NEW

MODULE

Mini-spectrometer TG series
C9404CA, C9404CAH, C9405CA

High sensitivity type (integrated with back-thinned type CCD image sensor)

TG series mini-spectrometers are polychromators integrated with optical elements, an image sensor and a driver circuit. Light to be measured is guided into the entrance port of TM series through an optical fiber and the spectrum measured with the built-in image sensor is output from the USB port to a PC for data acquisition. C9404CA, C9404CAH and C9405CA are high sensitivity mini-spectrometers employing a back-thinned type CCD image sensor. Their sensitivity is about two orders of magnitude higher than CMOS types making them even more ideal for low-light-level measurement. C9404CAH is high resolution type (resolution: 1 nm Typ.). Their products come 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

- Integrated with back-thinned type CCD image sensor: Sensitivity is about two orders of magnitude higher than CMOS types.
- High resolution 1 nm (C9404CAH)
- High throughput due to transmission grating made of quartz
- Highly accurate optical characteristics
- Easy to install into equipment
- Wavelength conversion factor is recorded in internal memory *1

Applications

- Low-light-level measurement such as fluorescence measurement
- Detection of saccharic acids in foods
- Taste analyzers
- Evaluation of light source characteristics such as UV light source

■ Optical characteristics

Parameter	TG-UV-CCD		TG-SWNIR-CCD	Unit
	C9404CA	C9404CAH	C9405CA	
Spectral response range	200 to 400		500 to 1100	nm
Spectral resolution Max. (Spectral response half width) *2	3	1 *3	5 *4	nm
Wavelength reproducibility *5	±0.1		±0.2	nm
Wavelength temperature dependence	0.02			nm/°C
Spectral stray light *2, *6	-35			dB

■ Electrical characteristics

Parameter	Specification	Unit
A/D conversion	16	bit
Integration time	10 to 10000	ms
Interface	USB1.1	-
USB bus power current consumption	100	mA
External power supply	5	V

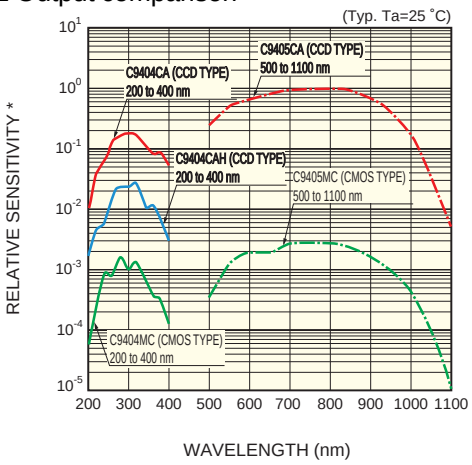
■ General ratings / Absolute maximum ratings

Parameter	Specification			Unit
Dimensions	125.7 (W) × 115.7 (D) × 75 (H)			mm
Image sensor	Back-thinned type CCD image sensor (S10420-1006)			-
Number of pixels	1024			pixels
Slit *7 (H) × (V)	140 × 500	10 × 1000	70 × 800	µm
Optical NA	0.11		0.22	-
Connector for optical fiber	SMA905D			-
Operating temperature *8	+5 to +40			°C
Storage temperature	-20 to +70			°C

*1: A conversion factor for converting the image sensor pixel number into a wavelength is recorded in the module. A calculation factor for converting the A/D converted count into the input light intensity is not provided.
*2: Depends on the slit opening. Values were measured with the slit listed in the table "■ General ratings /Absolute maximum ratings".
*3: Typical
*4: λ=550 to 900 nm
*5: Measured under constant light input conditions
*6: When monochromatic light of the following wavelengths 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 ±20 nm (C9404CA, C9404CAH) or ±40 nm (C9405CA).
C9404CA, C9404CAH: 300 nm, C9405CA: 800 nm
*7: Entrance slit aperture size
*8: No condensation

Comparison of CCD type and CMOS type

■ Output comparison



* A/D count when constant light level enters fiber.

