heat Resistant Specification Light Guide
Product Code	A-0637

● Camera for Infrared Light (IR Camera)

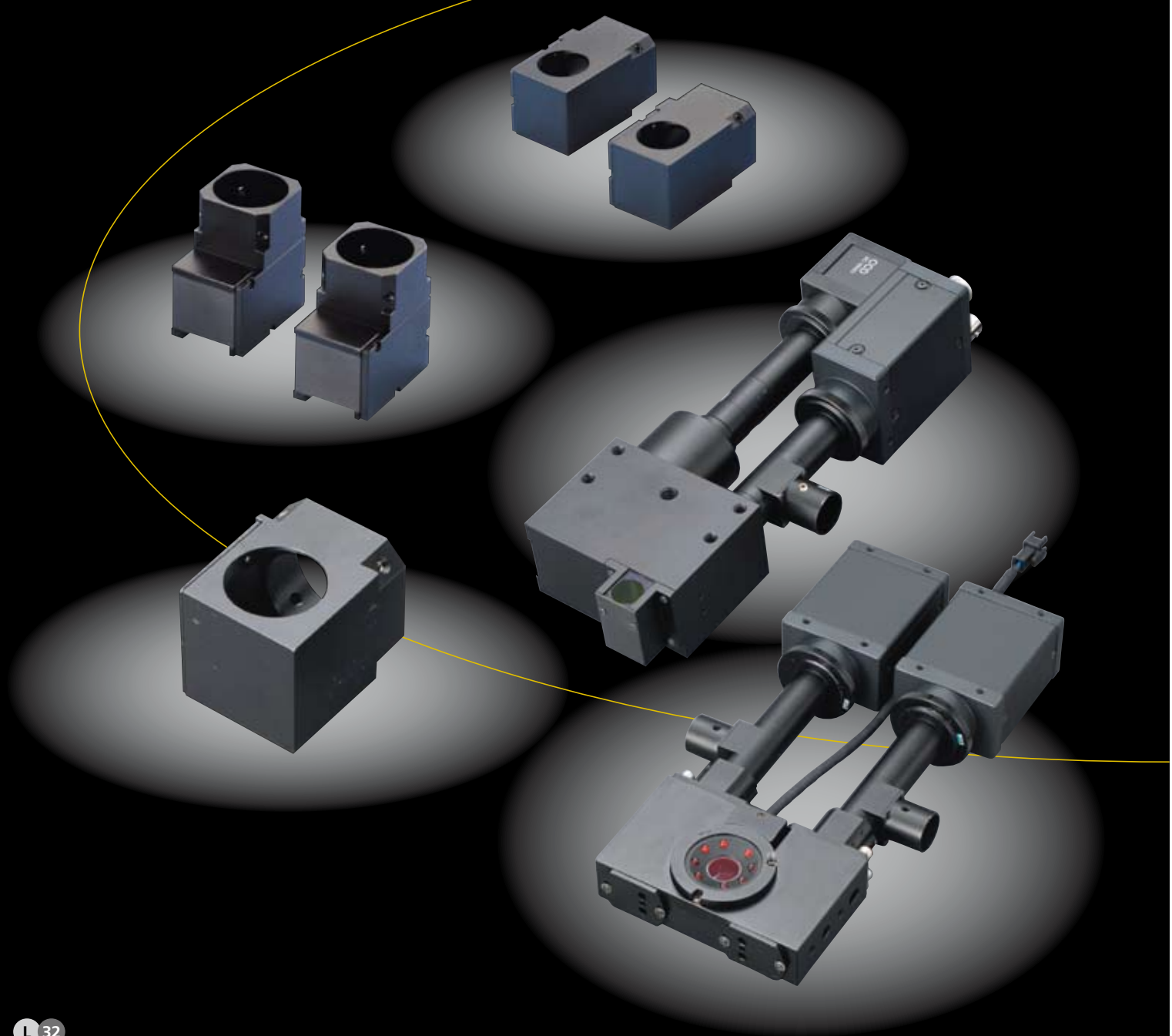
Model	MC-781P-0030
Specification	2/3" 780H×488pix NIR Sensitivity
Product Code	A-0346

OPTION
Options

Prism Adapters

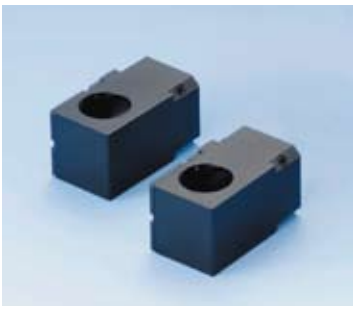
These prism adapters are for the MML-ST Series. Prism adapters make it possible to bend the optical axis at a right angle of 90°, and to perform mark recognition for microscopic objects by modifying the pitch between 2 MML lenses to a fine pitch.

Caution: Combination of certain prisms with the MML-HR Series may result in marked deterioration of the image due to individual differences between products. For this reason, combinations are not recommended.



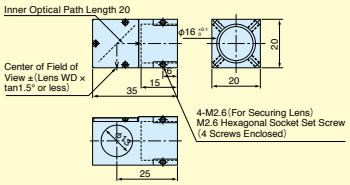
90° Side View Mirror Type Prisms

MML-PL16 MML-PL18 MML-PL25

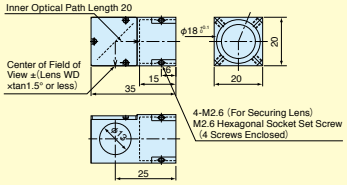


The optical axis can be bent at a 90°right angle. This is useful when there is no space in the upper direction.
The monitor image becomes a mirror image.

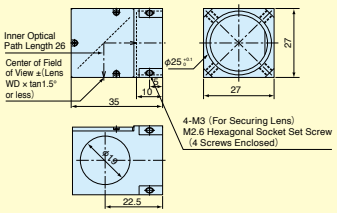
MML-PL16



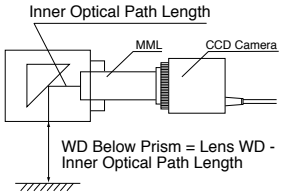
MML-PL18



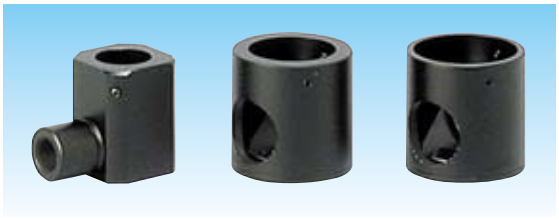
MML-PL25



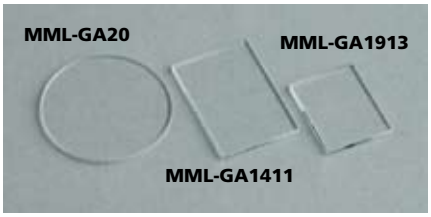
Model	MML-PL16	MML-PL18	MML-PL25	MML-GA20
Specification	For ϕ16 Lens	For ϕ18 Lens	For ϕ25 Lens	Cover Glass ϕ20 t=1mm
Inner Optical Path Length	20mm	20mm	26mm	
Product Code	A-8004	A-8005	A-8006	A-8062



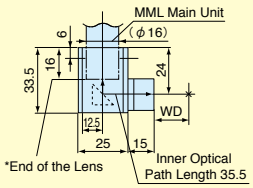
MML-P1 MML-P3 MML-P4



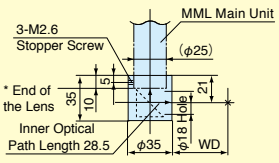
■Cover Glass



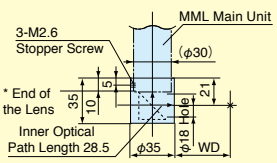
MML-P1



MML-P3



MML-P4



Model	MML-P1	MML-P3	MML-P4
Product Code	A-8001	A-8002	A-8003

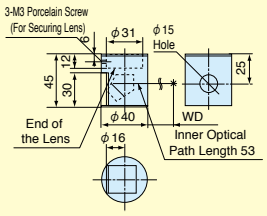
* WD in the diagrams is the lens working distance minus the inner optical path length.

90° Side View Pentaprism Type Prisms

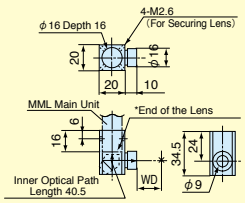
MML-P5 MML-P6 MML-P8

Monitor images are shown in an upright, normal position by the pentaprism

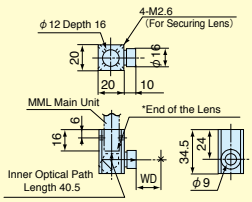
MML-P5 (For ML-Z07545)

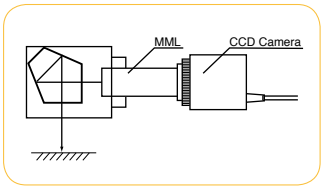


MML-P6



MML-P8





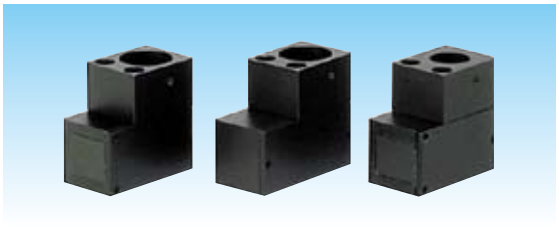
* WD in the diagrams is the lens working distance minus the inner optical path length.

Model	MML-P5	MML-P6	MML-P8
Product Code	A-8009	A-8010	A-8011

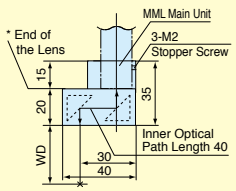
Variable Optical Axis Pitch Type

MML-P2 MML-P7 MML-P9

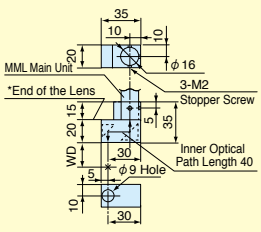
Mark recognition is possible for fine pitch between 2 points of microscopic objects.



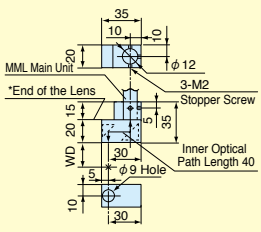
MML-P2 Pitch 10mm Type

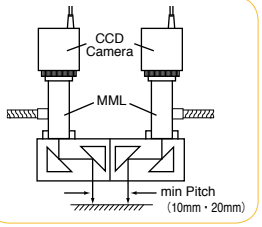


MML-P7 Pitch 5mm Type



MML-P9



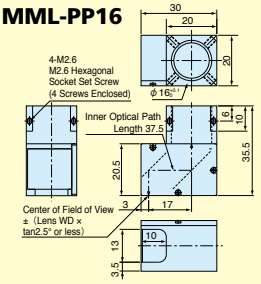


* WD in the diagrams is the lens working distance minus the inner optical path length.

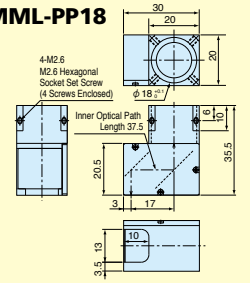
Model	MML-P2	MML-P7	MML-P9
Product Code	A-8017	A-8018	A-8019

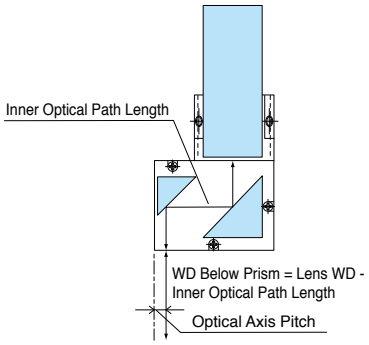
Variable Optical Axis Pitch Type
(Pitch 3mm type)
MML-PP16 MML-PP18 MML-PP25

MML-PP16

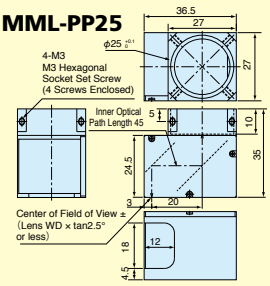


MML-PP18





MML-PP25

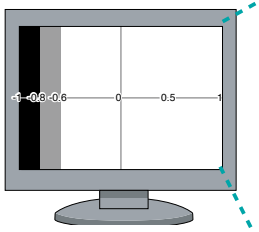


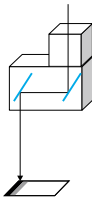
Model	MML-PP16	MML-PP18	MML-PP25	MML-GA1411	MML-GA1913
Specification	For φ16 Lens	For φ18 Lens	For φ25 Lens	Cover Glass 14×11 t=1mm	Cover Glass 19×13 t=1mm
Inner Optical Path Length	37.5mm	37.5mm	35mm		
Optical Axis Pitch	3mm	3mm	3mm		
Product Code	A-8020	A-8021	A-8022	A-8063	A-8064

Variable Optical Axis Prism
MML-PP Series Field of View Vignetting Chart

Because of its narrow-pitch design, the MML-PP Series is subject to vignetting.
Since vignetting varies depending on the object, illumination etc., in the environment that the customer uses, the prism must be tested in the actual machine.
*This is a calculated value only and is not guaranteed. For reference only.

MML1-ST65D+1/2"CCD





Model	Field of View (Horizontal Field of View Divided into 20 Equal Sections)																						
	CCD	-1	-0.9	-0.8	-0.7	-0.6	-0.5	-0.4	-0.3	-0.2	-0.1	0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1
MML1-ST65D / 65	1/2"	-100	-100	-92	-70	-43	-18	-1														
	1/3"	-100	-100	-43	-24	-8																
MML2-ST65D / 65	1/2"	-34	-28	-22	-17	-12	-7	-3	-1													
	1/3"	-19	-15	-12	-8	-5	-3	-1														
MML4-ST65D / 65	1/2"	-15	-13	-11	-9	-7	-6	-4	-3	-2	-1											
	1/3"	-10	-9	-7	-6	-5	-4	-3	-2	-1	-1											
MML6-ST65D / 65	1/2"	-9	-7	-6	-5	-4	-3	-3	-2	-1	-1											
	1/3"	-6	-5	-4	-4	-3	-2	-2	-1	-1												
MML1-ST110D / 110	1/2"	-93	-83	-72	-60	-47	-34	-22	-12	-3												
	1/3"	-66	-56	-47	-37	-28	-19	-12	-5	-1												
MML2-ST110D / 110	1/2"	-37	-32	-27	-22	-17	-13	-9	-6	-3	-1											
	1/3"	-24	-21	-17	-14	-11	-8	-6	-3	-1												
MML08-ST170D / 110	1/2"	-88	-81	-74	-66	-58	-50	-42	-34	-26	-19	-12	-6	-2								
	1/3"	-70	-64	-58	-52	-46	-40	-34	-28	-22	-17	-12	-8	-4	-1							
MML1-ST150D / 110	1/2"	-70	-65	-60	-54	-49	-43	-38	-32	-27	-22	-17	-13	-9	-5	-2						
	1/3"	-57	-53	-49	-44	-40	-36	-32	-28	-25	-21	-17	-14	-11	-8	-5	-3	-1				

Lowering of Light Quantity
-100% -70% -40% -20% 0%

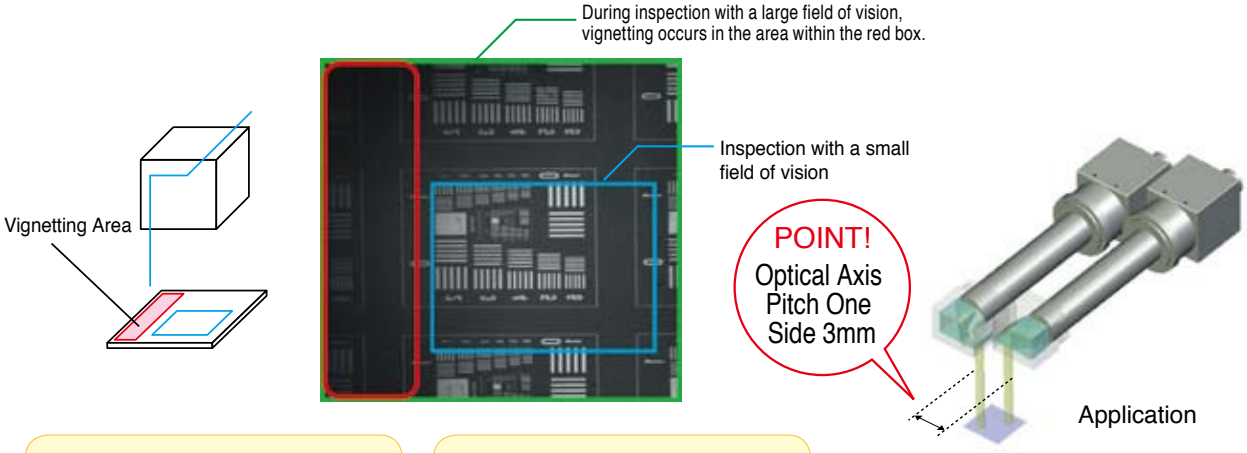
Variable Pitch Side View Prisms
MML-PSV16L/R

- MML-Standard for ϕ16
- Optical axis pitch 3mm.
- Length of inner optical path length: 20mm
- WD=40mm lens can also be attached.

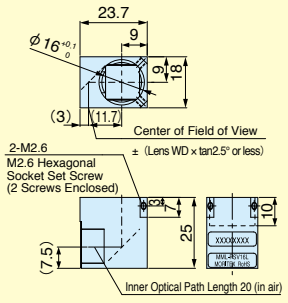
Fine pitch and small space observation is possible for the alignment marks between two points. Because of the prism's compact design, a working distance of 40mm can also be used.

MML-PSV 16L/R Vignetting Reference Data

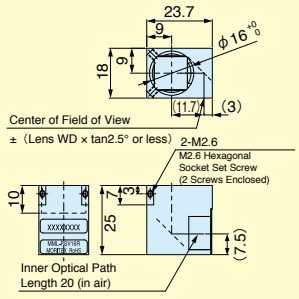
Note that the MML-PSV16 is designed with fine pitch which may cause vignetting in a portion of the screen when observation is performed with a wide field of vision. (Differences exist depending on the kind of lens or camera being used.)



MML-PSV16L



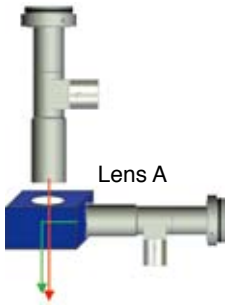
MML-PSV16R

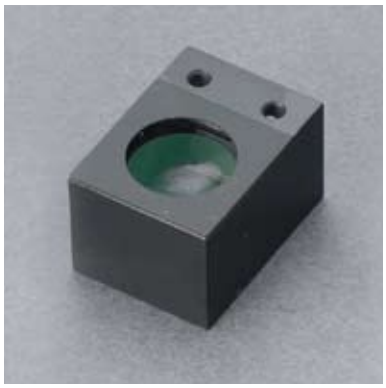


Model	Specifications	Optical Axis Pitch	Product Code
MML-PSV16R	Side View Prism for ST Series (Right Side)	One Side 3mm	A-8007
MML-PSV16L	Side View Prism for ST Series (Left Side)	One Side 3mm	A-8008

Variable Pitch Side View Prism

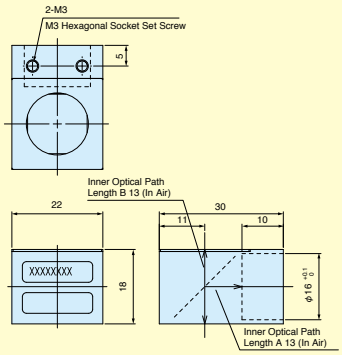
MML-P2S16



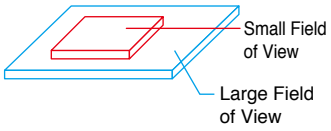


- 2 different fields of view type for ML-PL Series.
- Same field of view with two times the magnification, two fields of view with the same magnification, etc.
- Lens A for ϕ16

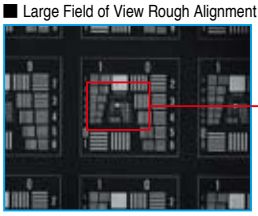
MML-P2S16



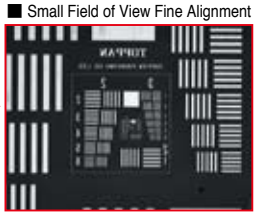
■ Low Magnification・
High Magnification Alignment



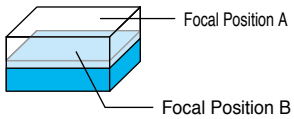
■ Large Field of View Rough Alignment



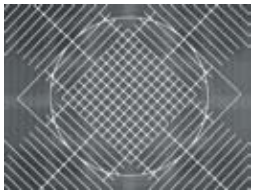
■ Small Field of View Fine Alignment



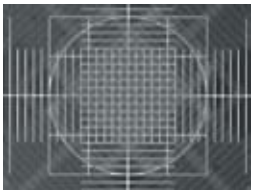
■ Two Focus Point Alignment



■ Focal Position A



■ Focal Position B



Model	Specifications	Product Code
MML-P2S16	For ST 2 fields of vision prism For ϕ16	A-8012

High Accuracy Two Fields of View Optical Unit

Made-to-order

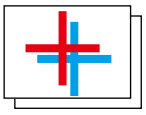
ML-2PLBOX

Two fields of view and two focus points can be observed with two lenses. Moritex adjusts CCD cameras and optical units to positions desired by customers. Support which meets the customer requirements for lenses and illumination, condition of optical units, etc.
Moritex performs adjustments and inspections to ensure high accuracy CCDs, lenses, and prisms.

