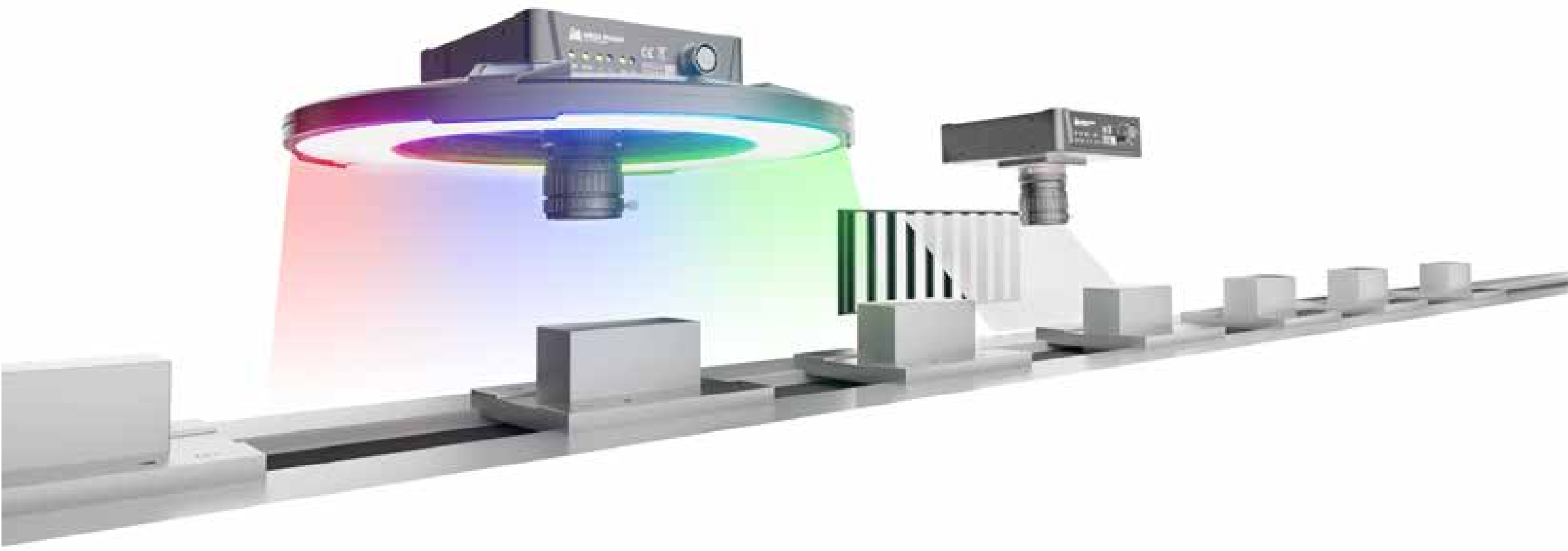
Hybrid Data Camera

Multi-image Platform for Future



MEGA PHASE
TECHNOLOGY

Hybrid Data Camera

Multi-image Platform for Future

Equipped with Photometric Stereo Mode and Phase Measuring Deflectometry Mode, Hybrid Data Camera (HDC) is considered as a leading vision detection hardware, which is mainly used for detecting various defects on surfaces of different materials.

HDC features powerful real-time processing capabilities for raw images, enabling direct output of high-quality, high-information-density 2D and 2.5D images. This enhances AI training efficiency, helps users increase defect detection rates, shorten project implementation time, and reduce overall detection costs.

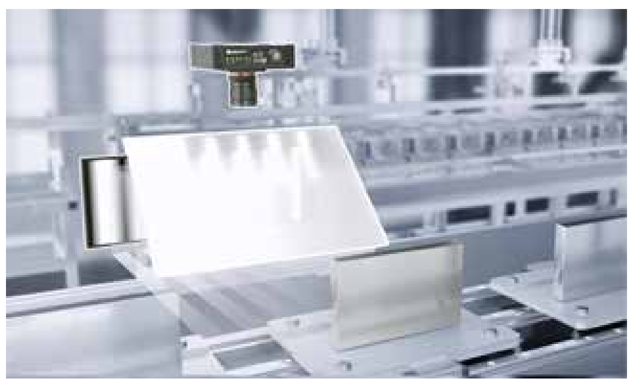
Key Features

Multi-image in real time*
Output 40+ images to highlight defects, and to simplify AI model creation.

Highly integrated
Replace multi-station 2D detection solutions for easier deployment.

Higher flexibility
Detect various defects effectively with one same detection system.

Photometric Stereo Mode

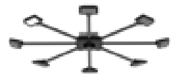


Phase Measuring Deflectometry Mode

*Output 40+ images is included raw and computation images from four imaging modes. The type and quantity of output images are selectable.

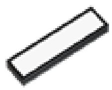
Formulas for more advanced Defect Detection

Photometric Stereo Mode

Hybrid Data Camera	Multispectral Partition Light Source	Lens
	 	

Phase Measuring Deflectometry Mode

Hybrid Data Camera	Programmable Screen Light Source Kit	Lens
	 	

Various standard light sources
    ...

3-pin standard light source interface x 4 available. Allowing users to select preferred light source, which is directly connecting to HDC, without light source controllers.

