NEW

MODULE

Mini-spectrometer RC series
C9407MA, C9409MA

Compact and low cost, OEM model (C9409MA)

C9409MA

HAMAMATSU mini-spectrometer RC series is a compact polychromator integrated with a reflection grating and a CMOS linear image sensor. Two models are available: a mini-spectrometer module (C9407MA) equipped with a driver circuit, and a mini-spectrometer head (C9409MA) for OEM applications, which contains an optical system and an image sensor in a tiny case measuring only 28 × 28 × 28 mm. Light guided into the mini-spectrometer head is dispersed into to a spectrum which is then photoelectrically converted and output as video signals. The mini-spectrometer module has a USB port that connects to a PC for spectrum data collection.
The mini-spectrometer module comes supplied with free sample software that allows setting measurement conditions, acquiring and saving data, and displaying graphs. Driver software and DLL are also supplied as accessory items to allow the users to configure their own measurement software.

Features

C9407MA (Module)

- Integrating spectrometer head and drive circuit
- Spectral measurement using PC
- No external power supply required: USB bus power
- A/D conversion: 16-bit
- Wavelength conversion factor *1 is recorded in internal memory.

C9409MA (Head)

- OEM model
- Integrating optical system and image sensor into a compact case: 28 × 28 × 28 mm
- Low cost

Applications

- Installation into measurement equipment
- Chemical measurement
- Visible light source testing
- Color measurement, etc.

■ Selection guide

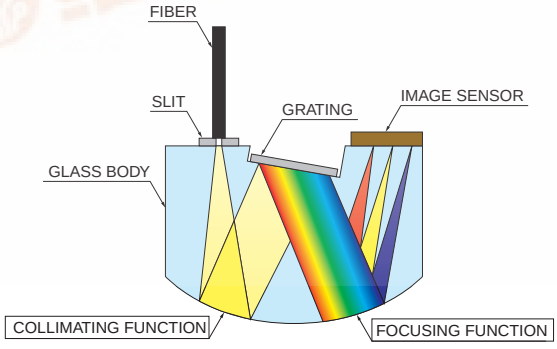
Product No.	Product type	Spectral response range (nm)	Spectral Resolution (nm)	Interface	Light input method
C9407MA	RC-VIS-MOS (Module)	340 to 780	9	USB1.1	fiber
C9409MA OEM model	RC-VIS-MOS (Head)	340 to 780	9	-	fiber

*1: A conversion factor for converting the image sensor pixel number into a wavelength is recorded in the module. Calculation factor for converting the A/D converted count into the input light intensity is not provided.

Structure of C9409MA

C9409MA is offered in small size, low-cost units achieved by integrating optical components into a glass body. The reflective grating mounted on the glass body is a plastic-molded replica grating.

■ Optical component layout



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■ Optical characteristics

Parameter	RC-VIS-MOS C9407MA (Spectrometer module)	RC-VIS-MOS OEM model C9409MA (Spectrometer head)	Unit
Spectral response range	340 to 780		nm
Spectral resolution Max. (Spectral response half width)*2	9		nm
Wavelength reproducibility *3	±0.5		nm
Wavelength temperature dependence	0.05		nm/°C
Spectral stray light *2 *4	-30		dB
Broadband stray light *2 *5	-25		dB

*2: Depends on the slit opening. Values were measured with the slit listed in the table "■ General ratings / Absolute maximum ratings".
*3: Measured under constant light input conditions.
*4: When light at 550 nm is input, spectral stray light is defined as the ratio of the count measured at the input wavelength, to the count measured in a region of the input wavelength ±40 nm.
*5: The ratio of the transmittance in the transmitting wavelength region of an optical filter (OG530) to that in the blocking region.

