K

Image Testing Components

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Image Testing Components

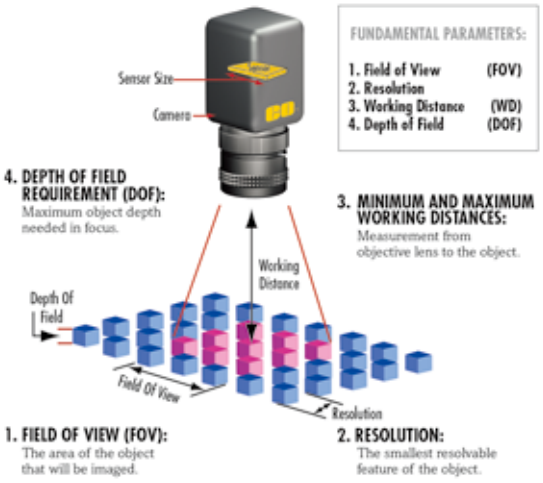
Technical Note

Where To Start?

Imaging System Basics

There are a few basic parameters that should be understood about every imaging system.

Knowing these parameters will help in selecting the ideal lens and camera combination.



Commonly Used Equations

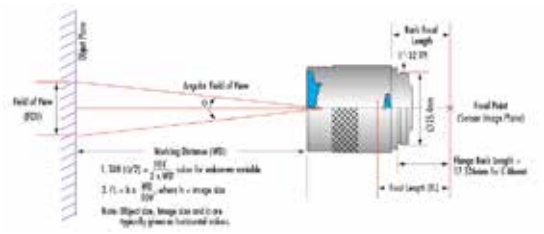
Analog	System Resolution
Horiz. Camera Res. (lp/mm) = Horiz. TV line x 1.333 / 2 x Sensor Size (Horiz.)	System Res. (µm) = Camera Res. (µm) / PMAG
Vertical Camera Res. (lp/mm) = Vertical TV line / 2 x Sensor Size (Vert.)	System Res. (lp/mm) = PMAG x Camera (lp/mm)

Digital	Magnification
Camera Res. (lp/mm) = # Pixels / 2 x Sensor Size	PMAG = Sensor Size (Horiz.) / Field of View (Horiz.)
Camera Res. (µm) = 2 x Pixel Size (µm)	System Mag. = PMAG x Monitor Size (diag.) / Sensor Size (diag.)

Abbreviations Used

Res. = Resolution
Horiz. = Horizontal
Mag. = Magnification
FOV = Field of View
Diag. = Diagonal
PMAG = Primary Magnification

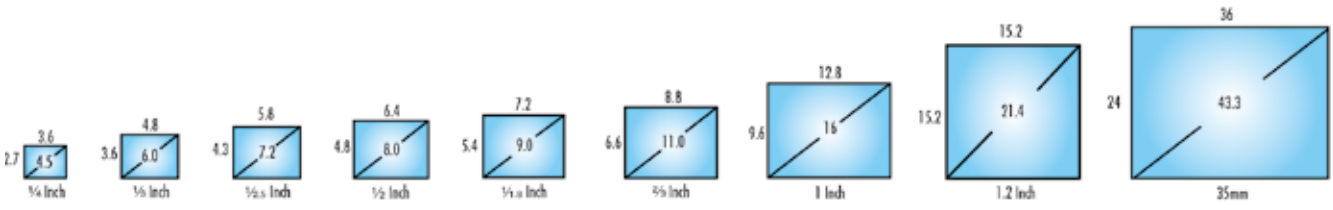
Fixed Focal Length Lenses



Camera Comparison

Sensor Size

* Determines System Field Of View (FOV)
* Determines Required Primary Magnification (PMAG)
* Most Have a 4:3 (H:V) Dimensional Aspect Ratio



Camera Resolution By Pixel Size

Pixel Size	10µm	7.5µm	6µm	5µm	4.5µm	4µm	3.5µm	3µm	2.5µm
Resolution	50 lp/mm	67 lp/mm	83 lp/mm	100 lp/mm	111 lp/mm	125 lp/mm	143 lp/mm	167 lp/mm	200 lp/mm
Typical 1/2" Sensor	0.3 MP	0.5 MP	0.9 MP	1.2 MP	1.5 MP	1.9 MP	2.5 MP	3.4 MP	4.9 MP
Typical 2/3" Sensor	0.6 MP	1.0 MP	1.6 MP	2.3 MP	2.9 MP	3.6 MP	4.7 MP	6.5 MP	9.3 MP

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彩色攝影機

WAT-221S2 1/2"

特性

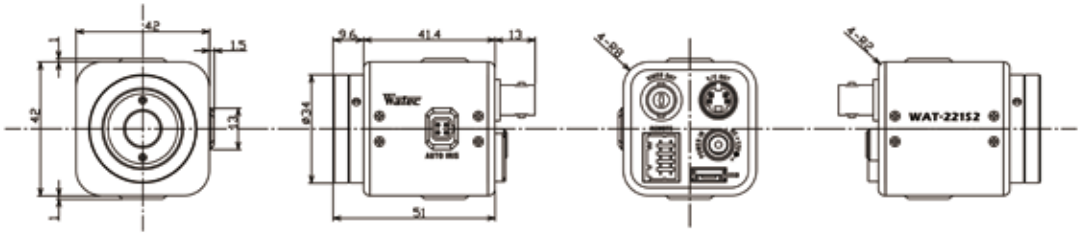
＊多功能
＊高感度
＊BNC & Y/C 雙輸出

功能

＊白平衡調整
＊電子快門調整
＊自動光圈
＊防止閃爍模式
＊AGC/MGC
＊背光補償
＊GAMMA 校正
＊光圈控制
＊影像 /DC 自動光圈選擇

規格

＊有效畫素 /410K
＊解析度 550 TVL
＊最低照度 /0.006 lx. F1.2
＊增益 /AGC ON (高：-3 ~ 44 dB , 低：-3 ~ 32 dB), MGC(-3 ~ 44 dB)
＊背光補償 /ON/OFF
＊信噪比 /55dB
＊電子快門 /EI (FL ~ 1/100000), OFF, FL, 1/250 , 1/500, 1/1000, 1/2000, 1/4000, 1/10000
＊白平衡 /ATW , PWB , MWB , 3200K , 4300K , 5100K , 6300K



彩色攝影機

WAT-231S2 1/3"

特性

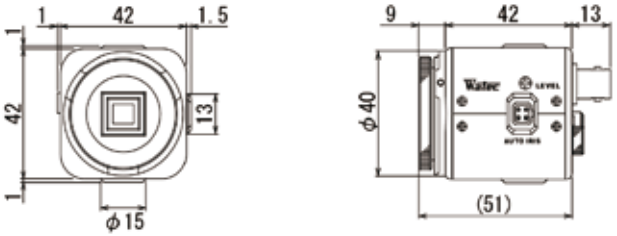
＊540 TVL
＊白點消除功能
＊手動 / 自動增益
＊全新後焦機構

功能

＊白點消除
＊白平衡設置
＊電子快門
＊自動光圈
＊防止閃爍模式
＊AGC/MGC
＊背光補燈
＊GAMMA 校正
＊影像 /DC 光圈自動選擇

規格

＊有效畫素 /380K
＊解析度 /540 TVL
＊最低照度 /0.05 lx. F1.2
＊增益 /AGC ON(高：0 ~ 38dB, 低：0 ~ 32dB), MGC(0 ~ 32dB)
＊背光補償 /ON/OFF
＊信躁比 /50dB
＊電子快門 /EI(1/60(N), EI (FL ~ 1/100000), OFF, FL , 1/250 , 1/500, 1/1000, 1/2000, 1/4000, 1/10000
＊白平衡 /ATW , PWB , MWB , 3200K ,4300K , 5100K , 6300K



彩色攝影機

WAT-250D2 1/3"

特性

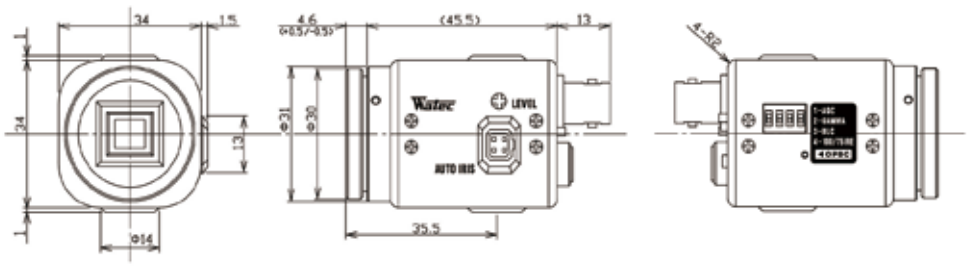
＊540 TVL
＊0.02 lx.F1.2
＊白點消除功能
＊全新後焦機構

功能

＊白點消除
＊自動光圈
＊防止閃爍模式
＊AGC
＊背光補償
＊GAMMA 校正
＊光圈控制
＊影像 /DC 自動光圈選擇

規格

＊有效畫素 /380K
＊解析度 540 TVL
＊最低照度 /0.1 lx. F1.2
＊增益 /AGC ON (0 ~ 38dB), OFF (0dB)
＊背光補償 /ON/OFF
＊信噪比 /50dB
＊白點消除 / 至 32 點
＊電子快門 /EI(1/60 ~ 1/100000), OFF, FL
＊白平衡 /ATW, PWB
＊重量 /90g



彩色攝影機

HD-13M

特性

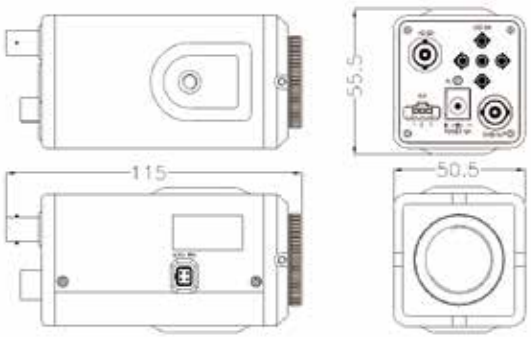
＊ 多功能
＊ 高感度
＊ BNC&HDMI 雙輸出

功能

＊白平衡調整
＊電子快門調整
＊自動光圈
＊防止閃爍模式
＊ AGC
＊背光補償
＊ GAMMA 校正
＊光圈控制

規格

＊1280 X 1024 / 130 萬畫素
＊解析度 / HD 720p
＊最低照度 / 0.05lux
＊增益 / AGC ON / OFF
＊背光補償 / ON / OFF
＊信躁比 / 50dB
＊電子快門 /EI(1/60(N) 或 1/50(P) ~ 1/100000)
EI(FL-1/100000), FL, OFF , 1/250 , 1/500, 1/1000, 1/2000, 1/4000, 1/10000
＊白平衡 /ATW , PWB , MWB



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黑白攝影機

WAT-902B 1/2"

特性

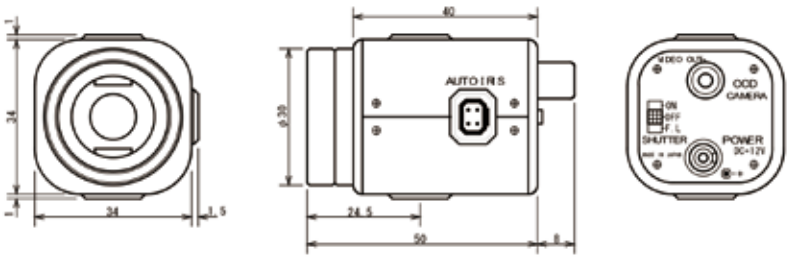
＊超高感度
＊小巧 & 輕便

功能

＊自動光圈
＊防止閃爍模式
＊ AGC
＊背光補償
＊ Gamma

規格

＊有效畫素 /380K
＊解析度 /570 TVL
＊最低照度 /0.3 lx.F1.4
＊背光補償 /ON/OFF
＊ Gamma/γ ≒ 0.45/1.0
＊增益 /AGC ON(高：5 ~ 32dB, 低：5 ~ 20dB), OFF
＊信躁比 /50dB
＊電子快門 /EI(1/60 ~ 1/100000) FL, OFF
＊重量 /90g



黑白攝影機

WAT-902H3 1/3" ULTIMATE

特性

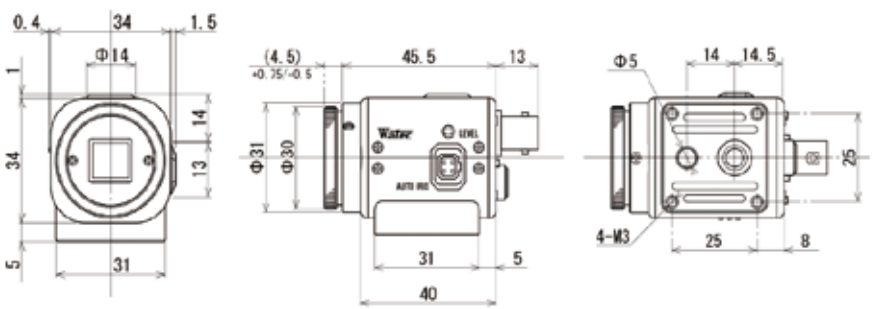
＊多功能
＊防閃爍模式
＊超高感度
＊低照度
＊小巧 & 輕便

功能

＊電子快門
＊自動光圈
＊ AGC/MGC
＊防閃爍模式
＊ Gamma 校正
＊背光補償
＊光圈位置設置

規格

＊有效畫素 /380K
＊解析度 /570 TVL
＊最低照度 /1/2” 0.0001 lx. F1.4, 1/3” 0.0002 lx. F1.4
＊背光補償 /OFF , 中心 , 下方 , 中心 + 下方增強
＊ Gamma/γ ≒ 0.35/0.45/1.0
＊信躁比 /50dB
＊增益 /AGC ON(高：5 ~ 60dB, 低：5 ~ 32dB), MGC (5 ~ 60dB)
＊電子快門 /EI(OFF-1/100,000), EI2(FL-1/100,000), OFF, FL, 1/250, 1/500, 1/1000, 1/2000, 1/5000, 1/10000, 1/1000000
＊重量 /98g



USB2.0 Cameras

Resolution	Model No.		Frame Rate	Effectice Pixels	Sensor size	Cell size (V × H, μm)	Lens Mount Dimensions
	B/W	Color					
VGA	STC-MB33USB	STC-MC33USB	90fps	640 × 480	1/3"	7.4 × 7.4μm	CS-Mount 28W*28H*37D mm
XGA	STC-MB83USB	STC-MC83USB	30fps	1024 × 768	1/3"	4.65 × 4.65μm	CS-Mount 28W*28H*37D mm
1.3M	STC-MB133USB	STC-MC133USB	22fps	1280 × 960	1/3"	3.75 × 3.75μm	CS-Mount 28W*28H*37D mm
SXGA	STC-MB152USB	STC-MC152USB	19fps	1360 × 1024	1/2"	4.65 × 4.65μm	C mount 28W*28H*42D mm
UXGA	STC-MB202USB	STC-MC202USB	15fps	1600 × 1200	1/1.8"	4.4 × 4.4μm	C mount 28W*28H*42D mm

USB3.0 Cameras

Resolution	Model No.			Frame speed	Resolution (Pixel)	Sensor size	Cell size (V × H, μm)	Lens Mount Dimensions
	Monochrome	Color	Monochrome NIR					
1.3M	STC-MBE132U3V	STC-MCE132U3V		60fps	1280 × 1024	1/1.8"	5.3 × 5.3μm	CS-Mount 28W*28H*37D mm
2M	STC-MBCM200U3V	STC-MCCM200U3V	STC-MBCM200U3V-NIR	167fps	2048 × 1088	2/3"	5.5 × 5.5μm	C mount 28W*28H*42D mm
2.3M	STC-MBS241U3V	STC-MCS241U3V		163fps	1920 × 1200	1/1.2"	5.86 × 5.86μm	C mount 28W*28H*42D mm
4M	STC-MBCM401U3V	STC-MCCM401U3V	STC-MBCM401U3V-NIR	89fps	2048 × 2048	1"	5.5 × 5.5μm	C mount 28W*28H*42D mm

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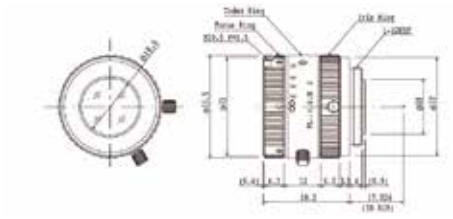
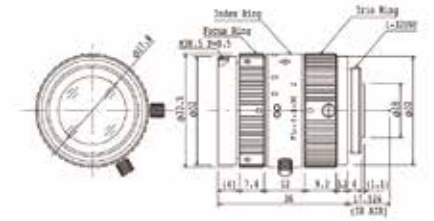
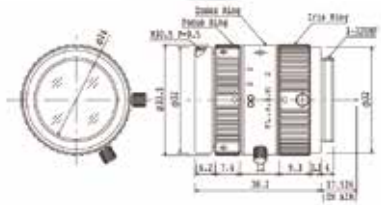
Megapixel Lenses



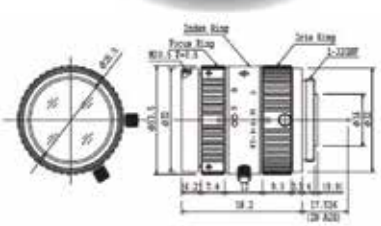
Model		M1614-MP2			
Focal Length		16mm			
Max. Image Format		8.8mm x 6.6mm (Φ11mm)			
Operation Range	Iris	F1.4 - F16C			
	Focus	0.3m - Inf.			
Object Dimension at M.O.D		17.2(H)cm x 12.9(V)cm 2/3"			
Angle of View	D	2/3"	38.0°	1/2"	28.2°
	H		30.8°		22.7°
	V		23.4°		17.1°
Distortion		2/3"	-0.1% (y=5.5)	1/2"	-0.3% (y=4.0)
Mount		C-Mount			
Filter Size		M30.5 P=0.5mm			
Dimensions		Φ33.5mm x 28.2mm			
Weight		60g			