3 steps to a highly integrated Defect Detection System

1 Materials of detected objects

Select imaging mode and matching light source

◯ **Diffuse reflection objects**

Photometric Stereo Mode
Paired with Multispectral Partition Light Source

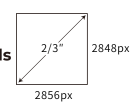
◯ **Highly reflective or transparent objects**

Phase Measuring Deflectometry Mode
Paired with Programmable Screen Light Source Kit

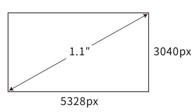
2 Detection accuracy requirements

Select camera resolution

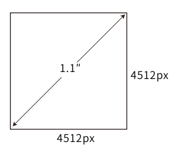
◯ **8.1 megapixels**



◯ **16.2 megapixels**

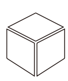
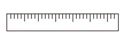
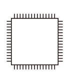


◯ **20 megapixels**



3 Other requirements

Select C-mount lens

Object Size	**Accuracy Requirements**	**CMOS Size**	**Working Distance**
			

Perfect for Defect Detection

Accelerate project evaluation and implementation
Significantly reduce time and labor costs

Time saving

Easier to deploy
Detect various defects at one time

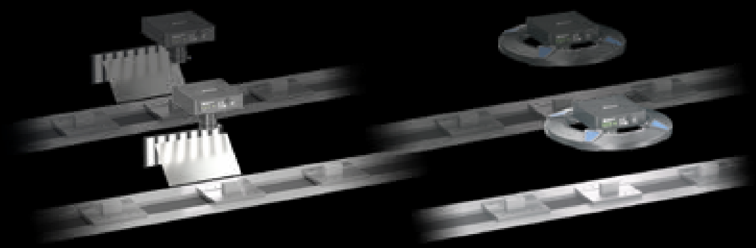
Station saving

More compact
Reduce the number and types of workstations

Labor saving

Easier to use
Users are able to be competent with a simple training

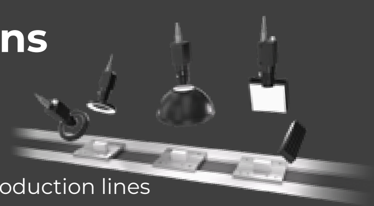
Relieving from repetitive and complicated debugging
Easy and efficient for production line duplications



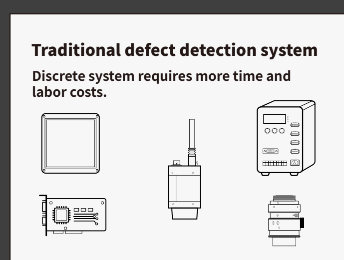
Effectively shorten the time required for production line duplication
Ensure system stability and imaging consistency after production line duplicated

Other defect detection solutions

Multiple workstations are required for various types of defect detection



- ✗ Larger installation space
- ✗ More difficult to duplicate production lines
- ✗ Longer lighting setup and debugging time
- ✗ Higher possibility of imaging inconsistancy



Photometric Stereo Mode

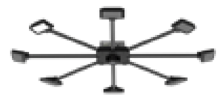
Suitable for diffuse or partially reflective objects

Hybrid Data Camera controls the Multispectral Partition Light Source to realize multi-angle lighting and capturing. With powerful hardware computation imaging technology, HDC is capable of processing images in real time, to eliminate various interferences, obtain information such as the surface normal vector and reflectivity of the object, and output various images. The Photometric Stereo Mode can effectively detect defects such as bumps, pits, slight scratches, discoloration, knife marks, dirt, etc. on the surface of diffuse reflection or some highly reflective objects.

Multispectral Partition Light Source

- Light source controller-free, low latency via synchronous camera control
- Multiple partitions & multispectral lighting for different scenes
- Easier setting up with less debugging time

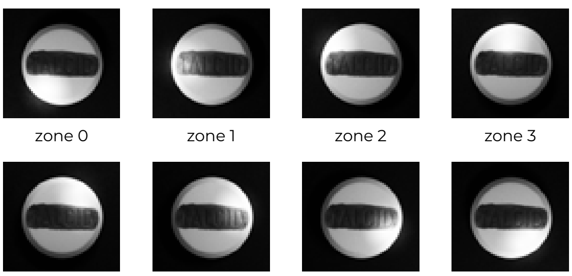
Multispectral Partition Ring Light



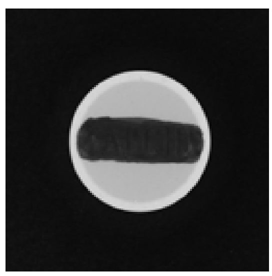
Multispectral Partition Spot Light

Multiple partitions

4- or 8-zone lighting enables the camera to capture a variety of object surface information, including normal vectors and reflectivity, which are difficult to obtain with a single-angle light source, and to output multi-channel images.



8-zone lighting diagram



Kd

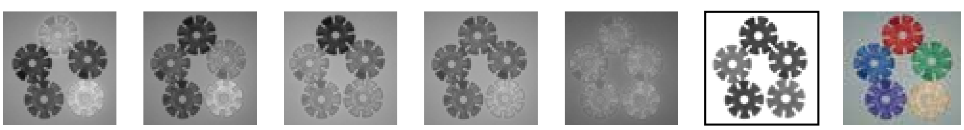
Highlight pattern

Nx+Ny

Highlight texture

Multispectral

Including red, blue, green, infrared, ultraviolet, white, etc., Multispectral Partition Light Source is flexibly applicable to various scenes.



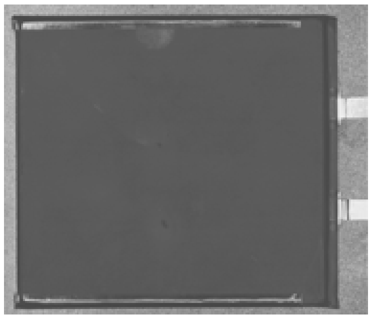
R G B W IR UV RGB

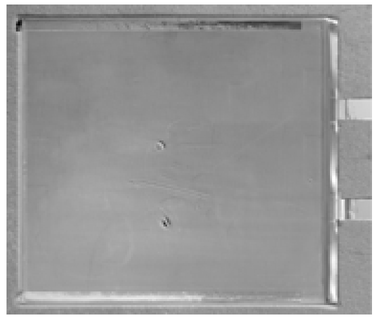
Multispectral illumination diagram

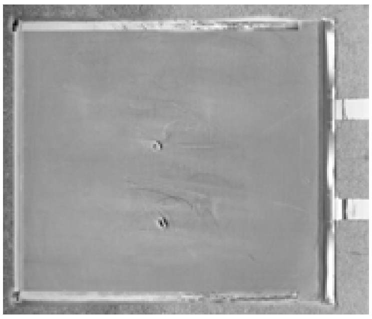
Multi-channel images

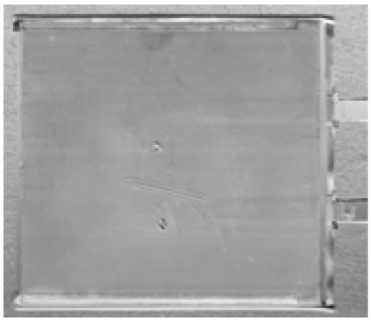
Improve the detection accuracy of various defects


