Specim

Enhance your perception

ImSpector
Imaging Spectrographs

Standard and Enhanced Series

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.

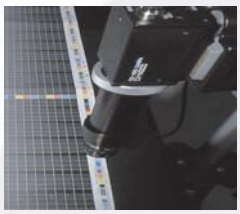
Compared to conventional colour cameras and other filter based imaging systems, **ImSpector produces full contiguous spectral information with high quality spectral and spatial resolution**. It enables flexible wavelength selections in software, and can simultaneously cover a broad spectral range.

Currently SPECIM offers two series of ImSpector; the standard ImSpector range and ImSpector Enhanced. Both series are suited for industrial and scientific applications that require rapid and precise spectral measurements for a low cost.

The ImSpector Enhanced series produces significantly higher quality and larger sized images than the standard series.



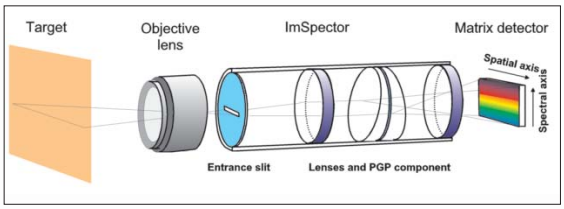


ImSpector Standard Series

SPECIM produces several versions of ImSpector imaging spectrographs, each consist of an input slit, collimating optics, transmission grating and focusing optics in a rugged package. The variants of the versions are,

1. Wavelength which can range between 380-2000 nm
2. Spectral resolution that can range between 1.5-15.0 nm
3. Light input through C-mount objective lens or multi-channel fibre optics
4. Cased or OEM (without the outer casing) version.



Operating principle of ImSpector

ImSpector provides high quality, astigmatism-free image and a high throughput that is independent of light polarization. ImSpector makes a spectral line imaging camera by coupling it to a monochrome area camera and objective lens with a standard C-mount.

ImSpector can also be combined with multi-channel fibre optics input, which is capable of measuring several points of a target simultaneously. The amount of channels in a fibre optics version can reach up to several dozen.

ImSpector cased version


ImSpector OEM version


ImSpector with fiber optics

Specifications

ImSpector	V8	V9	V10	N10	N17B
Optical characteristics					
Spectral range	380 - 780 nm *3	430 - 900 nm *3	400 - 1000 nm *3	700 - 1000nm	900 - 1700nm
Dispersion *1	69.6 nm/mm	71.2 nm/mm	90.9 nm/mm	45.5 nm/mm	120 nm/mm
Spectral resolution *2 (with 80 µm slit)	6 nm	7 nm	9 nm	5 nm	12 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.

Note: Due to continuous development work, specifications are subject to changes without a prior notice.

ImSpector Enhanced Series (E)

ImSpector Enhanced imaging spectrographs share the similar ease of use as the standard ImSpector imaging spectrographs with improved performance. The advantages of the enhanced series include;

- greater spatial image width
- high resolution (small spot size)
- smile and keystone distortions in subpixel level, and
- high throughput with telecentric input
- optional shutter

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 fibres.

ImSpector Enhanced spectrograph

The Enhanced series is now available for UV (200-400 nm) and for total SWIR (1000-2400 nm).

ImSpector Enhanced spectrograph with optional shutter.

Fibre optic cable with lens

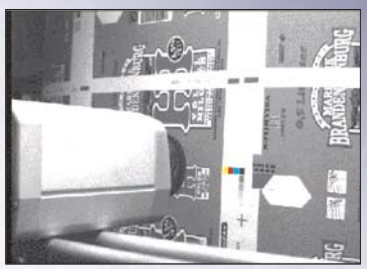
ImSpector Enhanced objective lens, with telecentric image side.

Enhanced Series Specifications

ImSpector	UV4E	V8E	V10E	N17E	N24E
Optical characteristics					
Spectral range	200 - 400 nm	380 - 780 nm *2	400 - 1000 nm *2	900 - 1700 nm	1000 - 2400 nm *2
Dispersion	47 nm/mm	65 nm/mm	97.5 nm/mm	110 nm/mm	190 nm/mm
Spectral resolution *1 (with 30 μm slit)	2 nm	2 nm	2.8 nm	5 nm	8 nm
Image size	max. 6.4 (spectral) x 8.8 (spatial) mm	max. 7.15 (spectral) x 14.3 (spatial) or max. 16 mm diagonally		max. 7.7 (spectral) x 12.8 (spatial) mm	
Spatial resolution *1	rms spot radius < 9 μm			rms spot radius < 15 μm	
Aberrations	No astigmatism 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/2.8	F/2.4		F/2.0	
Slit width	80 μm, others on request	18 and 30 μm, others on request		30 μm, others on request	
Effective slit length	9.3 mm	14.3 mm			
Optical input	Telecentric				
Total efficiency (typical)	> 50%, independent of polarization				
Mechanical characteristics					
Size (OEM)	(W) 50 x (H) 55 x (L) 165mm	(W) 60 x (H) 60 x (L) 175 mm		(W) 60 x (H) 60 x (L) 220 mm	
Body (OEM)	Anodized aluminum tube				
Lens mount	Standard C-mount adapter				
Camera mount	Standard C-mount adapter			Standard U- or 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:



Printing control

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 microscopy

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)

Color control in textile dyeing

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