Spectral DEVICES INC.

Product Sheet

Multispectral Linescan Camera for Agriculture

MSC2-AGRI-1-L

MSC2-AGRI-1-L

Specifications subject to change

Revised September 28, 2022

Version 007

Table of Contents

1. Description

The MSC2 multispectral linescan camera for agriculture incorporates a high performance 4MP CMOS sensor that is modified with Spectral Devices proprietary multispectral filter array technology. This miniature multispectral snapshot camera simultaneously captures line images at 4 distinct bands at up to 3500 frames per second. There is no requirement for additional filters, filter wheels, or tunable filters. The 4 bands are captured simultaneously by the multispectral sensor. The camera offers 4 bands of spectral discrimination spaced between 580 nm and 820 nm. 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. The MSC2-AGRI-1-L is ultra-compact, ultra-light, and designed for demanding agricultural imaging applications.

2. Key Features

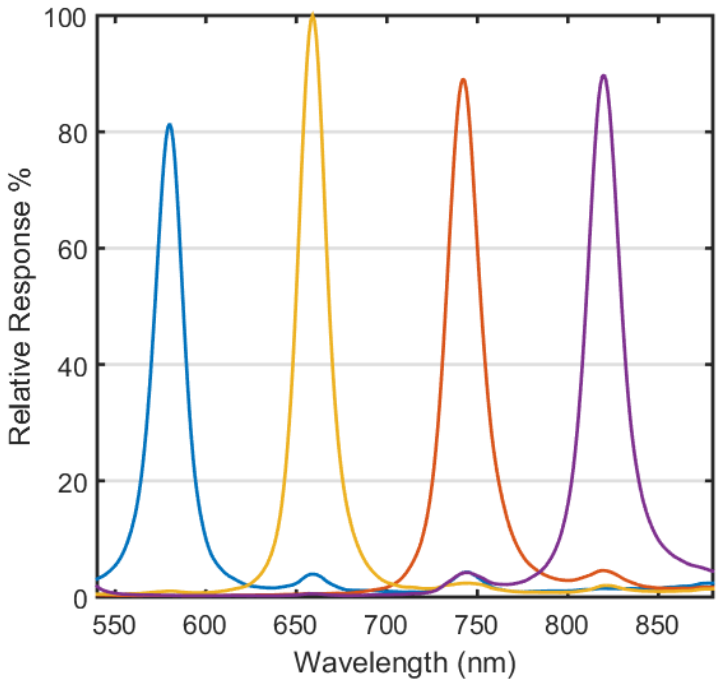
Snapshot Operation (capture spectral images simultaneously)
Captures 4 Bands (580, 660, 735, 820 nm)
Anti-X-Talk™ Technology (enhances contrast and spectral performance)
High Frame Rate (up to 3500 FPS at 2048 pixels x 4 bands)
High Performance (4MP Global Shutter CMOS Sensor)
USB3 Vision & GenICam Compliant
Ultracompact (28 mm x 28 mm x 47 mm)
Ultralight (< 55 g)
Low Power Requirement (< 4W from USB cable)
Multiple M2 and M4 Mounting Points
SDK for Windows, Linux, Raspberry Pi, and MacOS included

3. Applications

The camera is suitable for applications such as remote sensing for agriculture. Combined with Spectral Devices SBC-1 miniature vision computer, the MSC2-AGRI-1-L offers an easy-to-use lightweight and modular imaging solution for UAV users.

4. Spectral Characteristics

Spectral response of the MSC2-AGRI-1-L filter set



5. Anti-X-Talk™ Technology

Unique to Spectral Devices is an on-chip technology we refer to as 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 Anti-X-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 filter. The result is multispectral images with better spectral discrimination and higher contrast. Furthermore, high quality image data from the MSC2-AGRI-1-L 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).

6. Specifications

Lens Mount	C-mount
Sensor Type	CMOS
Sensor Model	AMS CMV4000
Sensor Format	1-inch
Number of Spectral Channels	4
Image Pixels Per Spectral Channel	2048 x 1
Effective Pixel Size (H x V)	5.5 µm x 5.5 µm
Capture Method	Line
Spectral Channels	580, 660, 735, 820 nm
Spectral Bandwidth (FWHM)	~25 nm
On-chip Spectral Enhancement	Anti-X-Talk™ Technology
Shutter Type	Global
Sync System	External trigger (Hardware, Software) / Free run
Maximum Frame Rate (at Full Frame)	8bits output 3500 FPS 10bits output 1900 FPS 12bits output 1600 FPS
ADC bit width	10bits / 12bits
Video Format	8bits / 10bits / 12bits output
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 µs to 16.77 seconds (Default: 11,116.0 µs)
Digital Gain	0 to 13.9 dB (Default: 0 dB)
Black Level	8bits output: 0 to 15 digits 10bits output: 0 to 63 digits 12bits output: 0 to 255 digits
Binning	Turned off for multispectral readout
Decimation	Turned off for multispectral readout
HDR	Turned off for multispectral readout
Image Flip	Horizontal / Vertical / Horizontal and Vertical / Off
Defective Pixel Correction	Turned off for multispectral readout
Auto Exposure	Supported
Auto Gain	Supported
Operational Mode	Edge preset Trigger / Pulse width Trigger / Start Stop Trigger / Free run
User Setting Storage	Supported
Communication	Through USB3.0 bus
Interface	USB3.0 Super speed (USB3.0 micro B)
Protocol	USB3 Vision® 1.0.1, GenICam Standard Version (SFNC 2.2, PFNC 2.0) compliant
Input / Output	Three GPIOs, One Camera Hardware Reset

