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NEW

Mini-spectrometer

WS series | C16449MA-01 C16449MA-02

Compact and thin, built-in high-sensitivity CMOS image sensor

The mini-spectrometer WS series is a polychromator provided in a compact, thin case that houses optical elements, image sensor, and driver circuit. Spectrum data can be acquired by guiding measurement light into a mini-spectrometer through an optical fiber and transferring the measured results to a PC via the USB connection. The incorporation of a high-sensitivity CMOS image sensor achieves high sensitivity and low power consumption. Changes to the spectral response range and spectral resolution are also available as options. Moreover, the trigger function that can be also used for short-term integration enables spectroscopic measurement of pulse emissions.
The product includes free evaluation software with functions for setting measurement conditions, acquiring and saving data, drawing graphs, and so on. Furthermore, the DLL function specifications are disclosed, so users can create their original measurement software programs.

Features

- **Wide spectral response range (C16449MA-01)**
- **High resolution**
- **Spectral response range and spectral resolution can be customized (optional).**
- **High-sensitivity CMOS image sensor built in (high sensitivity equivalent to that of a CCD)**
- **With a trigger function**
- **Shutter function**
- **External power supply not necessary (USB bus powered)**

Applications

- **Film thickness measurements**
- **LIBS (Laser-Induced Breakdown Spectroscopy)**
- **Color measurement**
- **Gas analysis**

Structure

Parameter	C16449MA-01	C16449MA-02	Unit
Dimensions (W × D × H)	80 × 75 × 25		mm
Weight	197		g
Image sensor	High-sensitivity CMOS linear image sensor		-
Number of pixels	2048		pixels
Slit*1 (H × V)	10 × 400		µm
NA*2	0.11		-
Connector for optical fiber	SMA905		-

*1: Input slit aperture size
*2: Numeric aperture (solid angle)

Absolute maximum ratings

Parameter	C16449MA-01	C16449MA-02	Unit
Operating temperature*3	+0 to +50		°C
Storage temperature*3	-30 to +70		°C

*3: No dew condensation
When there is a temperature difference between a product and the surrounding area in high humidity environment, dew condensation may occur on the product surface. Dew condensation on the product may cause deterioration in characteristics and reliability.
Note: Exceeding the absolute maximum ratings even momentarily may cause a drop in product quality. Always be sure to use the product within the absolute maximum ratings.

Optical characteristics

Parameter		C16449MA-01	C16449MA-02	Unit
Spectral response range		190 to 1100	200 to 600	nm
Spectral resolution (FWHM)*2	Typ.	1.0	0.45	nm
	Max.	2.0	0.7	
Wavelength reproducibility*3		-0.2 to +0.2		nm
Wavelength temperature dependence		-0.04 to +0.04	-0.02 to +0.02	nm/°C
Spectral stray light*2 *4		-35 max.		dB

*4: When the slit in the table in "Structure" is used. The spectral resolution depends on the slit.
C16449MA-01: λ=190 nm to 1100 nm, C16449MA-02: λ=200 nm to 600 nm

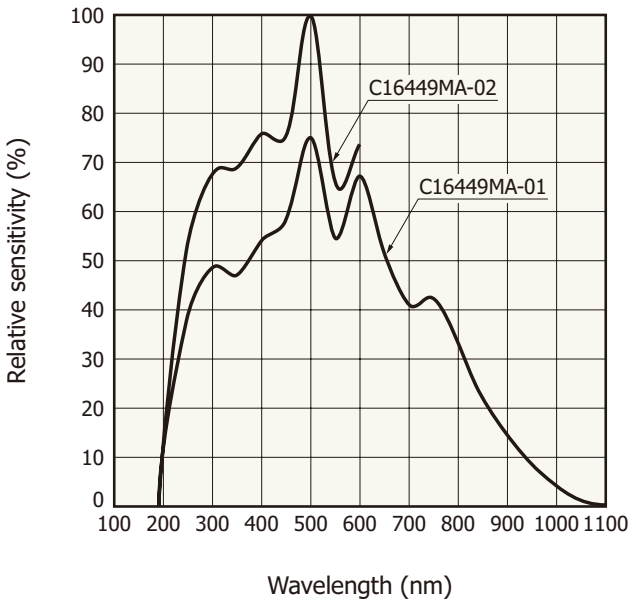
*5: Measured under constant light input conditions

*6: The ratio of the count measured when light (C16449MA-01: 650 nm, C16449MA-02: 400 nm) is input to the count measured when an ± 40 nm light is input.