RGB


Kd


Nx+Ny


Nx


Ny

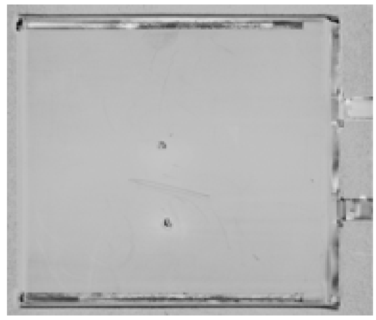

Nz

Image channels description*

Kd	Reflectivity graph Detect foreign object and dirt	**MinMax**	The difference between the maximun and minimum values Highlight defect characteristics and detect minor defects
Nx	X normal vector graph Detect Y-direction defects	**UniMax**	Normalized gray maximum Highlight luminance features and enhance defect visibility
Ny	Y normal vector graph Detect X-direction defects	**R/G/B**	R, G, B single-channel graphs Remove background interferences, and highlight specific color defects
Nz	Z normal vector graph Detect Z-direction defects	**IR**	IR graph Detect defects under the black plastic or colored coating
Nx+Ny	X and Y normal vectors sum Highlight the oblique / uncertain defects	**UV**	UV graph Detect the defects of UV-sensitive objects
Nx2+Ny2	The sum of squares of the X and Y normal vectors Highlight minor defects	**NormMix**	Vector fusion graph Remove texture and dirt interference, and highlight surface defects
Min	Grayscale minimum graph Eliminate reflection and highlight defects	**RGB**	Original color graph High-precision display of color information to detect the overall defects and location
Max	Grayscale maximum graph Eliminate shadow and extract contour	**IR/G/UV**	Infrared / Green light / UV fusion graph Detect the surface defects of special objects
Mid	Grayscale intermediate graph Eliminate shadow and reflection, and detect surface defects of complex high gloss objects		

* Provided based on the Principles of Computational Imaging, it is recommended to evaluate the applicability of an image by its actual imaging results.

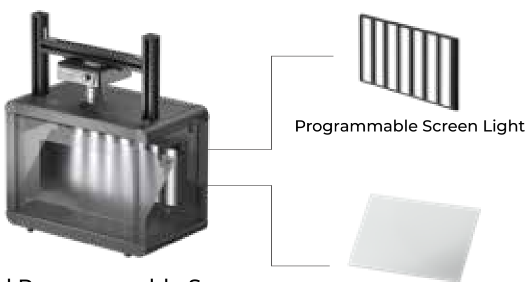
Phase Measuring Deflectometry Mode

Suitable for reflective or transparent objects

By adjusting the period of stripe pattern, projection directions or pattern styles and other parameters, which projected by programmable screen light source, HDC is able to effectively capture defects on shiny surfaces or transparent objects, such as bumps, slight scratches, tiny pits, etc.

Programmable Screen Light Source

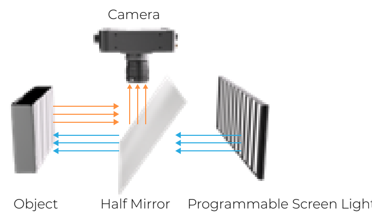
- Light source controller-free, low latency via synchronous camera control
- Project a variety of patterns, and the parameters such as stripe period, screen refresh rate etc. are adjustable



Coaxial Programmable Screen Light Source Kit

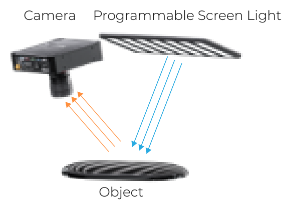
Triangle Programmable Screen Light Source Kit

Coaxial Kit



The Programmable Screen Light projects a stripe pattern onto the object through the Half Mirror. The camera captures the object image reflected from the Half Mirror and calculates and outputs a series of grayscale images. Different channel images can highlight various surface defects.

Triangle Kit

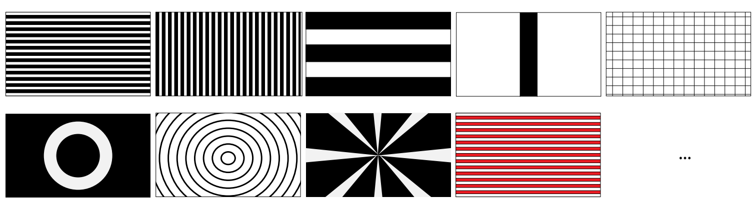


The Programmable Screen Light projects a stripe pattern onto the object, and the camera captures the object image and calculates and outputs a series of grayscale images. Different channel images can highlight various surface defects.

Comparison

		Coaxial Kit	Triangle Kit
Imaging	Light intensity	+	+++
	Uniformity	+++	+
	Anti-interference	+++	+
Applicability		flat	flat or small angle curved surface
Imaging time		short	shorter
Applicable scene		Static state	Collaboration/mobile

Multiple patterns, adjustable stripe period

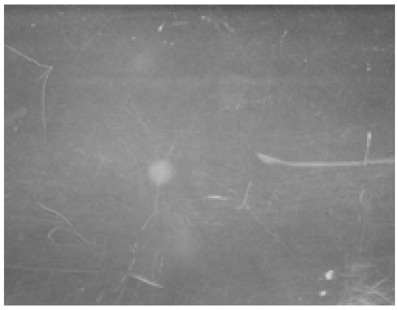


Project patterns of different forms, such as stripes, ring light, polar coordinates, etc., to flexibly meet the light source requirements in different scenes.