■ Electrical characteristics

Parameter	C9407MA (Spectrometer module)	OEM model C9409MA (Spectrometer head)	Unit
A/D conversion	16	-	bit
Integration time	5 to 10000	-	ms
Interface	USB1.1	-	-

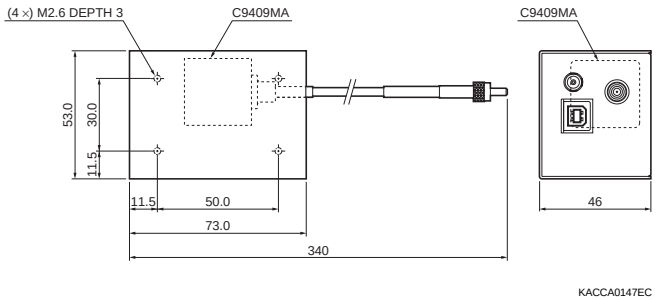
■ General ratings/Absolute maximum ratings

Parameter	C9407MA (Spectrometer module)	OEM model C9409MA (Spectrometer head)	Unit
Dimensions	73 (W) × 53 (D) × 46 (H)	28 (W) × 28 (D) × 28 (H)	mm
Built-in head	C9409MA	-	-
Image sensor	CMOS linear image sensor (S8378-256N)		-
Number of pixels	256		pixels
Slit *6	70 (H) × 550 (V)		µm
Optical NA	0.22		-
Fiber core diameter	600		µm
Optical fiber connector	SMA905		-
Operating temperature *7	+5 to +40		°C
Storage temperature	-20 to +70		°C

*6: Entrance slit aperture size of the incorporated image sensor.
*7: No condensation

■ Dimensional outlines (unit: mm)

C9407MA



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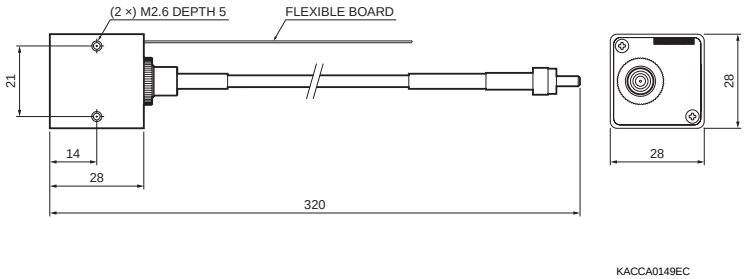
C9409MA



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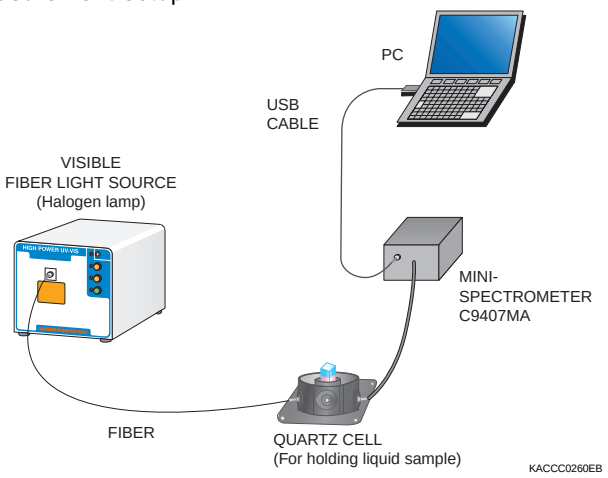
■ Connection example (transmission light measurement)

Light to be measured is guided into the entrance port of RC series through an optical fiber and the spectrum measured with the built-in image sensor is output through the USB port to a PC for data acquisition.

There are no moving parts inside the unit so stable measurement are obtained at all times. An optical fiber that guides light input from external sources allows a flexible measurement setup.

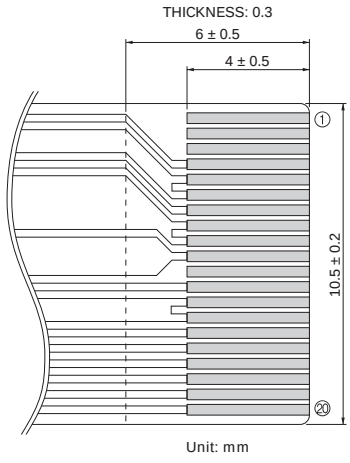


■ Light input method

For C9407MA and C9409MA, an SMA connector (plug) is attached with the other end of the optical fiber. Light can be easily guided by hooking up this connector to the SMA receptacle of an external unit. If the optical fiber connected to C9407MA and C9409MA is shorter than needed, an optical fiber of the desired length can be added by connecting a relay unit.