Electrical characteristics

Parameter		C16449MA-01	C16449MA-02	Unit
A/D conversion		16		bit
Integration time		11 to 100000		µs
Interface		USB 2.0		-
USB bus power current consumption	Typ.	250		mA
	Max.	330		

Spectral response (typical example)



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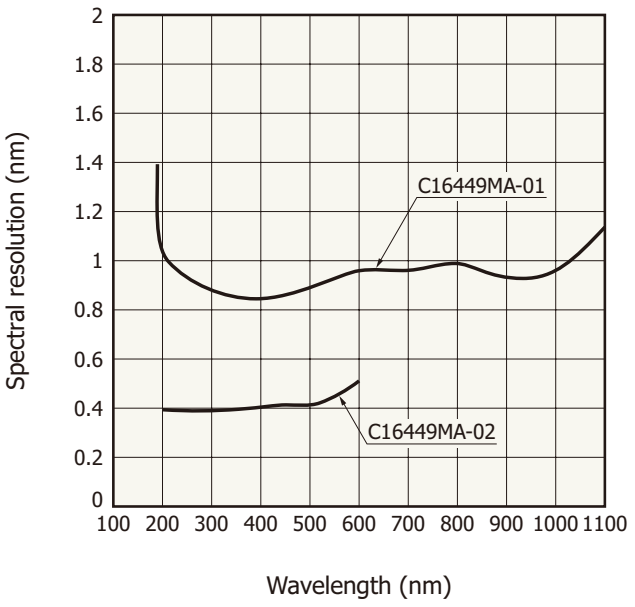
Spectral resolution vs. wavelength (typical example)



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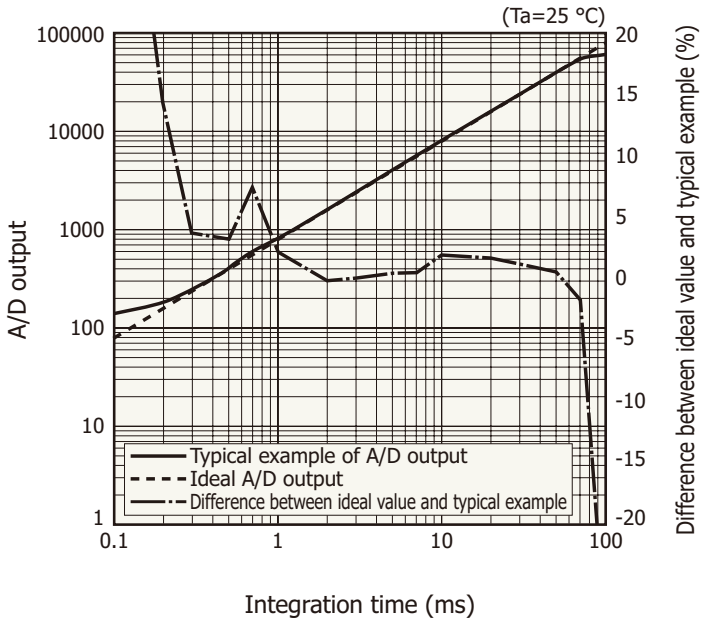
Linearity (typical example)