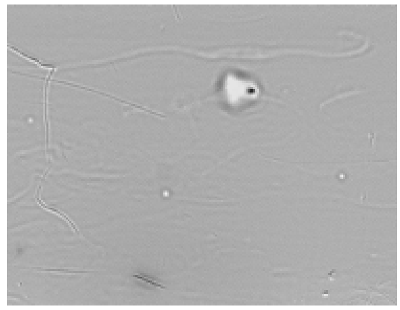
Multi-channel images

Improve the detection accuracy of various defects

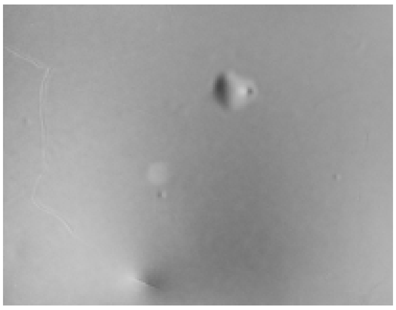
Gray



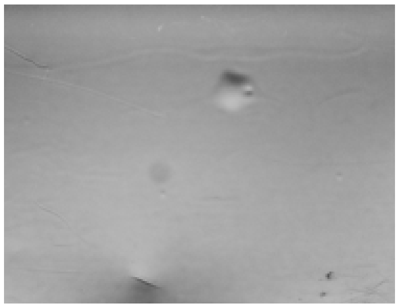
Diffuse



WinGradient



PhaseX



PhaseY

Specular

Image channels description*

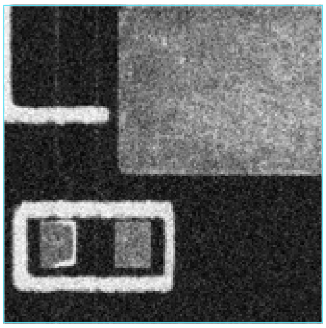
Gray	Grayscale graph See the overall status and position of defects	**PhaseX**	Phase graph of X direction Detect Y direction defects
Diffuse	Diffuse reflection graph Detect the foreign object and dirt	**PhaseY**	Phase graph of Y direction Detect X direction defects
Specular	Mirror reflection graph Extract the scratch of the surface	**R/G/B**	R, G, B single-channel graphs Remove background color interferences and highlight specific color defects
SRatio	Gloss graph Highlight the dark surface or curved surface defects	**RGB**	Original color graph Distinguish between different types of defects and background
WinGradient	Gradient enhancement graph Edge detection and feature extraction	**SurfaceMix**	Gray / Diffuse / Specular fusion graph Detect minor concave and convex

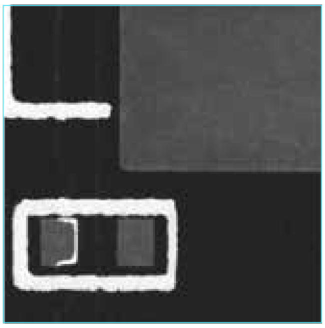
* Provided based on the Principles of Computational Imaging, it is recommended to evaluate the applicability of an image by considering its actual imaging results.

Unique image pre-processing function

Mono 2D Mode

By capturing multiple images, Hybrid Data Camera is able to compute and fuse images into one with ultra-high signal-to-noise ratio through hardware.


Raw

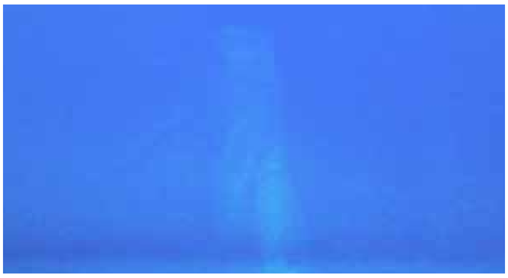

Mono 2D Mode

Color 2D Mode

HSV (Hue, Saturation, Value)

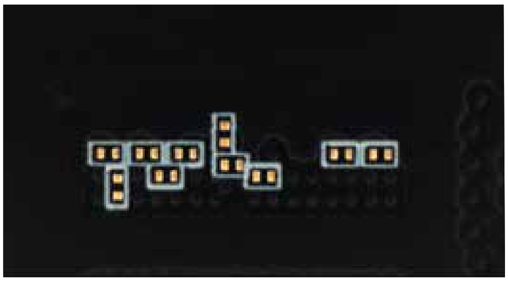
Quantify colors more finely and highlight subtle color differences.

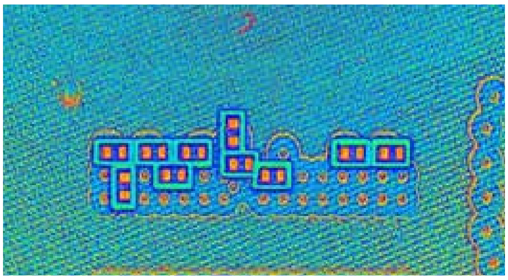

Common imaging


HSV

RGB Enhancing

Effectively identify the color changes of dark objects and greatly improve the detection rate of discoloration or other minor defects.