■ Electrical connection with a external circuit (C9409MA)

The flexible printed circuit board protruding from the head or module is used make electrical connections to an external circuit.

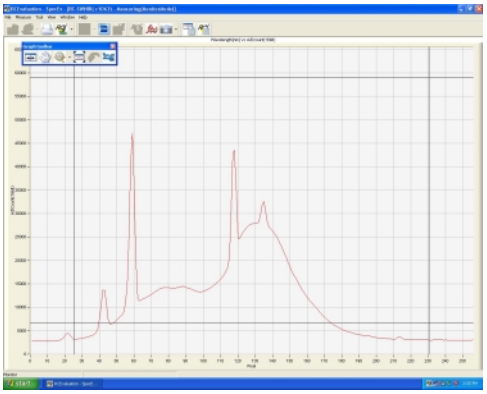


· Mating connectors:
FH12-20S-0.5SV vertical type [Made by HIROSE electric]
FH12 52745-2090 horizontal type [Made by MOLEX]

Note: Refer to the “CMOS linear image sensor S8377/S8378 series” datasheet for information on the operating conditions.

Pin No.	Terminal name	I/O	Discription	Pin No.	Terminal name	I/O	Discription
①	NC	-	No connection	⑪	NC	-	No connection
②	NC	-	No connection	⑫	GAIN	I	Gain setting
③	NC	-	No connection	⑬	A.GND	-	Analog GND
④	EOS	O	EOS (end of scan) signal	⑭	A.GND	-	Analog GND
⑤	A.GND	-	Analog GND	⑮	ST	I	Sensor scan start signal
⑥	A.GND	-	Analog GND	⑯	CLK	I	Sensor scan sync signal H-CMOS compatible
⑦	VIDEO	O	Video signal output	⑰	SDA	O	Thermosensor output signal
⑧	A.GND	-	Analog GND	⑱	SCL	I	Thermosensor driver signal
⑨	A.GND	-	Analog GND	⑲	D.GND	-	Digital GND
⑩	+5 V	I	Power supply of image sensor: +5 V	⑳	VCC	I	Power supply of thermosensor: +3.3 V

■ Dedicated software (C9407MA)



Installing the dedicated software package (containing sample software, device driver, DLL)*10 into your PC allows running the following basic tasks:

- · Measurement data acquisition and save
- · Measurement condition setup
- · Module information acquisition (wavelength conversion factor, polychromator type, etc)
- · Graphic display
- · Arithmetic operation
  - Pixel number to wavelength conversion
  - Dark subtraction
  - Comparison calculation with reference data (transmittance, reflectance)
  - Gaussian approximation (peak position and count, FWHM)

Note: This product cannot operate with the software that comes with the mini-spectrometer TM or TG series.

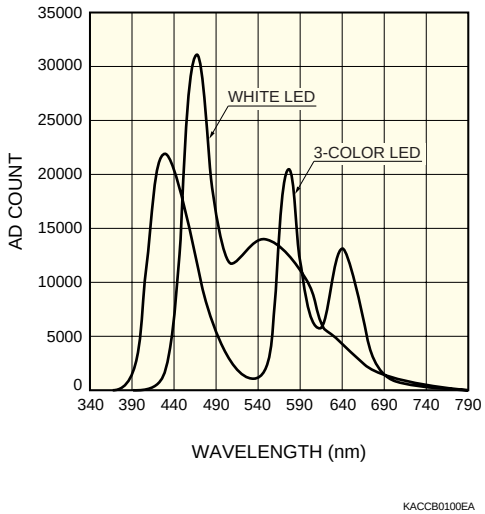
*10: Compatible OS: Microsoft Windows Professional Edition 2000 (SP3 or later) and XP (SP1 or later)

Device driver and DLL for controlling hardware are also provided.
You can develop your own measurement programs by using a software development environment that includes Microsoft Visual C++ and Visual Basic*11. The DLL provides functions such as USB port open/close, measurement condition setup, measurement data and module information acquisition.