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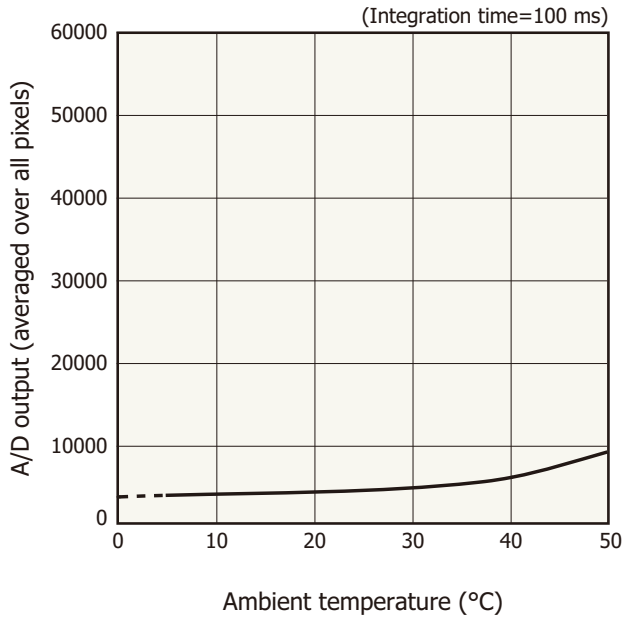
A/D output is the output with dark output subtracted when light is input. The difference between the ideal value and typical example contains a measurement error. The smaller the A/D output, the larger the measurement error.

Dark output vs. temperature (typical example)



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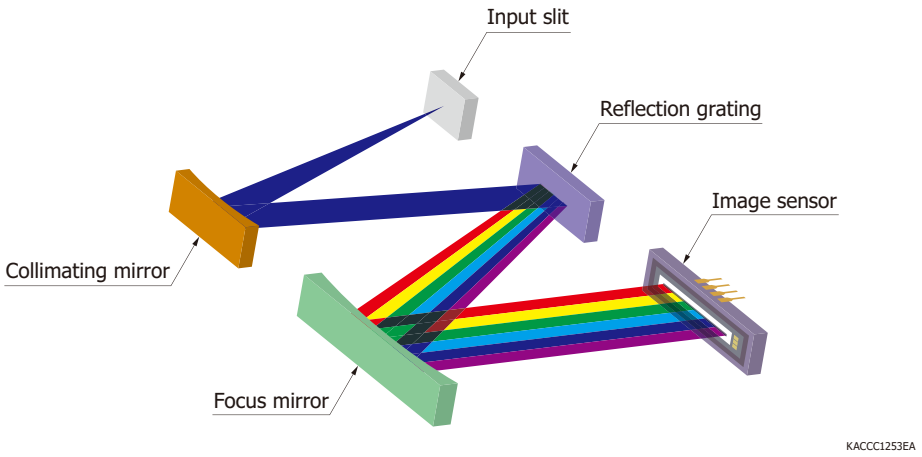
A/D output is the sum of the sensor and circuit offset outputs and the sensor dark output.

Optical component layout

The mini-spectrometer WS series employs a reflection grating and an optical system arranged on a robust optical base to produce high throughput and highly accurate optical characteristics.



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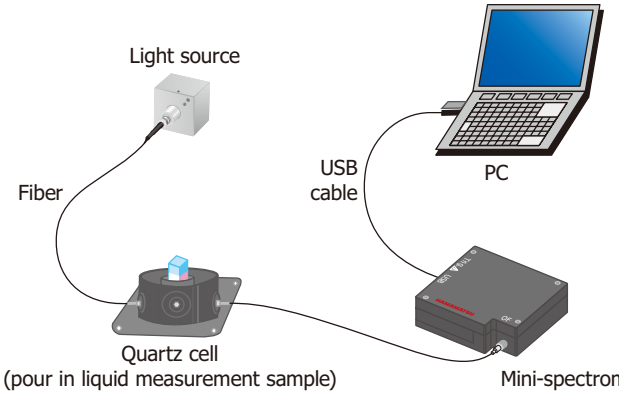
Connection example (transmitted light measurement)

Spectrum data can be acquired by guiding measurement light into a mini-spectrometer through an optical fiber and transferring the measured results to a PC via the USB connection. Since there are no moving parts inside the device, constantly stable measurements can be expected. Moreover, the optical guiding section uses an optical fiber making connection to the measured object flexible.