Model		M2514-MP2			
Focal Length		25mm			
Max. Image Format		8.8mm x 6.6mm (Φ11mm)			
Operation Range	Iris	F1.4 - F16C			
	Focus	0.3m - Inf.			
Object Dimension at M.O.D		10.6(H)cm x 7.9(V)cm 2/3"			
Angle of View	D	2/3"	24.9°	1/2"	18.2°
	H		20.0°		14.6°
	V		15.1°		11.0°
Distortion		2/3"	-0.3% (y=5.5)	1/2"	-0.1% (y=4.0)
Mount		C-Mount			
Filter Size		M30.5 P=0.5mm			
Dimensions		Φ33.5mm x 36.0mm			
Weight		71g			



Model		M3514-MP			
Focal Length		35mm			
Max. Image Format		8.8mm x 6.6mm (Φ11mm)			
Operation Range	Iris	F1.4 - F16C			
	Focus	0.3m - Inf.			
Object Dimension at M.O.D		8.1(H)cm x 6(V)cm 2/3"			
Angle of View	D	2/3"	17.3°	1/2"	12.6°
	H		13.9°		10.1°
	V		10.4°		7.6°
Distortion		2/3"	-0.8% (y=5.5)	1/2"	-0.4% (y=4.0)
Mount		C-Mount			
Filter Size		M30.5 P=0.5mm			
Dimensions		Φ33.5mm x 38.2mm			
Weight		87g			



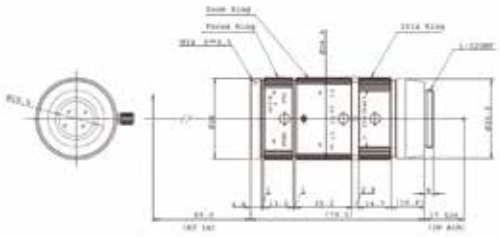
Model		M5018-MP2			
Focal Length		50mm			
Max. Image Format		8.8mm x 6.6mm (Φ11mm)			
Operation Range	Iris	F1.8 - F16C			
	Focus	0.5m - Inf.			
Object Dimension at M.O.D		8.7(H)cm x 6.5(V)cm 2/3"			
Angle of View	D	2/3"	13.1°	1/2"	9.5°
	H		10.5°		7.6°
	V		7.9°		5.7°
Distortion		2/3"	-0.3% (y=5.5)	1/2"	-0.2% (y=4.0)
Mount		C-Mount			
Filter Size		M30.5 P=0.5mm			
Dimensions		Φ33.5mm x 38.2mm			
Weight		85g			

Zoom Lenses

Macro zoom lens

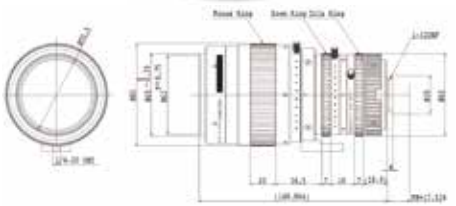
Model		MLH-10X					
Focal Length		0.084X - 0.84X					
Max. Image Format		6.4mm x 4.8mm (Φ8mm)					
Operation Range	Iris	F5.6 - F32C					
	Focus	0.15m - 0.45m					
Angle of View	D	1/2"	21.6° - 4.5°	1/3"	17.0° - 3.3°	1/4"	13.0° - 2.5°
	H		18.0° - 3.6°		13.8° - 2.7°		10.6° - 2.0°
	V		13.8° - 2.7°		10.6° - 2.0°		8.0° - 1.5°
Distortion		1/2"	+0.9% at 0.084x (y=4.0)				
			+1.6% at 0.84x (y=4.0)				
Mount		C-Mount					
Filter Size		M46 P=0.75mm					
Dimensions		Φ48mm x 98.5mm					
Weight		260g					

Megapixel Macro Zoom Lens



Model		MLM-3XMP			
Focal Length		0.3X - 1.0X			
Max. Image Format		8.8mm x 6.6mm (Φ11 mm)			
Operation Range	Iris	F4.5 - F22C			
	Focus	90mm			
Angle of View	D	2/3"	14.88° - 2.84°	1/2"	10.70°- 2.72°
	H		11.80° - 2.78°		8.48°- 2.18°
	V		8.74°-2.24°		6.38°- 1.64°
Distortion		2/3"	+0.12% at 0.3X(y=5.5)	1/2"	- 0.12% at 0.3X (y=4.0)
			+1.78% at 1.0X(y=5.5)		+0.77% at 1.0X (y=4.0)
Mount		C-Mount			
Filter Size		M34 P=0.5mm			
Dimensions		Φ 36.5mm x 79.5mm			
Weight		150g			

5 Megapixel Telecentric Macro Zoom Lens



Model		TEC-V7X					
Focal Length		0.07X - 0.5X					
Max. Image Format		12.3mm x 12.3mm (Φ 17.4mm)					
Operation Range	Iris	F4.3 - F32					
	Focus	182mm - 577.2mm					
Optical Distortion	Tele	1.1"	1.0%	1"	0.84%	2/3"	0.39%
	Wide		-1.7%		-1.45%		-0.7%
BackFocal Length	Tele	39.53mm					
	Wide	49.78mm					
Mount		C Mount					
Filter Size		M62 x P0.75					
Dimensions		Φ 61 x 152.86mm					
Weight		1.4kg					

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Selection Guide:TECHSPEC® Telecentric Lens Selection Guide

With magnifications ranging from 0.06X to 8.0X, and designs optimized for different sensor types, TECHSPEC® Telecentric Lenses are ideal for a wide range of metrology, gauging, and machine vision applications.

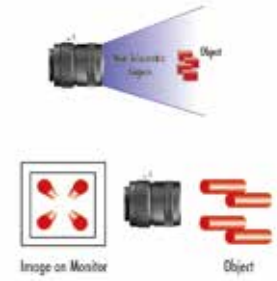
TECHSPEC® Telecentric Lenses Selection Guide

Lens Family	Magnification Range	Focus Adjustment	Iris Adjustment	Double Telecentric	Large Sensor	In-Line Option
Gold Series	0.06X - 1.0X	√	√			
Silver Series	0.16X - 4.0X		√	√		
5 Megapixel Series	0.28X - 1.7X		√	√		
Large Format Series	0.28X - 0.9X		√	√		
1''Format Sensor	0.361X - 055X		√	√	√	
Compact Series	0.5X - 8.0X					√
Variable Magnification	0.25X - 3.0X		√			

Technical Note

Telecentric Lenses

Conventional Lens



Advantages

* Lower Cost
* Greater Availability
* Greater Flexibility

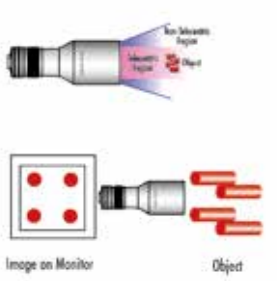
Disadvantages

* Change of Magnification within Depth of Field
* Perspective Error

Applications

* Imaging Large Objects

Telecentric lens



Advantages

* Constant Magnification within Depth of Field
* No Perspective Error

Disadvantages

* Higher Cost
* Larger Lens Diameters
* Larger Weight

Applications

* Metrology
* CCD Based Measurement
* Microlithography

Why Use Telecentric Lenses?

Perspective errors, or parallax, are part of everyday human experience and allow the brain to interpret the three dimensional world; we expect closer objects to appear relatively larger than those farther away. This phenomenon affects conventional imaging systems in that the magnification of the object changes with its distance from the lens. Telecentric lenses optically correct for such perspective error, so that objects remain the same perceived size independent of their location in space.

Arrangement

Fixed Focal Length Lens

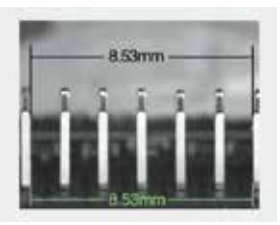
Telecentric Lens

Example 1

As shown in the example of the two cubes, one cube is positioned so that it is closer to the forefront than the other. The fixed focal length lens images the objects much like one would expect two objects of equal size but unequal distance would appear: the cube in the forefront appears larger than the cube in the rear. The telecentric lens, on the other hand, images the setup so that both cubes appear equal in size and distance.

Arrangement

Fixed Focal Length Lens



Telecentric Lens

Example 2

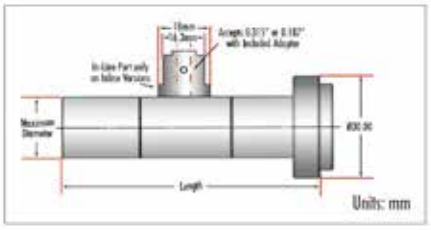
As advancements in technology result in the further miniaturization of electronic components, precision alignment becomes increasingly more complex. As shown in the example of a fixed focal length lens imaging the jumper pins of a typical circuit board at a 45° angle, perspective errors cause the image of the pins to tilt inward, making accurate measurements difficult. With the use of a telecentric lens, though, the pins are imaged accurately, removing the perspective error causing the inward tilt, and allowing for precise measurements

TECHSPEC® Compact Telecentric Lenses

* **Ultra-Compact Design**
* **Perfect for Volume Inspection Applications**
* **Inline Illumination Versions Available for Maximum Versatility**

Our TECHSPEC® Compact Telecentric Lenses were designed with space constrained applications in mind. Featuring a large maximum sensor format and a number of different working distance / magnification options, our TECHSPEC® Compact Telecentric Lenses are perfect for many applications. From single unit inspection stations, to high volume implementation, these Compact Telecentric Lenses are engineered to provide you the specifications you need at a competitive price point.

With excellent telecentricity and low distortion, our TECHSPEC® Compact Telecentric Lenses are perfect for integration into gauging systems. The fixed iris and focus are ideal for implementation into factory floors and assembly lines, as they will remain stationary over time.



Maximum Sensor Format	2/3"
Distortion	<0.2%
Telecentricity	<0.2°
Camera Mount	C-Mount
Light Guides Accepted	1/4" (0.315") and 1/8" (0.187")

TECHSPEC® Compact Telecentric Lenses - 40mm Working Distance * Horizontal

Primary Magnification	1X	2X	3X	4X
Working Distance (±1) (mm)	40mm	40mm	40mm	40mm
Field of View 2/3" Sensor* (mm)	8.8	4.4	2.9	2.2
Field of View 1/2" Sensor* (mm)	6.4	3.2	2.1	1.6
Field of View 1/3" Sensor* (mm)	4.8	2.4	1.6	1.2
Aperture (f/#)	11	14.3	16	20
Maximum Diameter (mm)	18	18	18	18
Length (mm) (Standard/In-Line)	50.0/53.5	37.0/40.0	48.0/52.3	47.1/50.3
Standard Stock Number	**UNI63745**	**UNI63746**	**UNI63747**	**UNI63748**
In-Line Stock Number	**UNI67319**	**UNI67320**	**UNI67321**	**UNI67322**

TECHSPEC® Compact Telecentric Lenses - 65mm Working Distance * Horizontal

Primary Magnification	0.5X	0.8X	1X	2X	3X	4X	6X	8X
Working Distance (±1) (mm)	65mm	65mm	65mm	65mm	65mm	65mm	65mm	65mm
Field of View 2/3" Sensor* (mm)	17.6	11	8.8	4.4	2.9	2.2	1.5	1.1
Field of View 1/2" Sensor* (mm)	12.8	8	6.4	3.2	2.1	1.6	1.1	0.8
Field of View 1/3" Sensor* (mm)	9.6	6	4.8	2.4	1.6	1.2	0.8	0.6
Aperture (f/#)	9	14.9	18.6	17.3	21.9	27	35	45
Maximum Diameter (mm)	32	21.4	18	18	18	18	18	18
Length (mm) (Standard/In-Line)	86.7/90.0	86.5/89.9	76.1/79.5	76.5/79.9	76.3/79.4	81.0/84.4	116.1/119.5	100.0/103.7
Standard Stock Number	**UNI63741**	**UNI63742**	**UNI63733**	**UNI63734**	**UNI63735**	**UNI63736**	**UNI63743**	**UNI63744**
In-Line Stock Number	**UNI67310**	**UNI67311**	**UNI67312**	**UNI67313**	**UNI67314**	**UNI67315**	**UNI67316**	**UNI67317**

TECHSPEC® Compact Telecentric LENSES - 110mm working distance * Horizontal

Primary Magnification	0.5X	0.75X	1X	2X	3X
Working Distance (±1) (mm)	110mm	110mm	110mm	110mm	110mm
Field of View 2/3" Sensor* (mm)	17.6	11.7	8.8	4.4	2.9
Field of View 1/2" Sensor* (mm)	12.8	8.5	6.4	3.2	2.1
Field of View 1/3" Sensor* (mm)	9.6	6.4	4.8	2.4	1.6
Aperture (f/#)	9.3	13.3	20.9	33	35
Maximum Diameter (mm)	40	29.5	22	18	18
Length (mm) (Standard/In-Line)	166.6/170.0	156.2/160.0	106.6/110.0	126.6/130.0	100.0/103.6
Standard Stock Number	**UNI63729**	**UNI63730**	**UNI63731**	**UNI63732**	**UNI63738**
In-Line Stock Number	**UNI67303**	**UNI67304**	**UNI67305**	**UNI67306**	**UNI67307**

TEL : (03)462-6569 (桃園-總公司) / (04)2261-0357 (台中) / (06)208-6651 (台南)

TECHSPEC® Silver Series Telecentric Lenses

- Designed for Metrology and Gauging Applications
- Magnification from 0.16X to 4.0X
- High Light Throughput (F6)
- Double-Telecentric Design
- Ideal for Factory Automation

Our line of TECHSPEC® Silver Series Telecentric Lenses offers a compact, cost-effective solution for replacing standard fixed focal length lenses. Telecentric Measuring lenses are ideal for both on-line and off-line production environments that require accurate measurement. Edmund has designed this series of lenses to specifically replace lenses that give inaccurate or inconsistent readings. Telecentric lenses correct perspective errors that yield variations in magnification through the depth of field.

Our TECHSPEC® Silver Series Telecentric Lenses offer superior image quality and less distortion than conventional fixed focal length lenses. This design yields more symmetrical images that are superior for software-integrated measurements. In addition, the double-telecentric design gives the sharpest image with the lowest amount of errors for the most accurate measurements. In combination with the high quality optics is a simplified non-focusing mechanical design with adjustable iris control.

Telecentric designs require larger objective lenses in order to maximize the size of the object viewed for each magnification, thus the mechanical housing has been streamlined to accommodate the larger optics and to provide a reasonable amount of mounting surface (see dimension D). Each lens also has a standard front filter thread for use with Edmund Optics® color filters, polarizers, UV filters, and illumination adapters for LED or fiber optic ring guides. Unique twin-ring mounting clamps are available separately.

Mounting clamps have the same twin-ring clamp design that fits on the 30mm diameter mounting surface. One offers a 1.75" stand-off distance (center of lens to bottom of mounting clamp base) that is ideal for the 0.60X through 0.25X lens. The 2.25" stand-off version is ideal for the larger 0.2X and 0.16X lenses. Bases have a variety of 1/4-20 tapped and clearance holes.

Telecentricity	<0.1° Max.
Distortion	<0.3% Max.
Lens Element Coating	BBAR from 425 - 675nm
Housing	Anodized Aluminum

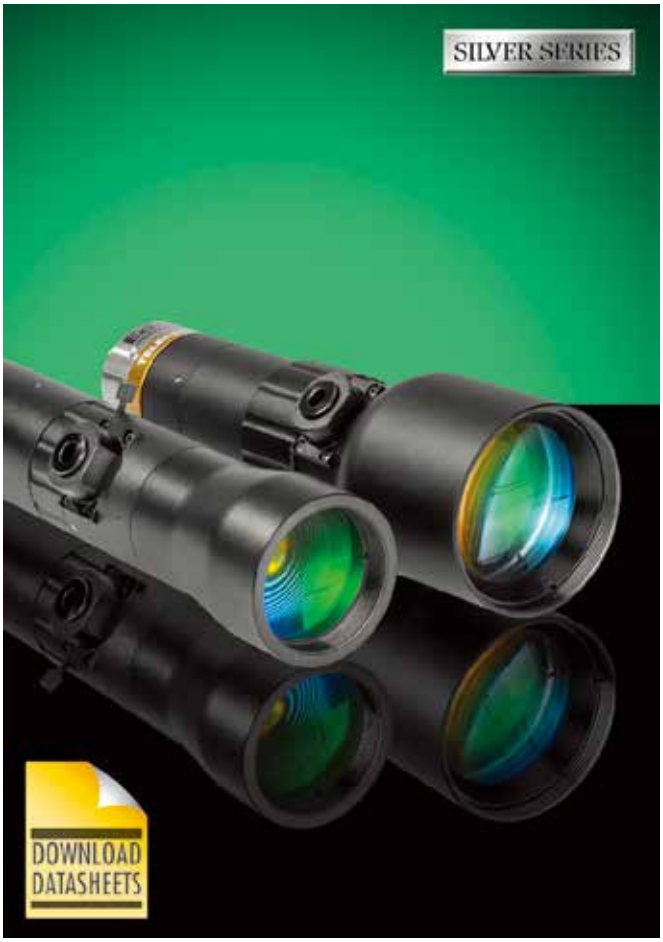
Mounting Clamps

	Stock No.
Mounting Clamp, 1.75" Centerline	UNI56870
Mounting Clamp, 2.25" Centerline	UNI56871
Allen Wrench for Mounting Clamps, #8-32 SHCS (Set of 2)	UNI55190

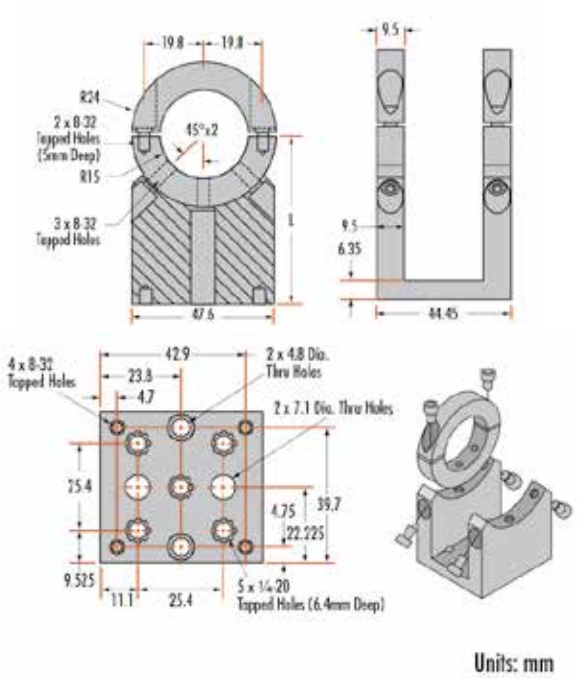
TECHSPEC® Silver Series Telecentric Lenses

