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Mini-spectrometer

TG series | C9404CA C9404CAH

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. The C9404CA and C9404CAH 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. The C9404CAH is high resolution type (resolution: 1 nm Typ.). Their products come supplied with evaluation software that allows setting measurement conditions, acquiring and saving data, and displaying graphs. DLL is also supplied as accessory item 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**
- **Easy to install into equipment**
- **Wavelength conversion factor*1 is recorded in internal memory**
- **Supprts external trigger input*2**

Applications

- **Low-light-level measurement such as fluorescence measurement**
- **Evaluation of light source characteristics such as UV light source**

*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: Coaxial cable for external trigger input is sold separately. Refer to the “Mini-spectrometers Selection Guide” for details on external triggers.

Optical characteristics

Parameter	TG-UV-CCD		Unit
	C9404CA	C9404CAH	
Spectral response range	200 to 400		nm
Spectral resolution (FWHM)*3	3 max.	1 typ.	nm
Wavelength reproducibility*4	-0.1 to +0.1		nm
Wavelength temperature dependence	-0.02 to +0.02		nm/℃
Spectral stray light*3 *5	-35 max.		dB

*3: Depends on the slit opening. Values were measured with the slit listed in the table “Structure / Absolute maximum ratings”.

*4: Measured under constant light input conditions

*5: When monochromatic light of 300 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 ±20 nm.

Electrical characteristics

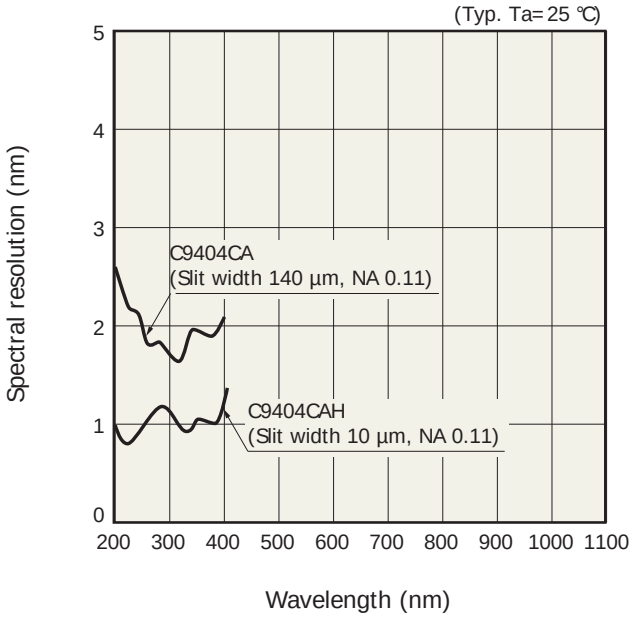
Parameter	Specification	Unit
A/D conversion	16	bit
Integration time	10 to 10000	ms
Interface	USB 1.1	-
USB bus power current consumption	100 max.	mA
External power supply	5	V

Structure / Absolute maximum ratings

Parameter	C9404CA	C9404CAH	Unit
Dimensions (W × D × H)	125.7 × 115.7 × 75		mm
Weight	670		g
Image sensor	Back-thinned type CCD image sensor (S10420-1006-01)		-
Number of pixels	1024		pixels
Slit*6 (H × V)	140 × 500	10 × 1000	µm
NA*7	0.11		-
Connector for optical fiber	SMA905D		-
Operating temperature*8	+5 to +40		℃
Storage temperature*8	-20 to +70		℃

*6: Entrance slit aperture size
*7: Numeric aperture (solid angle)
*8: No condensation
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.

Spectral resolution vs. wavelength



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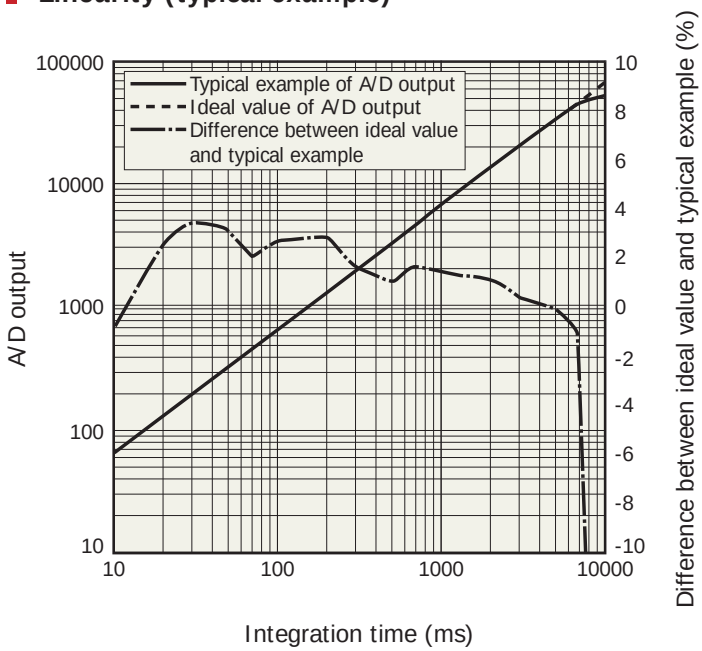
Linearity (typical example)



