

ImSpector Imaging Spectrographs



Cased & OEM Versions



Color inspection of plastic products



Fruit classification



Textile color inspection



Wood surface inspection

ImSpector is a direct sight imaging spectrograph that can be quickly combined with a broad range of industrial and scientific monochrome area cameras to form a spectral camera.

ImSpector produces high quality measurements with **full spectral and spatial information** on a target through capturing line images of the target and dispersing light from each line image pixel into spectral components.

Several standard versions are provided between 380-2400 nm wavelength range and 1.5-15.0 nm spectral resolution, with C-mount objective lens or multichannel fiber optics, and as a cased version, or an OEM version without the outer casing.



A new ImSpector Enhanced series has been developed to offer imaging spectrographs with **higher image quality and larger image size** especially when using mega pixel cameras.

The robust structure of ImSpector suits both for industrial and scientific applications that require rapid and precise spectral measurements at low cost.

Compared to conventional color cameras and other filter based imaging systems, ImSpector provides contiguous spectral information with good spectral and spatial resolution, flexible wavelength selections in software, simultaneous visible and near-infrared wavelengths, and total compensation for light source color temperature changes.

ImSpector Standard Series

ImSpector imaging spectrographs consist of input slit, collimating optics, transmission grating and focusing optics in a rugged package. ImSpector provides high quality, astigmatism-free image, high throughput that is independent of light polarization, and easy coupling to camera and lens by standard C-mount. Equipped with objective lens, and installed to a monochrome area camera, ImSpector converts it into a spectral line imaging camera. Combined with multichannel fiber optics input, ImSpector is capable of measuring several points of a target simultaneously. Amount of channels in a fiber optics version is up to several dozens.

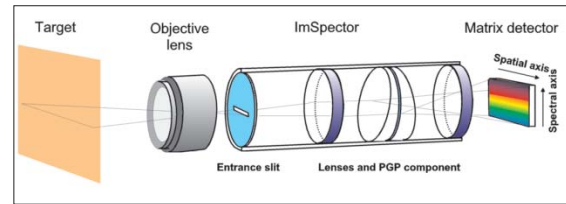


Figure 1. Operating principle of ImSpector



Figure 2. ImSpector cased version



Figure 3. ImSpector OEM version



Figure 4. ImSpector with fiber optics

Specifications

ImSpector	V7	V8	V9	V10	N10
Optical characteristics					
Spectral range	400 - 710 nm ±5 nm	380 - 780 nm ③ ±10 nm	430 - 900 nm ③ ±5 nm	400 - 1000 nm ③ ±10 nm	700 - 1000 nm ±5 nm
Dispersion ①	47 nm/mm	60.6 nm/mm	71.2 nm/mm	90.9 nm/mm	45.5 nm/mm
Spectral resolution② (with 80 μm slit)	5 nm	6 nm	7 nm	9 nm	5 nm
Image size	6.6 (spectral) x 8.8 (spatial) mm, corresponding to standard 2/3" image sensor. V8 and V9 are also available with 4.8 (spectral) x 6.4 (spatial) mm image size, corresponding to standard 1/2" image sensor.				
Spatial resolution	15 line-pairs/mm, rms spot radius < 40 μm within 1/2 " image area rms spot radius < 60 μm within 2/3 " image area				
Aberrations	Insignificant astigmatism Bending of spectral lines across spatial axis (smile) < 50 μm (1/2 " area), < 80 μm (2/3 " area) Bending of spatial lines across spectral axis (keystone) < 16 μm (1/2 " area), < 25 μm (2/3 " area)				
Numerical aperture	F/2.8				
Slit width	13, 25, 50, 80, 150 μm readily available				
Effective slit length	9.8 mm				
Total efficiency (typical)	> 50%, independent of polarization				
Stray light	< 0.5 % (halogen lamp, 633 nm notch filter)				
Mechanical characteristics					
Size, cased	(L) 135 x (W) 70 x (H) 60 mm				
Size, OEM	(D) 35 x (L) 139 mm				
Body, cased	Anodized aluminum with thread for standard camera tripod and M4				
Body, OEM	Anodized aluminum tube				
Lens and camera mount	Standard C-mount adapter				
User adjustments	Image axis relative to detector rows Back focal length adjustable ±1mm				
Environmental characteristics					
Storage	-20 ... +85 °C				
Operating	+5 ... +40 °C, non-condensing				
NOTES					
① Dispersion and resolution are given for 2/3 " image size, for 1/2 " image size the dispersion is 27% lower.					
② System spectral and spatial resolutions also depend on the discrete imaging nature of detector and lens quality.					
③ Order blocking filter is available for mounting on the detector window.					