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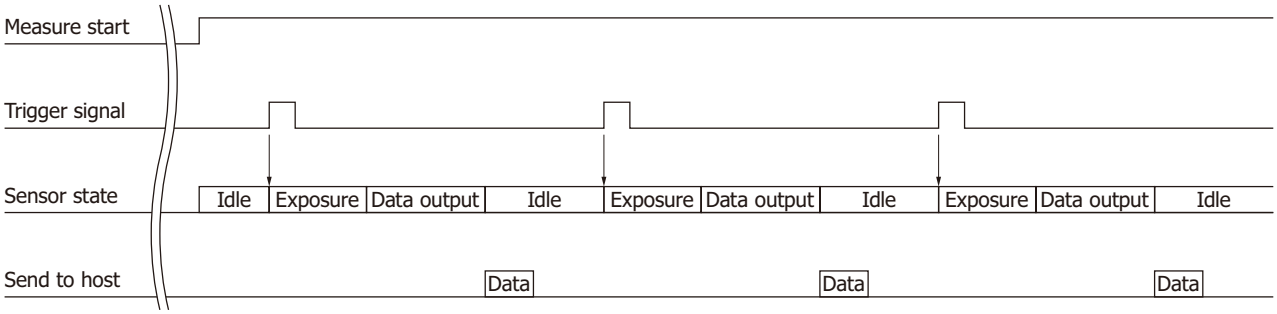
Trigger operation modes

In the C16449MA-01/-02, the following trigger operation modes are available. You can switch between these modes from the evaluation software supplied with the C16449MA-01/-02.

(1) Synchronous data measurement at external trigger input

Sensor operation (integration) starts when an external trigger edge (rising or falling edge can be specified) is applied to the external trigger terminal, and then the digital data is acquired.



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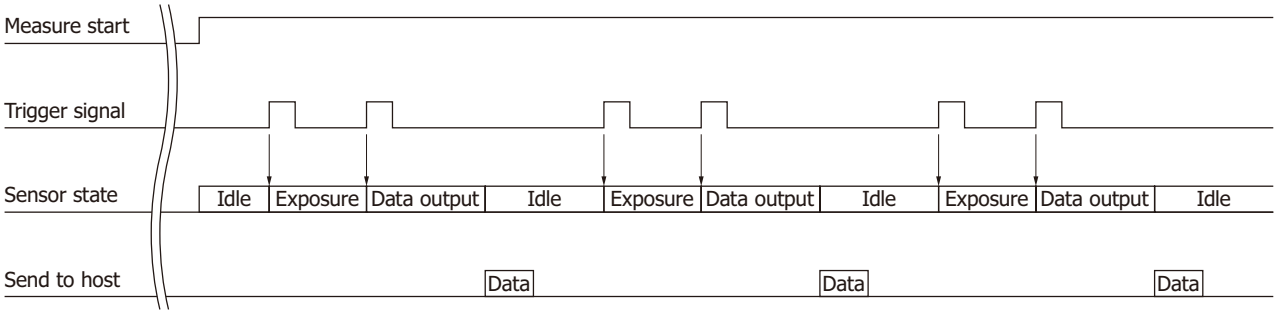
(2) Data measurement at external trigger input

Sensor operation (integration) starts at the odd-numbered external trigger edge (rising or falling edge can be specified) applied to the external trigger terminal, and the sensor operation (integration) completes at the even-numbered external trigger edge, acquiring digital data.