Primary Magnification	0.16X	0.20X	0.25X	0.30X	0.40X
Maximum Sensor Format	1/2"	1/1.8"	1/1.8"	1/2"	1/1.8"
Field of View, 1/2" Sensor*	40mm	32mm	25.6mm	21.3mm	16mm
Field of View, 1/3" Sensor*	30mm	24mm	19.2mm	16mm	12mm
Working Distance (±3mm)	177mm	164mm	160mm	139mm	103mm
Resolution (MTF Image Space @ f/10)	>40% at 40 lp/mm	>40% at 40 lp/mm	>40% at 40 lp/mm	>40% at 40 lp/mm	>40% at 40 lp/mm
Depth of Field (20lp/mm @ f/10)	±19.7mm at 20%	±12.9mm at 20%	±8.2mm at 20%	±5.7mm at 20%	±3.3mm at 20%
Aperture (f/#)	f/6-Closed (lockable)	f/6-Closed (lockable)	f/6-Closed (lockable)	f/6-Closed (lockable)	f/6-Closed (lockable)
Dimensions					
Maximum Outer Dia. (A)	65mm	60mm	48mm	46mm	45mm
Mounting Dia. (B)	30mm	30mm	30mm	30mm	30mm
Length (C) Standard / In-Line	191mm	188mm	158mm	158mm	159mm
Mounting Length (D) Standard / In-Line	50mm	42mm	49mm	60mm	67mm
Mounting Offset (E Standard / In-Line)	43mm	45mm	44mm	43mm	33mm
Filter Size (F): (Mount dia. x pitch)	M62 x 0.75	M58 x 0.75	M46 x 0.75	M43 x 0.75	M43 x 0.75
Standard Stock No.	**UNI56675**	**UNI63073**	**UNI56676**	**UNI58428**	**UNI56677**
Color Filter - Red	**UNI46532**	**UNI54765**	**UNI54762**	**N/A**	**N/A**
Color Filter - Green	**UNI46533**	**UNI54771**	**UNI54768**	**N/A**	**N/A**
Color Filter - Blue	**N/A**	**UNI54777**	**UNI46571**	**UNI46570**	**UNI46570**
UV/Protective Filter	**UNI54047**	**UNI54046**	**UNI54041**	**UNI54040**	**UNI54040**
Linear Polarizing Filter	**UNI36444**	**UNI36443**	**UNI36439**	**UNI52558**	**UNI52558**

TECHSPEC® Silver Series Telecentric Lenses

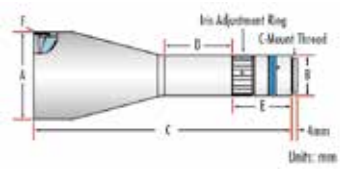


Mounting Brackets #56-870 & #56-871

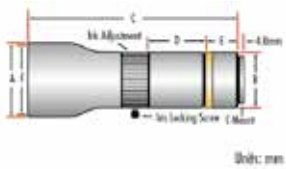


Units: mm

Standard 0.16X - 0.75X



Standard 1.0X - 4.0X



TECHSPEC® Silver Series Telecentric Lenses

0.50X	0.60X	0.75X	1.0X	2.0X	4.0X
1/1.8"	1/1.8"	2/3"	2/3"	2/3"	2/3"
12.8mm	10.7mm	8.5mm	6.4mm	3.2mm	1.6mm
9.6mm	8mm	6.4mm	4.8mm	2.4mm	1.2mm
120mm	103mm	100mm	83mm	75mm	44mm
>40% at 40 lp/mm	>40% at 40 lp/mm	>40% at 40 lp/mm	>40% at 40 lp/mm	>40% at 40 lp/mm	>40% at 40 lp/mm
±2.1mm at 20%	±1.4mm at 20%	±0.8mm at 20%	±0.5mm at 10%	±0.13mm at 10%	±0.03mm at 10%
f6-Closed (lockable)	f/6-Closed (lockable)	f/6-Closed (lockable)	f/6-Closed (lockable)	f/6-Closed (In-Line: f/10-Closed)	f/6-Closed (lockable)
Dimensions					* Mounting Clamp Fits Over Iris
40mm	42mm	36mm	40mm	45mm	61mm
30mm	30mm	30mm	30mm	30mm	30mm
153mm / 156.2mm	156mm	151.2mm / 155.2mm	114mm	141mm / 144.6mm	249mm
42mm / 45.1mm	57mm	34mm* / 46.2mm	32mm*	45mm / 42.2mm	99mm
68mm / 73.4mm	46mm	82.2mm / 16.9mm	17mm	17mm / 18.8mm	17mm
M37 x 0.75	M40.5 x 0.5	M30.5 x 0.5	M37 x 0.75	M43 x 0.75	M58 x 0.75
UNI63074	**UNI56678**	**UNI67731**	**UNI58430**	**UNI58431**	**UNI58432**
UNI88344	**N/A**	**UNI88346**	**N/A**	**UNI88348**	**N/A**
UNI58642	**N/A**	**UNI46545**	**UNI58642**	**N/A**	**UNI54765**
UNI58643	**N/A**	**UNI46546**	**UNI58643**	**N/A**	**UNI54771**
UNI58644	**N/A**	**UNI46547**	**UNI58644**	**UNI46570**	**UNI54777**
UNI54039	**UNI54725**	**UNI46576**	**UNI54039**	**UNI54040**	**UNI54046**
UNI52556	**UNI53999**	**UNI46574**	**UNI52556**	**UNI52558**	**UNI36443**

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In-line Illumination Telecentric C-Mount Lenses

* Fiber Optic Input for In-line Illumination (0.312″ Ferrule)
* Available in Working Distances of 65mm or 120mm
* 2/3″ Max. Sensor Format
* ≤0.1% Distortion

This compact series of telecentric lenses offers a versatile solution for many applications. Each lens offers an in-line illumination port that accepts a 1/4" fiber optic light guide. In-line illumination is convenient for situations in which there is no room for light sources between the lens and the object under test.

These lenses offer the same measuring advantages as our other telecentric lenses. They correct perspective errors throughout the depth of field to avoid changes in magnification. This correction is vital to the majority of automated measurement applications.

M3 set screws are incorporated in the in-line illumination port to secure the light guide. Each lens also includes a lockable ring to rotate the lens and ensure alignment with the camera sensor. Note: 1/4" fiber optic light guides are sold separately. Visit our website for dimensional drawings.

In-Line Illumination Telecentric C-Mount Lenses - 120mm Working Distance * Horizontal

Primary Magnification	0.5X	0.75X	1.0X	2.0X	3.0X	4.0X	5.0X	6.0X
Field of View, ½" Sensor* (mm)	12.8	8.5	6.4	3.2	2.1	1.6	1.2	1.1
Field of View, ⅔" Sensor* (mm)	17.6	11.7	8.8	4.4	2.9	2.2	1.8	1.5
Working Distance (mm)	120	120	120	120	120	120	120	120
Aperture (f/#)	9.3	13.3	16.7	32.5	36.3	43.9	52.4	62.2
Light Guide Ferrule Diameter	0.312"	0.312"	0.312"	0.312"	0.312"	0.312"	0.312"	0.312"
Stock No.	**UNI59740**	**UNI59836**	**UNI59741**	**UNI59837**	**UNI59742**	**UNI59838**	**UNI59839**	**UNI59743**

In-line Illumination Telecentric C-Mount Lenses - 65mm Working Distance * Horizontal

Primary Magnification	0.8X	1.0X	2.0X	3.0X	4.0X	5.0X
Field of View, ½" Sensor* (mm)	8	6.4	3.2	2.1	1.6	1.2
Field of View, ⅔" Sensor* (mm)	11	8.8	4.4	2.9	2.2	1.8
Working Distance (mm)	65	65	65	65	65	65
Aperture (f/#)	10.1	11.5	16.3	22.2	26.2	30.6
Light Guide Ferrule Diameter	0.312"	0.312"	0.312"	0.312"	0.312"	0.312"
Stock No.	**UNI62789**	**UNI62790**	**UNI62791**	**UNI62792**	**UNI62793**	**UNI62794**

In-Line Illumination High Resolution C-Mount Telecentric Lenses

* Designed for High Resolution Imaging
* In-Line Illumination Port (0.312″ Ferrule)
* 2/3″ Max. Sensor Format

This line of high resolution telecentric lenses was designed to permit in-line illumination, making them ideal for applications that require intense and direct illumination. The coaxial port accepts ¼" fiber bundles with a 0.312" ferrule diameter, which readily connects to our wide selection of light guides and illuminators.

The lenses feature a standard C-Mount threading to connect to the most common 2/3"and smaller machine vision cameras. Designed to have ≤0.05% distortion, these lenses are perfect for challenging measurement applications.

In-Line Illumination High Resolution C-Mount Telecentric Lenses

Magnification (±3%)	0.19X	1X	2X
Horizontal FOV, 2/3" Sensor (mm)	46.3	8.8	4.4
Max. Sensor Size	2/3"	2/3"	2/3"
Working Distance	110mm ± 3mm	120mm ± 1mm	100mm ± 1mm
Object Side N.A.	0.017	0.072	0.13
Aperture (f/#)	f/6	f/7 - C	f/8 - C
Image Space Resolving Power	4.0µm	5.2µm	5.7µm
Light Guide Ferrule Diameter	0.312"	0.312"	0.312"
Distortion	≤ 0.02%	≤ 0.05%	≤ 0.05%
Stock Number	**UNI65026**	**UNI65027**	**UNI65028**

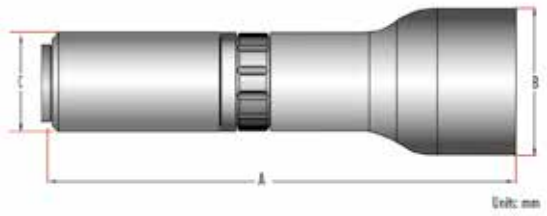
TECHSPEC® High Performance 5 Megapixel Telecentric Lenses

- Designed to Maximize 5 Megapixel Sensors
- 2/3″ Sensor Coverage (1″ for 0.9X)
- Superior Light Collecting F6 Designs
- High Contrast at 72 lp/mm Across Full Sensor Field
- Lockable Iris for High Vibration Environments
- Available in 0.28X, 0.5X, 0.9X, and 1.7X Magnifications

Our TECHSPEC® High Resolution Telecentric lenses were designed with the small pixels associated with 5 Megapixel sensors in mind. These highly telecentric lenses produce unparalleled levels of contrast, yielding maximum image quality with the highest degree of measurement accuracy. Designed with the lowest FUNI's in the industry, these lenses achieve the superior light collection required to solve many of today's applications. A locking iris prevents unintentional lens adjustments in high vibration environments.

Additionally, each lens employs an image side telecentric design that eliminates illumination roll off, which can be especially prevalent in systems utilizing larger sensors. A variety of magnifications are available. Mounting clamp (sold separately) is highly recommended to secure lens to instruments, manufacturing lines, and benchtop setups.

TECHSPEC® High Performance 5 Megapixel Telecentric Lenses



TECHSPEC® High Performance 5 Megapixel Telecentric Lenses

Lens Magnification	0.28X	0.5X	0.9X	1.7X
Maximum Sensor Size	2/3"	2/3"	1"	2/3"
Horizontal FOV, 2/3" Sensor (mm)	31.8	17.7	9.8	5.2
Horizontal FOV, 1/2" Sensor (mm)	23.1	12.9	7.11	3.8
Working Distance (mm)	180	173	111	123
Resolution @ Full Field	>40% @ 72 lp/mm	>40% @ 72 lp/mm	>45% @ 72 lp/m	>25% @ 72 lp/mm
Telecentricity (˚)	<0.1	<0.1	<0.1	<0.1
Distortion (%)	<0.1	<0.1	<0.1	<0.1
Aperture (f/#)	f/6-f/22	f/6-f/22	f/6-f/22	f/6-f/22
Filter Thread (mm)	M58 x 0.75	M46 x 0.75	M62 x 0.75	M58 x 0.75
Mount	C-Mount	C-Mount	C-Mount	C-Mount
Lens Stock Number	**UNI62933**	**UNI62932**	**UNI62901**	**UNI63232**
Mount Stock Number	**UNI63233**	**UNI56025**	**UNI63442**	**UNI63442**
Color Filter – Red	**UNI54765**	**UNI46532**	**UNI54762**	**UNI54765**
Color Filter – Green	**UNI54771**	**UNI46533**	**UNI54768**	**UNI54771**
Color Filter – Blue	**UNI54777**	**N/A**	**UNI46571**	**UNI54777**
UV Protective Filter	**UNI54046**	**UNI54047**	**UNI54041**	**UNI54046**
Linear Polarizing Filter	**UNI36443**	**UNI36444**	**UNI36439**	**UNI36443**

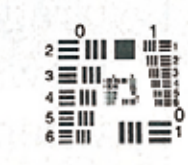
TECHSPEC® High Performance 5 Megapixel Telecentric Lenses – Dimensions

Magnification	Length (A) (mm)	Front Diameter (B) (mm)	Back Diameter (C) (mm)
1.7X	189.5	60	46
0.9X	199.8	65	53
0.5X	174.9	50	33.5
0.28X	203.8	60.5	33.5

Choosing the Correct Testing Target

Test targets can be used to evaluate or calibrate an imaging system's performance. Correct assessment of an imaging system is used in certifying proper measurements, establishing a baseline between systems working in parallel, or for troubleshooting. Edmund offers patterns which can characterize image quality in terms of its components: resolution, contrast, depth of field, and distortion.

Resolution



USAF

Ronchi Ruling

NBS 1963A

Star Target

Depth of Field

DOF Target

Contrast

EIA Graysale

ColorChecker®

Distortion

Distortion Targets

Featured Products

Star Target Arrays

USAF 1951 and Dot Grid Target
- **USAF 1951 Groups 0 to 3 (14 lp/mm)**
- **Fixed Frequency Grid on 0.2mm Centers**
- **2" x 2.75"**

Stock No. UNI62465

Image Quality Definitions

Resolution

An imaging system's resolution is its ability to distinguish object detail. This is often expressed in terms of line pairs per millimeter (lp/mm).

Contrast

This is a measurement of the separation between the light and the dark parts of the image. Contrast is often expressed in terms of percentage (%).

Distrotion

This is an optical error (aberration) in the lens that causes a difference in magnification of the object at different points in the image. This is often expressed in terms of a percentage (%).

Modulation Transfer Function (MTF)

MTF is a measurement of the imaging lens' ability to transfer contrast from the object plane to the image plane at a specific resolution.

Depth Of Field (DOF)

The ability of a lens to maintain a desired amount of image quality as the object moves in and out of focus. DOF should be defined with an associated resolution and contrast.

DOF 5-15 Depth of Field Target

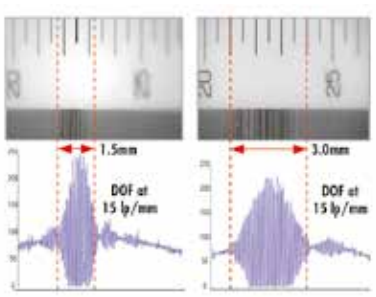
Edmund

* **Test Depth of Field in Imaging Systems**
* **Eliminates Need for Calculations**

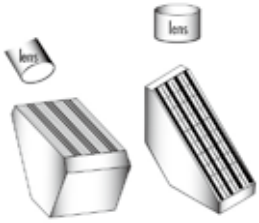
This target measures an area of optical tolerancing often determined theoretically. Depth of field calculations are often misleading, a problem this target solves by accurately determining the amount of object shift possible before affecting image quality. The degree of image quality needed is determined by user and application.
The DOF 5-15 consists of two sets of scales. Each, when viewed at 45˚, consists of horizontal and vertical lines at a frequency of 5 and 15 line pairs per mm. Instructions included.

Target	Black on white-backed film
Substrate	Aluminum
Maximum Depth	50mm
Dimensions	57mmH x 34mmW x 57mmD
Scale	5 and 15 lp/mm (both horizontal and vertical)

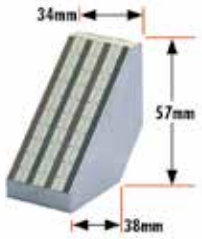
Depth of Field Target : UNI54440



Line spread functions of ruling. Taken with VZM™ 200i at 1X PMAG. Left: Iris Open. Right: Iris Half Open.



Lens Mound at 45° Angle
Lens Mounted Vertically



EO Telecentricity Target

Edmund

* **Critical Tool for Any Vision System Making Size or Distance Measurements**
* **Calibrates Any Type of Lens**
* **Covers Large Range of Magnifications**

Telecentricity is an extremely useful metric for measuring the amount of perspective error inherent in an imaging system. Determining the degree of telecentricity allows the user to calculate an imaging system's maximum measurement accuracy. The target can be used to calibrate the degree of telecentricity in both telecentric and non-telecentric lenses. Keystoning becomes visual with the target and can be measured with software.

Dimensions	110mmW x 110mmH x 110mmL	**Mid Mag Pattern**	20 lines, 0.1mm thick on 0.5mm centers
Pattern Size	110mmH x 156mmV	**High Mag Pattern**	40 lines, 0.1mm thick on 0.25mm centers
Pattern	Black Print on White Mylar®with Protective Lamination	**Base**	Aluminum
Low Mag Pattern 2 alternating frequencies	1) 3 lines, 2mm thick on 3mm centers 2) 4 lines, 0.1mm thick on 2mm centers	**Magnification Range**	0.08X to 5X

EO Telecentricity Target : UNI58404

Application Note

Our telecentric target allows keystoning in an image to be visualized and accurately measured. The amount of keystoning is related to the telecentricity of the lens that is imaging the target. The target is placed at a 45˚ angle to the optical axis so that the bottom of the target is further away from the lens than the top of the target. When imaging the target through a non-telecentric lens, the distance between the vertical lines will appear to decrease at the bottom of the image; this effect is known as keystoning. A perfectly telecentric lens will have no keystoning and the telecentricity will be 0˚.

It is apparent that the blur in this image (taken with a telecentric lens) is symmetric. If you take a horizontal line profile across the image and find the horizontal component of the center of each black line, the location will be equal in the blurred part of the image and the focused part of the image.

