



Multispectral Snapshot Cameras Series



2023 V1

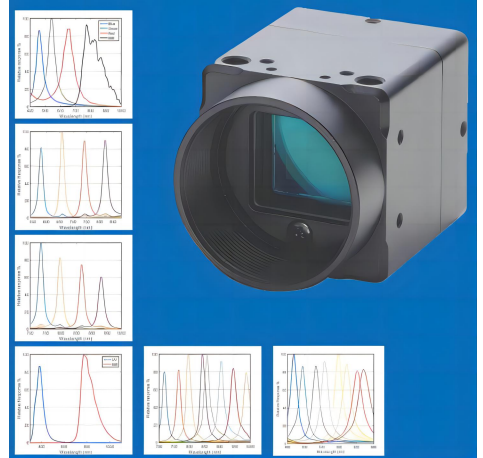
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Multispectral Snapshot Cameras Series

The multispectral camera incorporates a high performance 4MP CMOS sensor that is modified with multispectral filter array technology. With Anti-X-Talk™ Technology, this multispectral camera has enhanced contrast and spectral performance. The miniature multispectral snapshot camera simultaneously captures images at 2 or 4 or 8 distinct bands. The camera is USB3 Vision-compliant with many pre-built software options such as 2ndlook graphical camera software. Programmers can build camera applications in Windows and Linux using the included SDKs. Power is supplied through the USB3 interface.



How the multispectral camera work

This miniature multispectral snapshot camera simultaneously captures images at 2 or 4 or 8 distinct bands at 89 frames per second in full frame mode. There is no requirement for additional filters, filter wheels, or tunable filters. The spectral information in the 2 or 4 or 8 bands is captured simultaneously by the multispectral sensor. The camera offers 2 or 4 or 8 bands of spectral discrimination.

Anti-X-Talk™ Technology

Anti-X-Talk™ technology works at the filter level and prevents light leakage between individual filters. Without Anti-X-Talk™ technology, stray light between spectral channels is significant, often exceeding the light leakage due to spectral overlap between adjacent filters. Without AntiX-Talk™ technology, images suffer from low contrast and spectral ambiguity. Spectral Devices invented Anti-X-Talk™ technology to overcome these problems. It works by blocking stray light between adjacent filters, so the pixel response is predictable and directly related to the actual spectral response of the overlying pixelated filter. The result is multispectral images with better spectral discrimination and higher contrast. Furthermore, high quality image data from the MSC2-NIR-1-A can be used as is without the need for proprietary post-processing algorithms and the camera can be used with a wide range of lens types, even at large apertures (e.g., f/2).

Feature

- High frame rate, up to 89 FPS at full frame
- 4MP global shutter CMOS sensor
- USB3 vision & GenICam compliant
- Ultracompact ,ultralight (< 55 g)
- Low power requirement :< 4W from USB cable
- Multiple M2 and M4 mounting points
- SDK for Windows and Linux included
- Capture spectral images simultaneously(snapshot operation)
- Enhance contrast and spectral performance(Anti-X-Talk™ Technology)



RGB-NIR Camera

- With RGB and NIR bands and conventional red, green, and blue bands of spectral transmission
- NIR channel sensitive to near infrared light from 750 nm to 1000 nm
- The amount of cross-talk between bands is much lower

Agriculture Camera

- Offer multispectral imaging across 4 bands(580, 660, 735, 820 nm separately sensitive to live vegetation , the NDVI red channel , the 'red edge' channel,the NDVI NIR channel)

8-Band NIR Camera

- Offer nearly equally spaced bands across the near-infrared spectral range
- Compared to our 4-band cameras, the 8-band NIR camera offers 3-fold higher sensitivity

8-Band Visible Camera

- Offer nearly equally spaced bands across the visible spectral range
- Compared to our 4-band cameras, the 8-band visible camera offers 3-fold higher sensitivity

Biomedical Camera

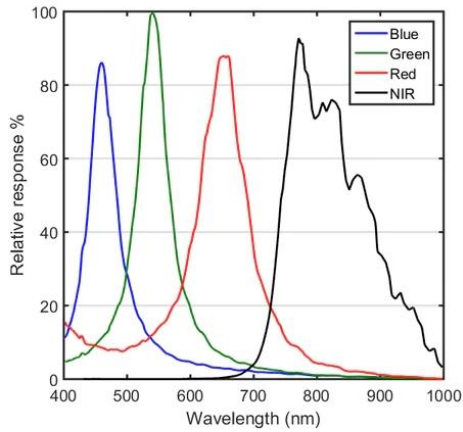
- Offer 4 bands of spectral discrimination(735, 800, 865, 930 nm , separately sensitive to deoxyhemoglobin ,total hemoglobin ,oxyhemoglobin , lipid)