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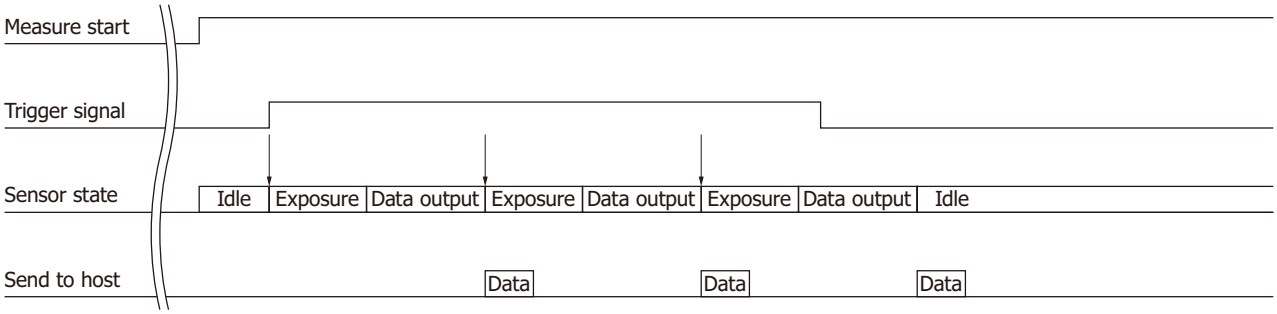
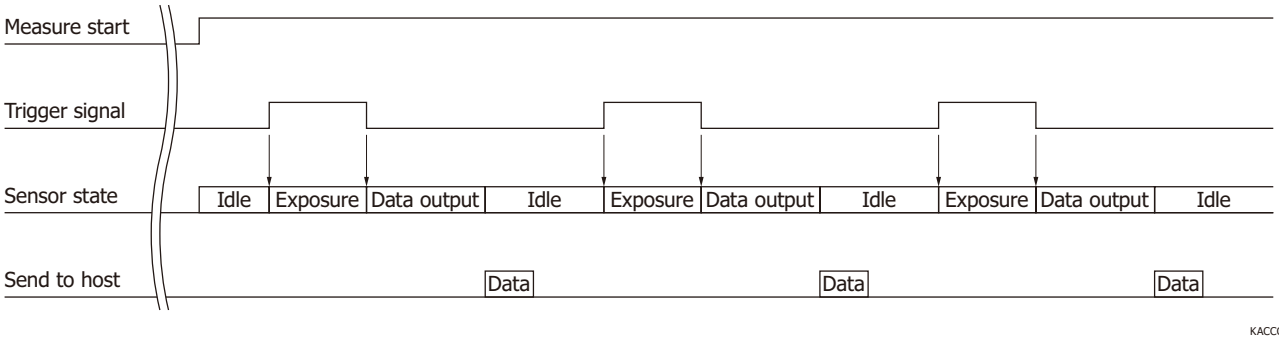
(3) Synchronous data measurement at external trigger input level

Sensor operation (integration) starts when a trigger (high level or low level can be specified) is applied to the external trigger terminal, and then the digital data is acquired.



(4) Data measurement at external trigger input level

Sensor operation (integration) period is determined by the width of the trigger (high level or low level can be specified) applied to the external trigger terminal, and then the digital data is acquired.

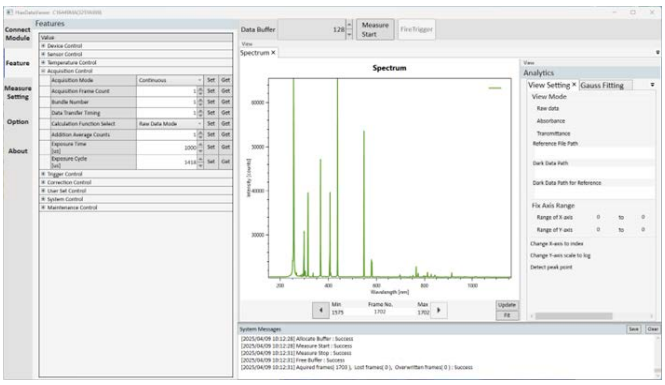


In any of the modes 1 to 4, if the trigger input cycle is shorter than the measurement cycle of the spectrometer, the input trigger is ignored.

Evaluation software (accessory)

By installing the evaluation software (HiasDataViewer.exe)*7 into a PC, you can perform the following basic operations.