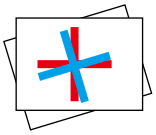
MML-ST110mm

MML-ST65mm

★Moritex performs adjustment and inspection to ensure high accuracy CCDs, prisms and lenses.



《Center Position Accuracy》
±(Lens WD × Tan1.5°)



《Rotation Alignment Accuracy》
Relative Position Within ±0.5°

Top and bottom, dual field optical system (Sample)

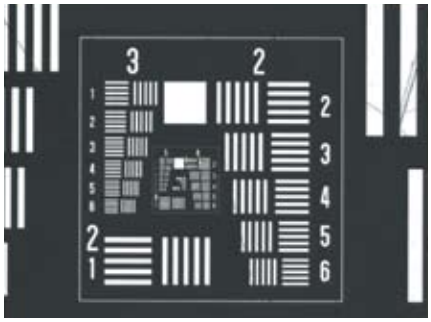
90° prism for MML-HR

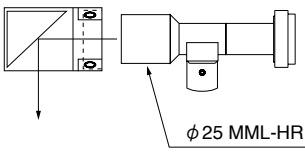
MML-PL25HR

New Release

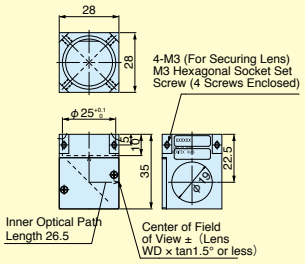
- Exclusive MML-High Resolution
- Lens barrel diameter ϕ25
- Length of inner optical path length 26.5mm

For optical systems with large NA, the image may blur or bend due to the strong effects from the profile irregularity of the prism.
However, a clear image can be acquired, even for HR types with large NA, by sorting and removing prisms with high profile irregularity before use.





MML-PL25HR

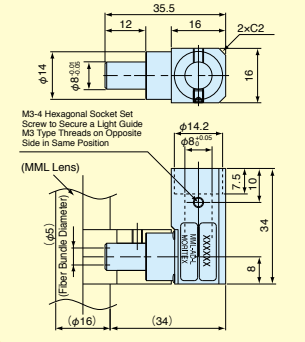


Model	Specifications	Product Code
MML-PL25HR	90° Side View Mirror for HR For ϕ25	A-8013

Coaxial L-Shaped Adapter

MML-AD-L

MML-AD-L



By connecting to a len's coaxial input, illumination can be inserted at right angles.
A very convenient adapter for small spaces.

Model	Specifications	Product Code
MML-AD-L	L-Shaped Coaxial Adapter	A-8049

MML Zoom Lens Series

MML Zoom Lenses are high-performance zoom lenses with a telecentric optic designed coaxial illumination function. Multiple zooming, long working distances, and a coaxial illumination function that covers the entire view allow for recognition of all types of objects.
Manual zoom and electric zoom type products with a stepping motor are available.
MML Zoom Lens Series

Explanation of Model Code

ML-Z □ – □ – □

Magnification Range	Illumination	Type of Zooming
	None	Manual
	D Coaxial Illumination	MR Motorized

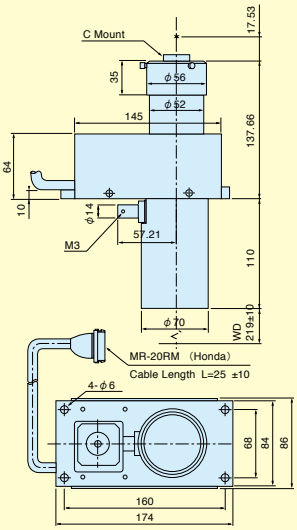
High-Performance Super Low Magnification Motor Zoom Lens

ML-Z01515DM

Made-to-Order

- Magnification range: 0.15x~1.5x (zoom ratio of 10:1)
- WD=219mm
- Includes a uniform coaxial illumination function that covers the entire view.

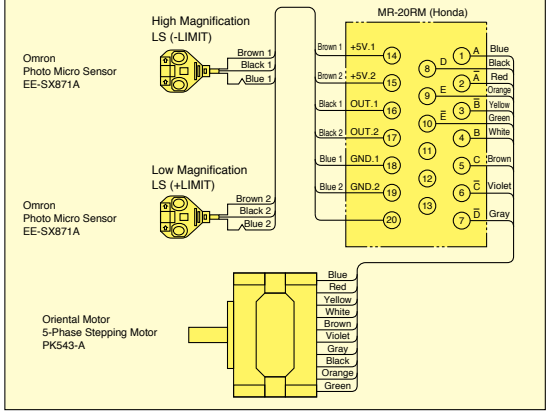
ML-Z01515DM



Model	ML-Z01515DM (Made-to-Order Product)		
Magnification	×0.15~×1.5 (Zoom Ratio of 10:1)		
WD (mm)	219±10		
With/Without Motor	With (Motorized Zoom/Pulse Control)		
Zoom Click Position	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
TV Distortion	-0.15% or less	-0.02% or less	0.06% or less
NA	0.01	0.02	0.05
Weight	1900g		
Largest Compatible CCD	1/2"		
Camera Mounts	C Mount		
Product Code	A-0109		

* Depth of field is calculated assuming a horizontal 240TV resolution using a 1/2" CCD camera. (Permissible circle of confusion on the image-formation side: 40μ)
* Resolution values indicate the theoretical resolution at a wavelength of 550nm.

ML-Z01515DM Wiring Diagram



High-Performance Low Magnification Zoom Lenses

Manual Type

ML-Z0220D

Electric Motorized Type

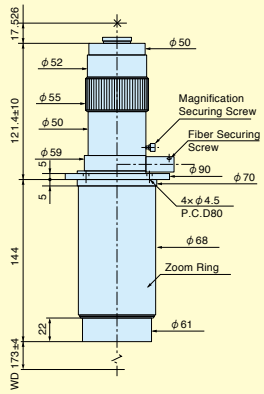
ML-Z0220DM

- Magnification range: 0.2×~2× (zoom ratio of 10:1)
- WD=173mm
- Includes a uniform coaxial illumination function that covers the entire view.
- Dedicated light attached.

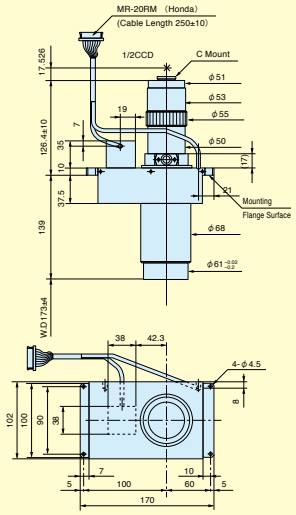
Coaxial light guide (super random specification) L=800mm

Color filters (red, green) attached.

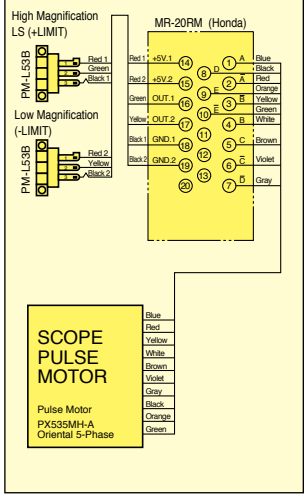
ML-Z0220D



ML-Z0220DM



ML-Z0220DM Wiring Diagram



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

Model	ML-Z0220D		ML-Z0220DM
Magnification	×0.2~×2 (Zoom Ratio of 10:1)		
WD(mm)	173±4		
With/Without Motor	Without (Manual Zoom)		With (Motorized Zoom/Pulse Control)
Zoom Click Position	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
TV Distortion	0.03% or less	0.15% or less	0.13% or less
NA	0.03	0.04	0.05
Largest Compatible CCD	1/2"		
Weight	1100g		1900g
Mount	C Mount		
Product Code	A-0110		A-0111

*Depth of field is calculated assuming a horizontal 240TV resolution using a 1/2" CCD camera. (Permissible circle of confusion on the image-formation side: 40μ)
*Resolution values indicate the theoretical resolution at a wavelength of 550nm.

Manual Click Zoom Lens

ML-Z0315D

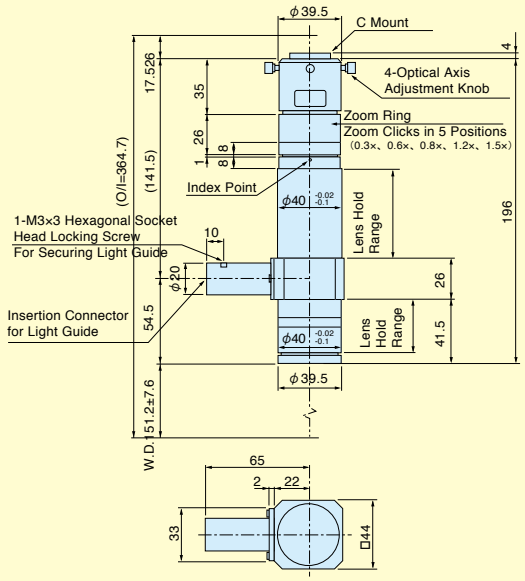
- Magnification range: ×0.3~×1.5 (in 5 clicks)
- WD=151.2mm
- Includes a uniform coaxial illumination system that covers the entire view.

By employing a manual click feature in the zoom system, a ±0.5% magnification reproducibility is realized. Magnification can be adjusted between five different levels.

Model	ML-Z0315D				
Magnification	×0.3~×1.5 (Zoom Ratio of 5:1)				
WD (mm)	151.2±7.6				
With/Without Motor	Without (Manual Click Zoom)				
Zoom Click Position	at 0.3X	at 0.6X	at 0.8X	at 1.2X	at 1.5X
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
TV Distortion	-0.09%	-0.05%	-0.02%	0.03%	0.06%
NA	0.02	0.03	0.03	0.04	0.05
Largest Compatible CCD	1/2"				
Weight	520g				
Mount	C Mount				
Product Code	A-0112				

* Depth of field is calculated assuming a horizontal 240TV resolution using a 1/2" CCD camera. (Permissible circle of confusion on the image-formation side: 40μ)
* Resolution values indicate the theoretical resolution at a wavelength of 550nm.

ML-Z0315D



Zoom Lenses

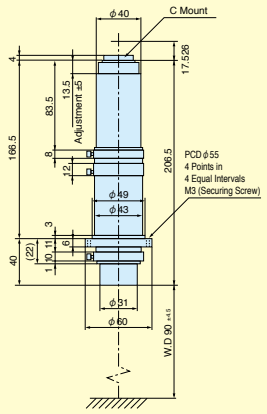
ML-Z07545 Series

- Magnification range : 0.75×~4.5× (zoom ratio of 6:1)
- WD=90mm
- Includes a uniform coaxial illumination function that covers the entire view.
- Equipped with built-in focus adjustment function (WD can be adjusted to -6 mm)

Standard model zoom lens with outstanding functionality. Adjustment of magnification and working distance is possible through combination with options.

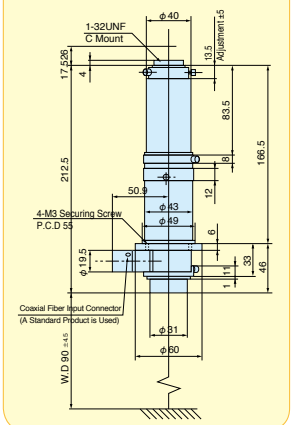
● Manual Zoom

ML-Z07545



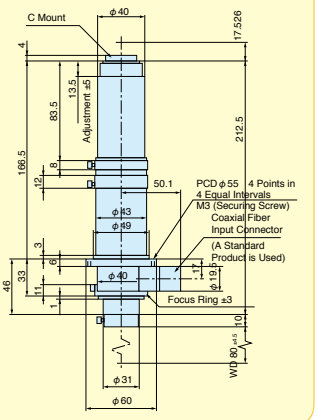
● Zoom with Coaxial Illumination

ML-Z07545D



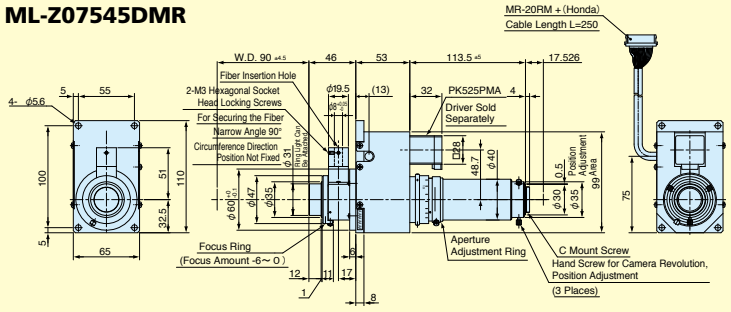
● Zoom with Coaxial Illumination & Deflection Function

ML-Z07545D-PL

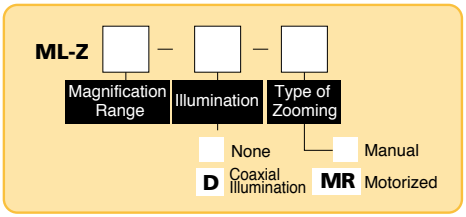


● Motor Zoom

ML-Z07545DMR



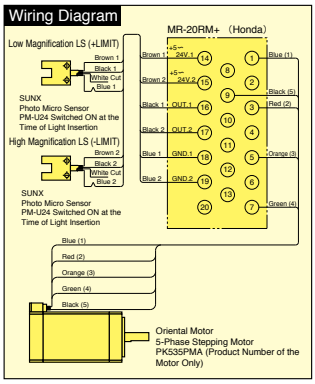
Explanation of Model Code



● All models equipped with focus, aperture, and zoom.

Model	ML-Z07545	ML-Z07545D	ML-Z07545D-PL	ML-Z07545DMR
Magnification	×0.75~×4.5 (Zoom Ratio of 6:1)			
WD (mm)	90±4.5		80±4.5	90±4.5
Focus Position	0~-6mm			
With/Without Motor	Without (Manual Zoom)			With (Motorized Zoom/Pulse Control)
Zoom Click Position	×0.75 time	×2 time		×4.5 time
Effective Fno	11	16		28
Depth of Field	1.6mm	0.3mm		0.1mm
Resolution	9.9μm	5.4μm		4.2μm
TV Distortion	0.02% or less	0.01% or less		-0.02% or less
NA	0.03	0.06		0.08
Operation Function	All models equipped with focus, aperture, and zoom.			
Weight	Approx. 440g	Approx. 470g	Approx. 490g	Approx. 1000g
Largest Compatible CCD	1/2"			
Mount	C Mount			
Product Code	A-0118	A-0119	A-0120	A-0122

Wiring Diagram



* Depth of field is calculated assuming a horizontal 240TV resolution using a 1/2" CCD camera. (Permissible circle of confusion on the image-formation side: 40μ)
* Resolution values indicate the theoretical resolution at a wavelength of 550nm.
* Effective FNO indicates a value when the iris is open.

Options

Sold Separately

■Proxar Lenses

ML-Z Series

Attach to end of lens to change magnification and working distance.

Model	Product Code
ML-Z03	A-8025
ML-Z04	A-8026
ML-Z05	A-8027
ML-Z07	A-8028
ML-Z14	A-8029
ML-Z20	A-8030

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

* Magnification and working distance can be altered slightly by turning the focus adjustment ring (N⇔F)
Indicated values are based on calculation formulas. Actual measurement may differ depending on tolerance.
Cannot be mounted on ML-Z07545D-PL.

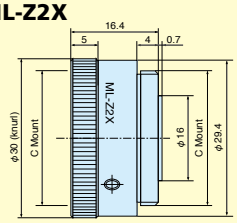
■Rear Converter Lens

ML-Z2X

Specially designed ×2 rear converter. Mounting this between a lens and CCD camera can double the magnification easily without changing working distance.

*May decrease the resolution.

ML-Z2X

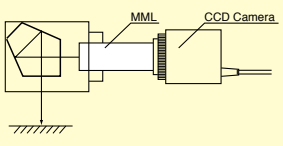


Model	Product Code
ML-Z2X	A-8036

■Prism Adapter

MML-P5

90° side view pentaprism type adapter.
Monitor images are shown in an upright, normal position by the pentaprism.



Model	Product Code
MML-P5	A-8009

Zoom Lens (Navitar)
12× Zoom Lens

Navitar's 12× zoom lens is the next-generation video zoom lens which achieves a wide-view observation in a wide zooming range with excellent resolution. This lens exhibits its power in inspecting various kinds of objects, such as semiconductor wafer, board, and BGA.

• Wide zoom range and high resolution

The basic magnification is 0.58×~7×. By changing the combination of adapter tubes and attachments, minimum 0.1× (resolution: 36um) ~ maximum 28×(resolution: 1um) can be supported.

• Flexible design

Module-based design with priority to optical quality and mounting to equipment. By combining the zoom lens with an adapter or attachment part, the optimum magnification and working distance can be selected or modified easily.

■Motor Option

The motor option can efficiently control zooming and focusing by a motor. The DC motor type has an anti-slip mechanism (made of metal) to prevent damage. The stepping motor type shows excellent performance in automated applications because of accurate pitch movement.

- 12 VDC motor without magnetic encoder
- 12 VDC motor with magnetic encoder
- Stepping motor
- Limit switch

*Contact Moritex for each product number.

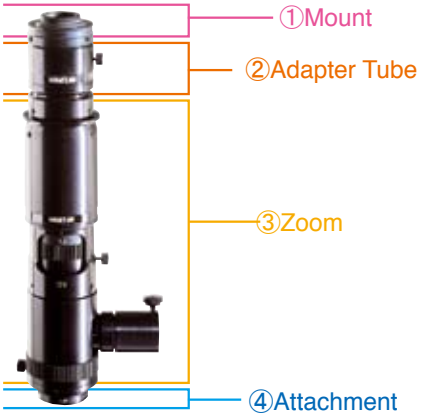
■Click option 'D'

7 click points can be set for zooming: 1×, 2×, 3×, 4×, 5×, 6×, 7× (basic magnification: 0.58×~7×). The magnification reproducibility is within 5%.

*Add 'D' to the end of a zoom product number for ordering.

● Combinations

Since the 12× zoom lens made by Navitar has a module-based design, the parts from (1) to (4) are combined to create a lens system.



Product Number

①Mount	
1-6010	C Mount Adapter
②Adapter Tube	
1-61001	0.67X Mini-Adapter
1-61400	1X Mini-Adapter
1-62136	2X Mini-Adapter
1-6245	1X Short Adapter
1-6233	2X short adapter
③Zoom	
1-50486	12X Zoom with 12mm Fine Focus
1-50487-M	12X Coaxial Zoom with 3mm Fine Focus
④Attachment	
1-50011*	0.25X Lens Attachment
1-50012*	0.5X Lens Attachment
1-50013*	0.75X Lens Attachment
1-50014	1.5X Lens Attachment
1-50015	2X Lens Attachment

*For 1-50486 only.