UV-NIR Camera

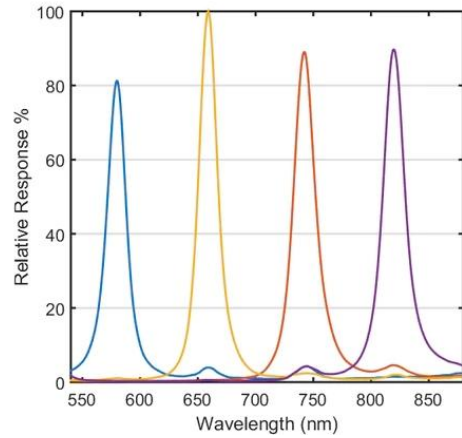
- Have 2 bands of spectral discrimination(One band is centered in the UV region covering 350 to 450 nm and the other covers the near infrared region between 700 and 1000 nm)

Spectral Characteristics

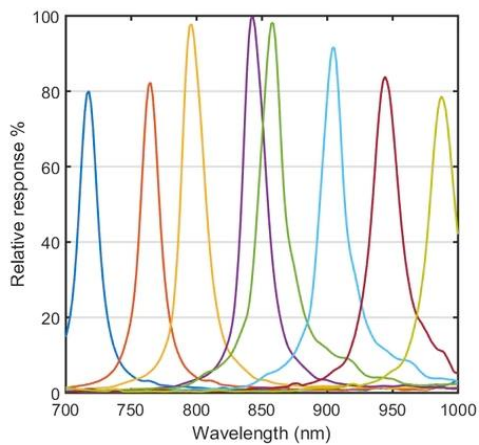
Spectral response of different filter set