This image (taken with an 8mm focal length lens) demonstrates keystoning. Clearly, the lines converge at the bottom of the image. The center location of a line at the bottom of the image does not have the same center location at the top of the image

This difference in position can be converted to a degree of telecentricity with the following steps:
(1) Find the distance between your top line profile and your bottom line profile, Y1 & Y2 △Y = (Y1 - Y2)
(2) Find the horizontal displacement (△X) of a target line: △X = |X1 - X2|
(3) Calculate the telecentric angle: q = Tan-1(△X/△Y)

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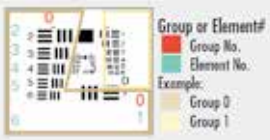
Technical Note: Using 1951 USAF Resolution Targets

1951 USAF Resolution Targets are a well-established standard when for testing the resolution of an imaging system. They consist of horizontal and vertical bars organized in groups and elements. Each group is composed of six elements, and each element is composed of three horizontal and three vertical bars equally spaced with one another. There can be a total of twelve groups, with larger numbers used for higher resolution. Vertical bars are used to calculate horizontal resolution and horizontal bars are used to calculate vertical resolution. Qualitatively, the resolution of an imaging system is defined as the group and element combination directly before the black and white bars begin to blur together. Quantitatively, resolution (in terms of line pairs per millimeter, or lp/mm) can be calculated by:

$$\text{Resolution} = 2^{\text{group \#} + \frac{(\text{element \#} - 1)}{6}}$$

Number of Line Pairs / MM In USAF Resolving Power Test Target 1951

	Group Number										For High Res. Only	
Element	-2	-1	0	1	2	3	4	5	6	7	8	9
1	0.25	0.5	1	2	4	8	16	32	64	128	256	512
2	0.28	0.561	1.12	2.24	4.49	8.98	17.95	36	71.8	144	287	575
3	0.315	0.63	1.26	2.52	5.04	10.1	20.16	40.3	80.6	161	323	645
4	0.353	0.707	1.41	2.83	5.66	11.3	22.62	45.3	90.5	181	362	-
5	0.397	0.793	1.59	3.17	6.35	12.7	25.39	50.8	102	203	406	-
6	0.445	0.891	1.78	3.56	7.13	14.3	28.5	57	114	228	456	-



1951 USAF Resolution Targets

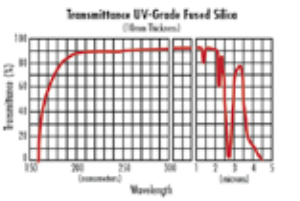
- Negative & Positive Patterns on Glass
- Each is Boxed and Includes Resolution Value Chart
- High Resolution Targets Available (up to 645 lp/mm)

Resolution test slides with the USAF 1951 test pattern are available in either positive (chrome pattern, clear background)or negative (clear pattern, chrome background) patterns. The positive pattern is recommended for quality control of vision systems and testing equipment. The negative pattern is most often backlit and is ideal for use with microscopes and high magnification video lenses. Each is boxed and includes resolution value chart. Targets conform to MIL-S-150A specifications.

Substrate	1.5mm (0.06") soda lime glass with beveled edges
Flatness	0.0001" or better
Surface Quality	20-10
Coating	Vacuum-deposited durable chromium, density 3.0 or greater

USAF Targets	Standard Resolution Stock No.	High Resolution Stock No.
2" x 2" Positive	UNI38257	UNI58198
2" x 2" Negative	UNI38256	UNI55622
3" x 3" Positive	UNI36275	UNI64862
3" x 3" Negative	UNI36408	UNI64863

UV Fused Silica & Fluorescent USAF 1951 Resolution Targets



- Designed for Calibration of UV or Fluorescence Microscopes
- Fluorescent Targets have 365nm Excitation Wavelength, 550nm Emission Wavelength
- Negative, Positive, & High Resolution Targets Available

Made with UV Fused Silica, these targets are ideal for calibration of imaging systems using UV illumination. The Fused Silica Positive Target (chrome pattern, clear background) has the chrome pattern deposited on the top surface of the target, as does the Fused Silica Negative Target (clear pattern, chrome background). The Fluorescent Fused Silica Targets are ideal for applications involving fluorescence and confocal microscopy, nanotechnology, photolithography, and other UV-based imaging systems. The Fluorescent Fused Silica Positive Target (chrome pattern, clear background) has a fluorescent material on the top surface of the target. The Fluorescent Fused Silica Negative Target (clear pattern, chrome background) has a fluorescent material on the bottom surface.
Note: chrome coated top surface will reflect UV radiation.

Substrate	UV Fused Silica	**Surface Quality**	20-10
Surface Accuracy	2λ	**Pattern Coating**	Chromium, OD>3.0
Thickness	1.0 ± 0.1*		

UV Fused Silica & Fluorescent USAF 1951 Resolution Targets

	2" x 2" Standard Resolution	3" x 3" Standard Resolution	2" x 2" High Resolution	2" x 2" Fluorescent Standard Resolution	3" x 3" Fluorescent Standard Resolution
Pattern Size (mm)	15.0 x 14.0	60.7 x 56.6	15.0 x 14.0	15.0 x 14.0	62.0 x 58.0
Min Frequency	Group 0, Element 1	Group -2, Element 1	Group 0, Element 1	Group 0, Element 1	Group –2, Element 1
Max Frequency	Group 7, Element 6	Group 7, Element 6	Group 9, Element 3	Group 7, Element 6	Group 7, Element 6
Transmissive Coating	N/A	N/A	N/A	365nm Excitation, 550nm Emission*	365nm Excitation, 550nm Emission*
Positive	UNI57896	UNI57898	UNI59152	UNI57855	UNI57894
Negative	UNI57895	UNI57897	UNI59153	UNI57792	UNI57893

* Fluorescent coating adds 0.1 to 0.2mm to the thickness

USAF Pattern Wheel Target

Edmund

* **Tests Resolutions from 4-228 lp/mm**
* **Reduces Testing Time**
* **Tests Multiple Field Points**

The USAF pattern wheel is an ideal target to measure resolution at different field points within an imaging system's field of view. The pattern is available on three different substrate sizes: 1" square, 1.5" diameter, or a 1" x 3" slide. Each size includes 8 USAF patterns in a circular pattern plus one pattern in the center. Each size is offered as positive (opaque pattern on clear background) or negative (clear pattern on opaque background).

No. of USAF Patterns	9	**Line Width Tolerance**	±0.0005mm
Substrate	Soda Lime Float Glass 1.5mm thick	**Flatness**	2λ/inch
Minimum Resolution	Group: 2 Element: 1 (4 lp/mm)	**Surface Quality**	20-10
Maximum Resolution	Group: 7 Element: 6 (228 lp/mm)	**Parallelism**	<0.0005"/inch
Coating	First Surface Refl ective Chromium		

USAF Pattern Wheel Target

USAF Wheel Target Negative, 1" x 3"	UNI59204
USAF Wheel Target Positive, 1" x 3"	UNI59203
USAF Wheel Target Negative, 1" x 1"	UNI59206
USAF Wheel Target Positive, 1" x 1"	UNI59205
USAF Wheel Target Negative, 1.5" Diameter	UNI59207
USAF Wheel Target Positive, 1.5" Diameter	UNI59208

Clear Optical Path USAF Target

Edmund

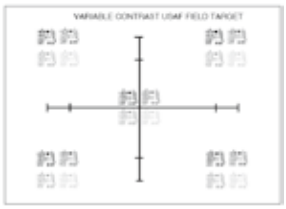
* **Determine Resolution for X-Ray, UV, Thermal, and Far-IR Imaging Systems**
* **Easy Mounting**
* **Ideal for Transmittance Applications**

Our Clear Optical Path USAF targets are manufactured from an extremely thin electroformed nickel substrate. Since there is no glass in the pattern area, light travels only through air, eliminating chromatic and absorption issues. The target pattern covers from Group 0, Element 1 to Group 3, Element 6. Our UV Fused Silica & fluorescent USAF targets are available for most NUV applications, but the Clear Optical Path Target can be used for very deep UV and Far-IR applications.

Minimum Resolution	Group 0, Element 1 (1 lp/mm)	**Mount Material**	Anodized Aluminum
Maximum Resolution	Group 3, Element 6 (14.30 lp/mm)	**Electroform Thickness**	0.0005" Nominal
Mount Thickness	0.0405"		

Clear Optical Path USAF Target - 38mm Dia.	UNI58402
Metric Optical Mount for 38.1mm Dia. Optics	UNI64565

1951 USAF Field Resolution Target



* Arranged on a 4:3 Aspect Ratio to Measure Resolution as a Function of Field
* Each Section Contains Four USAF Targets of Varying Density Levels

1951 USAF Photographic Target	
Substrate	8.5" x 11" Photo Paper
Thickness	0.2mm
Density Values	0.07, 0.55, 1.03, 1.5
Min. Resolution	Group 0 Element 1
Max. Resolution	Group 4 Element 3
Stock No.	**UNI53715**

1951 USAF Contrast Resolution Target

* 15 USAF Targets Which Vary in Density
* Allows Resolution Measurements at Diff erent Contrast Levels

1951 USAF Contrast Target	
Substrate	8.5" x 11" Photo Paper
Thickness	0.2mm
Density Values	Varies linearly 1.5 - 0.09
Min. Resolution	Group 0 Element 1
Max. Resolution	Group 4 Element 3
Stock No.	**UNI53714**

Resolving Power ReferencE Chart

1951 USAF Color Target	
Substrate	White Poster Paper
Size	36"L x 24"W
Min. Resolution	Group -2 Element 1
Max. Resolution	Group 2 Element 2
Stock No.	**UNI83001**

For complete specifi cations on our **Pocket USAF Target** UNI38710

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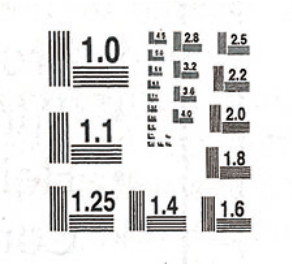
NBS 1963A Resolution Target

Edmund

* **Negative or Positive Patterns (≥3.0 OD Chromium Coating)**
* **Complies With NBS Standard 1010A**
* **Frequency Range From 1-512 Cycles/mm**



Utilizing the National Bureau of Standards 1963A Resolution Pattern, these targets - available in either positive (black pattern, clear field) or negative (clear pattern, black field) and on soda lime or opal glass, are ideal for precision optical testing.

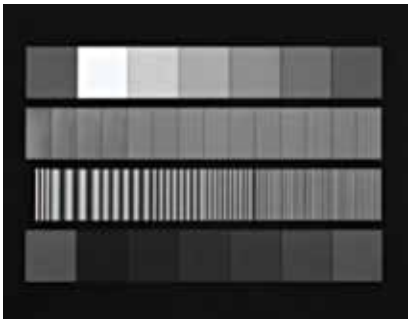
NBS 1963A Resolution Target

Frequency	Polarity	Dimensions (L x W x T)	Pattern Area	Chrome on Glass	Chrome on Opal
				Stock No.	Stock No.
1-18	Positive	50.8 x 50.8 x 1.5mm	45.5 x 43.0mm	UNI39857	-
	Negative	50.8 x 50.8 x 1.5mm	45.5 x 44.5mm	UNI39856	-
	Positive	101.6 x 101.6 x 1.5mm	42.9 x 40.9mm	UNI85274	UNI85281
	Negative	101.6 x 101.6 x 1.5mm	42.9 x 40.9mm	UNI85275	UNI85282
1-180	Positive	101.6 x 101.6 x 1.5mm	42.0 x 40.5mm	UNI85276	UNI85283
	Negative	101.6 x 101.6 x 1.5mm	42.0 x 40.5mm	UNI85277	UNI85284
1-512	Negative	101.6 x 101.6 x 1.5mm	42.0 x 40.5mm	UNI85280	UNI85285

Sinusoidal Targets

Edmund

* **Designed for MTF Testing**
* **Determines Image Quality of Imaging Components**



Sinusoidal patterns are designed specifically for evaluating the MTF of imaging lenses and other system components.This is accomplished by analyzing the ability of imaging components to reproduce the contrast of the sinusoidal target. MTF analysis is necessary when evaluating components to confirm that they meet design specifications and performance expectations. MTF evaluation is one of the best methods to determine overall image quality, not just absolute limitations. Implementation of MTF testing procedures can reduce costs by ensuring that neither under-specification nor overspecification occurs. The advantage of a sinusoidal target is that it relays image quality information over a full range of frequencies instead of only the maximum obtainable resolution. By using the different frequencies on the target, baselines can be established that directly relate to system requirements. The grayscales on the target are used as references for denoting the contrast levels of the sinusoidal frequencies.

Sinusoidal Targets

	Reflected	Transmitted	Transmitted Microslide
Frequency Range	0.1875 - 12 lp/mm	0.375 - 80 lp/mm	2 - 256 lp/mm
Grayscale Range	Optical Density of 0.2 - 1.2 ±0.02	Optical Density of 0.2 - 1.2 ±0.02	Optical Density of 0.2 - 1.2 ±0.02
Harmonic Distortion	Less than 3%	Less than 3%	Less than 3%
Modulation	60%	80%	80%
Overall Dimensions	85mm x 200mm x 0.175mm thick	70mm x 102mm x 2mm thick (film 0.175mm thick)	25.4mm x 76.2mm x 1.6mm thick on 1" x 3" x 0.062" microslide
Material	Semi-Matte, High Grain Quality Photographic Paper	High Resolution Film Sandwiched in Soda Lime Glass	High Resolution Film (0.175 mm) Sandwiched in Soda Lime Glass
Stock No.	**UNI54804**	**UNI54803**	**UNI55641**

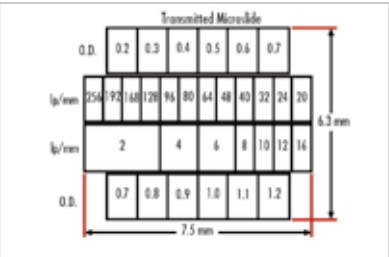


Image Analysis Micrometer

* **Designed for Measurement Calibration**

The circles, squares, bars, and other geometries on the micrometer are designed to be used for calibration and verification of measurement systems (see table). Also features a 2.5" linear scale for larger scale calibrations or measurements, labeled every 0.5". Each plate is accurate to within ±2µm of the stated dimension. Glass slide dimensions: 1" W x 3" L x 1.5mm T. Large circle at the right of the slide is 0.5" Dia. Test Plates 1-4 correspond to top patterns and 5-8 to bottom patterns, all left to right. Patterns 1, 2 and 8 are calibrated on NIST certified micrometers.

Plate	Frame Size	Description
1	4600 x 3500µm	Circles with diameters 2000µm, 1000µm, 500µm, 250µm
2	1000 x 800µm	Circles with diameters 500µm, 250µm, 125µm, 62.5µm
3	1000 x 800µm	7 bars (200µm x 20µm) separated by 30°
4	1000 x 800µm	Various circles, doughnuts, and HEX shapes
5	4000 x 3200µm	Squares of 100µm, 40µm, 20µm, (2 sets)
6	2050 x 1650µm	Grid with 50µm holes and walls
7	4200 x 3400µm	Grid with 200µm holes and walls
8	10000µm long	Scale (micrometer) 10µm

Description	Standard	NIST Certified
A) Image Analysis Micrometer	UNI53713	UNI59217
B) Image Analysis Micrometer on Opal Glass	UNI58605	UNI59272

Micro Line And Dot Standard Stage Micrometer

* **Calibrate Pixel Dithering**
* **Lines and Dot Range from 2µm to 100µm**
* **NIST Certified Versions Available**

The Micro Line and Dot Standard is designed to calibrate imaging devices performing critical measurements. The pattern features known dot and line sizes of 2µm, 3µm, 4µm, 5µm, 6µm, 7µm, 8µm, 9µm, 10µm, 25µm, 50µm, 75µm, 100µm. Calibrating with this target can limit the effects of pixel dithering in image processing algorithms. Target is chrome on glass, 1" x 3" x 1.5mm.

Description	Standard	NIST Certified
Micro Line and Dot Standard Stage Micrometer	UNI58606	UNI59273
Micro Line and Dot Standard Stage Micrometer on Opal Glass	UNI58762	UNI59274

Multi-Grid Standard Stage Micrometer

* **Calibrate Distortion in High Magnification Systems**
* **NIST Certified Version Available**

The Multi-Grid Stage Micrometer features grids of varying frequency, and is ideal for calibrating distortion in microscopic systems. Grid sizes are 0.5mm (25µm divisions), 1.0mm (50µm divisions), 2.0mm (100µm divisions) and4.0mm (200µm divisions). Micrometer also features an angle grid (15° segments). Target is chrome on glass, 1" x 3" x 1.5mm.

Description	Standard	NIST Certified
Multi-Grid Standard Stage Micrometer	UNI58607	UNI59275
Multi-Grid Standard Stage Micrometer on Opal Glass	UNI59278	UNI59279

Dual Axis Linear Scale Stage Micrometer

* **Dual Axis Design**
* **English and Metric Sales**
* **NIST Certified Version Available**

Our Linear Scale Stage Micrometer is designed to accurately calibrate machine vision systems simultaneously in the X- and Y- axes. This allows calibration without rotation, and without compensation for camera aspect ratios. Micrometer features two scales – a metric scale featuring 25µm divisions, and an English scale featuring 1 mil (0.001") divisions. Target is chrome on glass, 1" x 3" x 1.5mm.

Description	Standard	NIST Certified
Dual Axis Stage Micrometer	UNI58608	UNI59276
Dual Axis Stage Micrometer on Opal Glass	UNI58763	UNI59277

EO Machine Vision Stage Micrometers

* **N.I.S.T. Traceable Certificate of Accuracy Included**
* **Ideal for Quick Calibration of Vision Systems**
* **Durable Storage Case Included**

The EO Machine Vision Micrometers are ideal for calibrating a variety of machine vision systems. They provide a quick means for ensuring precise measurements, whether output is direct to a monitor or image analysis software is being utilized. Featuring a precision scale over the entire 300mm length, these micrometers are ideal for large fields of view and a wide range of resolutions. The line pattern is held to tight tolerances to guarantee accuracy and repeatability. These are an ideal tool for any mid or low power video lens measurement system. For higher power systems, consider our Multi-Function Calibration Targets.