Note: A/D output is the output with dark output is 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.

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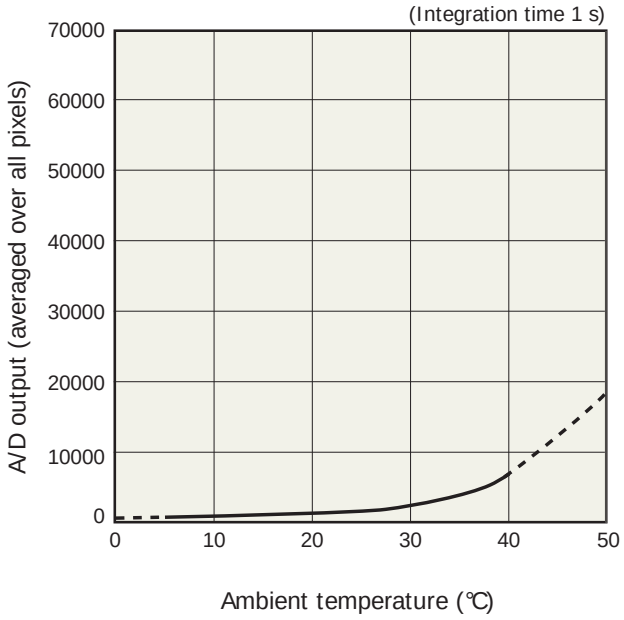
Dark output vs. ambient temperature (typical example)



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

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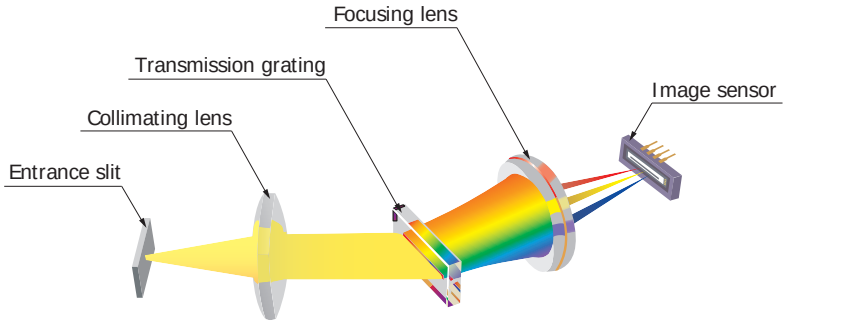
Optical component layout

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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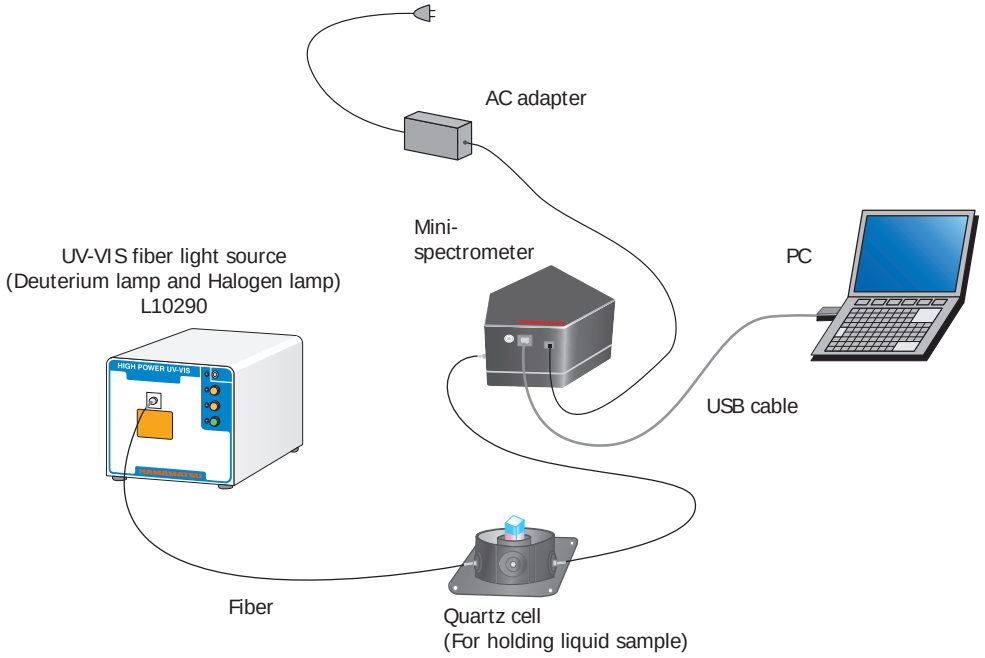
Connection example (transmission light measurement)