· Acquire and save measured data
· Set measurement conditions
· Module information acquisition
  (wavelength conversion factor, mini-spectrometer type, etc.)
· Display graphs
· Dark subtraction
· Gaussian approximation (peak position and count, FWHM)



*7: Compatible OS: Microsoft® Windows® 11 Professional (64-bit)

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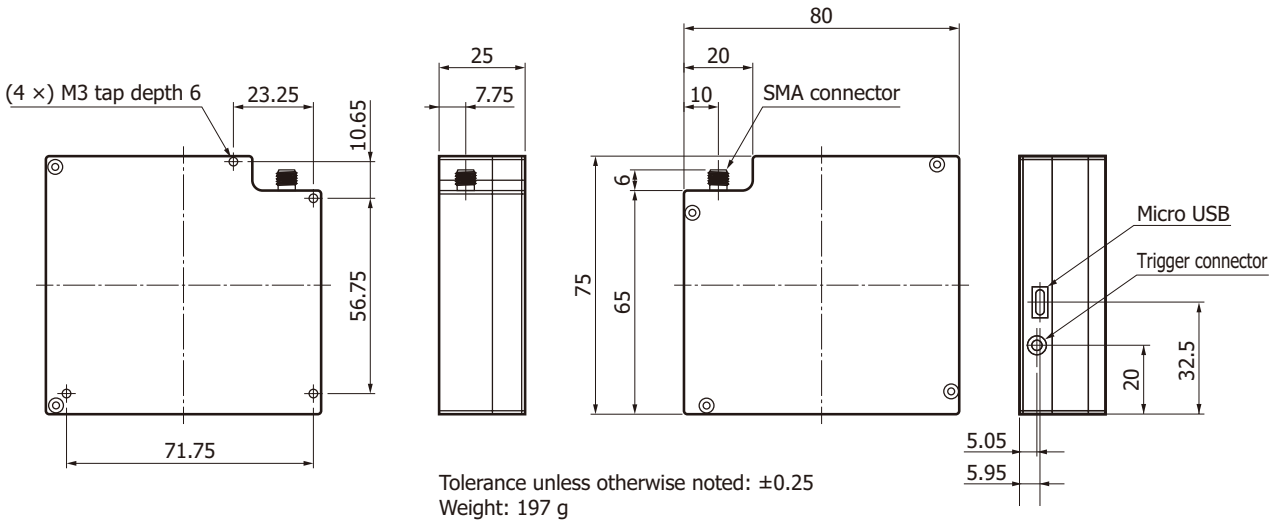
A DLL for controlling the hardware is available. Users can develop original measurement programs.

Dimensional outline (unit: mm)



Tolerance unless otherwise noted: ±0.25
Weight: 197 g

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Accessories

· Dedicated software (evaluation software, sample software, DLL)

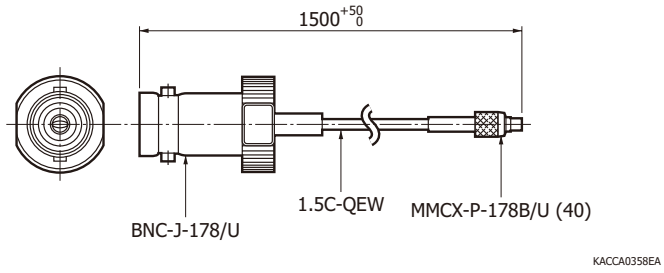
Options (sold separately)

· Input optical fiber

Type no.	Product name	Core diameter (µm)	Specification
A16962-01	Fiber for UV/visible range (resistance to UV)	600	NA=0.22, length=1.5 m, With SMA905D connector on each end

· Coaxial cable for external trigger input A12763

Dimensional outline (unit: mm)



Related information

www.hamamatsu.com/sp/ssd/doc_en.html

■ Precautions
· Disclaimer
· Precautions / Mini-spectrometers

■ Catalogs
· Selection guide / Mini-spectrometers
· Technical note / Mini-spectrometers

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