ImSpector Enhanced Series (E)

ImSpector Enhanced imaging spectrographs share the same features as standard ImSpector imaging spectrographs with highly improved image quality. They provide

- bigger image size width
- high resolution (small spot size)
- smile and keystone distortions in subpixel level, and
- high throughput

The Enhanced series meets the requirements when using larger size detectors with more and smaller pixels. These imaging spectrographs are suitable for applications that require high spatial image resolution or simultaneous measurement with large number of optical fibers.



Figure 5. ImSpector Enhanced spectrograph

Enhanced Series Specifications

ImSpector	V8E	V10E	N17E	N24E
Optical characteristics				
Spectral range	380 - 780 nm ② ±10 nm	400 - 1000 nm ② ±10 nm	900 - 1700 nm ±10 nm	1000 - 2400 nm ② ±10 nm
Dispersion		97.5 nm/mm	110 nm/mm	190 nm/mm
Spectral resolution ^① (with 30 µm slit)		2.8 nm	5 nm	8 nm
Image size	max. 7.15 (spectral) x 14.3 (spatial) or max. 16 mm diagonally rms spot radius < 9 µm		max. 7.7 (spectral) x 12.8 (spatial) mm	
Spatial resolution ^①	No astigmatism		rms spot radius < 15 µm	
Aberrations	Bending of spectral lines across spatial axis (smile) < 5 µm Bending of spatial lines across spectral axis (keystone) < 5 µm		No astigmatism Smile < 10 µm Keystone < 8 µm	
Numerical aperture	F/2.4		F/2.0	
Slit width	30 µm readily available, others on request			
Effective slit length	14.3 mm			
Total efficiency (typical)	> 50%, independent of polarization			
Mechanical characteristics				
Size (OEM)	(D) 55 x (L) 175 mm		(D) 65 x (L) 200 mm	
Body (OEM)	Anodized aluminum tube			
Lens and camera mount	Standard C-mount adapter			
User adjustments	Image axis relative to detector rows Back focal length adjustable ±1mm			
Environmental characteristics				
Storage	-20 ... +85 °C			
Operating	+5 ... +40 °C, non-condensing			
NOTES				
① System spectral and spatial resolutions also depend on the discrete imaging nature of detector and lens quality.				
② Order blocking filter is available for mounting on the detector window.				

Applications

ImSpector imaging spectrographs can be used in various applications. Examples include:

Spectral machine vision systems for online precise color sorting and quality monitoring (in manufacturing lines)

- timber and wood product classification based on knots, pitch stripes, blue stain, etc.
- ceramic tile and other decorative stones in construction applications
- glass or plastic bottle sorting
- textile dyeing
- printing control
- inspection of color matching in car parts, parts for telecom products, cosmetics

Spectral scanners for use in laboratory and at line

- color printout testing
- inspection of production samples
- forensic samples

Spectral imaging systems for light source and display testing

- inspection and sorting of LEDs, LDs and lamps based on spectral emission
- fast test scanning of LCD and other displays

Spectral measuring systems for biomedical applications

- blood or other body fluid analysis
- analysing multiple sample cells simultaneously
- fast checking of test pad charts (e.g. blood test pads)

Spectral microscope systems

- forensic sample investigation
- biomedical sample analysis

Scientific and research applications

- scanning old work of art
- 2D temperature distribution
- spectral flame analysis
- precision farming

NIR spectral imaging systems

- distribution determination of chemical constituents, like moisture, oil, varnish
- sorting of vegetables and fruits based on spectral features related to color and ripeness
- sorting and removal of foreign materials, like polymers from natural materials

Please visit our web site for more information about spectral imaging systems and applications, developed by our collaborators and customers.



Figure 6. Color control in textile dyeing



Figure 7. Spectral microscopy

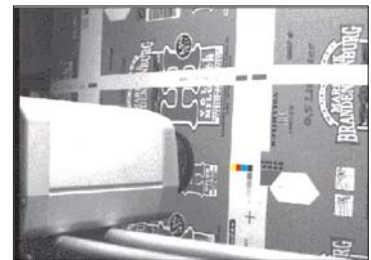


Figure 8. Printing control