Description	Scale Length	Divisions	Stock No.
1mm Machine Vision Micrometer	300mm	300 (1mm steps)	UNI58292
2mm Machine Vision Micrometer	300mm	150 (2mm Steps)	UNI58293
5mm Machine Vision Micrometer	300mm	60 (5mm Steps)	UNI58294

Dimensions	50.8mmW x 338.1mmL x 6.35mmT
Dimensional Tolerances	±1.27mm
Positional Accuracy	±0.003mm up to 125mm ; ±0.005mm up to 300mm
Reflectivity	50% ±5% @ 550nm
Line Width	0.125mm ±0.003mm
Material	Soda Lime Float Glass
Surface Quality	40-20 Over Pattern Area
Coating	First Surface Reflective Chromium,OD > 3.0

Star Target

* **Ideal for Detection of Focus Errors and Astigmatism**
* **Low and High Resolution Versions Available**

Star targets are ideal for identifying focus errors, astigmatism, and other aberrations existing in an imaging system. We have several targets to choose from. Our 60mm diameter targets feature an unresolved core of 8.7µm, and are ideal for high-resolution or high magnification imaging systems. Both targets are chrome on glass. Our 4" x 4" targets, available as chrome on glass (UNI46247) or photo paper (UNI46246), feature an unresolved core of 70µm, and are designed for mid-to low-range spatial frequencies common in macro imaging systems

Star Targets

* Sector = 1 transparent/1 opaque pair

Pattern Diameter	Target Dimensions	Thickness	Wedge Angle*	Number of Sectors*	Target Edge		Target Center		Stock No.
					Frequency	Line Width	Frequency	Line Width	
50mm	60mm dia.	1.5mm	10°	36	0.229 lp/mm	2.2mm	114.5 lp/mm	0.009mm	UNI58832
50mm	60mm dia.	1.5mm	5°	72	0.459 lp/mm	1.1mm	229 lp/mm	0.009mm	UNI58833
62.5mm	4" x 4"	1.5mm	6°	60	0.31 lp/mm	1.6mm	7.14 lp/mm	0.070mm	UNI46247
62.5mm	4" x 4"	0.2mm	6°	60	0.31 lp/mm	1.6mm	7.14 lp/mm	0.070mm	UNI46246

Star Target Arrays

* **Detect Aberrations at Various Field Points**

Our star target arrays are designed to identify focus errors and astigmatism along field points in the image of a vision system. With star targets located at the center, corner, and along the diagonals of the sensor, determining precision location and amplitude of the problem areas couldn't be easier. The small array features unresolved centers of 0.1mm, whereas the large array features unresolved centers of 0.15mm.

Star Target Arrays

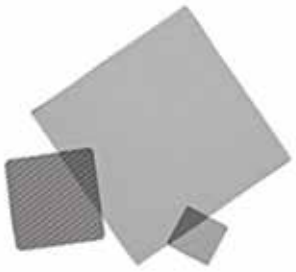
* Sector = 1 transparent/1 opaque pair

Description	Target Dimensions	Pattern Area	Number of Stars	Individual Star Diameter	Number of Sectors*	Frequency Range	Stock No.
Small Star Target Array	50 x 50 x 1.5mm	29.2 x 21mm	33	2.0mm	36	2.86 - 57.5lp/mm	UNI58834
Large Star Target Array	101x101x 2.0mm	90 x 90mm	59	4.5mm	36	1.27 - 38.5lp/mm	UNI58835

High Precision Ronchi Rulings

* **Chrome on Glass**
* **High Tolerance**
* **Superior to Etched and Filled Rulings**
* **Lines Parallel to Edge**
* **English & Metric Versions**

Substrate	Soda Lime Glass
Thickness	1.5mm nominal
Coating	Vacuum Deposited Chrome OD > 3.0
Surface Flatness	1λ per inch
Surface Quality	60-40
Parallelism of Pattern to Substrate	±1°
Line to Line Parallelism	±2 arcsec
Dimensional Tolerance	±0.02"



High Precision Ronchi Rulings-Mitric

LP/mm	0.5" x 0.5" Target	1" x 1" Target	2" x 2" Target
5	*	UNI58775	UNI58782
10	*	UNI58776	UNI58783
20	*	UNI58777	UNI58784
30	*	UNI66347	UNI66352
40	*	UNI58778	UNI58785
50	*	UNI58779	UNI58786
60	*	UNI66348	UNI66353
72	UNI66339	UNI66349	UNI66354
80	UNI66340	UNI62199	UNI62200
100	UNI66341	UNI58780	UNI58787
120	UNI66342	UNI62201	UNI62202
145	UNI66343	UNI66350	UNI66355
165	UNI66344	UNI66351	UNI66356
200	UNI66345	UNI58781	UNI58788
240	UNI66346	UNI62203	UNI62204

High Precision Ronchi Rulings-English

LP/mm	1" x 1" Target	2" x 2" Target	4" x 4" Target	6" x 6" Target
25	UNI58529	UNI58530	UNI58531	-
50	UNI56592	UNI56605	UNI56618	-
100	UNI56593	UNI56606	UNI56619	-
150	UNI56594	UNI56607	UNI56620	-
200	UNI56595	UNI56608	UNI56621	-
250	UNI56596	UNI56609	UNI56622	-
300	UNI56597	UNI56610	UNI56623	-
500	UNI56598	UNI56611	UNI56624	-
750	UNI56599	UNI56612	UNI58459	UNI58521
1000	UNI56600	UNI56613	UNI58460	-
2000	UNI56601	UNI56614	UNI58461	-
2500	UNI56602	UNI56615	UNI58462	-
3000	UNI56603	UNI56616	UNI58463	UNI58525
5000	UNI56604	UNI56617	UNI58464	UNI58526

Precision Ronchi Ruling Slides

* Used for Evaluation of Resolution, Field Distortion, and Parfocal Stability
* Ideal for Reticle and Field Calibration Requirements

Precision Ronchi Ruling Slides

Substrate Frequency	Soda Lime	Fused Silica	Fused Silica with Fluorescent Backing	Opal Glass
	Stock No.	Stock No.	Stock No.	Stock No.
5 lp/mm	UNI57903	UNI57904	UNI57905	UNI59544
10 lp/mm	UNI38258	UNI57884	UNI57875	UNI59545
20 lp/mm	UNI38259	UNI57885	UNI57876	UNI59546
40 lp/mm	UNI38260	UNI57886	UNI57877	UNI59547
80 lp/mm	UNI38261	UNI57887	UNI57878	UNI59548
100 lp/mm	UNI38562	UNI57888	UNI57879	UNI59549
120 lp/mm	UNI38563	UNI57889	UNI57880	UNI59550
150 lp/mm	UNI38564	UNI57890	UNI57881	UNI59551
200 lp/mm	UNI38565	UNI57891	UNI57882	UNI59552
400 lp/mm	UNI57899	UNI57900	UNI57901	-
600 lp/mm	UNI38566	UNI57892	UNI57883	-

Size	1" W x 3" L x 0.04" T nominal (0.06"T for Opal)
Target Size	0.5"W x 1"L
Coating	Vacuum Deposited Chrome OD > 3

Variable Frequency Targets

* 5 lp/mm to 120 lp/mm or 5 lp/mm to 200 lp/mm
* 1mm Wide Step Size
* 5 lp/mm Step Increments
* Used to Calibrate Video Systems
* Inspect Unknown Resolutions

Substrate	Soda lime float glass with beveled edges
Size	2" x 2" x 0.06" T
Target Sizes	1"W x 1.175"L (5-120 lp/mm); 1"W x 1.55"L (5-200 lp/mm)
Flatness	0.0001" or better
Surface Quality	40-10
Coating	Vacuum deposited durable chromium, density ≥3.0

Variable Frequency Targets

	Stock No.
5 lp/mm to 120 lp/mm	UNI38582
5 lp/mm to 200 lp/mm	UNI43488

Precision Ronchi Ruling On Opal Glass

* Chrome on Opal
* High Tolerance
* English and Metric Versions

Precision Ronchi Ruling On Opal Glass-Metric

LP/inch	1" x 1" Target	2" x 2" Target
5	UNI59511	UNI59532
10	UNI59512	UNI59533
20	UNI59513	UNI59534
40	UNI59514	UNI59535
50	UNI59515	UNI59536
100	UNI59516	UNI59537
200	UNI59517	UNI59538

Precision Ronchi Ruling On Opal Glass-English

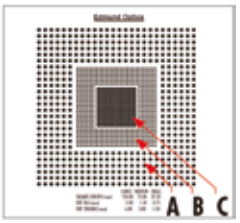
LP/inch	1" x 1" Target	2" x 2" Target
25	UNI59497	UNI59518
50	UNI59498	UNI59519
100	UNI59499	UNI59520
150	UNI59500	UNI59521
200	UNI59501	UNI59522
250	UNI59502	UNI59523
300	UNI59503	UNI59524
500	UNI59504	-
750	UNI59505	UNI59526
1000	-	UNI59527
2000	UNI59507	UNI59528
2500	UNI59508	UNI59529
3000	-	UNI59530
5000	-	UNI59531

TEL : (03)462-6569 (桃園-總公司) / (04)2261-0357 (台中) / (06)208-6651 (台南)

Multi-Frequency Grid Distortion Targets

Edmund

* For Calibration of Imaging Systems
* Fixed and Multi Frequency Targets Available
* N.I.S.T. Certificate of Accuracy Included



Multi-Frequency Target

Although distortion can often be troublesome in measurement applications, it is important to note that no information about the object is actually lost, but merely misplaced in the image. Using these targets, one can easily determine the precise amount of distortion present and back it out of measurements. The dot center can be located using blob (or centroid) analysis in measurement software. To accommodate the expanding variety of image analysis software and applications, we offer fixed frequency and variable frequency targets. The fixed frequency targets are available in a variety of dot size/spacing combinations to complement our full line of imaging lenses. Select a target to cover your entire field of view while maintaining an adequate number of dots across the field, and an adequate number of pixels per dot. The 3 or 5 grids on the multi frequency target scale down so that one target can be used for a variety of lenses and fields of view. Both types of targets are available in a chrome on glass or chrome on opal target to accommodate transmission or reflection based on applications respectively. Included in the packaging is a serialized N.I.S.T. Traceable Certificate of Accuracy per MIL-STD-45662A.

	3 Freq. Glass Target			5 Freq. Glass Target				
Substrate	Soda Lime or White Opal Glass			Soda Lime or White Opal Glass				
Overall Dimensions (L x W x T) (mm)	76.2 x 76.2 x 1.5*			76.2 x 76.2 x1.5*				
Tolerances: Placement of Squares (A, B ,C, D, E) (mm)	±0.004			±0.004				
Dot Diameter (mm)	±0.0025			±0.0025				
Dot Center to Center Spacing (mm)	±0.0025			±0.0025				
Grid Corner to Corner Accuracy (mm)	±0.004			±0.004				
Surface Flatness	4-6λ/25.4 mm area			1λ/25.4 mm area				
Surface Quality	40-10 (within 51mm sq. area)			20-10 (within 51mm sq. area)				
Coating	Vacuum Deposited Chromium Oxide (specular reflectivity <5% @ 550nm)			Vacuum Deposited Chromium Oxide (specular reflectivity <5% @ 550nm)				
Square	A	B	C	A	B	C	D	E
Square Size (center to center of dots) (mm)	50	25	12.5	50	34	20	10	5
Dot Diameter (mm)	1	0.5	0.25	1	0.5	0.25	0.125	0.0625
Dot Center Spacing (mm)	2	1	0.5	2	1	0.5	0.25	0.125
Chrome Stock Number/Price	UNI46250			UNI64864				
Opal Stock Number/Price	UNI58774			UNI64865				

* Opal Glass is 3.2mm Thick

Fixed Frequency Grid Distortion Targets

Edmund

	Chrome on Glass Target	Chrome on Opal Target
Substrate	Clear Soda Lime Float Glass	White Opal Glass
Substrate Thickness	1.5mm	3.2mm
Tolerances		
Dot Diameter	±0.002mm	±0.002mm
Dot Center to Center Accuracy	±0.001mm	±0.001mm
Surface Flatness	4-6λ/25.4mm area	4-6λ/25.4mm area
Surface Quality	40-20	40-20
Coating	Reflective First Surface Chromium OD > 3.0, R_{abs}= 50% ±5% @ 550nm	Reflective First Surface Chromium OD > 3.0, R_{abs}= 50% ±5% @ 550nm


Fixed Frequency Target

Target Dimen.	Pattern Size (mm)	Dot Dia. (mm)	Dot Spacing (mm)	Chrome on Glass		Chrome on Opal	
				Overall Accuracy (mm)	Stock No.	Overall Accuracy (mm)	Stock No.
2" x 2"	25 x 25	0.0625	0.125	±0.001	UNI58509	±0.001	UNI59209
2" x 2"	25 x 25	0.125	0.25	±0.001	UNI58527	±0.001	UNI63983
2" x 2"	25 x 25	0.25	0.5	±0.001	UNI57981	±0.001	UNI59210
2" x 2"	25 x 25	0.25	1	±0.001	UNI62209	±0.001	UNI63984
3" x 3"	50 x 50	0.125	0.25	±0.001	UNI59213	±0.001	UNI63985
3" x 3"	50 x 50	0.25	0.5	±0.001	UNI58536	±0.001	UNI63986
3" x 3"	50 x 50	0.25	1	±0.001	UNI62211	±0.001	UNI63987
3" x 3"	50 x 50	0.5	1	±0.001	UNI57983	±0.001	UNI59211
5" x 5"	100 x 100	0.25	0.5	±0.0015	UNI59215	±0.0015	UNI63988
5" x 5"	100 x 100	0.25	1	±0.0015	UNI62213	±0.0015	UNI63989
5" x 5"	100 x 100	0.5	1	±0.0015	UNI59217	±0.0015	UNI63990
5" x 5"	100 x 100	1	2	±0.002	UNI57985	±0.002	UNI59212
7" x 7"	150 x 150	0.5	1	±0.002	UNI62207	±0.002	UNI63991
7" x 7"	150 x 150	1	2	±0.002	UNI58507	±0.002	UNI63992

Diffuse Reflectance Grid Distortion Targets

Edmund

* Diffuse Reflectance Treatment Mimics Ceramic Targets
* Chrome Pattern on Substrate
* No Glare with On or Off Axis Lighting
* Perfect for Front Illuminated Measuring

Similar to ceramic targets, the Diffuse Reflectance Grid Distortion Targets have been treated to create a surface which diffusely reflects light back, avoiding glare across the image surface. Using these targets, one can easily determine the precise amount of distortion present in an image. The dot center can be calculated using blob analysis in measurement software, and calculated against the standard, to remove distortion from the image. Offered in 2 substrate sizes and 3 dot frequencies, the targets can be used with a wide variety of lenses from wide angle to telephoto.

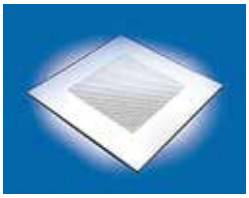
Diffuse Reflectance Grid Distortion Targets

Target Dimensions	Pattern Size (mm)	Dot Diameter (mm)	Dot Spacing (mm)	Dot Size Accuracy	Center to Center Accuracy	Stock No.
2" x 2"	25 x 25	0.0625	0.125	± 3µm	± 1µm	UNI62949
2" x 2"	25 x 25	0.125	0.25	± 3µm	± 1µm	UNI62950
2" x 2"	25 x 25	0.25	0.5	± 3µm	± 1µm	UNI62951
3" x 3"	50 x 50	0.125	0.25	± 3µm	± 1µm	UNI62952
3" x 3"	50 x 50	0.25	0.5	± 3µm	± 1µm	UNI62953
3" x 3"	50 x 50	0.5	1	± 3µm	± 1µm	UNI62954

Line Grid Target

* Test and Correction of Distortion in Vision Systems
* Calibration of Perspective Error in Microscope Stages
* Measure Physical Field of View

Designed for calibration of vision systems and microscope stages, the Line Grid Target offers repeated parallel lines in both X and Y axes. Using these lines as a reference, distortion and perspective error can be quantified and calibrated out of a system. Two types of targets are available, Chrome on Glass, and Low Reflection Chrome on clear glass, bonded to a white backing plate. The Low Reflection Chrome can be used with front lighting, without creating highlights that degrade the image of the target.



	2" x 2" Chrome on Glass	1" x 1" Low Reflective Chrome	2" x 2" Low Reflective Chrome
Overall Dimensions (L x W x D)	50.8mm x 50.8mm x 1.5mm	25.4mm x 25.4mm x 2.5mm	50.8mm x 50.8mm x 2.5mm
Pattern Area	30.1mm x 30.1mm	20.0mm x 20.0mm	30.1mm x 30.1mm
Substrate	Clear Soda Lime Float Glass	Clear Glass Bonded to White Backing Substrate	Clear Glass Bonded to White Backing Substrate
Coating	OD >3.0	OD >3.0	OD >3.0
Line Spacing (Center to Center)	1.00mm ± 0.001mm	1.00mm ± 0.001mm	1.00mm ± 0.001mm
Line Thickness (Center Line)	0.05mm ± 0.002mm	0.125mm ± 0.005mm	0.1mm ± 0.002mm
Line Thickness (Inner lines)	0.05mm ± 0.002mm	0.075mm ± 0.005mm	0.075mm ± 0.002mm
Overall Accuracy	±0.002mm	±0.002mm	±0.002mm
Surface Quality	20-10 over active area, 60-40 outside	20-10 over active area, 60-40 outside	20-10 over active area, 60-40 outside
Flatness	3-4λ / Inch	3-4λ/ Inch	3-4λ / Inch
Stock No.	**UNI62536**	**UNI62537**	**UNI62538**

Concentric Square Target

* For Calibration of Measurement Software
* N.I.S.T. Traceable Certificate of Accuracy Included
* 1mm-50mm Squares

These targets provide an accurate means of calibrating measurement software for image processing. The squares vary in dimensions to accommodate different fields of view. Included in the packaging is a serialized N.I.S.T. Traceable Certificate of Accuracy per MIL-STD-45662A.