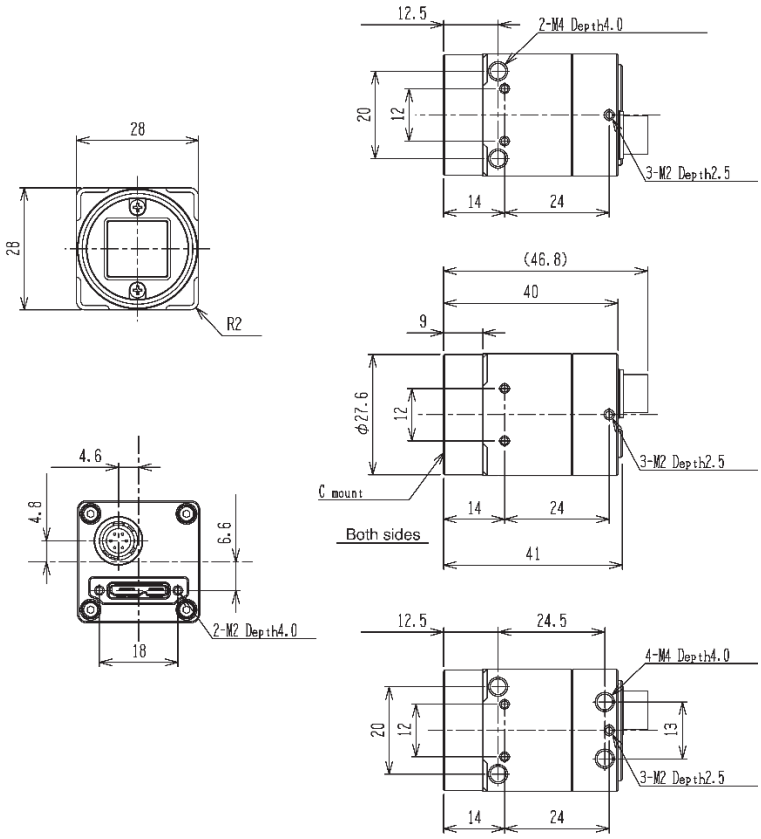
Power Input Voltage	+5V (typ.) (This conforms to USB standard)
Power Consumption	Less than 4.0 W
Case Construction	Anodized Aluminum
Mounting Holes	4 x M4 (bottom), 2 x M4 (top), 3 x M2 (4 sides)
Overall Size	28 mm x 28 mm x 47 mm (W x H x L)
Weight	< 55 g
Operational Temperature / Humidity	Minimum Environmental Temperature: 0 deg. C, Environmental Humidity: 0 to 85 %RH (No condensation) Maximum Camera housing temperature (top plate) shall not exceed 55 deg. C
Storage Temperature / Humidity	Environmental Temperature: -30 to +65 deg. C Environmental Humidity: 0 to 85 %RH (No condensation)
Vibration	20 Hz to 200 Hz to 20 Hz (5 min. / cycle), acceleration 10 G, XYZ 3 directions 30 min. each
Shock Acceleration	38 G, half amplitude 6 ms, XYZ 3 directions 3 times each
Standard Compliancy	EMS: EN61000-6-2, EMI: EN55011
RoHS	RoHS Compliant

(*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) The multiple ROI regions cannot set on the same horizontal line.

7. Mechanical Drawings



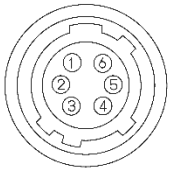
8. External Connector Specifications

External Connectors	USB: USB3.0 MicroB type, I/O signals: HR10A-7R-6PB(Hirose) or equivalent

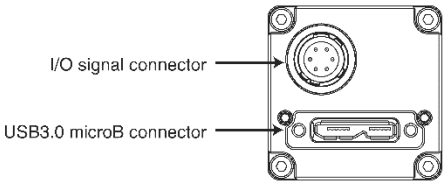
- This connector is for the output signal, not for the power of the camera. The camera power is supplied in +5V from the USB cable
  It does not affect the voltage for the input signal

Pin Assignment

Pin No.	Signal Name	I/O	Signal Voltage	
			Low	High
1	GND for I/O signal	-	0V	
2	Output 2(IO3)	OUT	0.8V or lower	+3.3 - +24V
3	Output 1(IO2)	OUT	0.8V or lower	+3.3 - +24V
4	Input 2(IO1)	IN	0.7V or lower	+2.5 - +5V
5	Input 1(IO0)	IN	0.7V or lower	+2.5 - +5V
6	Power supply for output signal (IO_VCC)	-	+3.3 to +24 Vdc	



[Rear view]



*Please use HR10A-7P-6S (Hirose) or equivalent for the cable

9. SDKs

Included with the MSC2-AGRI-1-L 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