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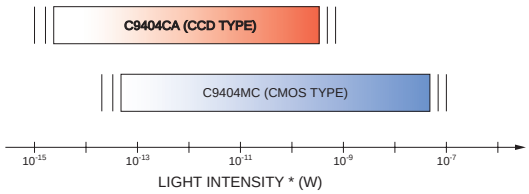
■ Measurable optical power



* Intensity of light incident on mini-spectrometer through slit is constant. (λ=300 nm, Integration time 10 to 10000 ms)

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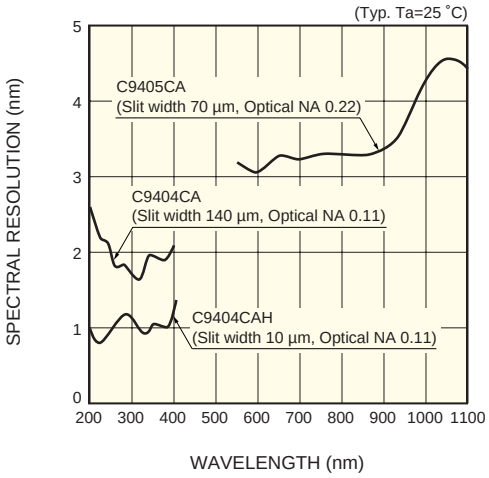
■ Spectral resolution vs. wavelength



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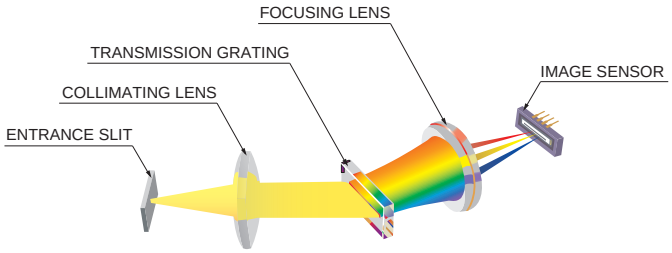
■ Optical component layout

TM series mini-spectrometers use a transmission holographic grating made of quartz and precision optical components arranged on a rugged optical base, making it possible to deliver high throughput and highly accurate optical characteristics.



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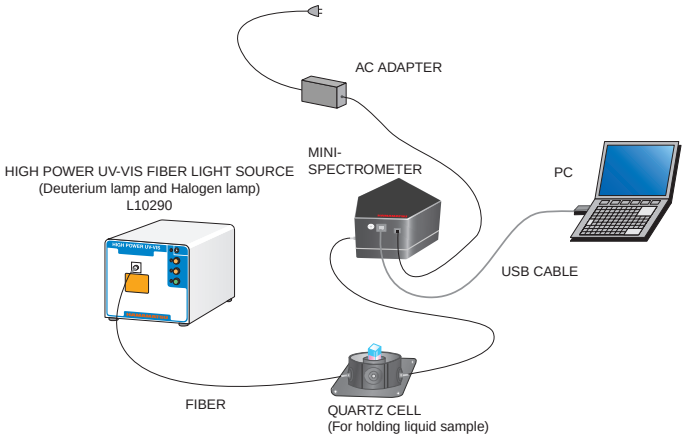
■ Connection example (transmission light measurement)

Light to be measured is guided into the entrance port of TG 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 measurements are obtained at all times. An optical fiber that guides light input from external sources allows a flexible measurement setup.



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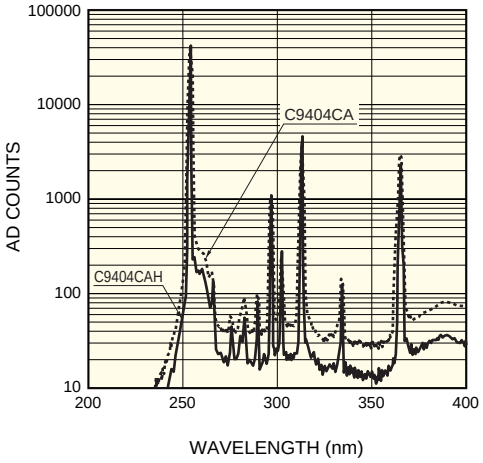
■ Measurement example

Line spectra from low-pressure mercuy lamp were measured with C9404CA (TG-UV-CCD), C9404CAH (TG-UV-CCD).