Field of View Data for 12×Zoom

		W.D.	Camera	Adapter Tube 0.67×*		1-61001	1×		1-61400/6245	2×		1-62136/6233	Resolution (μm) Low to High Magnification	Depth of Field (mm) Low to High Magnification
Attachment	0.25× 1-50011 *	341mm	Magnification	0.1X	~	1.2X	0.15X	~	1.75X	0.29X	~	3.5X	72-14	20.00-0.8
			1/3"	36.0×48.0	~	3.0×4.0	24.0×32.0	~	2.1×2.7	12.4×16.6	~	1.0×1.4		
			1/2"	48.0×64.0	~	4.0×5.3	32.0×42.7	~	2.7×3.7	16.6×22.1	~	1.4×1.8		
			2/3"	66.0×88.0	~	5.5×7.3	44.0×58.7	~	3.8×5.0	22.8×30.3	~	1.9×2.5		
	0.5× 1-50012 *	165mm	Magnification	0.2X	~	2.4X	0.29X	~	3.5X	0.58X	~	7X	36-6	6.17-0.19
			1/3"	18.0×24.0	~	1.5×2.0	12.4×16.6	~	1.0×1.4	6.2×8.3	~	0.5×0.7		
			1/2"	24.0×32.0	~	2.0×2.7	16.6×22.1	~	1.4×1.8	8.3×11.0	~	0.7×0.9		
			2/3"	33.0×44.0	~	2.8×3.7	22.8×30.3	~	1.9×2.5	11.4×15.2	~	0.9×1.3		
	0.75× 1.50013 *	108mm	Magnification	0.29X	~	3.5X	0.44X	~	5.3X	0.87X	~	10.5X	24-4	2.55-0.09
			1/3"	12.4×16.6	~	1.0×1.4	8.2×10.9	~	0.7×0.9	4.1×5.5	~	0.34×0.46		
			1/2"	16.6×22.1	~	1.4×1.8	10.9×14.5	~	0.9×1.2	5.5×7.4	~	0.46×0.61		
			2/3"	22.8×30.3	~	1.9×2.5	15.0×20.0	~	1.2×1.7	7.6×10.1	~	0.63×0.84		
	None	86mm	Magnification	0.39X	~	4.7X	0.58X	~	7X	1.16X	~	14X	18-4	1.39-0.05
			1/3"	9.2×12.3	~	0.8×1.0	6.2×8.3	~	0.5×0.7	3.1×4.1	~	0.26×0.34		
			1/2"	12.3×16.4	~	1.0×1.4	8.3×11.0	~	0.7×0.9	4.1×5.5	~	0.34×0.46		
			2/3"	16.9×22.6	~	1.4×1.9	11.4×15.2	~	0.9×1.3	5.7×7.6	~	0.47×0.63		
	1.5× 1-50014	50mm	Magnification	0.58X	~	7X	0.87X	~	10.5X	1.74X	~	21X	12-2	0.64-0.02
			1/3"	6.2×8.3	~	0.5×0.7	4.1×5.5	~	0.34×0.46	2.1×2.8	~	0.17×0.23		
			1/2"	8.3×11.0	~	0.7×0.9	5.5×7.4	~	0.46×0.61	2.8×3.7	~	0.23×0.30		
			2/3"	11.4×15.2	~	0.9×1.3	7.6×10.1	~	0.63×0.84	3.8×5.1	~	0.31×0.42		
	2.0× 1-51473	32mm	Magnification	0.78X	~	9.4X	1.16X	~	14X	2.32X	~	28X	10-2	0.35-0.01
			1/3"	4.6×6.2	~	0.38×0.51	3.1×4.1	~	0.26×0.34	1.6×2.1	~	0.13×0.17		
			1/2"	6.2×8.2	~	0.51×0.68	5.7×5.5	~	0.34×0.46	2.1×2.8	~	0.17×0.23		
			2/3"	8.5×11.3	~	0.70×0.94	4.1×7.6	~	0.47×0.63	2.8×3.8	~	0.24×0.31		

*Note that coaxial illumination cannot cover the total field of view with a low-magnification lens attachment.

Options for Lens with Motorized Specifications

- Supports 12× or 12× ultra-zoom.
- Select from 3 types of standard motors.
- Manual and motorized focuses are available.
- Available with or without coaxial illumination.

- Metal Fixture Attachment for 12× motorized zoom Product number: 1-51272

  Metal fixture attachment for 12× and 12× ultra-motorized zoom

- Controller

About the Control System

Navitar has prepared a driver integrated controller that supports all types of machines with 12× motorized zoom. The control system can control 1 or 2 axes using a serial RS-232 or USB. The software contains LabView™ and Windows Graphical User Interface “GUI” for simple axis control. Connection is performed using two D sub-connectors.

System Requirements
- Windows 98, ME, NT, 2000 or XP

Computer Requirements
- Windows OS
- Port: 1 serial or 1 USB port (hub is possible)
- Hard Disk: 1M byte
- RAM: Same as OS

List of Product Codes for Motor Zoom

①The Base is a Lens with Motor Zoom Function	②Additional Functions	③Type of Motor		
		2-Phase Stepping	5-Phase Stepping	DC Servo (with Encoder)
12X Motor Zoom	12mm Motorized Focus	1-51188	1-51206	1-51190
	3mm Motorized Focus・Coaxial Illumination	1-51200	1-51204	1-51202
	12mm Manual Focus	1-51319	1-51316	1-51337
	3mm Manual Focus・Coaxial Illumination	1-51311	1-51315	1-51338
	Without Focus, Without Coaxial	1-51314	1-51317	1-51335
	Without Focus, With Coaxial	1-51318	1-51306	1-51336
12x Ultra Motor Zoom	12mm Motorized Focus	1-51192	1-51208	1-51194
	3mm Motorized Focus・Coaxial Illumination	1-51196	1-51210	1-51198
	12mm Manual Focus	1-51325	1-51322	1-51333
	3mm Manual Focus・Coaxial Illumination	1-51326	1-51321	1-51334
	Without Focus, Without Coaxial	1-51320	1-51323	1-51331
	Without Focus, With Coaxial	1-51324	1-51327	1-51332

Controller	Box Type	Panel Type
Controller for 2-Phase Stepping Motor	1-62420	2-62577
Controller for 5-Phase Stepping Motor	1-62506	2-62507
Controller for DC Servo Motor	1-62508	2-62509
Power Supply Unit	1-62504	
USB Cable	8-62502	
RS232C Cable	8-62501	

NAVITAR
12× Ultra-Zoom Lens

The 12× ultra-zoom lens realizes amazing resolution and magnification in combination with an objective lens. If combined with an infinity corrected objective lens, the ultra-high magnification zoom lens realizes high resolution (1650/mm or more) with long working distance and high magnification (max 320×). This lens is optimum for high-magnification applications related to semiconductors, LCD inspection, and medical and bio-fields.

● Combinations

Since the 12× ultra-zoom lens has a module-based design, the parts from (1) to (4) are combined to create a lens system.
12× Ultra-zoom Lens

Product Number

①Mount	
1-6010	C Mount Adapter
②Adapter Tube	
1-61001	0.67X Mini-Adapter
1-61400	1X Mini-Adapter
1-62136	2X Mini-Adapter
1-6245	1X Short Adapter
1-6233	2X Short Adapter
③Ultra Zoom	
1-50504	12X Ultra-Zoom with 12mm Fine Focus
1-50503-M	12X Ultra-Coaxial Zoom with 3mm Fine Focus
④Objective Lens	
8-60758	2X WD32mm Objective Lens (Mitsutoyo)
1-60226	5X WD34mm Objective Lens (Mitsutoyo)
1-60227	10X WD33mm Objective Lens (Mitsutoyo)
1-60228	20X WD20mm Objective Lens (Mitsutoyo)
1-60229	50X WD13mm Objective Lens (Mitsutoyo)

Field of View Data for 12× Ultra-Zoom with Objective Lens

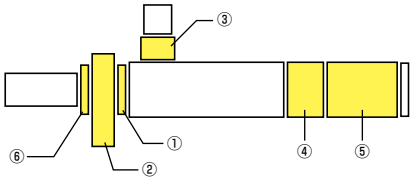
Objective Lens	WD		1X Adapter Tube			2X Adapter Tube		
		CCD / Magnification	Low Magnification		High Magnification	Low Magnification		High Magnification
×2	32mm		×0.52	~	×6.4	×1.04	~	×12.8
		2/3″	12.7×16.9×21.2	~	1.03×1.38×1.72	6.4×8.5×10.6	~	0.53×0.7×0.88
		1/2″	9.2×12.3×15.4	~	0.75×1.00×1.25	4.6×6.2×7.7	~	0.38×0.51×0.64
		1/3″	6.9×9.2×11.5	~	0.56×0.75×0.94	3.5×4.6×5.8	~	0.29×0.38×0.48
×5	34mm		×1.3	~	×16	×2.6	~	×32
		2/3″	5.1×6.8×8.5	~	0.41×0.55×0.69	2.5×3.4×4.2	~	0.21×0.28×0.34
		1/2″	3.7×4.9×6.2	~	0.3×0.4×0.5	1.9×2.5×3.1	~	0.15×0.2×0.25
		1/3″	2.8×3.7×4.6	~	0.23×0.3×0.38	1.4×1.9×2.3	~	0.11×0.15×0.19
×10	33mm		×2.6	~	×32	×5.2	~	×64
		2/3″	2.5×3.4×4.2	~	0.21×0.28×0.34	1.3×1.7×2.1	~	0.1×0.14×0.17
		1/2″	1.9×2.5×3.1	~	0.15×0.2×0.25	0.92×1.2×1.5	~	0.08×0.1×0.13
		1/3″	1.4×1.9×2.3	~	0.11×0.15×0.19	0.7×0.92×1.2	~	0.06×0.08×0.09
×20	20mm		×5.2	~	×64	×10.4	~	×128
		2/3″	1.3×1.7×2.1	~	0.1×0.14×0.17	0.63×0.85×1.1	~	0.05×0.07×0.09
		1/2″	0.92×1.2×1.5	~	0.08×0.1×0.13	0.46×0.62×0.77	~	0.04×0.05×0.06
		1/3″	0.7×0.92×1.2	~	0.06×0.08×0.09	0.35×0.46×0.58	~	0.03×0.04×0.05
×50	13mm		×13	~	×160	×26	~	×320
		2/3″	0.51×0.68×0.85	~	0.04×0.06×0.07	0.25×0.34×0.42	~	0.021×0.028×0.034
		1/2″	0.37×0.49×0.62	~	0.03×0.04×0.05	0.18×0.25×0.31	~	0.015×0.02×0.025
		1/3″	0.28×0.37×0.46	~	0.02×0.03×0.04	0.14×0.18×0.23	~	0.011×0.015×0.019

*At low magnification, vignetting occurs on the monitor.

DIC Differential Interference Module for Navitar 12× Ultra Zoom

By combining the DIC Differential Interference Module with the 12× Ultra Zoom, it is possible to emphasize and show in 3D, uneven areas that are normally difficult to observe in objects that have mirror-like surfaces, such as metal, precision processed, glass and wafer surfaces.
(Caution) The differential interference lens for the objective lens is recommended when using the objective lens.

Diagram of Unit Structure



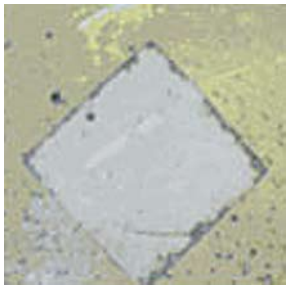
DIC Differential Interference Unit Structure

①	2-51370	M25x.75T adapters	Connect main unit and DIC
②	1-63726	DIC Prism	DIC prism unit area
③	2-51485	Polarizer	Install between the lens main unit and the coaxial ferrule
	1-50554	Ferrule with Polarizer	Set product number for polarizer and coaxial ferrule
④	1-60816	Analyzer	Install between the lens main unit and the adapter tube
⑤	1-61997	1X RA T	Dedicated adapter tube 1X
	1-6120	2X RA	Dedicated adapter tube 2X
⑥	2-51370	M2.5x.75T Adapter	Connect with differential interference object adapter manufactured by Nikon

* Mitsutoyo and Olympus are supported by adapters attached to the main unit of the ultra zoom.

DIC Differential Interference Module Images

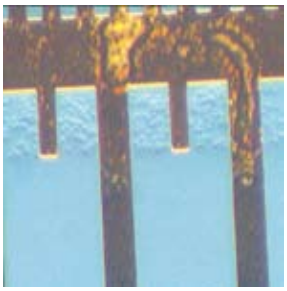
Without Prism



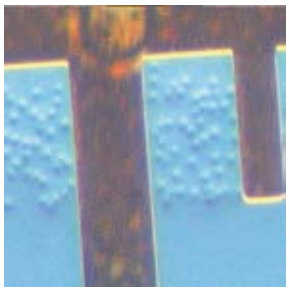
With Prism

Examples of Zoom Images

Low Magnification



High Magnification



Non-Telecentric Macro Lenses
ML-N Series

- Compact body of ϕ16
- High resolution, low TV distortion
- Reasonable prices
- Best matching with peripherals

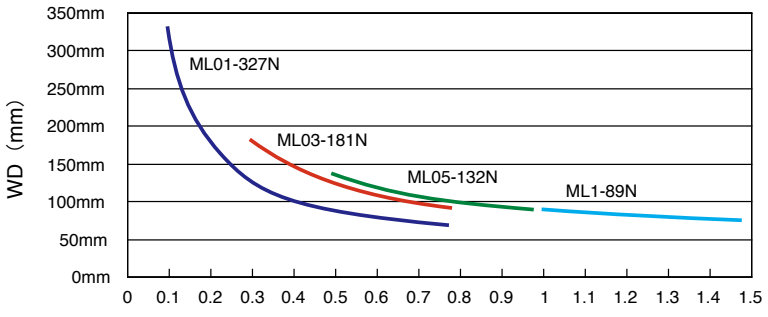
ML-N Series lenses were developed to be compact, high performance models. Based on many years of experience producing MMLs (Machine Micro Lens), Moritex adopted the non-telecentric optical system as the lens design for this series. By limiting the number of lenses in each layer to less than 3, we have succeeded in developing high performance models at reasonable prices.
Magnification and working distances can be tailored to your needs by using an optional close-up ring adapter.

Model	Magnification	WD (mm)	Resolution	Depth of Field	Effective Fno	TV Distortion	Largest Compatible CCD	Weight	Mount (Sold Separately)	Product code
ML01-327N	×0.1	327.7	33.9µm	37.66mm	4.71	0.4% or less	1/2"	10g	C Mount	A-0133
ML03-181N	×0.3	181.3	14.6µm	5.43mm	6.11	0.2% or less	1/2"	15g	C Mount	A-0134
ML05-132N	×0.5	132.5	11.7µm	1.95mm	6.08	0.08% or less	1/2"	18g	C Mount	A-0131
ML1-89N	×1	89.6	7.9µm	0.7mm	8.82	0.04% or less	1/2"	15g	C Mount	A-0132

*Depth of field is calculated assuming a horizontal 240TV resolution using a 1/2" CCD camera. (Permissible circle of confusion on the image-formation side: 40µ)

■The magnification can be changed by using the ML-EXR Series close-up ring.

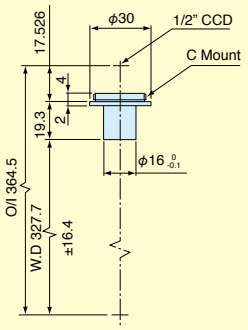
Reference magnification and WD data for close-up ring combinations



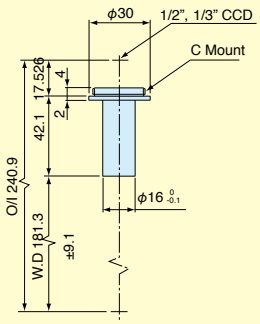
Magnification conversion table

	Close-Up Ring Thickness	0mm	1mm	2mm	5mm	7mm	10mm	15mm	17mm	20mm
ML01-327N	Magnification	0.1x	0.13x	0.17x	0.27x	0.33x	0.43x	0.6x	0.67x	0.77x
	WD	327.7mm	253mm	204mm	138.8mm	118.6mm	97.5mm	77.7mm	72.5mm	67.2mm
ML03-181N	Magnification	0.3x	0.32x	0.35x	0.42x	0.47x	0.54x	0.65x	0.7x	0.77x
	WD	181.3mm	170mm	162mm	140.7mm	131mm	119mm	104.6mm	100mm	94.6mm
ML05-132N	Magnification	0.5x	0.53x	0.55x	0.62x	0.66x	0.73x	0.85x	0.9x	0.97x
	WD	132.5mm	128.4mm	125mm	116.3mm	111.3mm	105.2mm	97.4mm	94.2mm	91mm
ML1-89N	Magnification	1x	1.02x	1.05x	1.12x	1.16x	1.2x	1.35x	1.4x	1.47x
	WD	89mm	88mm	87mm	85mm	83.5mm	81.5mm	78.5mm	77.3mm	75.9mm

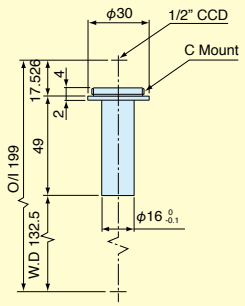
ML01-327N



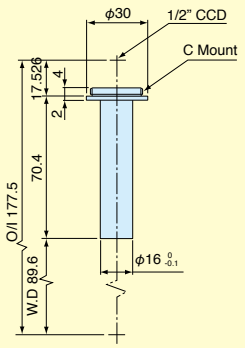
ML03-181N



ML05-132N



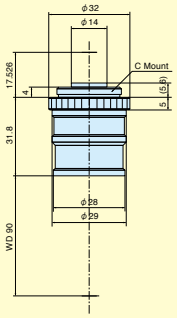
ML1-89N



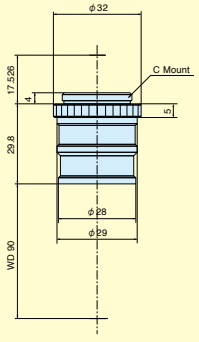
Low Magnification Macro Lenses

Small, high-resolution macro lenses to be mounted directly on machines. WD=90mm for all models.

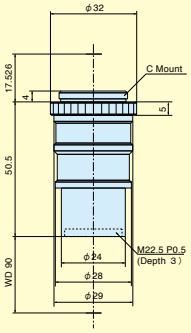
ML-15014



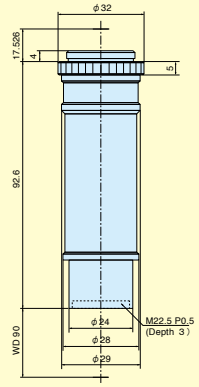
ML-24030



ML-3505



ML-5010

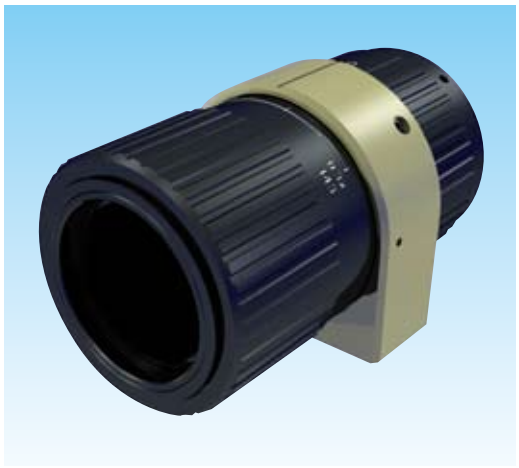


Model	Magnification	Effective Fno	WD	Depth of Field	Resolution	TV distortion	Weight	Largest Compatible CCD	Mount	Product Code
ML-15014	×0.14	4.6	90mm	18mm	36μm	0.1% or less	28g	2/3"	C Mount	A-0127
ML-24030	×0.3	7.3	90mm	6.5mm	21μm	0.1% or less	39g	2/3"	C Mount	A-0128
ML-3505	×0.5	8.4	90mm	2.7mm	13μm	0.1% or less	55g	2/3"	C Mount	A-0129
ML-5010	×1	8	90mm	0.6mm	6.3μm	0.1% or less	68g	2/3"	C Mount	A-0130

*Depth of field is calculated assuming a horizontal 240TV resolution using a 1/2" CCD camera. (Permissible circle of confusion on the image-formation side: 40μ)

Varifocal Lens for Large Width Camera Elements

ML-0310VF



- Supports camera format of up to 1.2” max. (15.15mm×15.15mm)
- Varifocal magnification variation of 0.3×~1×
- Equipped with variable aperture
- Equipped with screws to lock movable parts for FA
- Wide range of transmission transparence

Varifocal Lens optimum with magnification and working distance for FA. With a main feature which supports 1.2” large elements and the varifocal variable magnification (0.3×WD=143mm~1×WD=75mm), shooting a wide view in 1 shot in combination with a large element camera enables high-speed and high-resolution image recognition.

■Optical Specifications

Model	Magnification	WD (mm)	Resolution	Depth of Field	TV Distortion	Weight	Mount (Sold Separately)	Compatible Camera Size	Product Code
ML-0310VF	×0.3	143.5	15.3μm	6.0mm	0.07% or less	Approx. 180g	C Mount	Supports Maximum size of 1.2" (15.15mm×15.15mm)	A-3127
	×0.65	83.2	8.8μm	1.6mm	0.02% or less				
	×1.0	75.2	7.1μm	0.7mm	0.01% or less				

■Option Proxar Lens

Model	Magnification	WD (mm)	Resolution	Depth of Field	TV Distortion	Product Code
ML-VF03	×0.1	414.4	44.0μm	54.4mm	-0.1% or less	A-8034
	×0.37	133.4	15.3μm	4.9mm	-0.06% or less	
	×0.65	106.3	10.8μm	2.0mm	-0.03% or less	

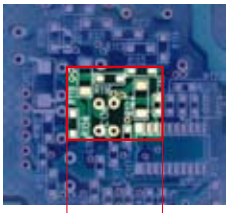
*Calculated from permissible circle of confusion diameter of 40μ. *Resolution values indicate the theoretical resolution at a wavelength of 550nm.