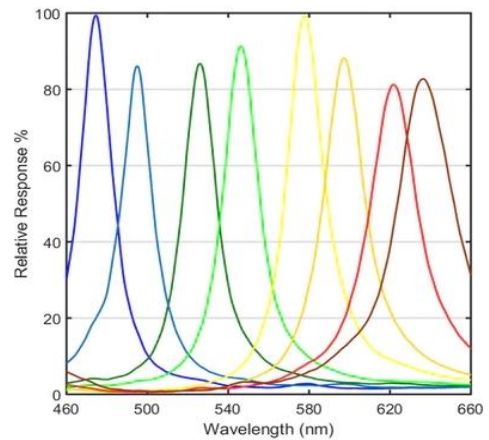
RGB-NIR Camera



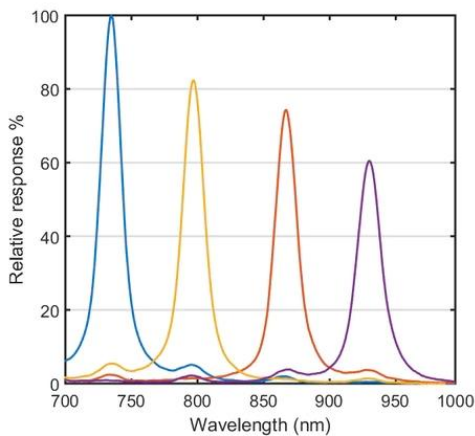
Agriculture Camera



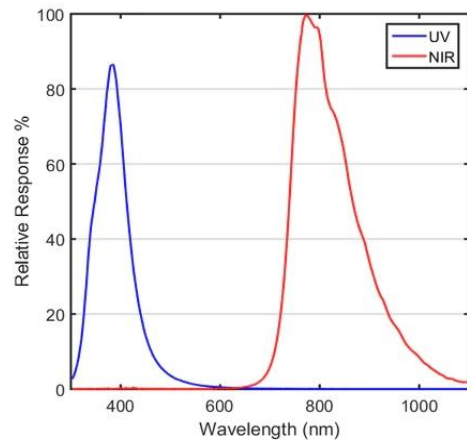
8-Band NIR Camera



8-Band Visible Camera



Biomedical Camera



UV-NIR Camera

Specification

| Parameters | RGB-NIR Camera | Agriculture Camera | 8-Band NIR Camera | 8-Band Visible Camera | Biomedical Camera | UV-NIR Camera |
|-----------------------------------|---|--|--|---|--|---|
| Sensor format | 1-inch | 1-inch | 1-inch | 1-inch | 1-inch | 1-inch |
| Number of spectral channels | 4 | 4 | 8 | 8 | 4 | 2 |
| Image pixels per Spectral channel | 512 x 512 (1024 x 1024 after debayering) | 512 x 512 (1024 x 1024 after debayering) | 256 x 256 (512 x 512 after debayering) | 256 x 256 (512 x 512 after debayering) | 512 x 512 (1024 x 1024 interpolated after optional debayering) | 2048 x 512 after debayering |
| Effective pixel size (H x V) | 5.5 μ m x 5.5 μ m | 5.5 μ m x 5.5 μ m | 16.5 μ m x 5.5 μ m | 16.5 μ m x 5.5 μ m | 5.5 μ m x 5.5 μ m | 5.5 μ m x 5.5 μ m |
| Spectral channels | 450, 550, 650, 800 nm | 580, 660, 735, 820 nm | 720, 760, 800, 840, 880, 900, 940, 980 nm | 474, 495, 526, 548, 578, 602, 621, 640 nm | 735, 800, 865, 930 nm | 400, 800 nm |
| Spectral bandwidth (FWHM) | ~70 nm | ~25 nm | 20 nm | 20, 23, 20, 21, 22, 25, 25, 35 nm, respectively | ~25 nm | ~60-120 nm |
| Shutter type | Global | | | | | |
| Sync system | External trigger (Hardware, Software) / Free run | | | | | |
| Maximum frame rate(at full frame) | 8bits output 89 fps | | | | | |
| | 10bits output 45 fps | | | | | |
| | 12bits output 37 fps | | | | | |
| ADC bit width | 10bits / 12bits | | | | | |
| Noise level | 8bits output: <3 digits (Gain 0 dB) | | | | | |
| | 10bits output: <12 digits (Gain 0 dB) | | | | | |
| | 12bits output: <48 digits (Gain 0 dB) | | | | | |
| Sensitivity (*1) | 210 Lux | | | | | |
| Exposure time | 22 μ s to 16.77 seconds | | | | | |
| External connectors(*2) | USB:USB3.0 MicroB type,I/O signals: HR10A-7R-6PB(Hirose) or equivalent | | | | | |
| Application | Suitable for applications such as remote sensing for agriculture and geological surveys, industrial color inspection, close examination of artwork, biomedical imaging, robotics, and automation. | A number of spectral analyses can be performed, including NDVI and SAVI, suitable for applications such as remote sensing for agriculture. | Suitable for applications such as remote sensing for agriculture and geological surveys, close examination of artwork, biomedical imaging, robotics, and automation. | Suitable for detailed color testing of paints and inks, spectral analysis of plants, and biomedical research applications where a greater number of bands is needed | Be used for investigational purposes only, suitable for applications in biomedical research involving detection of hemoglobin and lipids in skin and other tissues | Be useful for horticultural applications such as visualizing hidden features in flowers. It is also useful for detecting hidden skin defects and measuring the coverage of lotions such as sun screen products. |

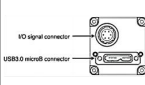
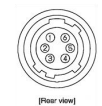
(*1) The sensitivity was measured as the luminance when white level achieved 100 % using the settings and conditions below.

| Camera Setting | | Environment | |
|--------------------|-----------------|-------------------|-------------------|
| Parameter | Setting | Parameter | Setting |
| Gain Up | 0 dB | Light Source | Light Box (White) |
| AGC | Off | Color temperature | 5,100K |
| White Balance | Optimum | Lens | |
| Electrical Shutter | 1/30 seconds | F on Lens | F5.6 |
| Black Level | Optimum | Target Luminance | IM-600 (Topcon) |
| Gamma | Factory Setting | | |