Common imaging

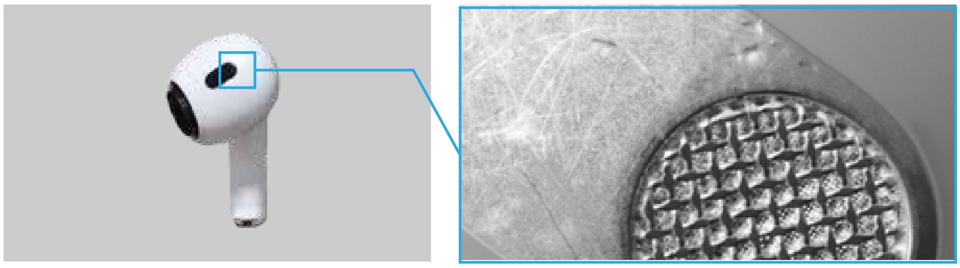

RGB Enhancing

Applications

Photometric Stereo Mode

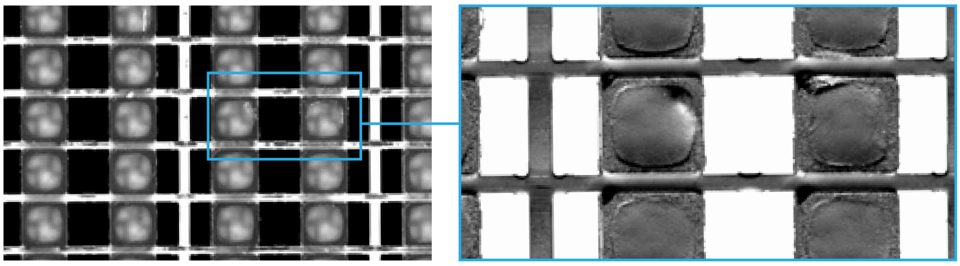
Earphone

Extract scratches and metal mesh deformation and other defects at one time.



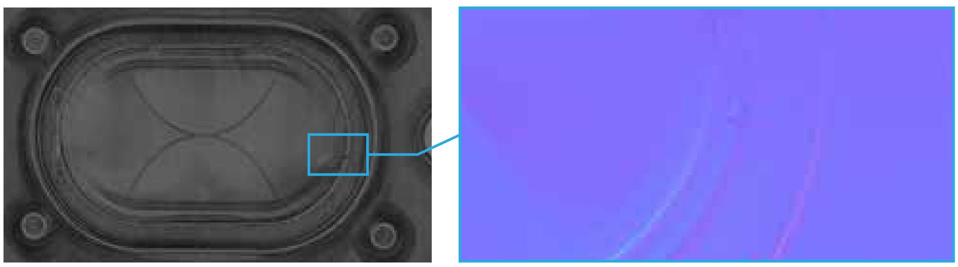
Mini LED

Extract deformation and process defects at one time.



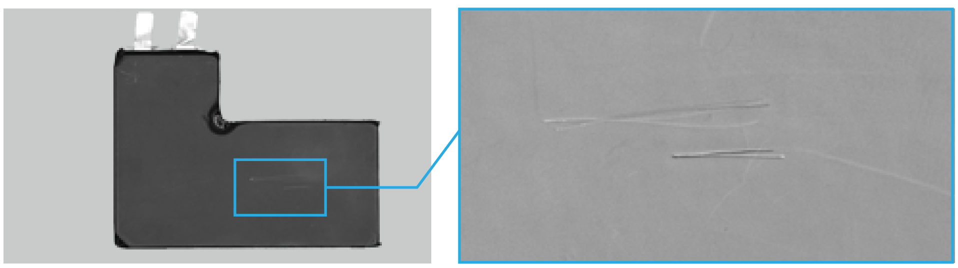
Battery top cover welding

Obtain various welding defects at one time.



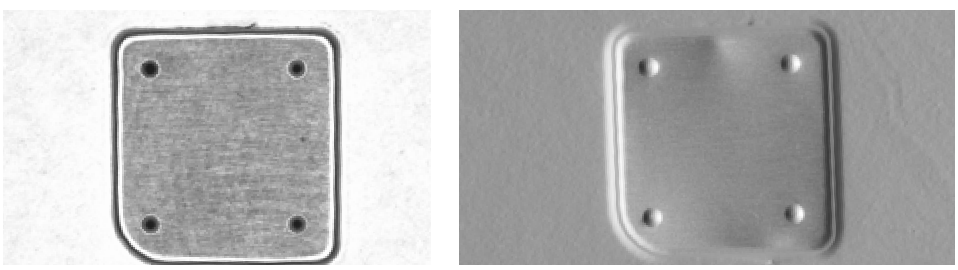
Lithium battery

Effectively identify various defects such as deformation, swollen, fine scratches, etc.



Brushed metal

Extract concave and convex deformation defects.

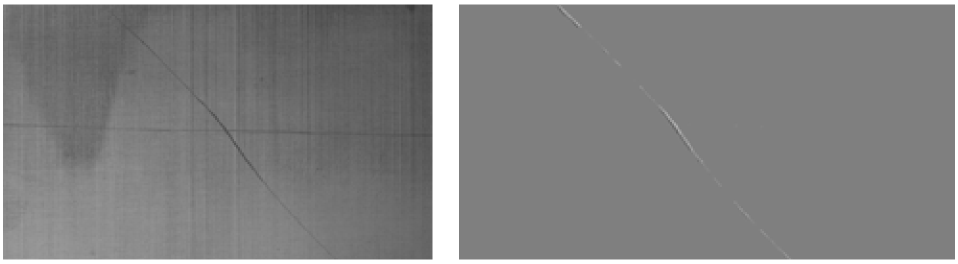


Applications

Phase Measuring Deflectometry Mode

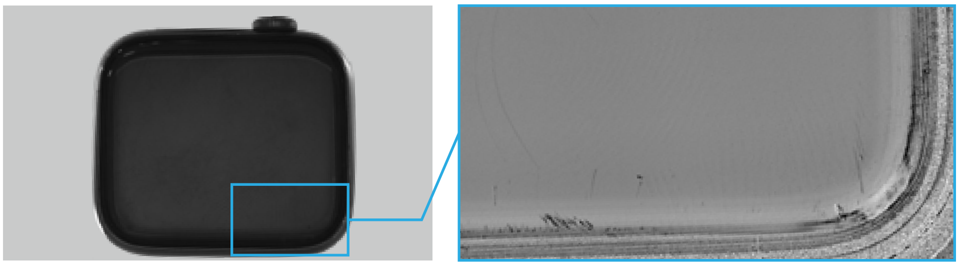
Brushed aluminum shell

Filter out interference such as brushed metal pattern, dirt and other factors to obtain true fine scratch defects.