*11: Operation of the device driver and DLL has been verified only with Microsoft Visual C++® and Visual Basic®.
Microsoft Visual C++ and Microsoft Visual Basic are either registerd trademarks or trademarks of Microsoft Corporation in the United States and other countries.

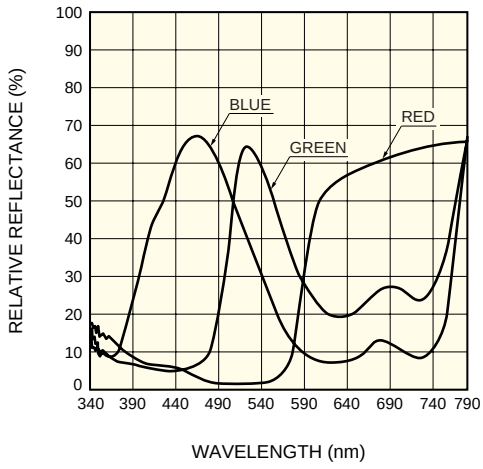
■ Measurement examples

(1) White LED and 3-color LED measurements (C9407MA)



(2) Reflected light from color paper (C9407MA)

Relative reflectance with 100 % being equal to reflectance of white plate



■ Accessories (C9407MA)

- · USB cable
- · Dedicated software (sample software, device driver, DLL)

■ Mini-spectrometer line-up

Type No.	Type		Spectral response range (nm)	Spectral resolution Max. (nm)	Image sensor
C10082CA	TM series	TM-UV/VIS-CCD High sensitivity	200 to 800	6	Back-thinned type CCD image sensor
C10082CAH	TM series	TM-UV/VIS-CCD High resolution	200 to 800	1*	Back-thinned type CCD image sensor
C10082MD	TM series	TM-UV/VIS-MOS Wide dynamic range	200 to 800	6	CMOS linear image sensor
C10083CA	TM series	TM-VIS/NIR-CCD High sensitivity	320 to 1000	8 (λ=320 to 900 nm)	Back-thinned type CCD image sensor
C10083CAH	TM series	TM-VIS/NIR-CCD High resolution	320 to 1000	1* (λ=320 to 900 nm)	Back-thinned type CCD image sensor
C10083MD	TM series	TM-VIS/NIR-MOS Wide dynamic range	320 to 1000	8	CMOS linear image sensor
C9404CA	TG series	TG-UV-CCD High sensitivity	200 to 400	3	Back-thinned type CCD image sensor
C9404CAH	TG series	TG-UV-CCD High resolution	200 to 400	1*	Back-thinned type CCD image sensor
C9404MC	TG series	TG-UV-MOS Wide dynamic range	200 to 400	3	CMOS linear image sensor
C9405CA	TG series	TG-SWNIR-CCD High sensitivity	500 to 1100	5 (λ=550 to 900 nm)	Back-thinned type CCD image sensor
C9405MC	TG series	TG-SWNIR-MOS Wide dynamic range	500 to 1100	5 (λ=550 to 1100 nm)	NMOS linear image sensor
C9406GC	TG series	TG-NIR Non-cooled type	900 to 1700	7	InGaAs linear image sensor
C9913GC	TG series	TG-cooled NIR-I Low noise (cooled type)	900 to 1700	7	InGaAs linear image sensor
C9914GB	TG series	TG-cooled NIR-II Low noise (cooled type)	1100 to 2200	8	InGaAs linear image sensor
C9407MA	RC series	RC-VIS-MOS Spectrometer module	340 to 780	9	CMOS linear image sensor

* Typ.

OEM model

Type No.	Type		Spectral response range (nm)	Spectral resolution Max. (nm)	Image sensor
C9409MA	RC series	RC-VIS-MOS Spectrometer head	340 to 780	9	CMOS linear image sensor

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