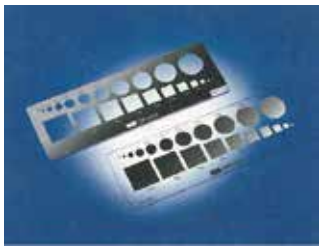
Dimensions	76.2mm x 76.2mm x 1.5mm (3.2mm Thick for Opal)
Square Sizes	1, 2, 3, 4, 5, 10, 15, 20, 30, 40, 50mm
Line Width Tolerance	±0.0025mm
Diagonally Opposite Corner Spacing (50mm square)	70.7107mm ±0.004mm
Centering Tolerance	±0.004mm
Substrate	Clear soda lime float glass
Surface Flatness	4 to 6λ / 25.4mm area
Surface Quality	40-10 (within 50mm sq. area)
Coating	Vacuum-deposited chromium oxide(specular reflectivity < 5% @ 550nm)

Concentric Square Target	UNI46248
Concentric Square Target on Opal Glass	UNI58773

Dot And Square Calibration Target

* Designed for Measurement Calibration
* Positive or Negative Chrome Patterns on Glass
* High Contrast Target for Imaging
* Elements from 0.5 to 10mm

This target provides a highly accurate reference for feature sizes of circles and squares and is ideal for testing the accuracy of non-contact metrology systems, especially those vulnerable to distortion and blooming. The precision pattern is formed in Low Reflection Chromium on a stable Soda Lime Glass substrate in standard microscope slide format. The low reflection pattern surface provides high contrast against a light background, ideal for diffuse or coaxial illumination applications. The pattern is applied to the first surface and features both circles and squares in 0.5mm and whole number sized increments from 1mm to 10mm. The Positive Target features an opaque pattern on a clear background whereas the Negative Target features a clear pattern on an opaque background.



Substrate	Float Glass
Plate Dimensions	1" x 3" ± .02"
Thickness	0.060" ± .001"
Flatness	<4 λ
Surface Quality	20-10
Parallelism	0.0005"
Element Size	±2.5µm

Target	Stock Number
Positive	UNI62268
Negative	UNI62269

Multi-Function High Magnification Calibration Targets

Edmund

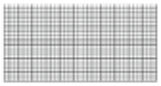
* **Designed for Measurement Calibration**
* **Ideal for Microscopes and Machine Vision Systems**
* **Two Targets Available for Different Magnifications**

Use these "all-in-one" targets to measure microscope and vision system parameters, without separate calibration targets. Targets will test and calibrate our Mitutoyo objectives, Zeiss microscopes, and high magnification video lenses for resolution, distortion, and depth of field (DOF). Targets include variable frequency Ronchi rulings, sets of grids and concentric circles with varying line spacings and widths, a microscale, and edge blocks to prop up target for DOF measurements. A user information card, complete manual on CD, and N.I.S.T. certificate are provided. Use Low Frequency Target for optical systems with 4X to 20X objectives. Target is useful for machine vision systems with low magnifications and long focal distances. Use High Frequency Target for optical systems with 20X to 100X objectives. Target is useful for microscopes and other systems with high magnifications and short focal distances.

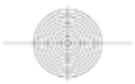
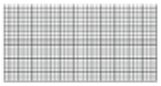
Substrate	Fused Silica	**Surface Quality**	20-10 (UNI56076), 10-2 (UNI56077)
Target Size	4X to 20X : 1" x 3" x 6.35mm	**Parallelism**	1 min
	20X to 100X : 1" x 3" x 9mm	**Flatness**	3-4λ
Coating	Evaporated chrome	**Overall Accuracy**	±1.0 μm

4X to 20X Multi-Function Target	UNI56076
20X to 100X Multi-Function Target	UNI56077

4X-20X Target Specifications

Concentric Circles	OD (mm)	Line Spacing (mm)	Line Width (μm)
	5	0.25	20
	4	0.25	15
	3	0.25	10
	2	0.1	7.5
	1	0.1	5
Grids	**Width (mm)**	**Line Spacing (mm)**	**Line Width (μm)**
	4.5	0.25	20
	4.5	0.25	15
	4.5	0.25	10
	4.5	0.1	15
	4.5	0.1	10
	4.5	0.1	5
	2.55	0.075	10
	2.55	0.075	5
	2.55	0.05	5
	2.55	0.05	2.5
Ronchi Rulings	Range	Frequency Change (lp/mm)	
	60 - 380	20	
Linear Microscale	Length (mm)	Div./mm	Microns/div.
	0 - 68.2	20	50

2X-100X Target Sprcifications

Concentric Circles	OD (mm)	Line Spacing (mm)	Line Width (μm)
	3	0.25	10
	2	0.1	7.5
	1.5	0.1	5
	1	0.05	5
	1	0.05	2.5
Grids	**Width (mm)**	**Line Spacing (mm)**	**Line Width (μm)**
	3	0.25	10
	3	0.25	7.5
	3	0.25	5
	3	0.1	10
	3	0.1	7.5
	3	0.1	5
	2.55	0.075	10
	2.55	0.075	5
	2.55	0.05	5
	2.55	0.05	2.5
Ronchi Rulings	Range	Frequency Change (lp/mm)	
	240-600	10	
Linear Microscale	Length (mm)	Div./mm	Microns/div.
	0 - 68.2	20	50

Multi-Function Calibration Target For Low Magnification Systems

Edmund

* **Calibrates Systems from 0.08X to 4X**
* **Can Calibrate Transmission or Reflective Systems**
* **Measures MTF, DOF, Resolution, FOV, & Distortion**
* **N.I.S.T. Certificate of Accuracy Included**

Designed to calculate systems from 0.08X to 4X magnification, this Multifunction Calibration Target has the ability to test many parameters of a visual system at one time, allowing more useful information to be obtained with one target. Depth of Field can be measured for a number of resolutions, allowing measurements to be made that are useful for each particular application. System MTF can be measured with frequencies from 5 lp/mm to 80 lp/mm. The target consists of two framed glass plates with a chrome deposit. The second plate has a circular and grid pattern to measure planar and tilted plane distortion. The Pattern is designed to make use of the entire FOV without having to move the target between measurements of each parameter, and it is designed for very high accuracy. Detailed specifications and a certificate of compliance are included. The target also comes with an operation card, tutorial CD, and carrying case. Set UNI58770 includes both opal and standard chrome on glass targets.

Substrate	Select Soda Lime or Opal Glass	**Flatness**	1λ per inch
Plate Dimensions	100mm x 166mm (±1.0mm)	**Surface Quality**	40-20
Thickness	1.5mm (3.2mm for Opal Glass)	**Parallelism**	0.05mm
Coating	Evaporated Chrome	**Maximum Bow**	0.75mm

Low Mag Multi-Function Target	UNI58403
Target on Opal Glass	UNI58769
Low Mag Multi-Function Target Set	UNI58770

Multi-Function Calibration Target For Low Magnification Systems

Tested Parameter	Pattern Size	Pattern Description
Resolution/MTF	154mm x 100mm	11 cycles of 5 to 40 to 5 lp/mm
Resolution/MTF	21.8mm x 28mm	50 lp/mm
Resolution/MTF	21.8mm x 26mm	60 lp/mm
Resolution/MTF	21.9mm x 24mm	70 lp/mm
Low Mag DOF	100mm x 154mm	80 lp/mm
FOV/DOF	154mm	Linear Scale, 0-154mm, 0.25mm pitch
Distortion	80mm x 80mm	5, 10, 15, 20, 30, 40, 50, 60, 70, 80, & 90mm Diameter Circles
Distortion	80mm x 80mm	1, 2 & 4mm Pitch
Blooming	115mm x 20mm	Positive and Negative Circles & Squares

X-Rite Colorchecker®

* Test True Color Balance
* Include Natural, Chromatic, Primary, and Gray Scale Colors
* 24, 30, or 140 Scientifically Designed Patches

The X-Rite ColorChecke® is a unique test pattern scientifically designed to help determine the true color balance or optical density of any color rendition system.It is an industry standard that provides a non-subjective comparison with a "test pattern" of 24 scientifically prepared colored squares. Each color square represents a natural object—human skin, foliage, blue sky, etc, providing a qualitative reference to quantifiable values. Each color will reflect light in the same way in all parts of the visible spectrum, thus maintaining color consistency over different illumination options. Some applications include spectroscopy, machine vision,photography, graphic arts, electronic publishing, and television.

X-RITE Colorchecker®

	Color Patch Size	Total # of Patches	Overall Size (L x W)	Finish Notes	Stock No.	
					Glass	Matte
ColorChecker ®SG Chart	5/8"	140	8" x 11.5"	All Patches Semi-Gloss	UNI58288	N/A
Large Macbeth ®ColorChecker ®	1 5/8"	24	8" x 11.5"		N/A	UNI37756
ColorGauge Micro	1/4"	30	1 3/8" x 1 5/8"	All 18 Color Patches Matte	UNI68767	UNI87420
ColorGauge Nano	1/8"	30	11/16" x 13/16"	All 18 Color Patches Matte	UNI68768	UNI87421
ColorGauge Pico	1/16"	30	3/8" x 7/16"	All 18 Color Patches Matte	UNI87413	UNI87414
RezChecker	1/4"	30	1 5/8" x 1 7/8"	All 18 Color Patches Matte	UNI87422	UNI87423
Macbeth ®White Balance Checker ®	-	1	8" x 11.5"		N/A	UNI58604

White Balance Reflectance Targets

* 99% Reflectance Across UV-VIS-NIR
* NIST Traceable Calibration Certificate
* Durable and Washable

The White Balance Reflectance Targets can be used for a variety of applications including calibration of imaging systems, back light illumination, laser targets, and optical reflectors.Such targets are important in determining the correlation between an input and output quantity for measurement devices. In the case of color reproduction of an imaging system, using the target can provide true color under any lighting conditions.In most color cameras, calculating the differences between input and output and applying correction factors is done automatically by the camera's "white balance" function. This makes the standard very easy to use. Besides alibrating for color, the standard can be used for calibrating lighting levels and uniformity within an imaging system.All targets come framed in an anodized aluminum housing with mounting holes for easy integration. Targets include tested calibration data from 250 to 2500nm every 50nm.

White Balance Refkectance Targets

2" White Balance Target	UNI58609
5" White Balance Target	UNI58610
10" White Balance Target	UNI58611
12" White Balance Target	UNI58612

Accessories

Wooden Case for 2" Target	N/A
Wooden Case for 5" Target	UNI59317
Wooden Case for 10" Target	UNI59318
Wooden Case for 12" Target	UNI59319

EIA Grayscale Pattern Slide

* Video Calibration
* Permanent Density Standard
* Evaluate/Compare the Dynamic Range of Cameras

Ideal for evaluation of video or optical inspection systems and cameras. Convenient format (50.8 x 50.8 x 1.5mm nominal) may be viewed directly or projected with 35mm slide projector. Pattern is a "standard" and consists of two scales: EIA Equal Steps Transmission (Linear) and EIA Equal Steps Density (Logarithmic). Each scale has nine steps from 3% to 60% T (EIA 20:1). All steps are accurately obtained by an ultra-precise halftone pattern.Pitch is 0.001". The steps are side-by-side, 0.200" x 0.100", without spaces or borders. Transmissions and Densities are shown below with strict tolerances. Scale is permanent chrome on glass material which resists harsh environments. Background is opaque with an Optical Density of 3.0 (T = 0.1%).

Step / Field	Equal Transmission Scale				Equal Density Scale			
	Linear EIA 20:1				Logarithmic EIA 20:1			
	Density		% Transmission		Density		% Transmission	
	Nominal	Tolerance ±	Nominal	Tolerance ±	Nominal	Tolerance ±	Nominal	Tolerance ±
1	1.523	0.228	3	1.5	1.523	0.228	3	1.5
2	0.995	0.117	10.125	2.7	1.36	0.185	4.363	1.8
3	0.763	0.088	17.25	3.5	1.198	0.15	6.344	2.2
4	0.613	0.073	24.375	4.1	1.035	0.123	9.266	2.6
5	0.502	0.064	31.5	4.6	0.872	0.1	13.416	3.1
6	0.413	0.058	38.625	5.1	0.71	0.08	19.51	3.7
7	0.34	0.053	45.75	5.6	0.547	0.068	28.372	4.4
8	0.277	0.049	52.875	6	0.384	0.056	41.259	5.3
9	0.222	0.046	60	6.4	0.222	0.046	60	6.4
EIA Pattern Slide – Combined Equal Steps Transmission and Density								**UNI52356**
Also available with only one pattern ascending and descending (reversed on lower scale). The Transmissions or Densities are sequentially identical for both scales, except they are arranged in reversed right/left–left/right order								
EIA Transmission (Linear) Grayscale Slide								**UNI52357**
EIA Density (Logarithmic) Grayscale Slide								**UNI52358**

Grayscale Targets

(A) ColorChecker® Grayscale

* White, 18% Gray and Black Steps
* Same values as 24-patch ColorChecker®
* 8.5" x 11" Rigid Substrate
* Use for Color-Correction & White Balancing

ColorChecker®Grayscale 3-Value UNI59658

(B) Logarithmic Grayscale

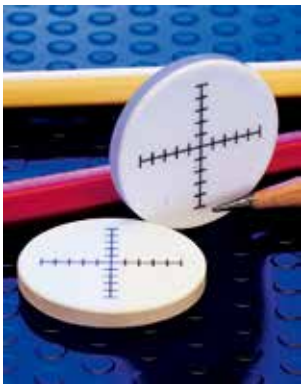
* Scale 1: Densities from 0.09 to 1.5
* Scale 2: Densities from 1.5 to 0.09
* 15 Density Steps per scale
* 8.5" x 11" Reflective Photographic paper

Large Grayscale Target UNI53712

B

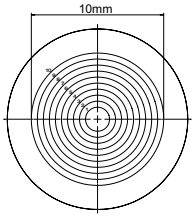
TEL : (03)462-6569 (桃園-總公司) / (04)2261-0357 (台中) / (06)208-6651 (台南)

Opal Glass Reticle Targets



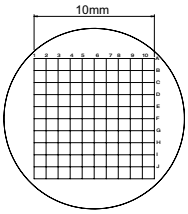
These reticles are ideal for imaging and laser targeting applications. They may be used for calibrating resolution, focus, and boresighting, as well as in general spot size, blob, and morphology analysis.

Diameter	27mm ±0.5mm
Thickness	3.5mm ±0.5mm
Edges	Smoothed for safe handling
Substrate	Ground white nonspecular opal glass
Flatness	1λ



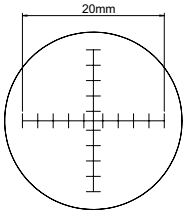
Opal Glass Concentric Circles Reticle

UNI58771



Opal Glass Index Grid

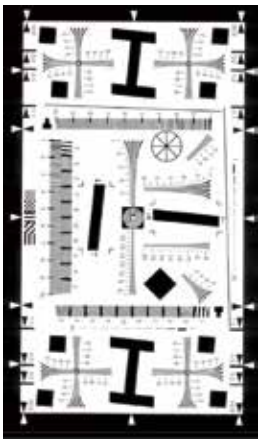
UNI58772



Opal Glass Crossline Reticle

UNI38263

I3A 12233 Resolution Test Chart



* **Offers Full Field Resolution Calibration**
* **Three Sizes Available**

This target is designed to test resolution of electronic still picture cameras. The target can be employed to measure visual resolution, limiting resolution, and offers a simple method in obtaining spatial frequency response (SFR) data. Features on the chart range from 100 to 2000 LW/PH (line widths per picture height), which corresponds to the finest feature being 0.1mm. Also includes 100-1000 line square wave sweeps, slanted lines, bars, squares, and checkerboard patterns for image compression artifacts. This chart is offered in three sizes to accommodate a variety of cameras and lenses.

Visit our Website for IEEE Resolution Targets.

Target	Black print on photo-paper
Dimensions	1X: 200mm x 356mm (7.9" x 14")
	2X: 400mm x 711mm (15.7" x 28")
	4X: 800mm x 1422mm (31.5" x 56")

	Standard I3A Target	Enhanced Digital Camera Target
I3A/ISO 1X Resolution Target	UNI56074	UNI58940
I3A/ISO 2X Resolution Target	UNI58234	UNI58941
I3A/ISO 4X Resolution Target	UNI56075	-

ISO-21550 Dynamic Range Film

The dynamic range 35mm film can be used to determine the optical density range of a transmission scanner or other transmission imaging systems. It is a perforated 35mm filmstrip with gray scale patches.

Substrate Size	75 x 35mm typical	**Total Image Size**	~28mm x 19mm
Substrate Type	Transmissive Photo Paper	**Patch Size**	4.5mm x 4.5mm

ISO-21550 Dynamic Range Film 0-4 OD	UNI58942
ISO-21550 Dynamic Range Film 0-6 OD	UNI58943

Kodak Imaging Chart

* **Over 18 Test Patterns**
* **$8^{1}/_{2}$" x 11" Film**

With over 18 different test patterns, Kodak's Imaging Test Chart is ideal for imaging system evaluation. Test criteria ranges from resolution and contrast measurement to subjective image evaluation through a continuous toned photograph. Each target is supplied with instructions defining the features of the target patterns. Film is 0.2mm thick.

Kodak Imaging Test Chart : UNI53716

ISO-14524 Reflective Camera Contrast Chart

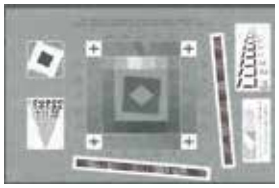
* **Determines Dynamic Range of Cameras**
* **12 gray level patches**

The Reflective Contrast Target is designed to determine the range of optical density that an imaging system can capture. This target complies with ISO-14524 specifications.

Substrate Size	240 x 395mm	**Background Density**	0.84
Working Area	200 x 356mm		
Patch Size	33 x 33mm	**Density Patches**	0.1, 0.2, 0.31, 0.43, 0.56, 0.70, 0.87, 1.05, 1.27, 1.53, 1.86, 2.30
Substrate Material	Reflective Photographic Paper		

ISO-14524 Reflective Camera Contrast Chart	UNI58944

ISO-16067-1 Scanner Test Target



The Reflective Scanner Test Target is designed to measure the reflective light resolution and imaging characteristics of digital scanning systems, in compliance with ISO 16067-1 specifications. Target patterns include the Landolt Ring, alphanumeric resolution and slant edge charts, grey step patches, and horizontal, vertical, and slanted ronchi ruling patterns.