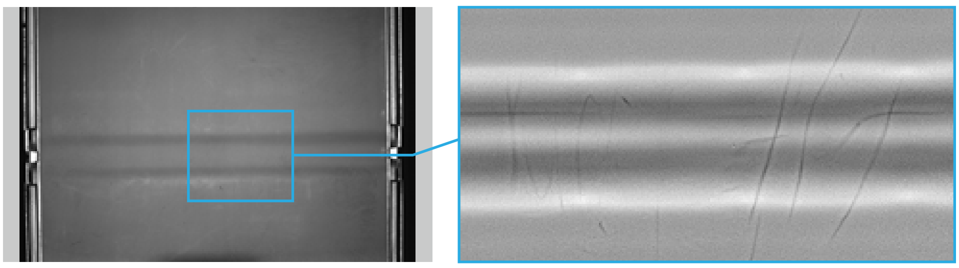
Smart watch

Obtain various defects on the glass shell at one time.



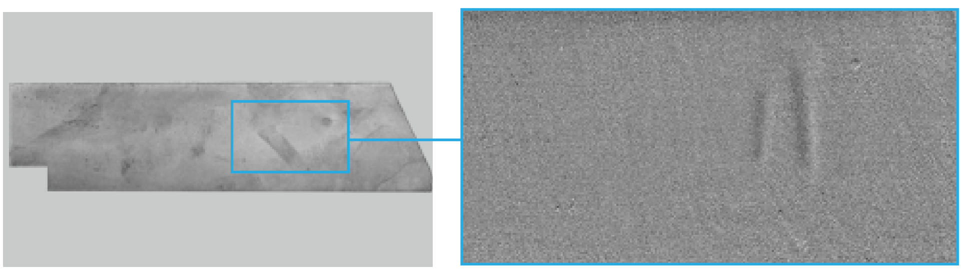
Foldable screen

Highlight various creases and detailed defects on the screen.



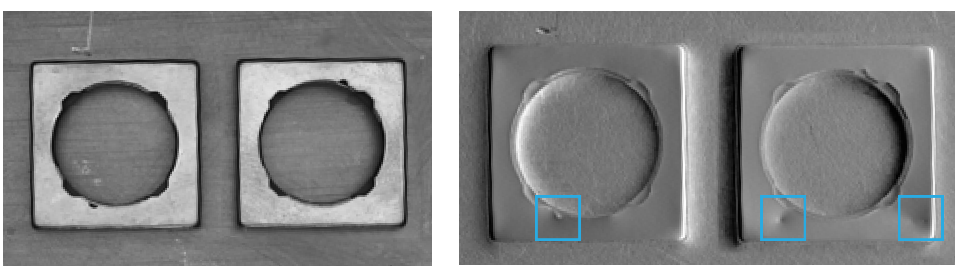
High gloss car paint

Obtain various defects such as bumps, pits, paint peel, scratches at one time.

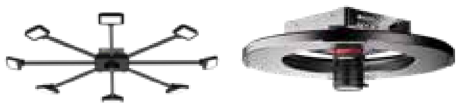


Mobile phone camera holder

Capture images of 9 to 12 products at one time. Effectively detect various deformation defects.

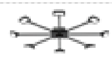


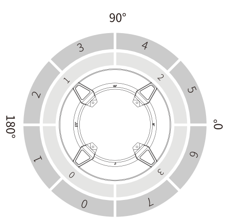
DS Series (Photometric Stereo Mode)



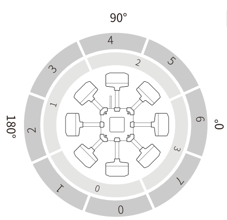
	DS081	DS162	DS200
Resolution(px)	8.1M (2856 x 2848)	16.2M (5328 x 3040)	20M (4512 x 4512)
Image Scale	1:1	16:9	1:1
CMOS Size	2/3"	1.1"	1.1"
CMOS Type	Monochrome CMOS		
Exposure Type	Global Shutter		
Unit Cell Size	2.74μm x 2.74μm		
Framerate of whole Cycle*1	≤11 FPS ≤40 FPS (Binning)	≤7 FPS ≤26 FPS (Binning)	≤5 FPS ≤18.5 FPS(Binning)
Light Interface	Multispectral Partition Light interface : 20 Pin Plug x1 Four-channel standard light interface (3-Pin, camera synchronous exposure, four overall current ≤6A)		
Lens Mount	C-Mount		
Data Interface	USB3.0		
Operating Voltage/Current	24V/5A		
Input/Output Signal	Two channel Nonpolar Level Signal Input/Switchable Signal Output(12/24V Compatible)		
SDK Operating System	Windows 7/8/10/11		
SDK Platform	C / C++ / C# / Python		
Dimension(LxWxH)	138.5mm x 120mm x 52.3mm		
Weight	640g		

*1 Whole cycle: refers to the time from the beginning of exposure to the end of data transmission; 50EXPI, 50 Exposure Intensity, fast algorithm mode, three output channels (Kd,Nx,Ny);

Multispectral Partition Light		MPD-RL-150	MPD-RL-274 MPD-RL-274LC	MPD-XL-500	MPD-XL-750	MPD-XL-1000
Light		 Multispectral Partition Ring Light Diffuse Light		 Multispectral Partition Spot Light Direct Light		
Light Angle α		0°		12°		
Color Wavelength Peak, Current 150mA		Red: 625nm; Blue: 460nm; Green: 525nm; Infrared: 940nm; UV: 375nm White: 6500K-7000K (standard color temperature)				
Power Supply		Camera				
Number of lamp beads	R/G/B	56	96	192		
	Infrared Light	104	96	192		
	Ultraviolet Light	48	96	192		
Drive Current		Monochrome 8-zone all bright: 1.2A Monochrome single-zone: 0.15A Total current ≤ 6A	Monochrome 8-zone all bright: 2.4A Monochrome single-zone: 0.3A Total current ≤ 6A	Monochrome 8-zone all bright: 4.8A Monochrome single-zone: 0.6A Total current ≤ 6A		
Voltage		24V				
Control		Camera				
Setting		4/8 Partition Exposure				
Service Life(hrs)		15000~50000 (* No attenuation within 15000 hours, with 50000 hours being the theoretical lifespan)				
Recommended FOV(WxH)		<80mmx80mm	<160mmx160mm	<300mmx300mm	<400mmx400mm	<600mmx600mm
Dimension(LxWxH)		150mmx150mmx20mm	274mmx274mmx30mm 274mmx274mmx16mm(LC)	500mmx500mmx28mm	750mmx750mmx28mm	1000mmx1000mmx28mm
Weight		0.3kg	1.3kg	3.3kg	3.7kg	4.1kg