■Chart for Field of View According to CCD Element Size • WD

Magnification	0310VF	VF03	1/3 (3.6×4.8)	1/2 (4.8×6.4)	2/3 (6.6×8.8)	1.1 (12×12.3)	1.2 (15.15×15.15)
0.1×	-	414.5mm	36×48	48×64	66×88	120×123	151.5×151.5
0.15×	-	288.5mm	24×32	32×42.7	44×58.7	80×82	101×101
0.2×	-	220.3mm	18×24	24×32	33×44	60×61.5	75.8×75.8
0.25×	-	180.9mm	14.4×19.2	19.2×25.6	26.4×35.2	48×49.2	60.6×60.6
0.3×	143mm	155.8mm	12×16	16×21	22×29.3	40×41	50.5×50.5
0.4×	114mm	127.1mm	9×12	12×16	16.5×22.0	30×30.8	37.9×37.9
0.5×	97mm	113.0mm	7.2×9.6	9.6×12.8	13.2×17.6	24×24.6	30.3×30.3
0.6×	87mm	107.2mm	6×8	8×10.7	11×14.7	20×20.5	25.3×25.3
0.65×	83mm	106.4mm	5.5×7.4	7.4×9.8	10.2×13.5	18.5×18.9	23.3×23.3
0.7×	81mm	-	5.1×6.9	6.9×9.1	9.4×12.6	17.1×17.6	21.6×21.6
0.8×	77mm	-	4.5×6	6×8	8.3×11.0	15×15.4	18.9×18.9
0.9×	76mm	-	4×5.3	5.3×7.1	7.3×9.8	13.3×13.7	16.8×16.8
1x	75mm	-	3.6×4.8	4.8×6.4	6.6×8.8	12×12.3	15.2×15.2

■ML-0310VF Examples of Field of View

1/2 CCD at 0.3X

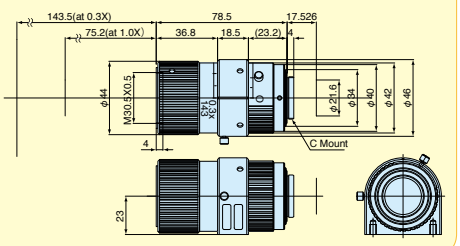


1.2 CCD at 0.3X

Benefits of Using the Large Element Camera

- Achieves a large field of view with one camera.
- Bright pictures due to large pixel size.

ML-0310VF



ML-VF03

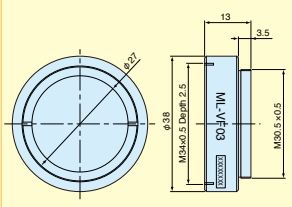
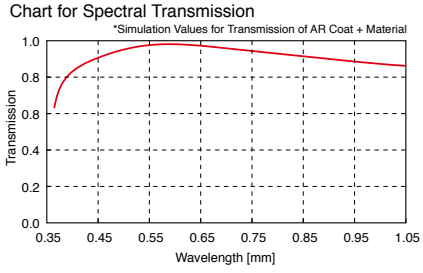


Chart for Spectral Transmission

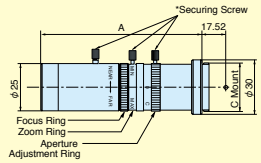


CCTV Macro Zoom Lenses

- Zoom ratio of 4:1. (0.02×~2.4×) 8 models are available.
- Iris, focus, and zoom are adjustable.
- Equipped with screws to lock movable parts.
- Maximum external diameter of ø25mm

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

ML-Z Series



*Fix the securing screw after setting conditions. Do not rotate the ring while holding the screw.

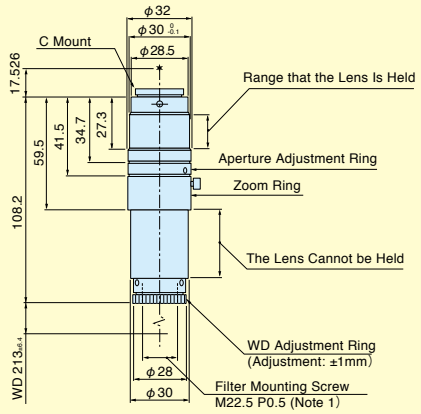
Model	ML-Z002		ML-Z004		ML-Z007		ML-Z014		ML-Z020		ML-Z026		ML-Z040		ML-Z052	
WD (mm) Max~Min	750~300		750~300		210~150		210~150		69~55		49~44		69~55		49~44	
Magnification	×0.02~ ×0.08	×0.06~ ×0.22	×0.044~ ×0.16	×0.12~ ×0.43	×0.07~ ×0.25	×0.11~ ×0.39	×0.14~ ×0.51	×0.21~ ×0.77	×0.21~ ×0.77	×0.3~ ×1.1	×0.27~ ×0.98	×0.33~ ×1.21	×0.42~ ×1.52	×0.58~ ×2.13	×0.54~ ×1.94	×0.66~ ×2.37
Depth of Field (mm)	±387~ ±30	±51~ ±3.9	±202~ ±15	±28~ ±2.1	±37~ ±2.7	±16~ ±1.2	±19~ ±1.5	±8.3~ ±0.6	±4.2~ ±0.3	±2.1~ ±0.17	±2.7~ ±0.2	±1.8~ ±0.13	±2.2~ ±0.17	±1.1~ ±0.08	±1.3~ ±0.1	±1.2~ ±0.07
Effective Fno	4.6~22		9.2~44		4.6~22		9.2~44		4.6~22		4.6~22		9.2~44		9.2~44	
Weight (g)	94		101		94		102		103		103		110		111	
Largest Compatible CCD	1/2"		1/2"		1/2"		1/2"		1/2"		1/2"		1/2"		1/2"	
Mount	C Mount		C Mount		C Mount		C Mount		C Mount		C Mount		C Mount		C Mount	
Product Code	A-0136		A-0137		A-0138		A-0139		A-0140		A-0141		A-0142		A-0143	

High Performance Macro Zoom Lens ML-Z0108

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

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

ML-Z0108



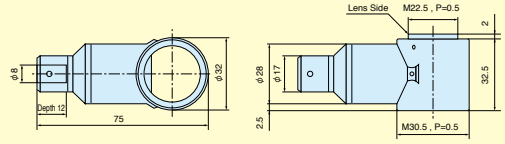
Model	ML-Z0108		
Magnification	0.1X to 0.8X (Zoom Ratio of 8:1)		
WD	213mm		
Focus Position	±20mm(Aperture Adjustment Amount of The Lens ±1mm, Magnification Variation ±13%)		
Motor	Without (Manual Zoom)		
	at 0.1X	at 0.4X	at 0.8X
Effective Fno	8.2		9.3
Depth of Field	32.8mm	2.1mm	0.6mm
Resolution	55µm	14µm	8µm
TV Distortion	-0.02% or less	0.18% or less	0.17% or less
Operation Function	Manual (Adjusting Aperture, Zoom, and Focus)		
Weight	140g		
Largest Compatible CCD	1/2"		
Mount	C Mount		
Product Code	A-0155		

* Depth of field is calculated assuming a horizontal 240TV resolution using a 1/2" CCD camera. (Permissible circle of confusion on the image-formation side: 40µ)
* Resolution values indicate the theoretical resolution at a wavelength of 550nm.

TV Macro Lens Options

■Simulated Coaxial Illumination Unit (MLZ-HM)

(Dedicated for ML-Z040,ML-Z052)



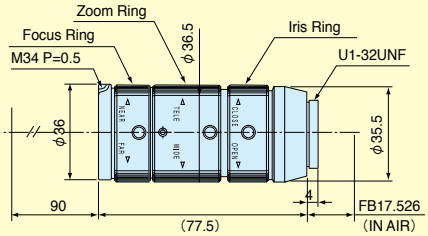
Mega pixel Macro Zoom Lens

MLH-3XMP

Main Use: High-Contrast Image Recognition

- Zoom: Optical magnification of 0.3×~1×
- WD=90mm
- Variable focus
- Variable iris Effective NO4.5~Close
- Equipped with screws to lock movable parts (Zoom, focus, and iris)
- Maximum compatible camera format ~2/3"
- C mount

This high-performance macro zoom lens supports CCD cameras of the 1 million pixel class. The zoom range is 0.3×~1× by optical magnification. The resolution of 100/mm or more is realized at the center and periphery of the entire zoom range. Combination with a mega pixel CCD realizes wide-range image recognition with excellent contrast.



Model	MLH-3XMP
Magnification	0.3X to 1X (Manual Zoom)
WD	90mm
Aperture (FNO)	F4.5~Close
Filter Screw	M34~P~0.5
Weight	150g
Largest Compatible CCD	2/3"
Camera Mounts	C Mount
Product Code	A-0220

10x Zoom Lens

MLH-10X

Main Uses: Alignment, Parts Recognition, Dimension Measurements

- Zoom ratio of 10:1 (Magnification range: 0.084×(min)~0.84×(max))
- WD=450mm(min)~150mm(max)
- Iris, focus, and zoom are adjustable.
- Equipped with locking screws.

A wide range zoom lenses developed for wide field. Zoom ratio of 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.

MLH-10X

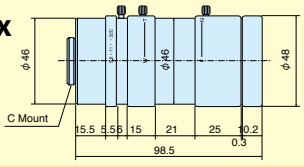


Chart for Field of View

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

Model	MLH-10X
Magnification	0.084X to 0.84X (Zoom Ratio of 10:1)
WD	150~450mm
Iris	F5.6~Close
Filter Size	M46 P=0.75
Weight	233g
largest Compatible CCD	1/2"
Camera Mount	C Mount
product Code	A-0149

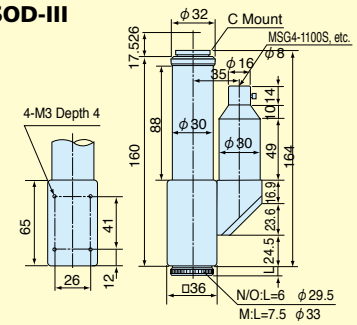
SOD-III Coaxial Epi-illumination Unit for Objective Lenses

SOD-III Series

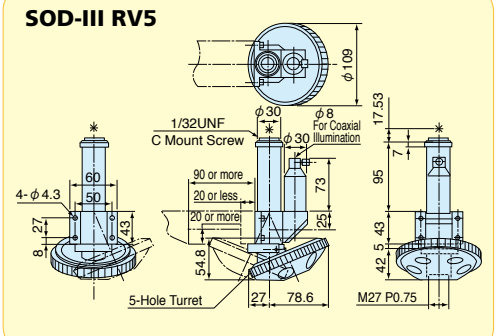
- Compact design
- Compatible with various bright field lenses
- Enables horizontal and various other kinds of mountings

SOD-III is an optical unit used for coaxial illumination with objective lenses. If you are using a metallurgical microscope, this unit is effective for image input because it produces video of the same level. It is designed for infinity corrected objective lens (bright vision) and can be used with the lenses listed below. In addition to the monocular type, the 5-hole revolver type (manual and electric) is available, which can be mounted with 5 objective lenses,

SOD-III



SOD-III RV5



SODIII RV5

Model	SOD-III	SOD-III RV5	SOD-III RV5M
Remarks	——	5-Hole Manual Revolver Type	5-Hole Electric Revolver Type
Product Code	A-0171	A-0172	A-0173

Compact Objective Lenses

Mitsutoyo

Model	NA	WD (mm)	Product Code
M Plan Apo 2 ×	0.055	34	A-8132
M Plan Apo 5 ×	0.14	34	A-8133
M Plan Apo 10 ×	0.28	33.5	A-8134
M Plan Apo 20 ×	0.42	20	A-8137
M Plan Apo SL 20 ×	0.28	30.5	A-8135
M Plan Apo SL 50 ×	0.42	20.5	A-8136

Nikon

Model	NA	WD (mm)	Product Code
CF IC EPI Plan 2.5 ×	0.075	8.8	A-8143
CF IC EPI Plan 5 ×	0.13	22.5	A-8144
CF IC EPI Plan 10 × A	0.3	16.5	A-8148
CF IC EPI SLWDPlan 10 × A	0.21	20.3	A-8145
CF IC EPI SLWDPlan 20 × A	0.35	20.5	A-8146
CF IC EPI SLWDPlan 50 × A	0.45	13.8	A-8147

High Power Objective Lens Sliding Change

SOD-SRV Series

A new slide mechanism changes objective lens at high speed.
Achieves rapid and highly accurate online inspection.

▲2-Hole Type ▼6-Hole Type

- Ultra-high speed Variable magnification Maximum <= 0.33 seconds
- High accuracy Repeated positioning ±1.5μm
- High durability 50 million times
- WD adjustment function
- Image positioning adjustment function
- Independent operation panel
- USB 2.0 external control

Magnification is changed by sliding 5 objective lenses on the X- and Y- axes. This achieves high speed, accuracy, and durability when compared to the conventional revolution method. Unique new functions also provide smooth installation and adjustment when loading onto machines.

System Structure

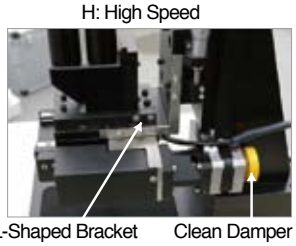
	Main Unit	Control Box			Accessories				Z-Axis			
	Changer LV-SRV	Control Box LV-CR	Control Panel (Optional)	Clean Damper (Optional)	Changer Cable CV-N/ RCV-N	Objective Lens Adapters OBN	L-Shaped Bracket (Optional)	Barrel (Optional)	Z-Axis	Clean Damper (Optional)	Limit Sensor (Optional)	Z-Axis Cable CV-Z
2-Hole Type	**LV-SRV2H6**	LV-CRT1	LV-CR-OP	1	1	2	BR2H	SOD-3				
3-Hole Type	**LV-SRV3H6**	LV-CRT1	LV-CR-OP	1	1	2	BR3H	SOD-3				
5-Hole Type	**LV-SRV5H6**	LV-CRT2	LV-CR-OP	2	2	3	BR5H	SOD-3				
6-Hole Type	**LV-SRV6H4**	LV-CRT2	LV-CR-OP	2	2	3	BR6H	SOD-3				
2-Hole Type + Z-Axis	**LV-SRV2H6**	LV-CRT1-ZT LV-CRT1-ZO	LV-CR-OP	1	1	2	BR2H	SOD-3	LV-SRV41-H50S	1	1	1
3-Hole Type + Z-Axis	**LV-SRV3M2**	LV-CRT1-ZT LV-CRT1-ZO	LV-CR-OP	1	1	2	BR3H	SOD-3	LV-SRV41-H50S	1	1	1
5-Hole Type + Z-Axis	**LV-SRV5H6**	LV-CRT2-ZT LV-CRT2-ZO	LV-CR-OP	2	2	3	BR5H	SOD-3	LV-SRV41-H50S	1	1	1
6-Hole Type + Z-Axis	**LV-SRV6H4**	LV-CRT2-ZT LV-CRT2-ZO	LV-CR-OP	2	2	3	BR6H	SOD-3	LV-SRV41-H50S	1	1	1
Z-Axis Only		LV-CRT1(Custom Designed:LV-CR01)	LV-CR-OP						LV-SRV41-H50S	1	1	1

Changer Model

LV-SRV□H□ — 6: Lead 6mm, 4: Lead 4mm

2-Hole: 2
3-Hole: 3
5-Hole: 5
6-Hole: 6

H: High Speed



L-Shaped Bracket — Clean Damper

Control Box Model

LV-CR□□-Z□ — Z-Axis Area

(Standard) Manufactured by Technodrive: T
(Custom Designed) Manufactured by Oriental: O

(Standard) Manufactured by Technodrive: T
(Custom Designed) Manufactured by Oriental: O

Changer Part 1-Axis: 1
2-Axis: 2

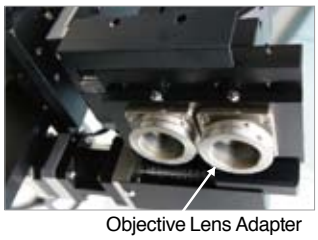
Operation Panel : OP

LV-CR-OP
LC-CR

*Technodrive products are included with dedicated driving software (Motion Control).
*Oriental products are assembled at customer's place.

Objective Lens Model

OBN□ — Nikon φ20.32:20
Mitsutoyo: 26



Objective Lens Adapter

Z-Axis Model

LV-SRV4□-H50S

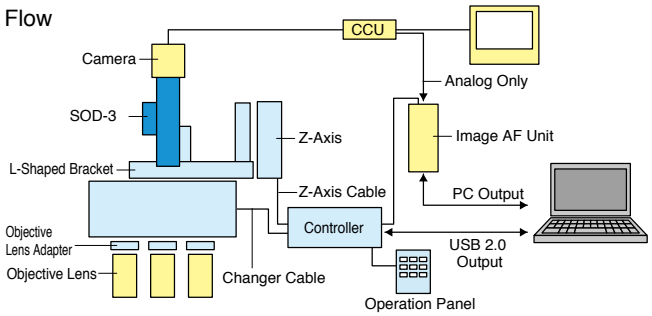
1: Lead 1mm
2: Lead 2mm

Harmonic Gear Motor
PK543BW-H50S

Clean Damper

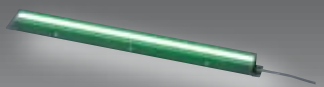
Limit Sensor Cover

System Flow



Line CCD Lenses

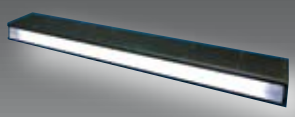
Illuminations for Line Sensors



MBRC Series

Chip-type Emission Plate Line Illumination

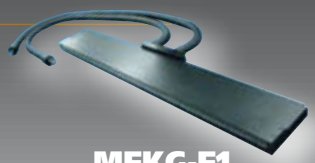
* See **P.I-31** of Illumination Section



MLNX Series

High Power Line LED Illumination

* See **P.I-28** of Illumination Section



MFKG-F1

Long Uniform Line Light Guide

* See **P.I-95** of Illumination Section

NAVITAR Raptar Pro

Model	Sensor Size	Size of Field of View	WD	Magnification	Effective Fno	Resolution	TV Distortion	Mount
NAVITAR Raptar Pro	90mm at max	90mm at max	95mm	1x	F4-22 Manual Iris	100lp/mm	0.1% or less	C,T,F, Dalsa,M72

ML-L12K5 Series

- A high-resolution model compatible with Pixel size 5µm.
- Maximum imager size of ϕ61.4.
- Equipped with base lens and various lens barrels making it compatible with all types of cameras.
- The barrel is equipped with camera adjustment ring.

The 12K5 Series is a high-resolution model with large diameter and compatible with a 12000-bit (5µm pixel size) line sensor camera. As a result of equipping each kind of camera application with a lens barrel diameter, the base lens is easier to use and a large number of variations have become possible.