Target	Black Print on Photo Paper
Dimensions	100mm x 152mm
Ronchi Patterns	6 - 40 lp/mm

ISO-16067-1 Reflective Scanner Test Target	UNI58196

同軸擴散光源系列 / CAD-SERIES

產品特色

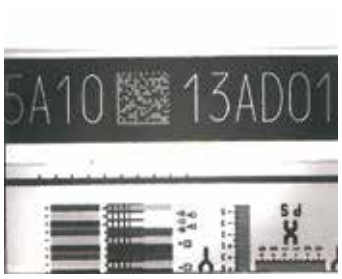
＊提供遊 18x25mm 至 150x150mm 的均勻照明範圍
＊內建高透光率多層鍍膜保護鏡片，確保長期使用時，分光鏡不受灰塵及指紋汙染。
＊影像中不會有反光亮點，最適合高反射率樣品的測驗。
＊多種光源顏色可供選擇，以配合各種攝影機和樣品的特性，達到最佳照明效果。
＊可選配濾鏡螺牙轉接環，適合各種口徑之 CCD 鏡頭。

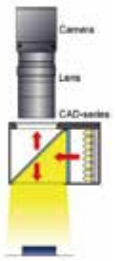
適合用途

＊晶圓、TFT 玻璃基板、Color Filter 對位記號辨識及條碼自動判讀。
＊玻璃或光滑金屬表面瑕疵檢測。
＊刑事指紋鑑定。

液晶面板定位標誌辨識

二維條碼判讀應用





基本規格

型　號	顏　色	發光範圍	最大消耗功率	尺寸圖
CAD-018-025	Ⓘ Ⓦ Ⓡ Ⓖ Ⓑ	18×25	1.3 W	1
CAD-025-025	Ⓘ Ⓦ Ⓡ Ⓖ Ⓑ	25×25	1.5 W	2
CAD-038-038	Ⓘ Ⓦ Ⓡ Ⓖ Ⓑ	38×38	3.0 W	3
CAD-050-050	Ⓘ Ⓦ Ⓡ Ⓖ Ⓑ	50×50	5.0 W	4
CAD-050-075	Ⓘ Ⓦ Ⓡ Ⓖ Ⓑ	50×75	4.0 W	5
CAD-075-075	Ⓘ Ⓦ Ⓡ Ⓖ Ⓑ	75×75	6.0 W	6
CAD-075-100	Ⓘ Ⓦ Ⓡ Ⓖ Ⓑ	75×100	8.1 W	7
CAD-100-100	Ⓘ Ⓦ Ⓡ Ⓖ Ⓑ	100×100	10.1 W	8
CAD-150-150	Ⓘ Ⓦ Ⓡ Ⓖ Ⓑ	150×150	17.6 W	9

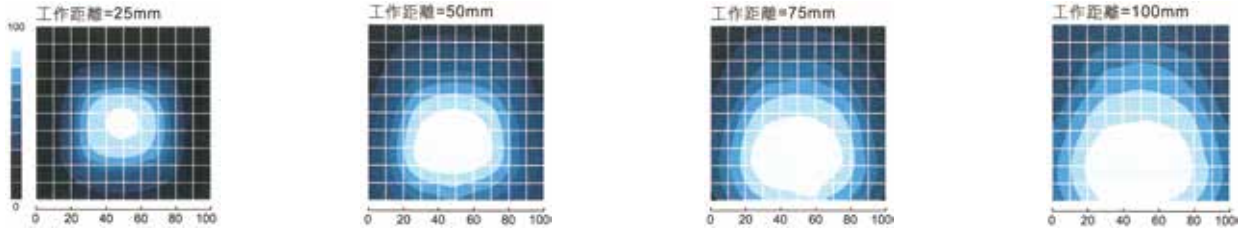
註：1.本系列提供紅外線Ⓘ、白光Ⓦ、紅光Ⓡ、綠光Ⓖ、藍光Ⓑ等顏色。
2.發光範圍數值單位為毫米（mm）。

型號說明

CAD-□□□-□□□-□-□-□
1 2 3 4 5

1 發光區寬度，單位為mm
2 發光區長度，單位為mm
3 光源顏色
I：紅外線　G：綠光
W：白光　B：藍光
R：紅光
4 供電方式
1：DC 12V
2：DC 24V
U：搭配U系列控制器
N：搭配N系列控制器
5 附加說明碼
A：標準版本
Z：特殊版本

照度分布圖型號（CAD-050-050）

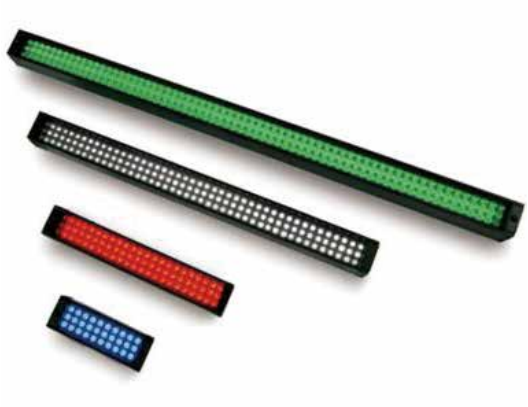


TEL：(03)462-6569 (桃園-總公司) / (04)2261-0357 (台中) / (06)208-6651 (台南)

高亮度光源棒 / DL-SERIES

產品特色

＊採用高亮度 LED 密集排列，提供高亮度的狹長照明範圍，可依不同架設方式達成直射、斜射及側光等多種照明效果，亦可在前方裝置擴散板，產生較柔和的擴散光、或作為長條形背光源使用。
＊本系列有多種光長度可供選擇，亦可依照的實際需求，訂製標準規格之外的特殊機型。



基本規格

型　號	顏　色	發光範圍	最大消耗功率	尺寸圖
EDL-015-045	Ⓘ Ⓦ Ⓡ Ⓖ Ⓑ	15×45	1.3 W	1
EDL-015-072	Ⓘ Ⓦ Ⓡ Ⓖ Ⓑ	15×72	2.0 W	*
EDL-015-100	Ⓘ Ⓦ Ⓡ Ⓖ Ⓑ	15×100	2.8 W	2
EDL-015-145	Ⓘ Ⓦ Ⓡ Ⓖ Ⓑ	15×145	4.0 W	*
EDL-015-200	Ⓘ Ⓦ Ⓡ Ⓖ Ⓑ	15×200	5.5 W	*
EDL-015-300	Ⓘ Ⓦ Ⓡ Ⓖ Ⓑ	15×300	8.3 W	3
EDL-015-400	Ⓘ Ⓦ Ⓡ Ⓖ Ⓑ	15×400	11.1 W	*
EDL-015-500	Ⓘ Ⓦ Ⓡ Ⓖ Ⓑ	15×500	13.9 W	*
EDL-015-600	Ⓘ Ⓦ Ⓡ Ⓖ Ⓑ	15×600	16.6 W	4
EDL-015-700	Ⓘ Ⓦ Ⓡ Ⓖ Ⓑ	15×700	19.4 W	*
EDL-015-800	Ⓘ Ⓦ Ⓡ Ⓖ Ⓑ	15×800	22.2 W	*
EDL-015-900	Ⓘ Ⓦ Ⓡ Ⓖ Ⓑ	15×900	24.9 W	*
EDL-015-A00	Ⓘ Ⓦ Ⓡ Ⓖ Ⓑ	15×1000	27.7 W	*
EDL-015-C00	Ⓘ Ⓦ Ⓡ Ⓖ Ⓑ	15×1200	33.2 W	*

註：1.本系列提供紅外線Ⓘ、白光Ⓦ、紅光Ⓡ、綠光Ⓖ、藍光Ⓑ等顏色。
2.發光範圍數值單位為毫米（mm）。
3.尺寸圖標示"＊"者，請洽本公司。

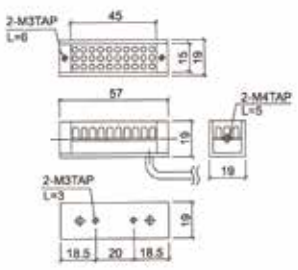
型號說明

EDL-□□□-□□□-□-□-□
1 2 3 4 5

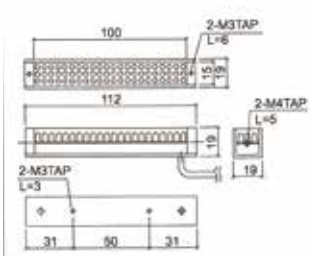
1 發光區寬度，單位為mm
2 發光區長度，單位為mm
3 光源顏色
I：紅外線　G：綠光
W：白光　B：藍光
R：紅光
4 供電方式
1：DC 12V
2：DC 24V
U：搭配U系列控制器
N：搭配N系列控制器
5 附加說明碼
A：標準版本
Z：特殊版本

尺寸圖

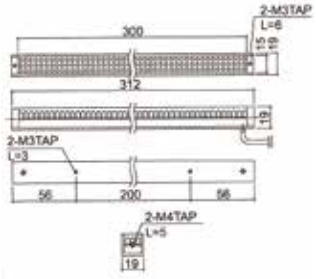
1 EDL-015-045



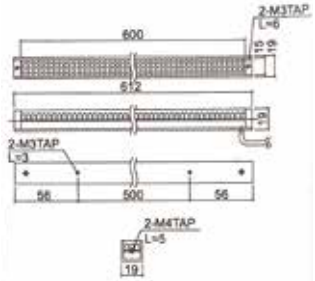
2 EDL-015-100



3 EDL-015-300



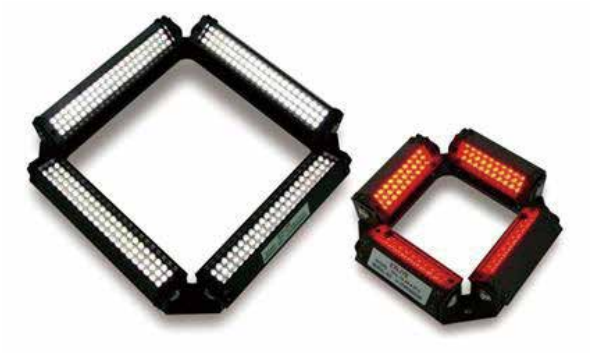
4 EDL-015-600



可調角度棒狀光源 / DL-SERIES

產品特色

由 4 支棒狀光源組合而成，每一棒狀光源可獨立調整成 0~90° 之間的照射角度，以配合不同特性的待測物與工作距離，亦可於訂購時指定為可分別調整亮度的機型，搭配四通道控制器，成為使用彈性更大的照明工具。



適合用途

＊ PC 版缺件、錫分佈狀況、IC 腳位偏差、及零件表面印刷字跡之自動檢測。
＊晶圓、各種玻璃基板及鏡片表面刮痕、微塵顆粒之檢測

IC 表面 Laser Mark 判讀

DAL高角度照明效果

DAL低角度照明效果

基本規格

型　號	顏　色	內部尺寸	外部尺寸	最大消耗功率	尺寸圖
DAL-015-045	Ⓘ Ⓦ Ⓡ Ⓖ Ⓑ	67×67	105×105	5.2 W	1
DAL-015-100	Ⓘ Ⓦ Ⓡ Ⓖ Ⓑ	120×120	160×160	11.1 W	2
DAL-015-200	Ⓘ Ⓦ Ⓡ Ⓖ Ⓑ	210×210	260×260	22 W	3
DAL-015-300	Ⓘ Ⓦ Ⓡ Ⓖ Ⓑ	310×310	360×360	33.2 W	＊

註：1.本系列提供紅外線Ⓘ、白光Ⓦ、紅光Ⓡ、綠光Ⓖ、藍光Ⓑ等顏色。
2.內部尺寸、外部尺寸數值單位為毫米（mm）。
3.尺寸圖標示"＊"者，請洽本公司。

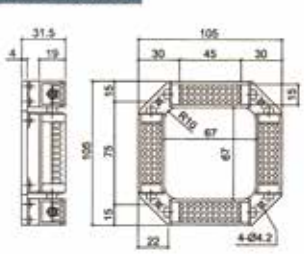
型號說明

DAL-□□□-□□□-□-□-□
1 2 3 4 5

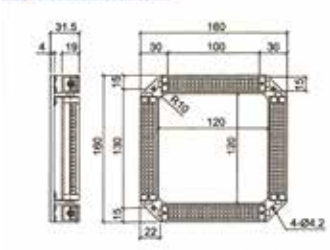
1 發光區寬度，單位為mm
2 發光區長度，單位為mm
3 光源顏色
I：紅外線　G：綠光
W：白光　B：藍光
R：紅光
4 供電方式
1：DC 12V
2：DC 24V
U：搭配U系列控制器
N：搭配N系列控制器
5 附加說明碼
A：標準版本
Z：特殊版本

尺寸圖

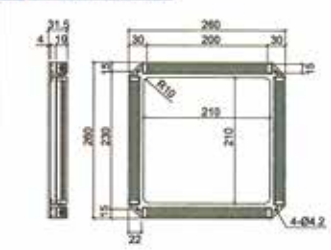
1 DAL-015-045



2 DAL-015-100



3 DAL-015-200



TEL：(03)462-6569 (桃園-總公司) / (04)2261-0357 (台中) / (06)208-6651 (台南)

半球形擴散光源系列 / DOM-SERIES

產品特色

DOM 系列利用 LED 向上照射於半球型的反射式擴散燈罩，光線經過擴散燈罩的漫射，在光源下方形成一個圓形均勻照明區域，與直線光源照明效果有明顯的不同，以 DOM 光源照射，影像無明顯的陰影，光滑面亦無強烈的反射光，可以避免取像時受到陰影或反光的影響，降低影像處理的難度。DOM 系列光源可以與 CAD 系列光源搭配使用，提供完全無瑕疵的均勻光源，對於檢查光滑曲面尤其適用。

適合用途

＊金屬、玻璃等光滑曲面上之刮痕、裂紋、表面污漬等瑕疵及印刷字跡自動檢測。
＊各種光滑軟性包裝材料表面檢測。

金屬切削面以環球形光源照明效果

金屬切削面以半球形光源照明效果

基本規格

型　號	顏　色	上開口直徑	光源外徑	高度	最大消耗功率	尺寸圖
DOM-022-095	Ⓦ Ⓡ Ⓖ Ⓑ	22	95	43	2.8 W	1
DOM-030-140	Ⓦ Ⓡ Ⓖ Ⓑ	30	140	67	2.0 W	2
DOM-040-230	Ⓦ Ⓡ Ⓖ Ⓑ	40	230	104	6.0 W	3

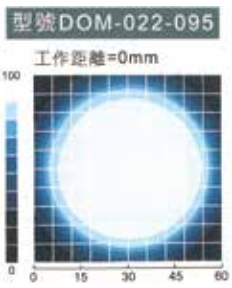
註：1.本系列提供白光 Ⓦ、紅光 Ⓡ、綠光 Ⓖ、藍光 Ⓑ等顏色。
2.上開口直徑、光源外徑、高度數值單位為毫米（mm）。

型號說明

DOM-□□□-□□□-□-□-□
1 2 3 4 5

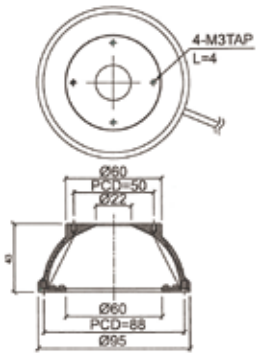
1 上開口直徑，單位為mm
2 光源外徑，單位為mm
3 光源顏色
W：白光　G：綠光
R：紅光　B：藍光
4 供電方式
1：DC 12V
2：DC 24V
U：搭配U系列控制器
N：搭配N系列控制器
5 附加說明碼
A：標準版本
Z：特殊版本

照度分佈圖

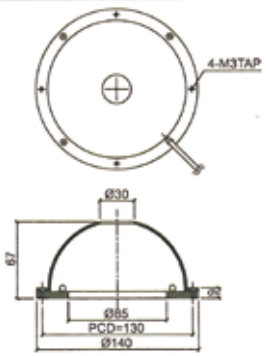


尺寸圖

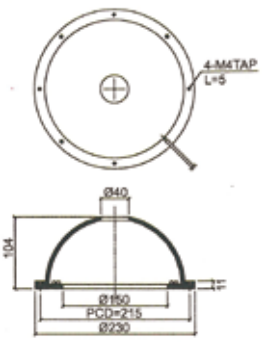
1 DOM-022-095



2 DOM-030-140



3 DOM-040-230



同軸光源系列 / NSC-SERIES, HSC-SERIES

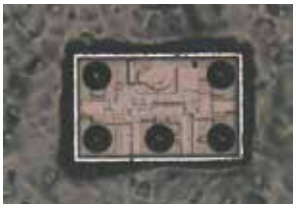
產品特色

＊體積小、低耗能，超高亮度且發熱量低，最適合搭配高倍率同軸照明鏡頭，可取代使用傳統鹵素燈泡的光纖燈。
＊多種光源顏色可供選擇，以配合各種攝影機和樣品特性，達到最佳照明效果。
＊前端出光口尺寸可指定變更，適合各廠牌同軸照明鏡頭及金相顯微鏡。
＊ HSC-030-021 款可作為投射燈使用。

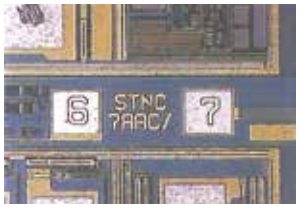
適合用途

＊晶圓、TFT 玻璃基板、Color Filter 對位記號識別及條碼自動判讀，玻璃或金屬表面瑕疵檢測。
＊單色光源可用於激發螢光等生物科技應用。

高角度環形光源照明效果



高功率同軸光源照明效果

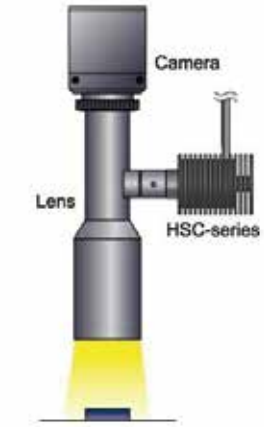


晶圓表面檢查

基本規格

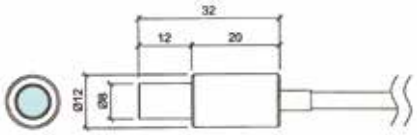
型　號	顏　色	接口徑	外徑	長度	最大消耗功率	尺寸圖
NSC-012-008	Ⓦ Ⓡ Ⓐ Ⓖ Ⓑ	8	30	32	0.1 W	1
HSC-030-008	Ⓦ Ⓡ Ⓐ Ⓖ Ⓑ	8	30	57	3.0 W	2
HSC-030-021	Ⓦ Ⓡ Ⓐ Ⓖ Ⓑ	20.8	12	50	3.0 W	3