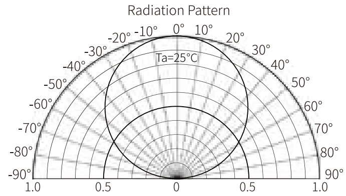
Multispectral Partition Ring Light



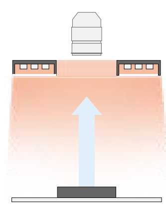
Multispectral Partition Spot Light

4 Partition
8 Partition

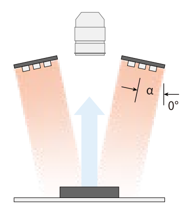
Partition lighting diagram



Bead light distribution diagram



Multispectral Partition Ring Light
Diffuse Light



Multispectral Partition Spot Light
Direct Light

Illumination diagram

DM Series (Phase Measuring Deflectometry Mode)


	DM081	DM162	DM200
Resolution(px)	8.1M (2856 x 2848)	16.2M (5328 x 3040)	20M (4512 x 4512)
Image Scale	1:1	16:9	1:1
CMOS Size	2/3"	1.1"	1.1"
CMOS Type		Monochrome CMOS	
Exposure Type		Global Shutter	
Unit Cell Size		2.74μm x 2.74μm	
Framerate of whole Cycle*1	≤2 FPS ≤3.5 FPS (Binning)	≤1.85 FPS ≤3.3 FPS (Binning)	≤1.6 FPS ≤3.2 FPS(Binning)
Light Interface		Programmable Screen Light interface Mini HDMI x 1 Four-channel standard light interface (3-Pin, camera synchronous exposure, four overall current ≤6A)	
Lens Mount		C-Mount	
Data Interface		USB3.0	
Operating Voltage/Current		24V/5A	
Input/Output Signal		Two channel Nonpolar Level Signal Input/Switchable Signal Output(12/24V Compatible)	
SDK Operating System		Windows 7/8/10/11	
SDK Platform		C / C++ / C# / Python	
Dimension(LxWxH)		138.5mm x 120mm x 52.3mm	
Weight		640g	

*1. Whole cycle: refers to the time from the beginning of exposure to the end of data transmission; 500EXPI, 50 exposure intensity, XY dual cycle, output three channels (Gray,PhaseX,PhaseY), screen light refresh rate 120hz.

Coaxial Programmable Screen Light Source Kit	MPD-SL-200	MPD-SL-400 MPD-SL-400LC	MPD-SL-700
Dimension(LxWxH)	279mmX 192mmX 346.5mm (including camera bracket)	420mmX 230mmX 495mm (including camera bracket) 400mmX 250mmX 500mm (including camera bracket,LC)	732mmX 410mmX 650mm (including camera bracket)
Weight	3.7kg	8.6kg	20kg
Recommended FOV(WxH)*2	<120mmx68mm	<100mmx60mm <160mmx90mm(LC)	<185mmx104mm
Light	MPD-S-TPZ	MPD-S-Q1G	MPD-S-DX3
Half Mirror	MPD-GS-120	MPD-GS-140	MPD-GS-170
Light Angle		0°	
Power		USB	
Control		Camera Synchronization Control	

*2. The field of view is affected by the camera and lens. Subject to actual selection.

Programmable Screen Light	MPD-S-TPZ	MPD-S-Q1G	MPD-S-DX3
Screen Size	10.1"	15.6"	31.5"
Dimension(LxWxH)	232mmx12mmx157mm	355mmx4mmx225mm	720mmx40mmx424mm
Weight	0.4kg	1kg	4.3kg
Resolution	1920*1080p	2560*1440p	1920*1080p
Refresh Rate	60hz	144hz	165hz
Response Time	5ms	1-2ms	1ms
Brightness	300cd/㎡	400cd/㎡	450cd/㎡
Power Supply		USB	
Control		Camera Synchronization Control	
Interface Type	Mini HDMI	Mini HDMI	HDMI

Optional Screen Recommended Specifications

Screen Scale	4:3/5:4/16:9
Brightness	≥400cd/m²
Available Imaging Ratio of Luminescent Surface	~1: 2 (200mm * 100mm luminescent surface) The available imaging luminous surface surface size is about 100mm * 50mm
Resolution	600p/768p/720p/1024p/1080p
Refresh Rate	60hz/120hz/240hz
Interface Type	HDMI/Mini HDMI

Half Mirror	**MPD-GS-120**	**MPD-GS-140**	**MPD-GS-170**
Material		Float Glass Double sided coating (one side coated with spectroscopic film and one side coated with antireflective film) Antireflective film: 400-700nm, spectroscopic film: 400-700nm T: R=50%: 50%	
Depth of Parallelism		±15"	
Smoothness		λ/4	
Surface Finish		60-40	
Incidence Angle		45°	
Dimension(LxWxH)	230mmx2mmx170mm	280mmx2mmx222mm	440mmx2mmx440mm
Weight	192g	275g	950g