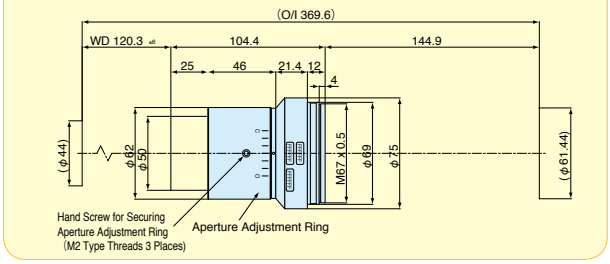
Base Lens

Model	Focal Distance	Magnification	WD	Effective Fno	TV Distortion	O/I	External Diameter φ	Weight	Effective Image Size	Mount	Product Code
ML-L1.4-12K5A	100mm	1.4x	120mm	F6.83~19.1	-0.10%	370	75	850	ϕ61.4mm	Mount Adapter 12K5	A-3152
ML-L1.75-12K5A	101mm	1.75x	73mm	F7.4 - 24	0.10%	310.1	75	980	ϕ61.4mm	Mount Adapte 12K5	A-3153

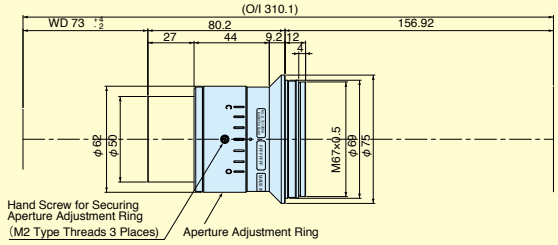
Barrel Part

Model	Product Code
12K5-M72-6.56	A-3154
12K5-M72-31.8/19.55	A-3155

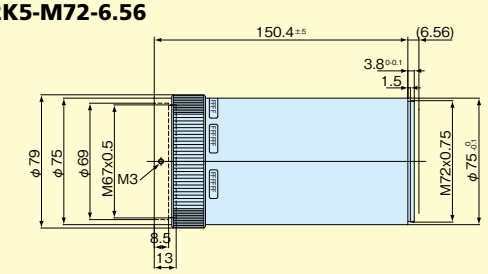
ML-L1.4-12K5A



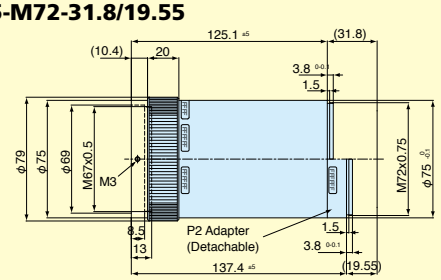
ML-L1.75-12K5A

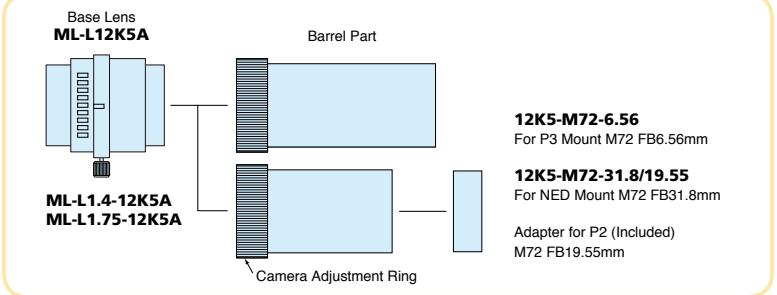


12K5-M72-6.56



12K5-M72-31.8/19.55





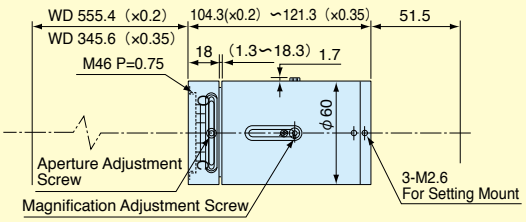
Line CCD Lenses

Line Scan CCD Lens Series for 57mm Sensor

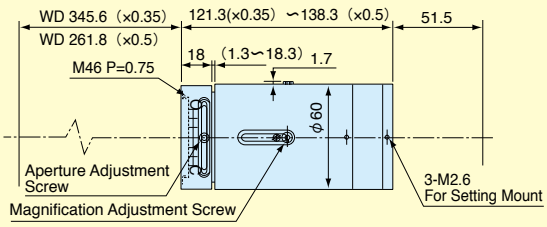
- Advanced optical design for maximum 8000-bit (57.3mm)
- Advanced optical design for 1" mega pixel (2 million pixels~) area CCD
- Designed with variable magnification (0.2x~0.35x or 0.35x~0.5x)
- Low chromatic aberration and low distortion
- Designed for various mountings

High performance Line CCD lenses for a maximum of 8000-bit (element length of 57.3mm) line sensor. Variable magnification by focus adjustment allows fine magnification setup with a flexible design. Outstanding performance is achieved by minimizing RGB color chromatic aberration and distortion. Various mounts can be chosen with all options. This series is designed not only for the maximum of φ 57mm (7μm/Pix) image format, but also for the large width CCD Sensor (max 40mm□).

ML-L02035



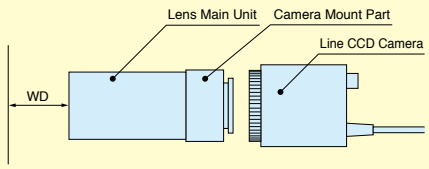
ML-L03505



Model	Focal Distance	Magnification	WD	Effective Fno	TV distortion	O/I	External Diameter φ	Weight	Effective Image Size	Mount	Product Code
ML-L02035	100mm~ 102mm	0.2x - 0.35x	555.4mm - 345.6mm	F5.8 - 36.6	0.10%	711.2~ 518.4	60	750g	φ57.3mm	Mount Adapter ML-MTS	A-0184
ML-L03505	102mm~ 103mm	0.35x - 0.5x	345.6mm - 261.7mm	F6.6 - 41	0.10%	518.4~ 451.6	60	800g	φ57.3mm	Mount Adapter ML-MTS	A-0185

*Depth of field is calculated based on resolution.
*Resolution values indicate the theoretical resolution at a wavelength of 550nm.

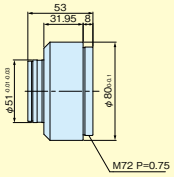
Camera Mounts (Optional)



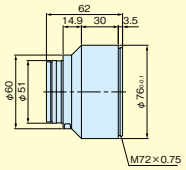
Model	P2MT-S ★	P3MT-S ★	FMT-S	CMT-S
Mount Name	DALSA Piranha 2 Mount	DALSA Piranha 3 Mount	Nikon F Mount	C Mount
Product code	A-0195	A-0196	A-0193	A-0194

★ Mad e-to-order product

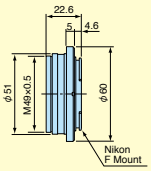
P2MT-S (DALSA Piranha 2 Mount)



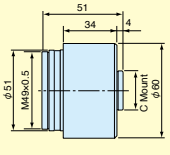
P3MT-S (DALSA Piranha 3 Mount)



FMT-S (Nikon F Mount)



CMT-S (C Mount)

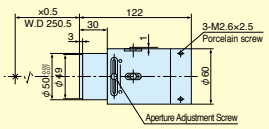


★Moritex can also provide mounts from various other manufacturers.

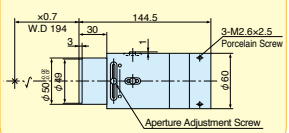
Line CCD Lenses
ML-L Series

- Optimal for high speed processing of large fields of view.
- Low TV distortion, all models less than 0.1%
- Low marginal rays difference
- High resolution, high contrast
- Suitable for long working distance applications

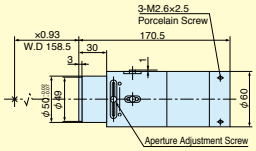
ML-L05



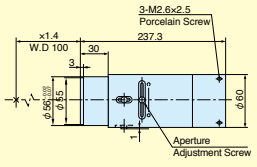
ML-L07



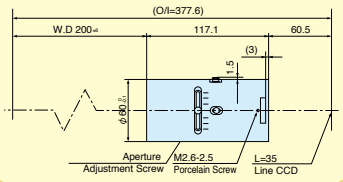
ML-L09



ML-L14



ML-L047-200 Made-to-Order

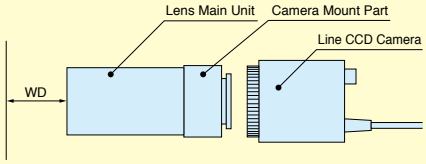


Model	Magnification	Effective Fno	WD	Depth of Field	Resolution	TV Distortion	Weight	Mount (Sold Separately)	Product Code
ML-L05	×0.5	5.9~28	250.5mm	470µm	20µm	0.1% or less	700g	MMT / FDMT / FMT / CM (See below)	A-0179
ML-L07	×0.7	6.7~32	194mm	270µm	14µm	0.1% or less	800g	MMT / FDMT / FMT / CM (See below)	A-0180
ML-L09	×0.933	7.7~37	158.5mm	160µm	10µm	0.1% or less	800g	MMT / FDMT / FMT / CM (See below)	A-0181
ML-L14	×1.4	9.5~45	100mm	95µm	7µm	0.1% or less	800g	MMT / FDMT / FMT / CM (See below)	A-0182
ML-L047-200	×0.47	5.9~32	200mm	300µm	12µm	0.01% or less	720g	MMT / FDMT / FMT / CM (See below)	A-0183

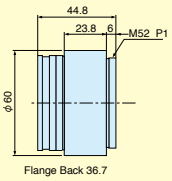
*Depth of field is calculated based on resolution.

Camera Mounts (Optional)

Model	MMT	FDMT	FMT	CMT
Mount Name	NED Compatible Mount	Canon Mount	Nikon Mount	C Mount
Product Code	A-0191	A-0190	A-0189	A-0192

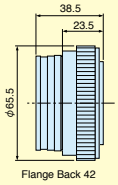


MMT



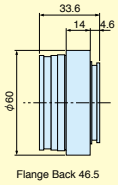
NED Compatible Mount

FDMT



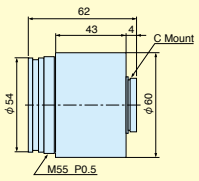
Canon Mount

FMT



Nikon Mount

CMT



C Mount

Line CCD Camera Element List

Model
14µm×1024bit
11µm×2048bit
11µm×2592bit
7µm×5000bit
4.7µm×5000bit
4.7µm×7500bit

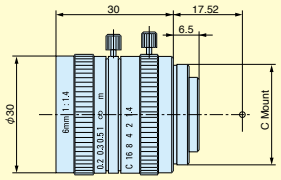
CCTV Lenses

- A wide range of products from f=6mm to 100mm.
- Variable focus and iris equipped with lock screws.
- Camera mount: C mount

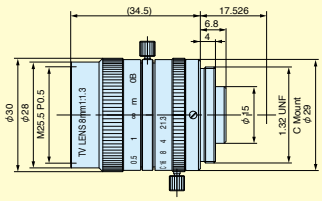
CCTV (Closed Circuit Television) lenses were developed to recognize images in a wide field of view. With all model variations of the variable iris and focus (with locking screws) optional positions can be set as required (*1). The lenses also support macro photographing in combination with an optional close-up ring and a rear converter lens (*2).

(*1) Vibration resistance is not considered in design.
(*2) Image quality may be distorted with enlargement of lens tolerance.

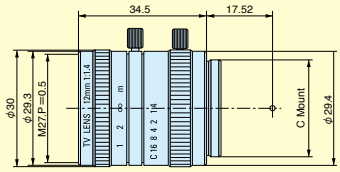
ML-0614



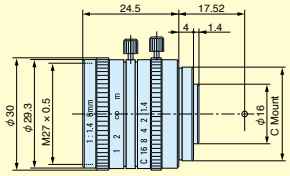
ML-0813



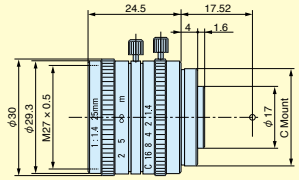
ML-1214



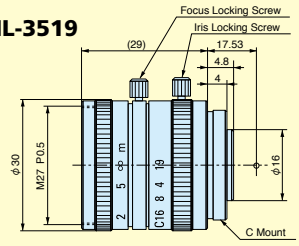
ML-1614



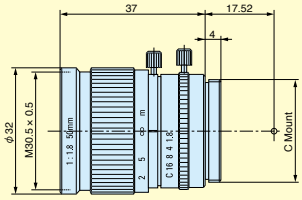
ML-2514



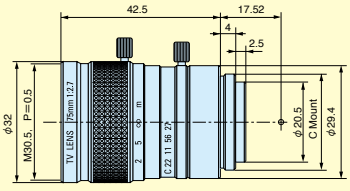
ML-3519



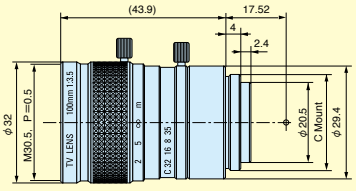
ML-5018



ML-7527



ML-10035



Model	Focal Distance f	Aperture (F No.)	Field of View (V×H)	Closest Distance	Filter Screw	Weight	Largest Compatible CCD	Mount	Product Code
ML-0614	6mm	F1.4~Close	42.3°×54.6°	0.2m	M27 P0.5	60g	1/2"	C Mount	A-0198
ML-0813	8mm	F1.3~Close	45.0°×57.8°	0.2m	M25.5 P0.5	60g	2/3"	C Mount	A-0199
ML-1214	12mm	F1.4~Close	21.9°×29.0°	0.3m	M27 P0.5	60g	1/2"	C Mount	A-0200
ML-1614	16mm	F1.4~Close	23.0°×30.4°	0.4m	M27 P0.5	40g	2/3"	C Mount	A-0201
ML-2514	25mm	F1.4~Close	21.6°×28.5°	0.5m	M27 P0.5	45g	1"	C Mount	A-0202
ML-3519	35mm	F1.9~Close	10.8°×14.4°	0.5m	M27 P0.5	50g	2/3"	C Mount	A-0203
ML-5018	50mm	F1.8~Close	7.9°×10.5°	1m	M30.5 P0.5	60g	2/3"	C Mount	A-0204
ML-7527	75mm	F2.7~Close	4.9°× 6.5°	1m	M30.5 P0.5	65g	2/3"	C Mount	A-0205
ML-10035	100mm	F3.5~Close	3.8°× 5.1°	1m	M30.5 P0.5	65g	2/3"	C Mount	A-0206

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)	Magnification	Field of View (Length x Width) 1/2"	Field of View (Length x Width) 1/3"	WD (mm)	Magnification	Field of View (Length x Width) 1/2"	Field of View (Length x Width) 1/3"	WD (mm)	Magnification
0	165 × 221	124 × 165	200	0.03	96 × 128	72 × 96	148	0.05	103 × 137	77 × 103	248	0.05
0.5	44 × 58	33 × 44	43	0.11	43 × 57	32 × 43	59	0.11	55 × 73	41 × 55	125	0.09
	60 × 79	45 × 60	63	0.08	77 × 102	57 × 77	115	0.06	119 × 159	89 × 119	289	0.04
1	25 × 34	19 × 25	19	0.19	27 × 37	21 × 27	34	0.18	38 × 50	28 × 38	80	0.13
	30 × 40	22 × 30	25	0.16	38 × 51	29 × 38	52	0.13	59 × 79	45 × 59	136	0.08
1.5					20 × 27	15 × 20	22	0.24	29 × 38	21 × 29	57	0.17
					26 × 34	19 × 26	31	0.19	40 × 53	30 × 40	85	0.12
2									23 × 31	17 × 23	42	0.21
									30 × 40	22 × 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)	Magnification	Field of View (Length x Width) 1/2"	Field of View (Length x Width) 1/3"	WD (mm)	Magnification	Field of View (Length x Width) 1/2"	Field of View (Length x Width) 1/3"	WD (mm)	Magnification
0	109 x 145	82 x 109	358	×0.04	87 x 115	65 x 87	458	×0.06	66 x 87	49 x 66	500	×0.07
0.5	64 x 86	48 x 64	206	×0.07	64 x 85	48 x 64	338	×0.08	55 x 73	41 x 55	422	×0.09
	156 x 208	117 x 156	515	×0.03	242 x 322	181 x 242	1270	×0.02	335 x 447	251 x 335	2459	×0.01
1	45 x 61	34 x 45	143	×0.11	50 x 67	38 x 50	269	×0.10	47 x 63	35 x 47	366	×0.10
	78 x 104	58 x 78	252	×0.06	121 x 161	91 x 121	637	×0.04	168 x 223	126 x 168	1240	×0.03
1.5	35 x 47	26 x 35	108	×0.14	42 x 56	31 x 42	223	×0.12	41 x 55	31 x 41	324	×0.12
	52 x 69	39 x 52	164	×0.09	81 x 107	60 x 81	425	×0.06	112 x 149	84 x 112	834	×0.04
2	29 x 38	22 x 29	86	×0.17	36 x 47	27 x 36	191	×0.13	37 x 49	28 x 37	291	×0.13
	39 x 52	29 x 39	120	×0.12	60 x 81	45 x 60	320	×0.08	84 x 112	63 x 84	631	×0.06
5	14 x 18	10 x 14	35	×0.35	19 x 25	14 x 19	103	×0.25	22 x 30	17 x 22	185	×0.22
	16 x 21	12 x 16	42	×0.31	24 x 32	18 x 24	130	×0.20	34 x 45	25 x 34	265	×0.14
10	7.3 x 9.7	5.4 x 7.3	14	×0.66	11 x 14	8.0 x 11	60	×0.45	13 x 18	10 x 13	121	×0.36
	7.8 x 10	5.8 x 7.8	15	×0.62	12 x 16	9.1 x 12	66	×0.40	17 x 22	13 x 17	143	×0.29
15					7.4 x 9.8	5.5 x 7.4	43	×0.65	9.5 x 13	7.2 x 9.5	93	×0.50
					8.1 x 11	6.0 x 8.1	45	×0.60	11 x 15	8.4 x 11	103	×0.43
20					5.6 x 7.5	4.2 x 5.6	34	×0.85	7.4 x 9.9	5.6 x 7.4	78	×0.65
					6.0 x 8.1	4.5 x 6.0	35	×0.79	8.4 x 11	6.3 x 8.4	82	×0.57
25									6.1 x 8.1	4.6 x 6.1	68	×0.79
									6.7 x 8.9	5.0 x 6.7	70	×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)	Magnification	Field of View (Length x Width) 1/2"	Field of View (Length x Width) 1/3"	WD (mm)	Magnification	Field of View (Length x Width) 1/2"	Field of View (Length x Width) 1/3"	WD (mm)	Magnification
0	90 x 120	68 x 90	943	×0.05	60 x 80	45 x 60	1000	×0.08	46 x 62	35 x 46	1000	×0.10
1.5	57 x 76	43 x 57	610	×0.08								
	154 x 205	115 x 154	1577	×0.03								
2	51 x 67	38 x 51	548	×0.10	43 x 57	32 x 43	776	×0.11				
	115 x 154	86 x 115	1193	×0.04	184 x 246	138 x 184	3189	×0.03				
5	31 x 41	23 x 31	347	×0.16	30 x 40	23 x 30	607	×0.16	27 x 37	21 x 27	724	×0.18
	46 x 61	35 x 46	503	×0.10	74 x 98	55 x 74	1422	×0.07	95 x 127	71 x 95	2413	×0.05
10	18 x 25	14 x 18	226	×0.26	20 x 27	15 x 20	475	×0.24	19 x 26	15 x 19	609	×0.25
	23 x 31	17 x 23	273	×0.21	37 x 49	28 x 37	833	×0.13	48 x 63	36 x 48	1432	×0.10
15	13 x 18	10 x 13	174	×0.37	15 x 20	11 x 15	408	×0.32	15 x 20	11 x 15	546	×0.32
	15 x 21	12 x 15	196	×0.31	25 x 33	18 x 25	636	×0.20	32 x 42	24 x 32	1105	×0.15
20	10 x 14	7.7 x 10	145	×0.47	12 x 16	9 x 12	369	×0.40	12 x 16	9 x 12	505	×0.39
	12 x 15	8.6 x 12	158	×0.42	18 x 25	14 x 18	538	×0.26	24 x 32	18 x 24	941	×0.20
25	8.4 x 11	6.3 x 8.4	126	×0.57	10 x 14	7.6 x 10	342	×0.47	10 x 14	8 x 10	478	×0.46
	9.2 x 12	6.9 x 9.2	134	×0.52	15 x 20	11 x 15	479	×0.33	19 x 25	14 x 19	843	×0.25
30	7.1 x 9.4	5.3 x 7.1	113	×0.68	8.7 x 12	6.5 x 8.7	323	×0.55	9.0 x 12	6.7 x 9.0	458	×0.54
	7.7 x 10	5.8 x 7.7	119	×0.63	12 x 16	9.2 x 12	440	×0.39	16 x 21	12 x 16	778	×0.30
35	6.1 x 8.2	4.6 x 6.1	104	×0.78	7.6 x 10	5.7 x 7.6	309	×0.63	7.9 x 11	5.9 x 7.9	443	×0.61
	6.6 x 8.8	4.9 x 6.6	108	×0.73	11 x 14	7.9 x 11	412	×0.46	14 x 18	10 x 14	731	×0.35
40	5.4 x 7.2	4.1 x 5.4	97	×0.89	6.7 x 9.0	5.1 x 6.7	297	×0.71	7.1 x 9.4	5.3 x 7.1	430	×0.68
	5.8 x 7.7	4.3 x 5.8	100	×0.83	9.2 x 12	6.9 x 9.2	391	×0.52	12 x 16	8.9 x 12	696	×0.40
45					6.1 x 8.1	4.6 x 6.1	289	×0.79	6.4 x 8.5	4.8 x 6.4	421	×0.75
					8.2 x 11	6.1 x 8.2	375	×0.59	11 x 14	7.9 x 11	669	×0.45
50					5.5 x 7.4	4.1 x 5.5	281	×0.87	5.8 x 7.8	4.4 x 5.8	412	×0.82
					7.4 x 9.8	5.5 x 7.4	361	×0.65	9.5 x 13	7.1 x 9.5	647	×0.50
60									5.0 x 6.6	3.7 x 5.0	400	×0.97
									7.9 x 11	5.9 x 7.9	614	×0.61

- Indicated values are based on calculation and actual measurements may differ. Use values as a reference.
- Accuracy of the products is guaranteed only when used without additional attachments.
  Please note that when using in combination with a close-up ring or other equipment
  Working distance and image will be distorted due to enlargement of the lens tolerance.