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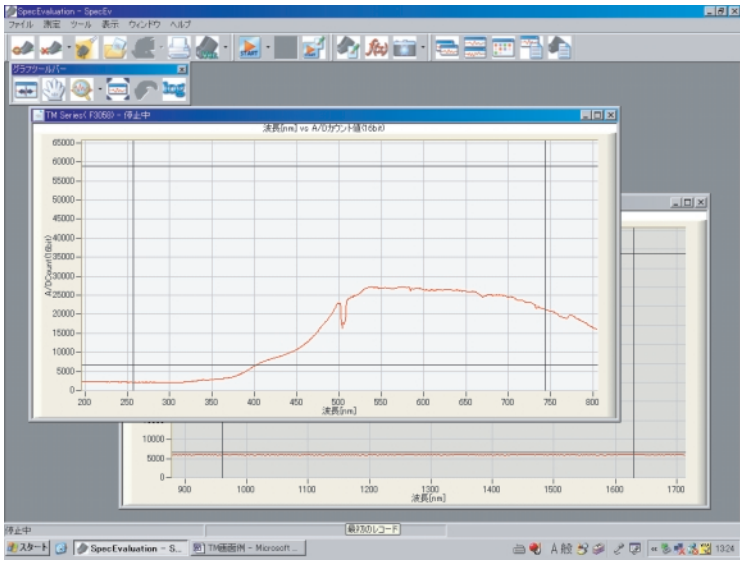
■ Dedicated software package (supplied with unit)

Installing the dedicated software package (containing sample software, device driver, DLL)*9 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: Two or more mini-spectrometers can be connected and used with one PC simultaneously.

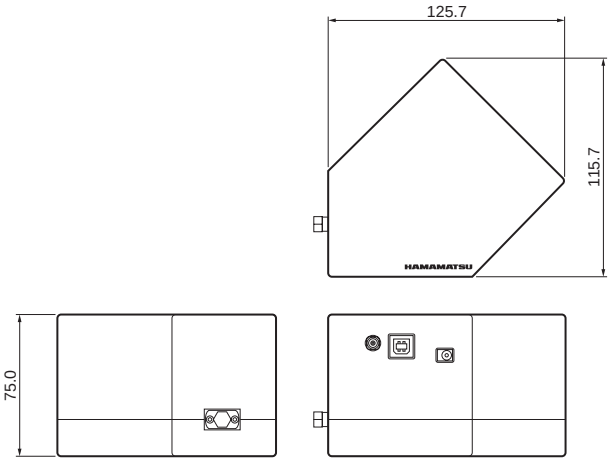
*9: Compatible OS: Microsoft Windows Professional Edition 2000 (SP3 or later) and XP (SP1a or later)



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.*10 The DLL provides functions such as USB port open/close, measurement condition setup, measurement data and module information acquisition.

*10: 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.

■ Dimensional outline (unit: mm)



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■ Accessories

· USB cable
· Dedicated software (sample software, device driver, DLL)
· AC adapter (for power supply)

■ Options (sold separately)

Optical fibers for light input

Type. No	Product name	Applicable mini-spectrometer	Core diameter (μm)	Specification
A9762-01	Fiber for UV/visible range (resistance to UV)	C9404CA (TG-UV-CCD) C9404CAH (TG-UV-CCD)	600	N.A.=0.22, length 1.5 m, connectorized SMA905D at both ends
A9763-01	Fiber for visible/near infrared range	C9405CA (TG-SWNIR-CCD)	600	

■ 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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