NEW

Triangle Programmable Screen Light Source Kit 	**MPD-CL-600**

DH Series

Photometric Stereo Mode &
Phase Measuring Deflectometry Mode

		DH081	**DH162**	**DH200**
Resolution(px)		8.1M (2856 x 2848)	16.2M (5328 x 3040)	20M (4512 x 4512)
Image Scale		1:1	16:9	1:1
CMOS Size		2/3"	1.1"	1.1"
CMOS Type			Monochrome CMOS	
Exposure Type			Global Shutter	
Unit Cell Size			2.74μm x 2.74μm	
Framerate of whole Cycle*1	Photometric Stereo *2	≤11 FPS ≤40 FPS (Binning)	≤7 FPS ≤26 FPS (Binning)	≤5 FPS ≤18.5 FPS(Binning)
	Phase Measuring Deflectometry*3	≤2 FPS ≤3.5 FPS (Binning)	≤1.85 FPS ≤3.3 FPS (Binning)	≤1.6 FPS ≤3.2 FPS(Binning)
Light Interface			Multispectral Partition Light interface : 20 Pin Plug x1	
			Programmable Screen Light interface Mini HDMI x 1	
			Four-channel standard light interface (3-Pin, camera synchronous exposure, four overall current ≤6A)	
Lens Mount			C-Mount	
Data Interface			USB3.0	
Operating Voltage/Current			24V/5A	
Input/Output Signal			Two channel Nonpolar Level Signal Input/Switchable Signal Output(12/24V Compatible)	
SDK Operating System			Windows 7/8/10/11	
SDK Platform			C / C++ / C# / Python	
Dimension(LxWxH)			138.5mm x 120mm x 52.3mm	
Weight			640g	

*1. Whole cycle: refers to the time from the beginning of exposure to the end of data transmission;
*2. 50EXPI, 50 Exposure Intensity, fast algorithm mode, three output channels (Kd,Nx,Ny);
*3. 500EXPI, 50 exposure intensity, XY dual cycle, output three channels (Gray,PhaseX,PhaseY), screen light refresh rate 120hz.

Light Source

Please refer to "Multispectral Partition Light " , "Coaxial Programmable Screen Light Kit" , "Programmable Screen Light" , "Half Mirror" and "Triangle Programmable Screen Light Kit" .

Lens	MPD-F2518M-G	MPD-F3518M-G	MPD-F5020M-G	MPD-F1640M
Lens Type	FA Lens			
Lens Mount	C-Mount			
Focal Length	25mm	35mm	50mm	16mm
Fno	F1.8~F16.0	F1.8~F16.0	F2.0~F16.0	F4.0
CMOS Size	1.1"	19.2mm/1.2"	19.2mm/1.2"	1"
Unit Cell Size	2.2μm			3.50μm
Resolution	200lp/mm			150lp/mm
WD	500mm-70mm	600mm-150mm	600mm-150mm	550mm-150mm
Magnification（X）	0.06-0.306	0.058-0.236	0.083-0.371	0.03-0.09

FOV(VxH，mm) *Theoretical

Magnification		0.060x	0.306x	0.058x	0.236x	0.083x	0.371x	0.03x	0.09x
Camera Resolution(px)	8.1M (2856 x 2848)	130.4x130.0	25.5x25.5	134.9x134.5	33.1x33.0	94.2x94.0	21.0x21.0	260.8x260.1	86.9x86.7
	16.2M (5328 x 3040)	243.3x138.8	47.7x27.2	251.7x143.6	61.8x35.2	175.8x100.3	39.3x22.4	486.6x277.6	162.2x92.5
	20M (4512 x 4512)	206.0x206.0	40.4x40.4	213.1x213.1	52.3x52.3	148.9x148.9	33.3x33.3	412.0x412.0	137.3x137.3

Lens	MPD-Y015X359CR
Lens Type	Approximate Telecentric Lens
Lens Mount	C-Mount
Fno	F6.5
DOF	28.8mm
CMOS Size	2/3"
Unit Cell Size	2.15μm
Object-space Resolution	28.6μm
O/I	428.1mm
WD	359±3%mm
Magnification（X）	0.15
Object FOV	ϕ73.3mm
Image FOV	ϕ11mm

*Recommended lens specifications: Unit Cell Size≤2.74 μm, lens COMS size ≥ camera CMOS size, C-Mount interface.

Accessory

MP-PW-1500
1.5 Meters
Power Cable

MPS-ADP120A24
Hybrid Data Camera
Power Adapter

MP-USB-3000
3 meters USB 3.0
high-flex cable

MPD-PWI-3000
3 meters aviation plug-in power supply/high flexible cable

MPD-PWI-7000
7 meters aviation plug-in power supply/high flexible cable

MPD-PWI-15000
15 meters aviation plug-in power supply/high flexible cable

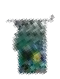
MPD-PWI-3000L
3 meters aviation plug-in power supply/high flexible cable(Elbow)

MP-OUSB-7000
7 meters USB 3.1 high-flex hybrid fiber data cable

MP-OUSB-10000
10 meters USB 3.1 high-flex hybrid fiber data cable

MP-OUSB-15000
15 meters USB 3.1 high-flex hybrid fiber data cable

MP-OUSB-20000
20 meters USB 3.1 high-flex hybrid fiber data cable



MP-PICE-U3
PICE interface USB3.0 expansion card 4 ports independent power supply
If choosing a USB fiber data cable, it is recommended to choose this card as the standard configuration.

MPD-MINI-HDMI
Mini-HDMI signal interface cable connecting screen and camera
For DH/DM Series

MPD-Tripod
Hybrid Data Camera Tripod
For Multispectral Partition light

MPD-Xbracket
Hybrid Data Camera Bracket
For Multispectral Partition Spot Light

MP-PWC-3000
3 meters Type-C to USB power cord
For DH/DM Series

MPD-L-10030W
100mm*30mm White Bar Light

MPD-L-10030IR
100mm*30mm IR Bar Light

MPD-L-14030W
140mm*30mm White Bar Light

MPD-L-14030IR
140mm*30mm IR Bar Light

MPD-L-21030W
210mm*30mm White Bar Light

MPD-L-21030IR
210mm*30mm IR Bar Light

MPD-L-42030W
420mm*30mm White Bar Light

MPD-L-42030IR
420mm*30mm IR Bar Light

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