註：1.本系列提供白光 Ⓦ、紅光 Ⓡ、琥珀色 Ⓐ、綠光 Ⓖ、藍光 Ⓑ 等顏色。
2.接口徑、外徑、長度數值單位為毫米（mm）。

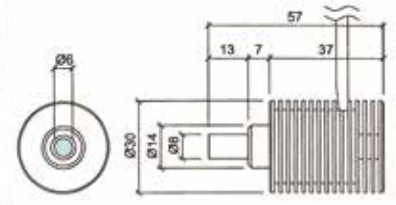


尺寸圖

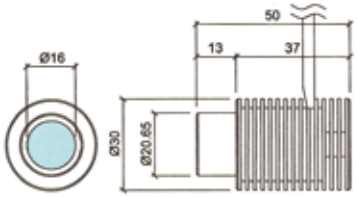
1 NSC-012-008



2 HSC-030-008



3 HSC-030-021



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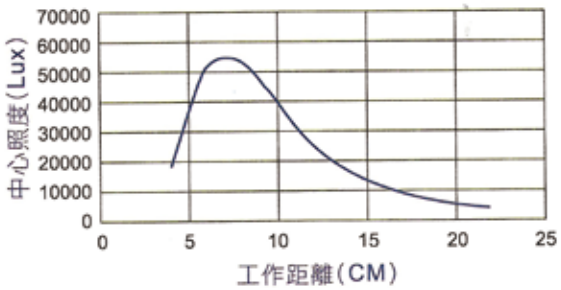
環形光源 / RING SERIES

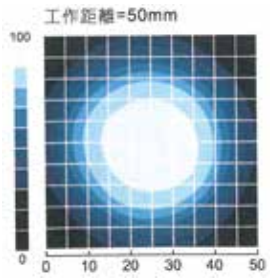
產品特色

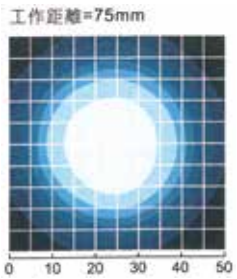
以高亮度 LED 密集排列成為特定角度的環形，以平行於鏡頭視線方向、錐形匯聚，乃至於水平對射等不同型態，形成圓形、高亮度的照明區域涵蓋待測物，以消除照明死角，備有多種內外徑尺寸及照射角度，可依待測物表面特性、工作距離及檢測目標作選擇，以達到最佳照明效果，每一種尺寸規格均可提供白光、紅光、綠光及藍光等可見光機型，以及紅外光、紫外光之特殊機型，滿足您最多樣化的視覺檢測需求。

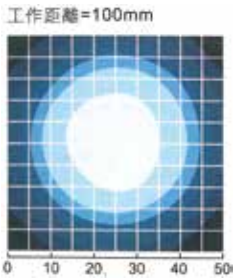
性能曲線圖　型號 HER-050-087



照度分佈圖







高角度

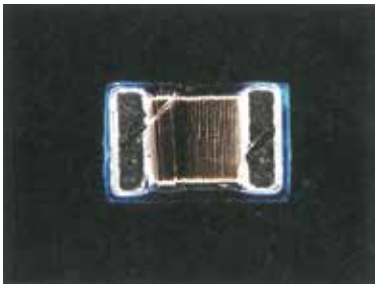
＊廣泛應用於各種條碼判讀、光學對位及自動檢測 (AOI) 系統。
＊特殊微距攝影及醫療攝影。
＊與各大廠牌實體顯微鏡，及高倍變焦鏡頭相容，應用於電子、機械、2D、3D 精密量測機及生物科技領域。

高角度環形

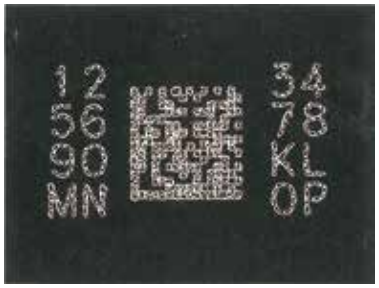
高角度環形

低角度

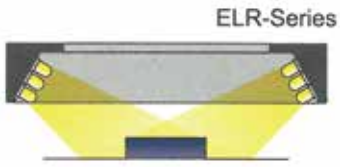
＊用以強調樣品表面高差，輪廓及加工痕跡。
＊檢查樣品表面之裂痕，刮傷。
＊玻璃基板或光學鏡片邊緣缺損、表面刮傷檢出。



低角度環形



低角度環形

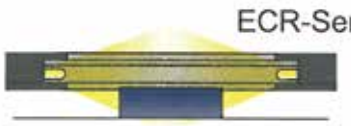


水平徑向

＊形成暗視野照明效果，排除背景干擾。
＊樣品表面微塵顆粒檢出。
＊透明材料內部之氣泡、雜質、裂隙檢出。

水平徑向環形光源照明效果

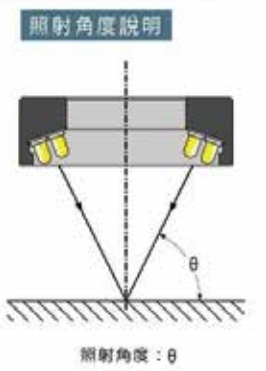
水平徑向環形光源照明效果



基本規格

型號	顏色	內徑	外徑	高度	最大消耗功率	照射角度	尺寸圖
EHR-018-042	ⓘⓦⓡⓖⓑ	18	42	18	1.8 W	70°	1
EHR-025-050	ⓘⓦⓡⓖⓑⓤ	25	50	20	0.8 W	78°	2
EHR-028-050	ⓘⓦⓡⓖⓑ	28	50	16	2.3 W	70°	3
EHR-032-064	ⓘⓦⓡⓖⓑⓤ	32	64	19	1.8 W	70°	4
EHR-052-076	ⓘⓦⓡⓖⓑⓤ	52	76	22	1.5 W	69°	5
EHR-050-087	ⓘⓦⓡⓖⓑⓤ	50	87	24.5	3 W	69°	6
EHR-070-110	ⓘⓦⓡⓖⓑⓤ	70	110	24	3 W	70°	7
EHR-120-188	ⓘⓦⓡⓖⓑⓤ	120	188	24	11.6 W	71°	8
EPR-036-087	ⓘⓦⓡⓖⓑⓤ	36	87	22	3.8 W	90°	9
EPR-050-087	ⓘⓦⓡⓖⓑⓤ	50	87	24.5	2.8 W	90°	★
ELR-025-050	ⓘⓦⓡⓖⓑ	25	50	18	1.5 W	30°	★
ELR-050-075	ⓘⓦⓡⓖⓑ	50	75	18	3.3 W	30°	10
ELR-070-095	ⓘⓦⓡⓖⓑ	70	95	18	4.3 W	30°	★
ELR-090-140	ⓘⓦⓡⓖⓑⓤ	90	140	26	6.0 W	30°	11
SLR-090-140	ⓘⓦⓡⓖⓑⓤ	90	140	26	6.0 W	15°	★
ECR-060-095	ⓘⓦⓡⓖⓑ	60	95	10.5	2.0 W	0°	12

註：1.本系列提供紅外線ⓘ、白光ⓦ、紅光ⓡ、綠光ⓖ、藍光ⓑ、紫外光ⓤ等顏色。
2.內徑、外徑、高度數值單位為毫米（mm）。
3.尺寸圖標示"★"者，請洽本公司。



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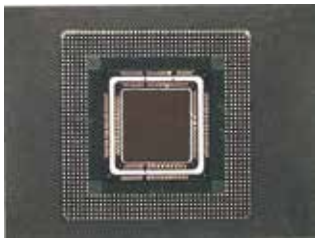
ML-66 顯微鏡環形光源

產品特色

＊高角度直射光，圓形光場，無照明死角。
＊內建 DC 定電流驅動器，亮度穩定且可無段微調。
＊工作溫度低、壽命超長、不閃爍，最適宜取代傳統鹵素燈及高頻環型螢光燈。
＊ 60mm~150mm 標準工作距離設定，適合大部分實體顯微鏡。
＊另有內建擴散板機型可供選擇，以配合高反射率樣品特性，減少反光干擾。



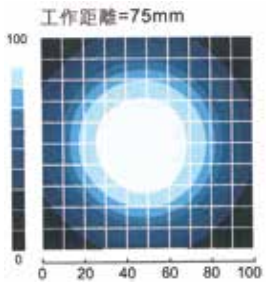
適合用途

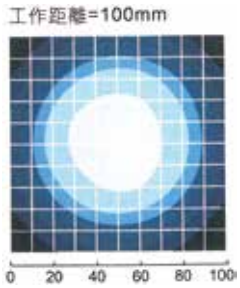
＊特殊微距攝影及醫療攝影。
＊與各大廠牌實體顯微鏡相容，廣泛應用於電子、機械及生物科技領域。

基本規格

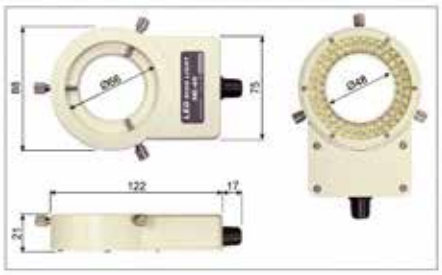
機型	ML-66
發光元件	高亮度LED
光源顏色	白光
工作距離	60mm~150mm
控制器	內建/可調亮度
調控方式	定電流控制
輸入電壓	DC24V
消耗功率	4W max
環境濕度	20%~80RH
環境溫度	0℃~45℃
中心照度	>39,000Lux (W.D=80mm)

照度分佈圖





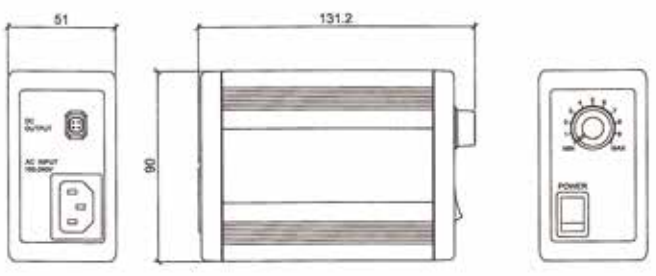
尺寸圖



光源定電流控制器

LP-1201H-3

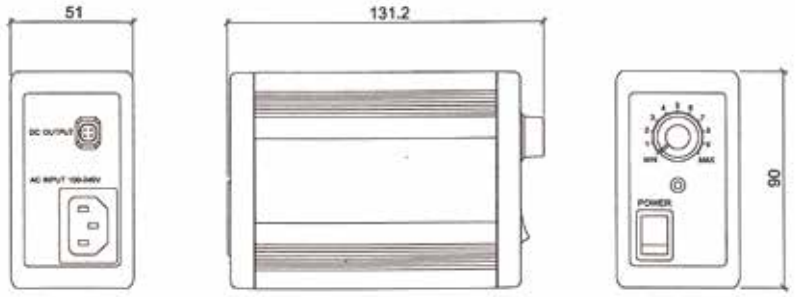
型 號	LP-1201H-3
輸入電壓	AC 100~240V Input
電源頻率	50/60Hz
輸出功率	3W (Max)
輸出電壓	DC 4V (Max)
輸出電流	700mA (Max)
操作環境濕度	20%~80% RH
操作環境溫度	0℃~45℃



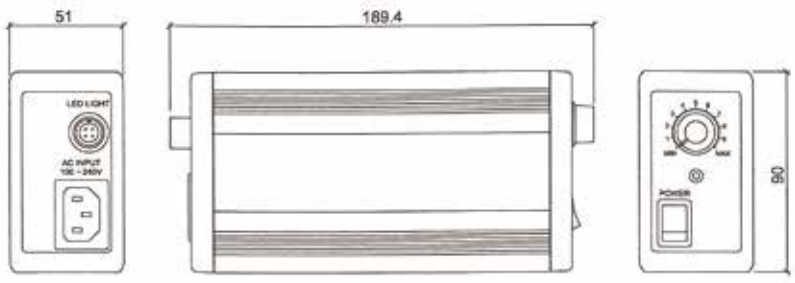
單通道手調定電流控制器

型 號	LP-24V-12-U	LP-24V-20-U	LP-24V-50-U
輸入電壓	AC 100~240V Input		
電源頻率	50/60Hz		
輸出功率	8W (Max)	18W (Max)	35W (Max)
輸出電壓	DC 22V (Max)	DC 22V (Max)	DC 22V (Max)
輸出電流	360mA (Max)	800mA (Max)	1500mA (Max)
亮度調控方式	自動偵測定電流		
操作環境濕度	20%~80% RH		
操作環境溫度	0℃~45℃		

LP-24V-12-U



LP-24V-20-U



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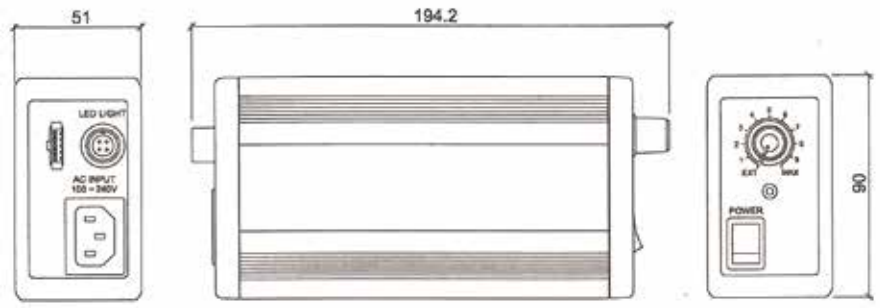
單通道類比調控定電流控制器

型 號	LP-24V-20-U-IO	LP-24V-50-U-IO	LP-24V-50-N-IO
輸入電壓	AC 100~240V Input		
電源頻率	50/60Hz		
輸出功率	18W (Max)	35W (Max)	35W (Max)
輸出電壓	DC 22V (Max)	DC 22V (Max)	DC 22V (Max)
輸出電流	800mA (Max)	1500mA (Max)	1500mA (Max)
外部調控訊號	DC 0~5V (對應亮度0~Max)		
訊號連接座	5PIN 空中街頭		
調控解析度	0~Max 共256段		
閃頻觸發訊號	ACTIVE / LOW (對應ON / OFF)		
閃頻響應頻率	1KHz (Max)	1KHz (Max)	1KHz (Max)
亮度調控方式	自動偵測定電流		
操作環境濕度	20%~80% RH		
操作環境溫度	0℃~45℃		

LP-24V-20-U-IO



LP-24V-20-U-IO

單通道數位調控定電流控制器

型 號	LP-24V-20-U-RS232	LP-24V-50-N-RS232	PSS-3203
輸入電壓	AC 100~240V Input		
電源頻率	50/60Hz		
輸出功率	18W (Max)	35W (Max)	96W (Max)
輸出電壓	DC 22V (Max)	DC 22V (Max)	DC 32V (Max)
輸出電流	800mA (Max)	1500mA (Max)	3000mA (Max)
外部調控訊號	RS-232C		
訊號連接座	D TYPE 9 PIN 公座		
調控解析度	0~Max 共256段		
亮度調控方式	自動偵測定電流		
操作環境濕度	20%~80% RH		
操作環境溫度	0℃~45℃		

LP-24V-20-U-RS232

多通道手調定電流控制器

型 號	LP-24V-30-U-2CH	LP-24V-60-U-4CH
輸入電壓	AC 100~240V Input	
電源頻率	50/60Hz	
通道數	2	4
輸出功率	30W ; 每通道15W(Max)	53W ; 每通道15W(Max)
輸出電壓	DC 22V (Max)	DC 22V (Max)
輸出電流	每通道800mA (Max	每通道600mA (Max)
亮度調控方式	自動偵測定電流	
操作環境濕度	20%~80% RH	
操作環境溫度	0℃~45℃	

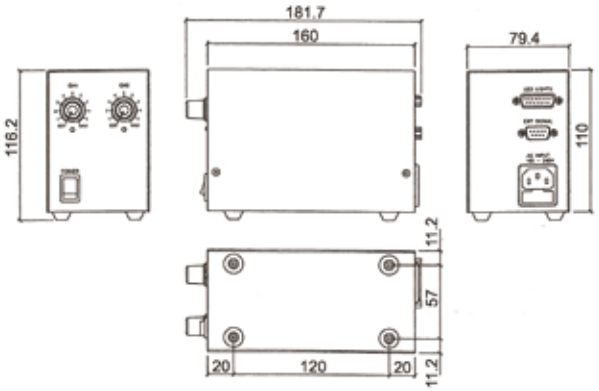
LP-24V-30-U-2CH

LP-24V-60-U-4CH

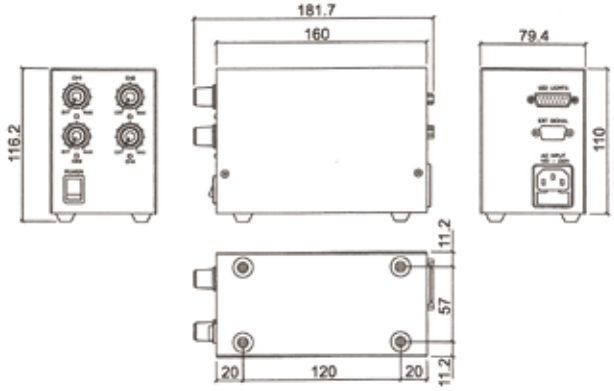
多通道數位調控定電流控制器

型 號	LP-24V-20-U-RS232	LP-24V-50-N-RS232	PSS-3203
輸入電壓	AC 100~240V Input		
電源頻率	50/60Hz		
輸出功率	18W (Max)	35W (Max)	96W (Max)
輸出電壓	DC 22V (Max)	DC 22V (Max)	DC 32V (Max)
輸出電流	800mA (Max)	1500mA (Max)	3000mA (Max)
外部調控訊號	RS-232C		
訊號連接座	D TYPE 9 PIN 公座		
調控解析度	0~Max 共256段		
亮度調控方式	自動偵測定電流		
操作環境濕度	20%~80% RH		
操作環境溫度	0℃~45℃		

LP-24V-30-U-2CH-RS232-CW)



LP-24V-60-U-4CH-RS232-CW



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MEMO