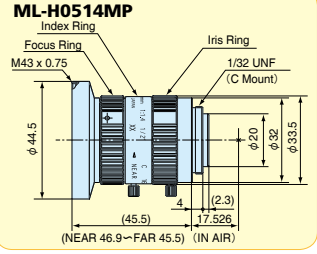
Mega Pixel CCTV Lens Series

- Lineup of 6 models (f = 5~50mm)
- Compatible with mega pixel cameras
- Variable focus and iris
- Equipped with screws to lock movable parts (focus and iris)
- Maximum compatible camera format ~2/3 ”
- C mount

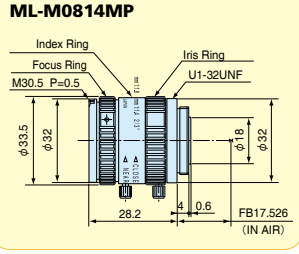
The Mega pixel CCTV Series provides monitor lenses developed for wide view image recognition with higher definition. The ability of the lenses to realize a resolution of higher than 100/mm both at the center and periphery when photographing at close distances is a particularly strong feature. In combination with a mega pixel camera, photography of a higher resolution and contrast than conventional CCTV is achieved. With all model variations of the variable iris and focus (with locking screws) optional positions can be set as required(*1). The lenses also support macro photographing in combination with a close-up ring and a rear converter lens (*2).

(*1) Vibration resistance is not considered in design.
(*2) If a close-up ring and a rear converter lens are used, individual differences in product performance, or image deterioration occurs due to an enlargement of lens tolerance.
(Images must be checked when using the lenses. Contact us if uncertain.)
Note: Product performance is guaranteed only if the product is used without additional attachments.

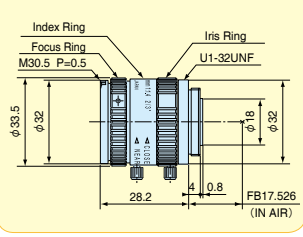
ML-H0514MP



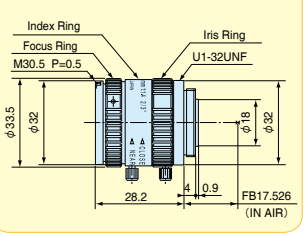
ML-M0814MP



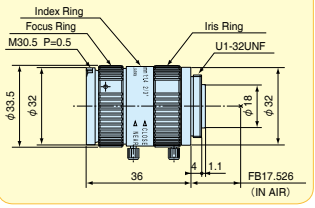
ML-M1214MP



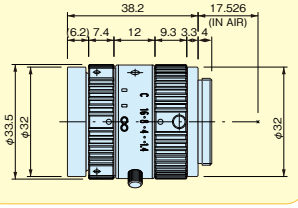
ML-M1614MP



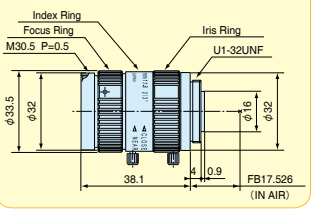
ML-M2514MP



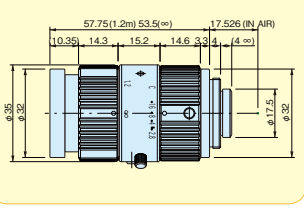
ML-M3514MP



ML-M5018MP



ML-M7528MP

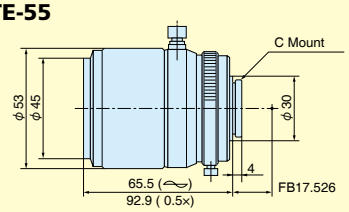


Model	Focal Distance (f)	Aperture (FNO)	Field of View (VXH)	Closest Distance	Filter Screw	Weight	Largest Compatible CCD	Mount	Product Code
ML-H0514MP	5mm	F1.4~16C	51.4°×65.5°	0.3m	M43 P0.75	107g	1/2"	C Mount	A-3100
ML-M0814MP	8mm	F1.4~16C	43.7°×56.3°	0.1m	M30.5 P0.5	70g	2/3"	C Mount	A-0221
ML-M1214MP	12mm	F1.4~16C	30.8°×40.4°	0.15m	M30.5 P0.5	65g	2/3"	C Mount	A-0222
ML-M1614MP	16mm	F1.4~16C	23.4°×30.8°	0.3m	M30.5 P0.5	65g	2/3"	C Mount	A-0223
ML-M2514MP	25mm	F1.4~16C	15.1°×20°	0.3m	M30.5 P0.5	75g	2/3"	C Mount	A-0224
ML-M3514MP	35mm	F1.4~16C	10.4°×13.9°	0.3m	M30.5 P0.5	87g	2/3"	C Mount	A-0227
ML-M5018MP	50mm	F1.8~16C	7.9°×10.5°	0.5m	M30.5 P0.5	90g	2/3"	C Mount	A-0225
ML-M7528MP	75mm	F2.8~16C	5.1°×6.8°	0.3m	M30.5 P0.5	113g	2/3"	C Mount	A-0228

Telecentric CCTV lens
MTE-55

The MTE-55 lens adopts F2.8/ f-55mm telecentric optical system that reduces angle and magnification errors when observing objects. Accurate telecentric performance is achieved when combined with the optional lens MTE2 with at a magnification of 0.4× ~ 0.9×. Although no telecentric effect is achieved at the magnification of infinite ~ 0.4×, it is designed to correct aberrations far better than regular lenses.

MTE-55



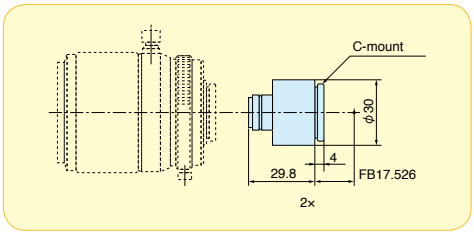
Model	MTE-55
Magnification	Infinite to 0.5X (when dedicated converter is used. 1.0x at max)
Focal Distance f (mm)	55
F no	2.8~close
Photographing Distance	Infinite to 140mm
Distortion	0.6% at max
Marginal Light Quantity	78.50%
Mount	C Mount
Filter Size	M43 P0.75
Largest Compatible Camera	2/3"
Weight	320g
Product Code	A-0212

Chart for Field of View by CCD Camera Size (MTE-55)

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

Options

■ ×2 Converter Lens (MTE2)

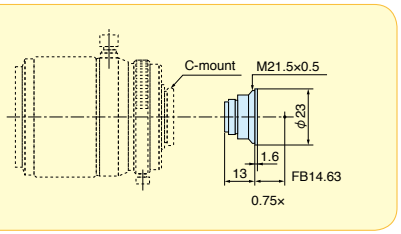


Dedicated ×2 Converter Lens	MTE2
Product Code	A-8083

Chart for Field of View by CCD Camera Size(MTE-55+MTE2)

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

■ ×0.75 Converter Lens (MTE075)



Dedicated ×0.75 Converter Lens	MTE075
Product Code	A-8084

Chart for Field of View by CCD Camera Size(MTE-55+MTE075)

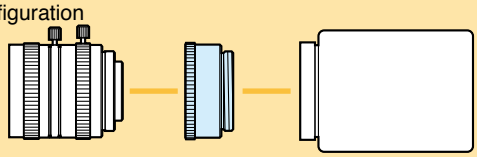
WD (mm)	MTE-55 +0.75×Converter Lenses (MTE075)			
	2/3" (Length × Width)	1/2" (Length × Width)	1/3" (Length × Width)	Optical Magnification
5000	733×977	553×733	400×533	×0.009
3000	440×586	320×426	226×293	×0.015
1000	176×234	120×160	81×109	×0.03
500	73×97	53×70	40×53	×0.09
300	41×54	32×42	22×29	×0.15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

Options for CCTV Lens

Rear Converter Lenses

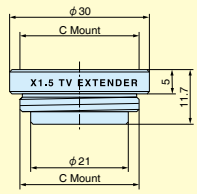
Attaching these lenses between a CCTV lens and a CCD camera enables the adjustment of magnification without changing the working distance of the system.
*May decrease the resolution.

Configuration

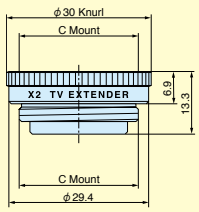


Model	Product Code
ML-1.5X	A-8090
ML-2X	A-8091
ML-2.5X	A-8092
ML-3X	A-8093
ML-4X	A-8094

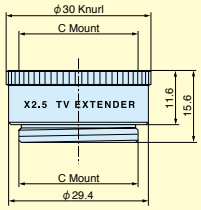
ML-1.5X



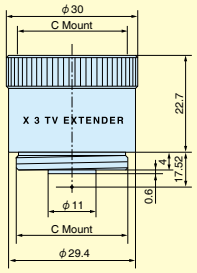
ML-2X



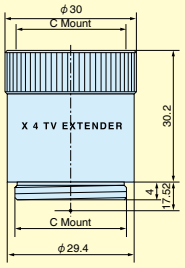
ML-2.5X



ML-3X



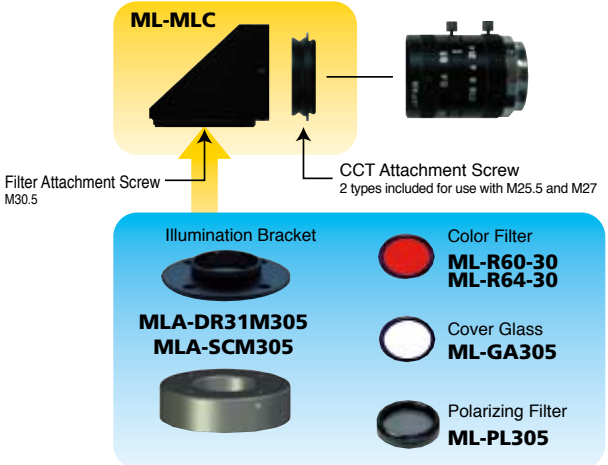
ML-4X



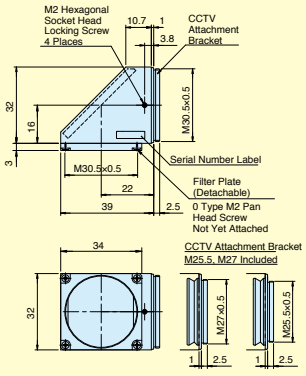
90° Mirror Prism for CCTV

ML-MLC

- Fully supports CCTV M25.5, 27, and 30.5.
- Equipped with screws to attach filters.



ML-MLC



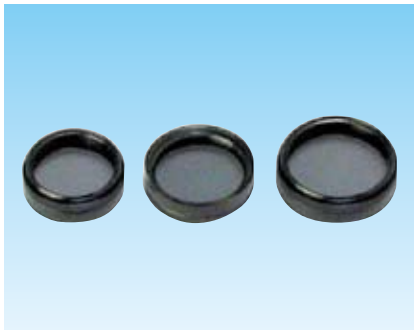
Model	Product Code
ML-MLC	A-8014

Options for CCTV Lens

Glass Covers **ML-GA**

A cover glass adapter for preventing the adhesion of dirt and foreign objects to the lens surface.

Polarizing Filters **ML-PL**



A polarizing filter adapter with revolution function for suppressing glare from objects and localized flare when used as a set with polarizing illumination.

Ring Illumination Attachment Adapters **ML-FL**

Ring illumination adapter ML-FL.

Options

Screw Pitch	255		270		305	
	Model	Product Code	Model	Product Code	Model	Product Code
Glass Covers	**ML-GA255**	A-8059	**ML-GA270**	A-8060	**ML-GA305**	A-8061
Polarizing Filter	**ML-PL255**	A-8067	**ML-PL270**	A-8068	**ML-PL305**	A-8069
Polarizing Filter (With Locking Screw)	**ML-PL255LB**	A-3130	**ML-PL270LB**	A-3131	**ML-PL305LB**	A-3132
Ring Illumination Attachment Adapter	**ML-FL255**	A-8075	**ML-FL270**	A-8076	**ML-FL305**	A-8077
Red Filter	**ML-R60-25**	A-8031	**ML-R60-27**	A-8032	**ML-R60-30**	A-8033
Sharp Cut Filter	**ML-R64-25**	A-9055	**ML-R64-27**	A-9056	**ML-R64-30**	A-9057
Close-Up Ring	**ML-EXR / ML-EXR1520 / ML-EXR3042**					

Close-Up Rings

Used when using the CCTV lens at a close distance or when enlarging the magnification.

See comparison table on page L-60 for the field of view, working distance, and magnification when close-up ring is attached.

Model	Remarks	Product Code
ML-EXR	Set of 7 (0.5, 1, 2, 5, 10, 20, 40)	A-8100
ML-EXR05	0.5mm	A-8101
ML-EXR1	1mm	A-8102
ML-EXR2	2mm	A-8103
ML-EXR5	5mm	A-8104
ML-EXR10	10mm	A-8105
ML-EXR15	15mm	A-8106
ML-EXR20	20mm	A-8107
ML-EXR25	25mm	A-8108
ML-EXR30	30mm	A-8109
ML-EXR40	40mm	A-8110
ML-EXR50	50mm	A-8111
ML-EXR100	100mm	A-8112
ML-EXR1520	Variable Type (15 to 20 mm)	A-8113
ML-EXR3042	Variable Type (30 to 42 mm)	A-8114

Telecentric Lenses

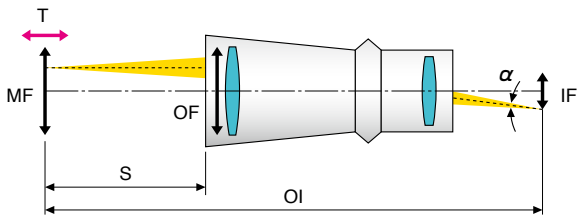
VISIONMES®

Telecentric Lenses
VISIONMES®

Carl Zeiss

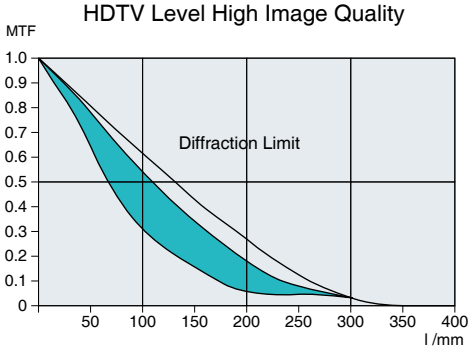
Ultimate Measuring Environment with Outstanding Performance

- The ultimate in distortion-free images.
- Able to recognize accurate images of the structure and form of complicated objects.
- A high performance optical lens that presents quality at the HDTV level.
- High numerical aperture (NA) enables the achievement of a bright image even in a short exposure time.
- Lineup offering a maximum diameter of ϕ300mm.

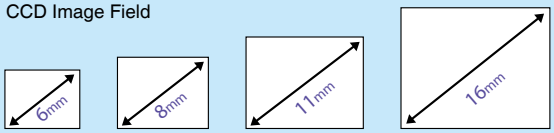


MF	Measurement Field	Measurement range (Length × Width)
OF	Object Field	Lens opening diameter at object side (ϕmm)
IF	Image Field	CCD element surface
OI	Distance Between Object & Image	Distance from object surface to CCD element
S	Working Distance	Distance from end of metal material to focus position
T	Telecentric Range	Range in which measurement of an accurate image is possible if the object moves up and down
Sin α	Numerical Aperture	
Mag.	Magnification	Image field ÷ Object field

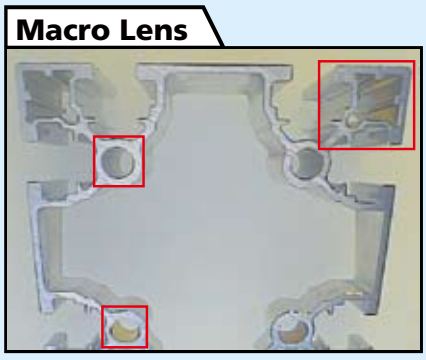
HDTV Level High Image Quality

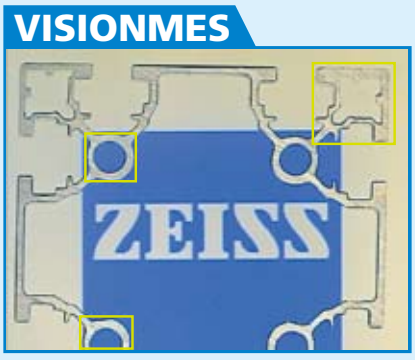


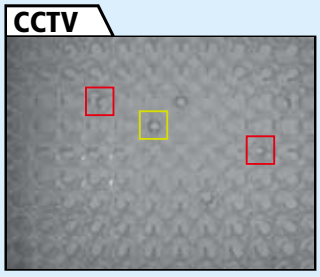
CCD Image Field

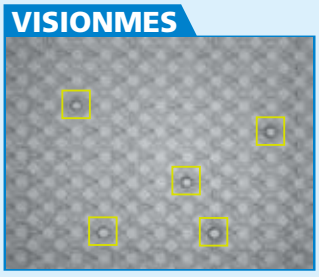


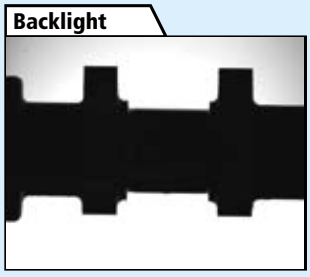
Sample Images











Application

Early detection of defects by performing batch inspections at various inspection points on the production line.

Molding • Casting	Wide-range, 3D inspection for dimension measurements (internal diameter, external form, diameter, concentricity)
Semiconductors	Inspection for uneven surfaces and damage in silicon wafers, pattern verification
Various Parts	Mass batch inspection without contact for bolts, wipers, screws, plastic parts, plastic bottles and rubber products

Optical Specifications

Telecentric Lens for 1/3" CCD Camera (Angle 6mm)

Model	Object Field (mm)	CCD (mm)	Image Side NA	Working Distance WD (mm)	Telecentric Range (mm)	Depth of Field (mm)	Magnification (×)	Measurement Field (mm)
18/6/0.05	18	6	0.05	66	+/–10	+/–3	0.33	10×14
35/6/0.1	35	6	0.1	67	+/–2.5	+/–7.5	0.17	20×27
70/6/0.1	70	6	0.1	113	+/–13	+/–25	0.086	41×55
105/6/0.1	105	6	0.1	182	+/–16	+/–50	0.057	62×82

Telecentric Lens for 1/2" CCD Camera (Angle 8mm)

Model	Object Field (mm)	CCD (mm)	Image Side NA	Working Distance WD (mm)	Telecentric Range (mm)	Depth of Field (mm)	Magnification (×)	Measurement Field (mm)
11/8/0.01	11	8	0.01	160	+/–9	+/–6	0.72	6×8
35/8/0.1	35	8	0.1	64	+/–2	+/–4	0.228	21×28
70/8/0.1	70	8	0.1	103	+/–10.5	+/–16	0.114	43×55
105/8/0.1	105	8	0.1	171	+/–12	+/–33	0.076	65×83
150/8/0.1	105*	8	0.1	225	+/–35	+/–75	0.05	93×118
225/8/0.1	225*	8	0.1	340	+/–55	+/–165	0.035	140×177
300/8/0.1	300*	8	0.1	450	+/–75	+/–300	0.026	187×236

Telecentric Lens for 2/3" CCD Camera (diagonal 11 mm)

Model	Object Field (mm)	CCD (mm)	Image Side NA	Working Distance WD (mm)	Telecentric Range (mm)	Depth of Field (mm)	Magnification (×)	Measurement Field (mm)
11/11/0.02	11	11	0.02	54	+/–2.5	+/–1.25	1	6×8
11A/11/0.02	11A (Made-to-Order)	11	0.02	17	+/–5	+/–1.25	1	6×8
11B/11/0.02	11B (Made-to-Order)	11	0.02	54	+/–5	+/–1.25	1	6×8
13/11/0.01	13	11	0.01	65	+/–2	+/–1	0.846	8×10
22/11/0.05	22	11	0.05	66	+/–2.5	+/–2	0.5	13×17
22A/11/0.05	22A	11	0.05	56	+/–5	+/–2	0.5	13×17
35/11/0.1	35	11	0.1	58	+/–1.4	+/–2	0.314	21×28
70/11/0.1	70	11	0.1	75	+/–8	+/–9	0.157	43×55
105/11/0.1	105	11	0.1	121	+/–10	+/–20	0.104	65×83
150/11/0.1	150*	11	0.1	165	+/–25	+/–38	0.07	90×120
225/11/0.1	225*	11	0.1	250	+/–44	+/–90	0.048	135×180
300/11/0.1	300*	11	0.1	335	+/–55	+/–150	0.036	180×240

Telecentric Lens for 1" CCD Camera (Angle 16mm) (Made-to-Order)

Model	Object Field (mm)	CCD (mm)	Image Side NA	Working Distance WD (mm)	Telecentric Range (mm)	Depth of Field (mm)	Magnification (×)	Measurement Field (mm)
8/16/0.08	8*	16	0.08	50	+/–1	+/–0.05	2	3×4
16/16/0.1	16*–LD	16	0.1	92	+/–2	+/–0.2	1	6×9
32/16/0.1	32*	16	0.1	78	+/–4	+/–0.8	0.5	13×17
70/16/0.1	70*	16	0.1	58	+/–4	+/–4	0.23	40×40
150/16/0.1	150*	16	0.1	110	+/–20	+/–17	0.1	86×86
300/16/0.1	300*	16	0.1	230	+/–40	+/–60	0.05	172×172