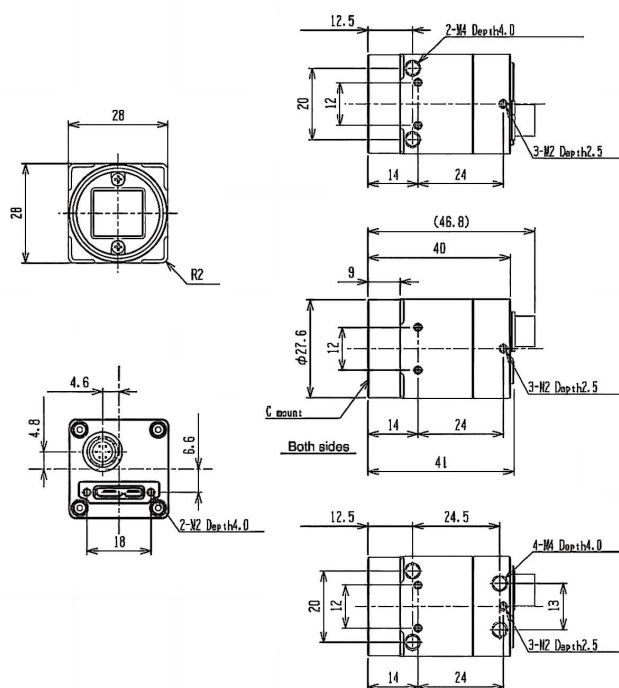
(*2) Note: the external connector is for the output signal, not for the power of the camera. The camera power is supplied in +5B for the USB cable. It does not affect the voltage for the input signal.

Pin Assignment

| Pin No. | Signal Name | I/O | Signal Voltage | |
|---------|---|-----|-----------------|-------------|
| | | | Low | High |
| 1 | GND for I/O signal | - | 0V | |
| 2 | Output 2(I/O3) | OUT | 0.8V or lower | +3.3 ~ +24V |
| 3 | Output 1(I/O2) | OUT | 0.8V or lower | +3.3 ~ +24V |
| 4 | Input 2(I/O1) | IN | 0.7V or lower | +2.5 ~ +5V |
| 5 | Input 1(I/O0) | IN | 0.7V or lower | +2.5 ~ +5V |
| 6 | Power supply for output signal (IO_VCC) | - | +3.3 to +24 Vdc | |

Dimension



SDKs

SDKs Included with the multispectral snapshot camera is an industrial-grade SDK for camera control and image capture. The SDK is compatible with variety of Windows, Linux and MacOS operating systems. It includes drivers, libraries, documentation, and samples. Environments such as Python and OpenCV are also supported.

| Operating System | Development Environments | SDK Includes |
|--|--|---|
| Windows 10 (32bit / 64bit) Windows 8.1 (32bit / 64bit) Windows 7 SP1 (32bit / 64bit) | Visual Studio 6 Visual Studio 2003 Visual Studio 2005 Visual Studio 2008 Visual Studio 2010 Visual Studio 2012 Visual Studio 2013 Visual Studio 2015 MinGW (Minimalist GNU for Windows) embarcadero Free C++ Compiler Python 3.6.x Python 3.7.x | Windows driver Windows SDK StApi (Visual C++, .net Framework 2.0, C) StGenTL module Viewing Software (StViewer) Sample Programs (Visual C++, Visual C#, Visual Basic, C) DirectShow Filter Documentation |
| Ubuntu 18.04 (64bit) Ubuntu 18.04 (ARM 64bit) Raspberry Pi OS (32bit) | Python 3.6.x Python 3.7.x | StApi (C++, C) StGenTL module Viewing Software (StViewer) Sample Programs (C++, C) Documentation |
| MacOSX Sierra MacOSX High Sierra MacOSX Catalina | Python 3.6.x Python 3.7.x | StApi (C++) StGenTL module Viewing Software (StViewer) Sample Programs Documentation |

Windows Software (optional)

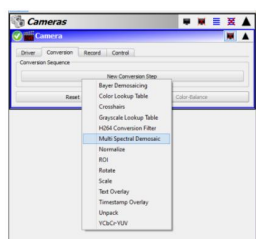
Windows Software (optional) 2ndLook is a complete image acquisition software package that enables users to connect and acquire images from one or more multispectral cameras on a single PC. Offering real-time synchronized video recording from GenICam-compliant USB3 Vision, GigE Vision, and DirectShow cameras (Figure 10.1). Easily record directly to popular file formats such as AVI and TIFF. Record from multiple cameras to different file formats concurrently.

Multispectral imaging conversion filters for cameras are built in (Figure 10.2). View montage of spectral images in real-time (Figure 10.3). Built-in debayering algorithm to show color image from RGB multispectral images. Easy to use interface with interactive help and user guides. Demo version provides all features, except save to disk function.



Real-time display of raw multispectral images.

Figure 10.1



Multispectral conversion filters

Figure 10.2



Real-time display of multispectral images in montage format. Example here collected with 4-band multispectral camera for agriculture

Figure 10.3