Telecentric Lens for 1.1" CCD Camera (Angle 18mm)

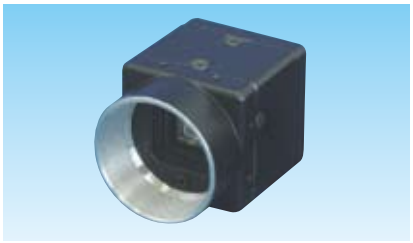
Model	Object Field (mm)	CCD (mm)	Image Side NA	Working Distance WD (mm)	Telecentric Range (mm)	Depth of Field (mm)	Magnification (×)	Measurement Field (mm)
6/18/0.029	6	18	0.029	85	+/–1	+/–0.1	3	2×3

A = Object side lens (90° L-shaped type)
B = Imaging side lens (90° L-shaped type)
* = Variable aperture model
LD = Long working distance

Peripheral Equipments

CCD Cameras

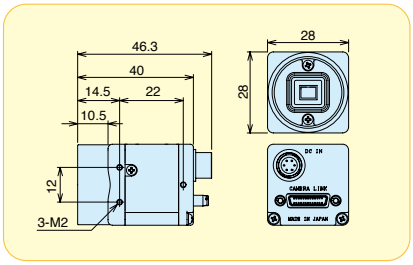
Video Output		Number of Effective Pixels
TV Format	752 X 485	380 Thousand
VGA	640 X 480	330 Thousand
SVGA	800 X 600	480 Thousand
XGA	1024 X 768	800 Thousand
SXGA	1280 X 1024	1.3 Million
UXGA	1600 X 1200	2 Million or More



STC-CL/CLC/A Series

Industry Smallest 28mm×28mm CCD Camera

Progressive	Digital/Analog
Black & White/Color	VGA/XGA/SXGA/UXGA



STC-CL33/Black & White Camera Link
STC-CLC33/Color Camera Link
STC-A33/Black & White Analog
1/3 Type Progressive Scan CCD
330 Thousand Effective Pixels/659(H)×494(V)
Pixel Size/7.4µm(H)×7.4µm(V)
Frame Rate/90fps
High-Rate Scan Function/Arbitrary Positioning/Line Readout

STC-CL83/Black & White Camera Link
STC-CLC83/Color Camera Link
STC-A83/Black & White Analog
1/3 Type Progressive Scan CCD
800 Thousand Effective Pixels/1034(H)×768(V)
Pixel size/4.65µm(H)×4.65µm(V)
Frame Rate/30fps
High-Rate scan Function/Arbitrary Positioning/Line Readout

STC-CL152/Black & White Camera Link
STC-CLC152/Color Camera Link
STC-A152/Black & White Analog
1/2 Type Progressive Scan CCD
1.45 Million Effective Pixels/1392(H)×1040(V)
Pixel Size/4.65µm(H)×4.65µm(V)
19 Fps
High-Rate Scan Function/Arbitrary Positioning/Line Readout

STC-CL202/Black & White Camera Link
STC-CLC202/Color Camera Link
STC-A202/Black & White Analog
1/1.8 Type Progressive Scan CCD
2.01 Million Effective Pixels/1628(H)×1236(V)
Pixel Size/4.40µm(H)×4.40µm(V)
Frame Rate/15fps
High-Rate Scan Function/Arbitrary Positioning/Line Readout

Model	Product Code
STC-CL33	A-1141
STC-CLC33	A-1142
STC-A33	A-1143
STC-CL83	A-1144
STC-CLC83	A-1145
STC-A83	A-1146

Model	Product Code
STC-CL152	A-1163
STC-CLC152	A-1164
STC-A152	A-1165
STC-CL202	A-1147
STC-CLC202	A-1148
STC-A202	A-1149

STC-USB Series

Digital USB2.0 Output Type

Progressive	Digital
Black & White/Color	VGA / XGA

STC-B33USB-AT/Black &White VGA Camera
STC-C33USB-AT/Color VGA Camera
1/3 Type Progressive Scan CCD
330 Thousand Effective Pixels/659(H)×494(V)
Pixel Size/7.4µm(H)×7.4µm(V)
Frame Rate/60fps
High-Rate Scan Function/Highest 240Fps/80Line

STC-B83USB-AT/Black &White XGA Camera
STC-C83USB-AT/Color XGA Camera
1/3 Type Progressive Scan CCD
800 Thousand Effective Pixels/1034(H)×768(V)
Pixel Size/4.65µm(H)×4.65µm(V)
Frame Rate/30fps
High-Rate Scan Function/Highest 120Fps/136Line

Model	Product Code
STC-B33USB-AT	A-1150
STC-C33USB-AT	A-1151
STC-B83USB-AT	A-1152
STC-C83USB-AT	A-1153

STC-232 Series

UXGA, 30fps, Highest Speed Camera

Progressive	Digital
Black & White/Color	UXGA

STC-CL232/Black &White Camera Link
STC-CLC232/Color Camera Link

1/1.8 Type Progressive Scan CCD
2.01 Million Effective Pixels/1978(H)×1236(V)
Pixel Size/4.40µm(H)×4.40m(V)
Frame Rate/Compatible with 30fps
Compatible with Each Type of Scanner Mode
Case Size/28mm(W)×28mm(H)×47mm(V)

Model	Product Code
STC-CL232	A-1166
STC-CLC232	A-1167

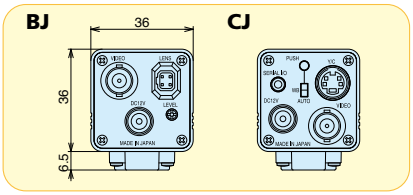
STC-N63 Series

Compact Case Type Color Camera

TV Format	NTSC
Color	380 Thousand Pixels

STC-N63 BJ / CJ

1/3 Type Interline CCD
380 Thousand Effective Pixels/768(H)×494(V)
Pixel Size/6.35µm(H)×7.40m(V)
Video Output/VBS, Y/C



Model	Product Code
STC-N63 BJ	A-1154
STC-N63 CJ	A-1161

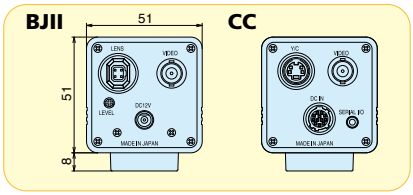
STC-620 Series

1/2 inch color camera of high sensitivity and definition

TV Format	NTSC
Color	380 Thousand Pixels

STC-620 BJII / CC

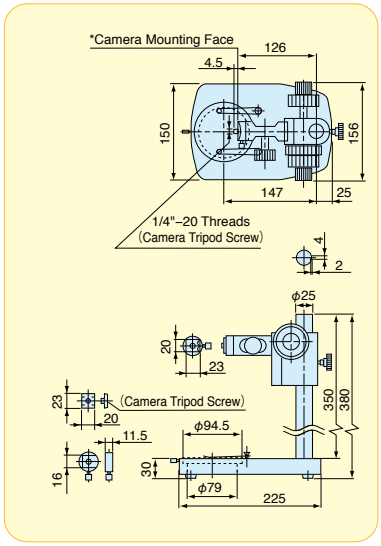
1/2 Type Interline CCD
380 Thousand Effective Pixels/768(H)×494(V)
Pixel Size/8.4µm(H)×9.8m(V)
Video Output/VBS, Y/C



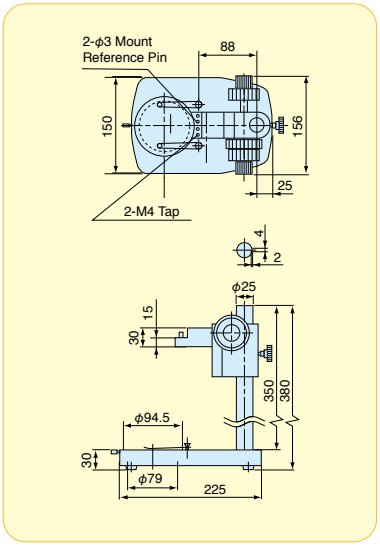
Model	Product Code
STC-620 BJII	A-1155
STC-620 CC	A-1162

Stands

CCD Camera Stands

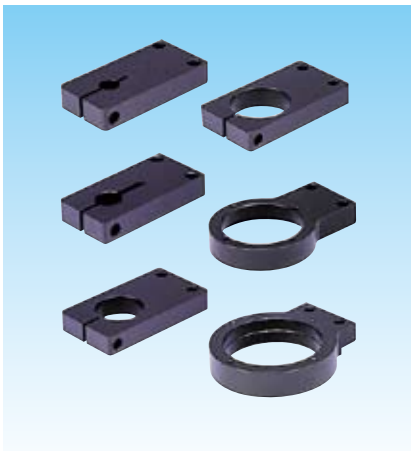


Model	Product Code
MML-STD5A	A-0257



Model	Product Code
MML-STD5B	A-0258

Lens Mounting Holder for Stand

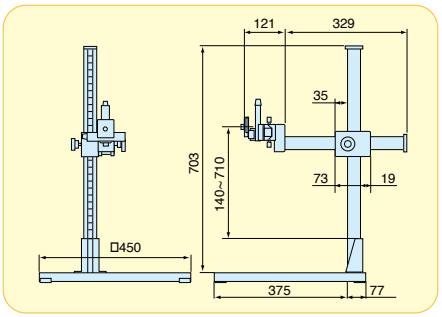


Model	Lens Type	Product Code
MML-HA12	Lens External Diameter ϕ12	A-0264
MML-HA16	Lens External Diameter ϕ16	A-0265
MML-HA33	Lens External Diameter ϕ33	A-0266
MML-HA40	Lens External Diameter ϕ40	A-0267
MML-HA62	ML-Z07545·D·PL	A-0268
MML-HA70	ML-Z0220D	A-0269

*Use the parts in combination with MML-STD5B at left.

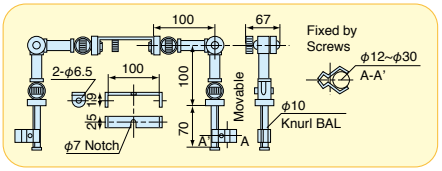
XY Micro Motion Stage

*Using the option enables to hold a straight light guide. The holder can be fixed to the stand.



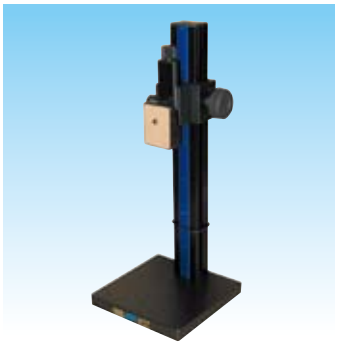
Model	Product Code
MML-STD700	A-0275

Option
(Light Guide Holder)



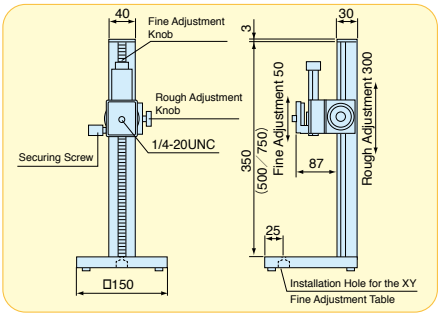
Model	Product Code
MLH-60EX	A-0276

3 Legged Screw Type Stand



*Standard pole height is 350 mm. 500 and 750 mm models are also available.

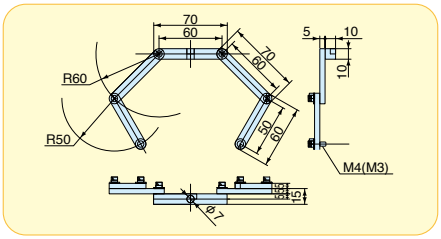
* When used with the options, the stand holds Ring LED and Ring Light Guides.
Fixed to back of stand by M3 screws



Model	Product Code
MLH-50-L350	A-0277
MLH-50-L500	A-0324
MLH-50-L750	A-0325

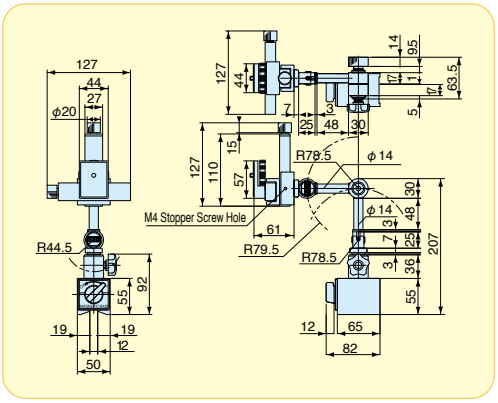
Option

(LED Illumination Device Holder)



Model	Product Code
LED Illumination Device Holder	A-0278

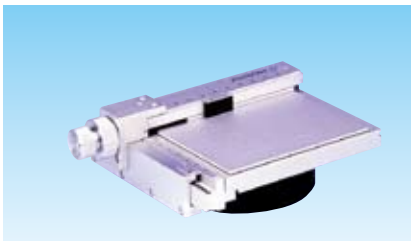
MLH-FAC



Model	Product Code
MLH-FAC	A-0326

Stages

XY Stage

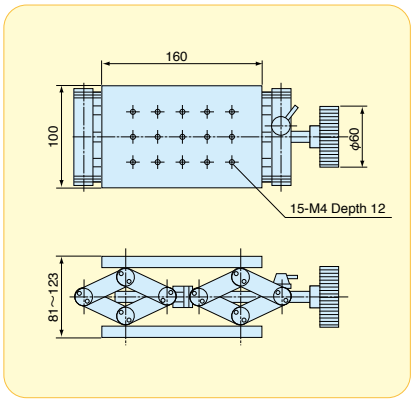


•Can be attached easily to the CCD Camera Stands MML-STD5A/5B.
•Suitable for simple experiments since movement is in an X and Y direction.

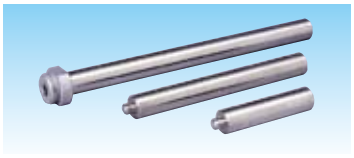
Model	Product Code
MML-XY2	A-0284

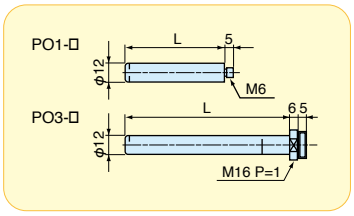
Z Stage

Model	Product Code
MML-STD-Z	A-0285



Stand Poles



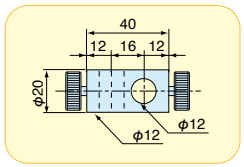


Model	Diameter	Length	Product Code
PO1-20 **PO1-80**	12	20~80*1	–
PO1-100	12	100	A-0298
PO1-120	12	120	A-0299
PO1-150	12	150	A-0300
PO1-200	12	200	A-0301
PO1-250	12	250	A-0302
PO1-300	12	300	A-0303
PO1-400	12	400	A-0304
PO1-500	12	500	A-0305

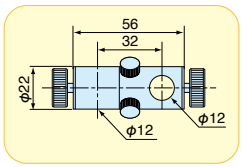
*1 Please specify in units of 10mm.

Model	Diameter	Length	Product Code
PO3-100	12	100	A-0306
PO3-120	12	120	A-0307
PO3-150	12	150	A-0308
PO3-200	12	200	A-0309
PO3-250	12	250	A-0310
PO3-300	12	300	A-0311
PO3-400	12	400	A-0312
PO3-500	12	500	A-0313

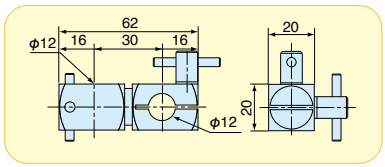
Cross Clamps



Model	Product Code
CL1-1212	A-0314

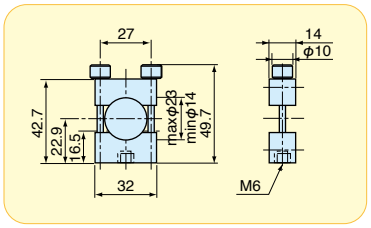


Model	Product Code
CL2-1212	A-0315



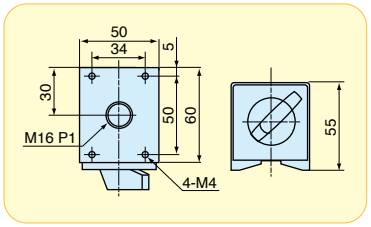
Model	Product Code
CL3-1212	A-0316

Fiber Holder



Model	Product Code
FC-01	A-0317

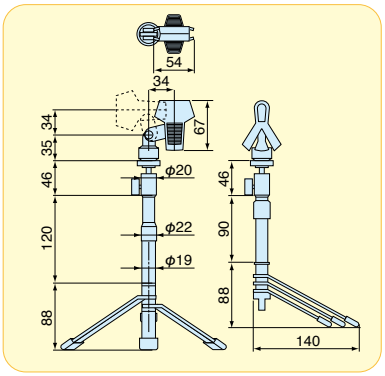
Magnetic Base



Model	Product Code
MGB-6050	A-0318

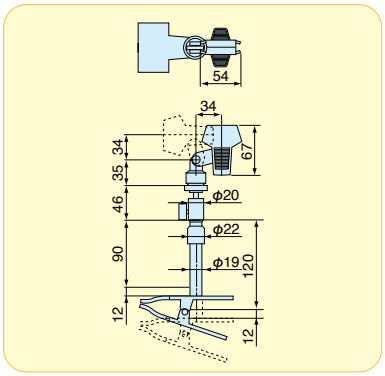
Light Guide Holding Arms

Tripod Type



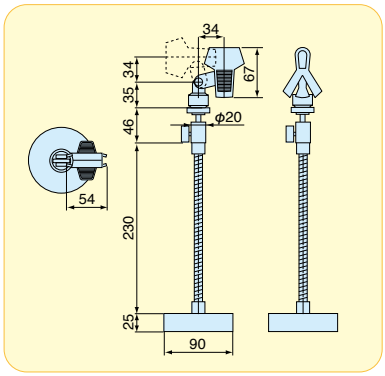
Model	Product Code
MLH-10	A-0319

Clip Type



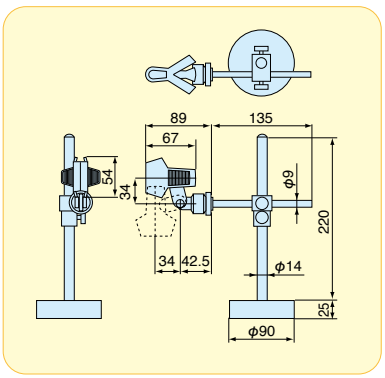
Model	Product Code
MLH-20	A-0320

Interlocking Type



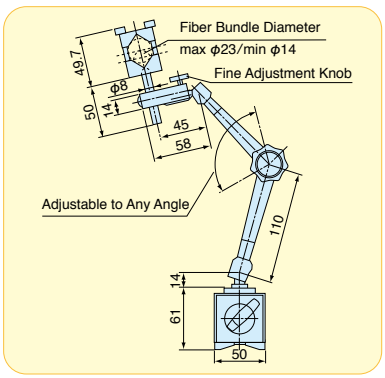
Model	Product Code
MLH-30	A-0321

Arm Type



Model	Product Code
MLH-40	A-0322

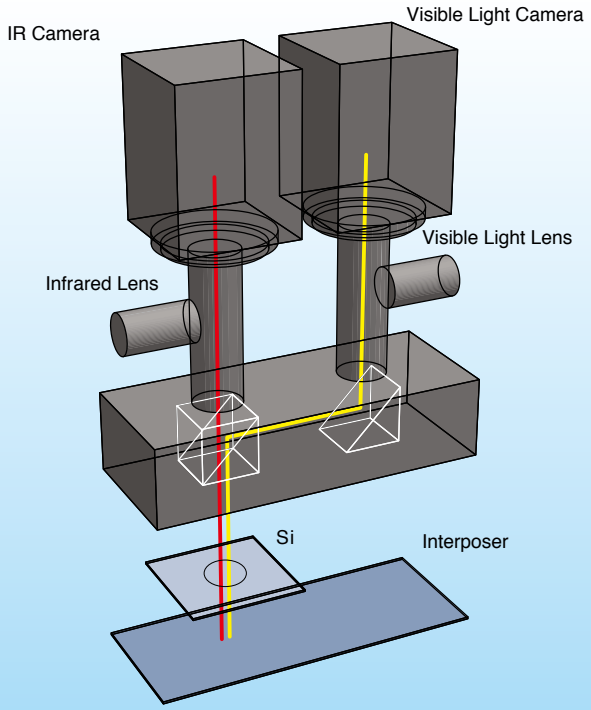
Magnetic Base Type



Model	Product Code
MLH-70	A-0323

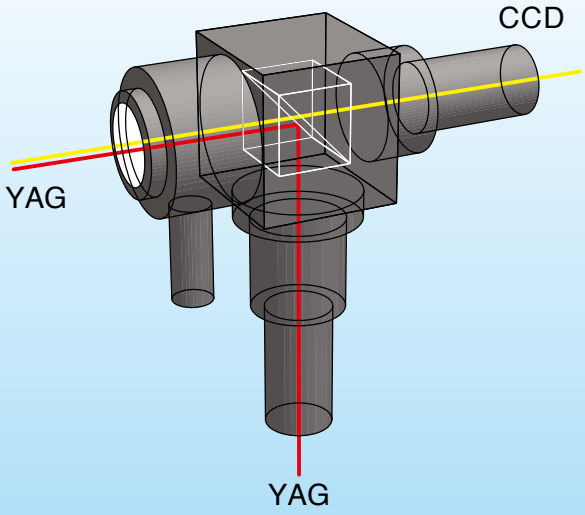
Total Optical Illumination System

Infrared & Visible Ray Transmission System



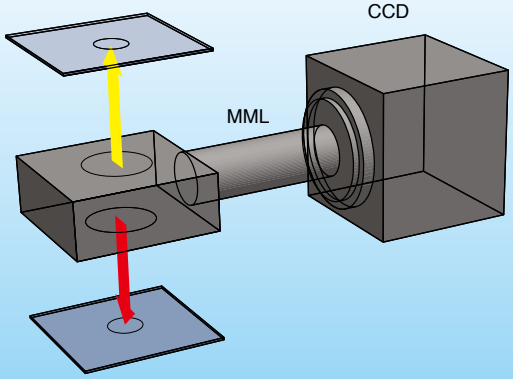
A total lens and lighting system which uses infrared rays to transmit through a Si, GaAS, or Ge substrate to recognize IR penetration patterns

YAG Laser Optical System



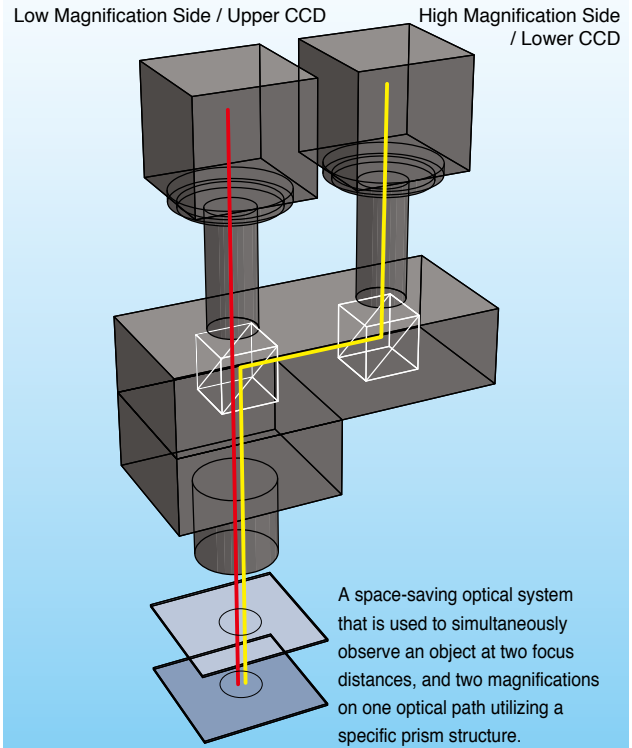
A space-saving optical system to check YAG laser welding and assembly on an optical path, using a CCD.

Top and Bottom Dual Field Optical System (2CCD Type)



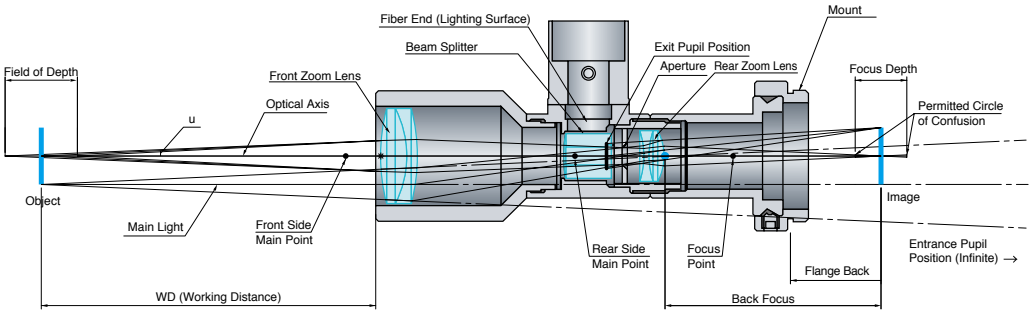
A space-saving optical system for attaching 2 opposite-facing objects with accuracy.

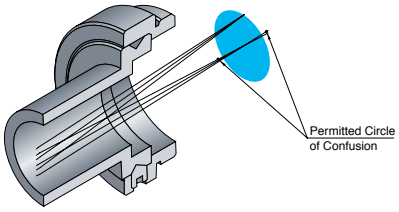
Twin-View, Dual Magnification/Twin-View, Dual Focal Optical System



A space-saving optical system that is used to simultaneously observe an object at two focus distances, and two magnifications on one optical path utilizing a specific prism structure.

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





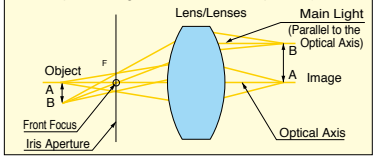
*This diagram is intended for the purpose of explaining technology. The positions and distances shown in this diagram are not necessarily accurate.

Performance

Telecentric Optics

An optical system where the principal ray is parallel to the lens optical axis. An optical system where the light comes from an object toward a lens and stays parallel to the optical axis, even outside the axis, is called object side telecentric optics. A system where the light comes from a lens toward an image and stays parallel to the optical axis, even outside the axis, is called image side telecentric optics. Telecentric optics indicated in this catalog are object side telecentric optics.

■ Example of Image Side Telecentric Optical System



Resolution (μm)

Resolution is a measured by how closely 2 points can be before they cannot be distinguished. For example, 1μm resolution means that 2 points that are 1μm away from each other can be distinguished. Resolution values in this catalog are theoretical resolutions for the lenses. The following is a formula to calculate theoretical resolution based on a lens's ray diffraction with no aberration.

(Rayleigh formula)

$$\text{Resolution} = \frac{0.61 \times \lambda}{NA}$$

λ : Wavelength 0.61: Fixed Number

Resolution (Lines/ mm)

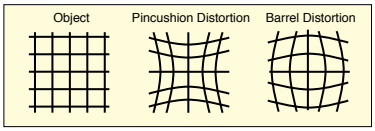
Resolution indicates the number of black and white lines distinguished within 1mm in an image through a black and white grid-like chart lens. Resolution is expressed by lines/ mm. For example, 100 lines/mm means that black and white pitch 1/100mm (10μm) can be distinguished. Width of both the black and white lines is 1/200mm (5μm).

Horizontal TV Resolution (TV lines)

The total number of black and white horizontal stripes in the width, equivalent to the height of the vertical height on a TV monitor screen. The total stripes in the horizontal width would be 3/4, because the ratio of vertical and horizontal length of the screen is usually 3:4. When the horizontal TV resolution is 240TV lines, total stripes in the horizontal width of the TV monitor would be 320 lines. When measuring resolution of a lens, a pair of black and white lines is counted as one line. However, for TV lines, one pair is counted as 2TV lines.

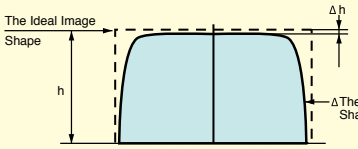
Distortion (%)

Distortion is the aberration of a lens where a straight object outside of the optical axis appears curved. Distortion of a straight line towards the center is called pincushion distortion, while distortion expanding outwards is called barrel distortion



TV Distortion (%)

Image distortion on a TV monitor. The closer to zero, the better the performance.



$$\text{TV distortion (\%)} = \frac{\Delta h}{2h} \times 100$$

The curve amount on the long side is considered as distortion. Percentage of the depth of distortion Δh against vertical screen is TV distortion

Aperture Efficiency Marginal Light Quantity (%)

Aperture efficiency indicates the brightness difference between the optical axis of the image formation plane and its surrounding area when an evenly bright object is captured with a lens. It is expressed by percent (%) assuming that the center brightness is 100. It is one of the optical characteristics of a lens. Marginal light quantity in this catalog indicates aperture efficiency.

Shading (%)

Shading is the brightness difference between the center of a TV monitor and its edges when an evenly bright object is captured with a lens and a CCD-TV camera. It is expressed by percent (%). Generally, this percentage is calculated based on power ratio of light receiving elements and CCD elements. Shading indicates comprehensive performance of a lens and TV camera. To make shading smaller, telecentric optics is used.

Chromatic Aberration

In lens optics, positions where images are formed and image magnification differ according to the light's wavelength. Rays of different wavelengths have different colors. This is called chromatic aberration. Aberration on the optical axis is called chromatic aberration on the axis, and magnification difference is called magnification chromatic aberration.

Distance

WD (Working Distance) (mm)

Distance from the front end of a lens system to the object under inspection.

Focal Distance f (mm) Back Focus / Front Focus

Focal distance is the distance from the optical system's principle point to the focal point. Distance from the vertex of the last lens to the back focal point is called back focus. Distance from the vertex of the first lens to the front focal point is called front focus.

Depth of Field

Depth is the distance between the nearest and farthest points that appear in acceptably sharp focus when an object is shifted back and forth from the best focal point. Depth range of the object side is called depth of field.

$$\text{Depth of Field} = 2\,(\text{Permissible Circle of Confusion} \times \text{Effective FNO} \times \text{Magnification}^2)$$

Images through lenses theoretically form as points. Acceptable blur on an acceptably clear image is called the permissible circle of confusion

Depth of Focus

Depth is the distance between the nearest and farthest points that appear in acceptably sharp focus when a CCD is shifted back and forth from the best focal point. Depth range of the image side is called depth of focus.

Flange Back (mm)

Distance from the front of the camera mount plane to the image.

C-Mount Specifications

Name	Standard External Diameter	No. of Screw Threads (for 25.4mm)	Flange Back
U1	25.400mm	32 Threads	17.526mm

Brightness

Numerical Aperture NA, NA'

When the half angle that an object makes on the entrance pupil is u, and refractive index is n, n x sin u is called object side numerical aperture, NA.
When the half angle that an image makes on exit pupil is u', and refractive index is n', n' x sin u' is called image side numerical aperture, NA'.
NAs in this catalog indicate object side numerical apertures. Numerical aperture is an important value that expresses lens resolution and brightness.

$$NA = n \times \sin u \qquad NA' = n' \times \sin u'$$

The higher the NA, the greater the resolution and brightness are of the lens.

F Number F No

The value indicates lens brightness. It is calculated by dividing the focal distance of the lens by its effective diameter (entrance pupil diameter D mm) looking from its object side. It can also be calculated by NA and the lens' optical magnification (β). The smaller the number the brighter the lens is.

$$F\ No = f/D$$

Effective F No

The value indicates lens brightness when an object is located in finite distance, the value which indicates the brightness when actually operated. The higher the optical magnification (β), the darker the lens is.

$$\text{Effective F No} = \beta/(2 \times NA) = (1 \times NA')$$
$$\text{Effective F No} = (1+\beta) \times F\ No^*$$

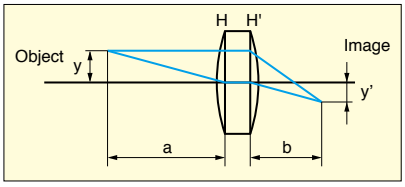
*Approximation for Thin-Walled Systems

Magnification

Optical Magnification β

Image size ratio against the object size.

$\beta = y'/y$
$= b/a$
$= NA/NA'$
$=$ CCD Camera Element Size / Actual Size of Dield of View



Electronic Magnification

Electronic magnification is the magnification of an image on a CCD camera when it is displayed on a monitor screen.

Monitor Magnification

Monitor magnification is the magnification of an object displayed on a monitor screen through a lens.

$$\text{Monitor Magnification} = (\text{Optical Magnification } \beta) \times (\text{Electronic Magnification})$$

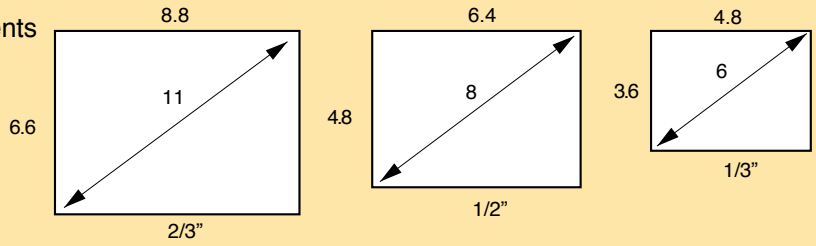
(Calculation Example) Optical Magnification β= 0.2x, CCD Size 1/2" (Diagonal Line 8mm), Monitor 14" :
Electronic Magnification =14 x 25.4 β 8 = 44.45 (Times)
Monitor Magnification = 0.2 x 44.45= 8.89 (Times) (1 Inch = 25.4mm)

Field of View

Field of view is the size of an object that can be shot when the lens is attached to a CCD-TV camera.
The size of field of view is (CCD format size) ÷ (optical magnification β).

(Calculation Example) Optical Magnification β=0.2x, CCD Size 1/2" (4.8mm Long, 6.4mm Wide) :
Size of Field of View Length =4.8/0.2=24 (mm)
Width =6.4/0.2=32 (mm)

Size of CCD Camera Elements

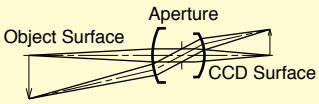


Formula

Resolution (μm)	=	0.61(Fixed Number) ×0.55 (Design Wavelength) ÷NA
Effective Fno	=	Magnification / 2NA
Depth of Field (mm)	=	2(Permissible Circle of Confusion Diameter × Effective Fno ÷ Magnifications^2)
Light Flux Diameter (ϕ)	=	2NA × Height from Object + Size of Field of View (Angle)

Features of Telecentric Optical System

Non-Telecentric Lens



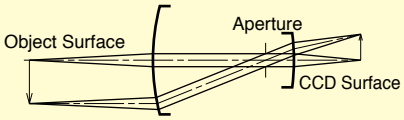
Advantages

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

Disadvantages

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

Object Side Telecentric Lens



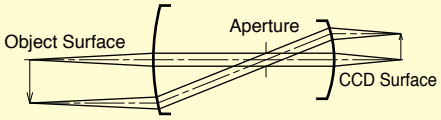
Advantages

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

Disadvantages

- Larger than regular lenses when coaxial illumination is not used.

Double-Sided Telecentric Lens



Advantages

- Similar to MML. However, accuracy improves when the size of camera flange back differs greatly.

Disadvantages

- Similar to MML. However, higher cost than MML.

Example of Attachment

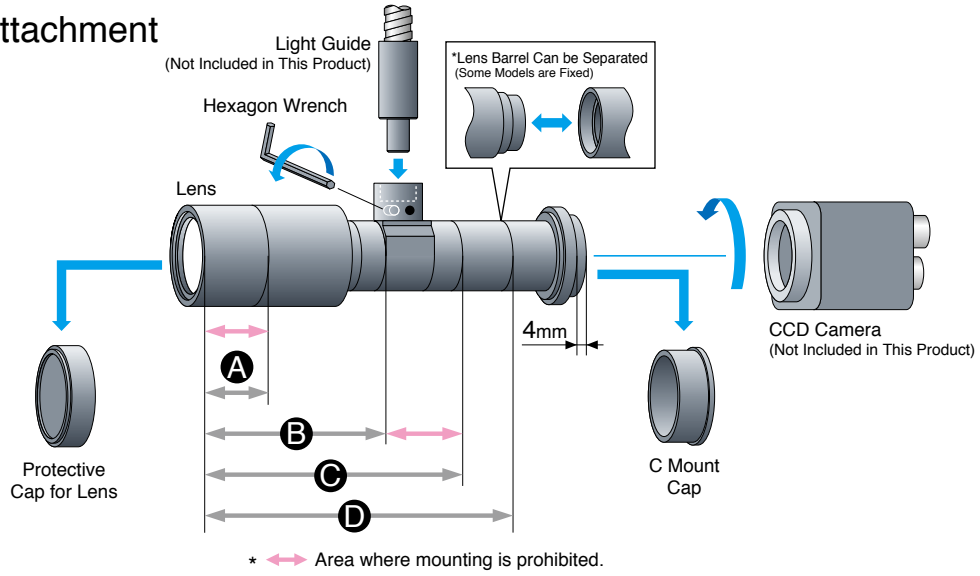


Chart for Positions That Cannot be Held, and That Can be Separated

Model	A	B	C	D
■ ST40 Series				
MML1-ST40D	11	17	34	37
MML1-ST40	11	17	34	
MML1.5-ST40D	10	14	30	34
MML1.5-ST40	10	14	30	
MML2-ST40D	9	12	27	32
MML2-ST40	9	12	27	
MML3-ST40D	9	12	27	32
MML3-ST40	9	12	27	
MML4-ST40D	10	10	27	31
MML4-ST40	10	10	27	
MML6-ST40D	10	10	27	31
MML6-ST40	10	10	27	
MML8-ST40D	10	10	27	31
MML8-ST40	10	10	27	

Model	A	B	C	D
■ ST65 Series				
MML08-ST65D	15	39	62	59
MML08-ST65	15	39	62	59
MML1-ST65D	15	33	53	53
MML1-ST65	15	33	53	
MML1.5-ST65D	11	23	41	44
MML1.5-ST65	11	23	41	
MML2-ST65D	15	25	46	46
MML2-ST65	15	25	46	
MML4-ST65D	20	26	47	85
MML4-ST65	20	26	47	
MML6-ST65D	20	30	47	100
MML6-ST65	20	30	47	
MML2-ST65DS	9	20	40	40
MML2-ST65S	9	20	40	
MML3-ST65DS	10	17	47	38
MML3-ST65S	10	17	47	
MML4-ST65DS	9	18	34	55
MML4-ST65S	9	18	34	
MML6-ST65DS	9	18	55	55
MML6-ST65S	9	18	55	
MML8-ST65DS	9	18	55	55
MML8-ST65S	9	18	55	

Model	A	B	C	D
■ ST110 Series				
MML08-ST110D	20	65	93	85
MML08-ST110	20	65	93	85
MML1-ST110D	20	50	75	75
MML1-ST110	20	50	75	
MML2-ST110D	20	44	68	64
MML2-ST110	20	44	68	
MML4-ST110D	15	29	68	49
MML4-ST110	15	29	68	
MML6-ST110D	15	29	68	49
MML6-ST110	15	29	68	
MML8-ST110D	15	29	68	49
MML8-ST110	15	29	68	
MML2-ST110DS	12	27	50	48
MML2-ST110S	12	27	50	
MML3-ST110DS	12	27	50	48
MML3-ST110S	12	27	50	

Model	A	B	C	D
■ Other ST				
MML1-ST150D	10	74	91	91
MML1-ST150	10	74	91	
MML08-ST170D	10	74	91	91
MML08-ST170	10	74	91	
MML1-ST300D	25	100	150	190

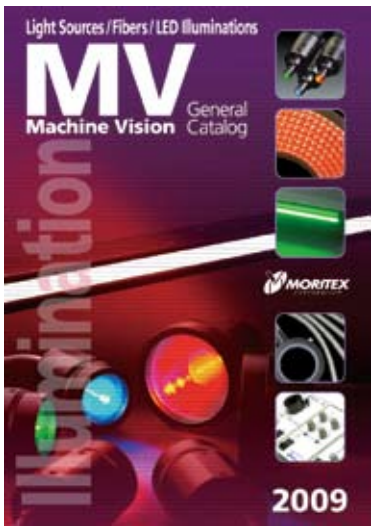
Model	A	B	C	D
■ HR65 Series				
MML05-HR65D	10	25	69	61
MML05-HR65	10	25	69	61
MML08-HR65D	15	35	64	59
MML08-HR65	15	35	64	59
MML1-HR65D	15	33	53	53
MML1-HR65	15	33	53	
MML1.5-HR65D	11	23	41	44
MML1.5-HR65	11	23	41	
MML2-HR65D	15	25	46	46
MML2-HR65	15	25	46	
MML4-HR65D	20	26	47	86
MML4-HR65	20	26	47	
MML6-HR65D	20	30	47	100
MML6-HR65	20	30	47	

Model	A	B	C	D
■ HR110 Series				
MML05-HR110D	11	67	102	93
MML05-HR110	11	67	102	93
MML08-HR110D	20	65	91	82
MML08-HR110	20	65	91	82
MML1-HR110D	30	64	95	81
MML1-HR110	30	64	95	81
MML1.5-HR110D	13	50	76	72
MML1.5-HR110	13	50	76	72
MML2-HR110D	20	43	70	68
MML2-HR110	20	43	70	68
MML4-HR110D	20	94	120	107
MML6-HR110D	15	105	120	110

Chart for Field of View

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

MV General Catalog
[Light Sources / Fibers / LED Illuminations]



Guide

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