Light to be measured is guided into the entrance port of TM 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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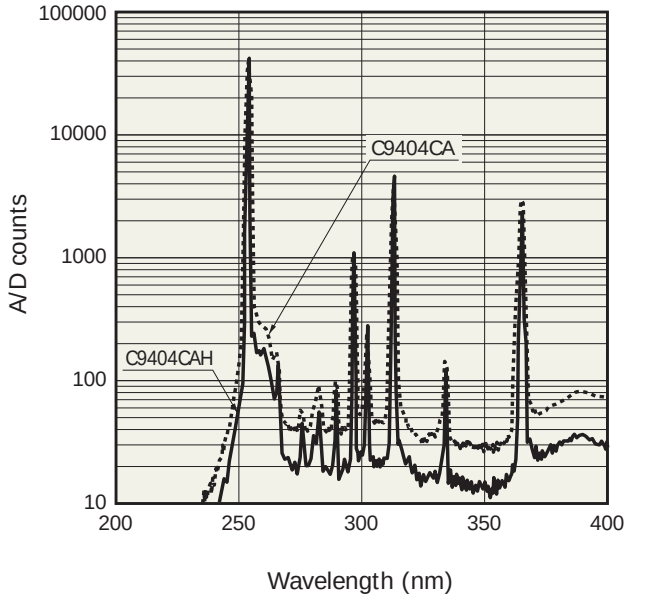
Measurement example

Line spectra from low-pressure mercuy lamp



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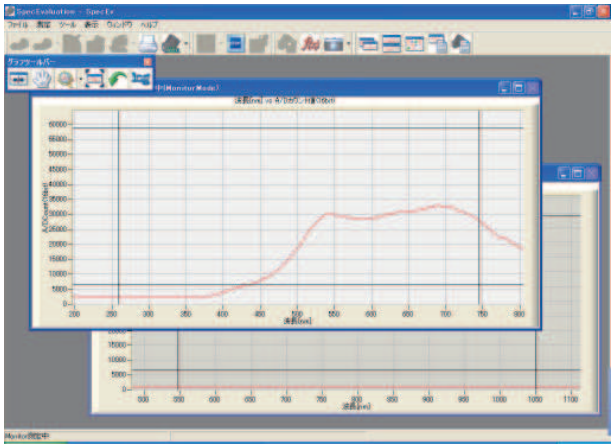
Evaluation software package (supplied with unit)

Installing the evaluation software package (Spec Evaluation.exe)*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
  Comparison calculation with reference data
  (transmittance, reflectance)
  Dark subtraction
  Gaussian approximation
  (peak position and count, FWHM)



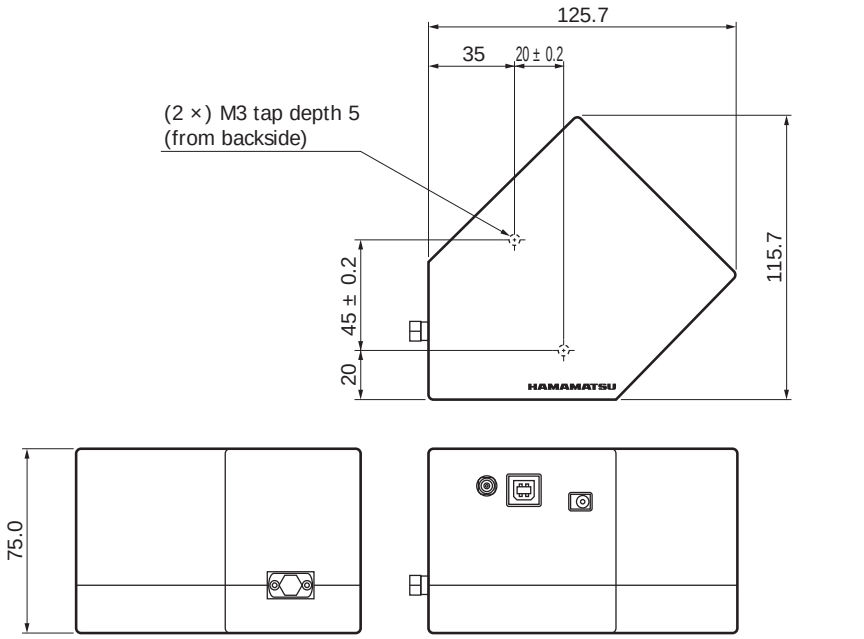
Note:

- Two or more mini-spectrometers can be connected and used with one PC simultaneously.
- The external trigger input function does not work with the evaluation software. If using an external trigger input or designing original application software, the user software must be configured to support that function.

*9: Compatible OS: Microsoft® Windows® XP Professional SP3 (32-bit)*10
Microsoft® Windows® Vista Business SP2 (32-bit)*10
Microsoft® Windows® 7 Ultimate SP1 (32-bit)*10
Microsoft® Windows® 7 Ultimate SP1 (64-bit)*10

DLL for controlling hardware is also provided.
You can develop your own measurement programs by using a following software development environment.
Microsoft® Visual Studio® 2008 (SP1) Visual C++®*10
Microsoft® Visual Studio® 2008 (SP1) Visual Basic®*10
*10: Microsoft, Windows, Visual Studio, Visual C++ and Visual Basic are either registerd trademarks or trademarks of Microsoft Corporation in the United States and other countries.

Dimensional outline (unit: mm, tolerance unless otherwise noted: ±0.5)



Weight: 670 g

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Accessories

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

Options (sold separately)

· Coaxial cable for external trigger input A10670
· 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	NA=0.22, length 1.5 m, connectorized SMA905D at both ends

CE

The C9404CA and C9404CAH conform to the European EMC directives (Applied standard: EN 61326-1 Class B) and Low voltage directives (Applied standard: EN 61010-1).

Mini-spectrometer lineup

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
NEW C11697MA	TM series	TM-VIS/NIR-MOS-II Trigger-compatible	320 to 1000	8	CMOS image sensor with amp array
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
NEW C9405CB	TG series	TG-SWNIR-CCD-II IR-enhanced	500 to 1100	5 (λ=550 to 900 nm)	IR-enhanced back-thinned CCD image sensor
NEW C11713CA	TG series	TG-RAMAN-I High resolution	500 to 600	0.3*	Back-thinned type CCD image sensor
NEW C11714CA	TG series	TG-RAMAN-II High resolution	790 to 920	0.3*	Back-thinned type CCD 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
C11118GA	TG series	TG-cooled NIR-III Low noise (cooled type)	900 to 2550	20	InGaAs linear image sensor
C11007MA	RC series	RC-VIS-MOS Spectrometer module	340 to 780	9	CMOS linear image sensor
C11008MA	RC series	RC-SWNIR-MOS Spectrometer module	640 to 1050	8	IR-enhanced CMOS linear image sensor

* Typ.

For installation into mobile measuring equipment

Type no.	Type		Spectral response range (nm)	Spectral resolution max. (nm)	Image sensor
C11009MA	RC series	RC-VIS-MOS Spectrometer head	340 to 780	9	CMOS linear image sensor
C11010MA	RC series	RC-SWNIR-MOS Spectrometer head	640 to 1050	8	IR-enhanced CMOS linear image sensor

Ultra-compact type for installation into mobile measuring equipment

Type no.	Type		Spectral response range (nm)	Spectral resolution max. (nm)	Image sensor
C10988MA	MS series	MS-VIS-MOS Spectrometer head	340 to 750	14	CMOS linear image sensor
NEW C11708MA	MS series	MS-SWNIR-MOS Spectrometer head	640 to 1050	20	CMOS linear image sensor

Information described in this material is current as of September, 2012.
Product specifications are subject to change without prior notice due to improvements or other reasons. Before assembly into final products, please contact us for the delivery specification sheet to check the latest information.
Type numbers of products listed in the delivery specification sheets or supplied as samples may have a suffix "(X)" which means preliminary specifications or a suffix "(Z)" which means developmental specifications.
The product warranty is valid for one year after delivery and is limited to product repair or replacement for defects discovered and reported to us within that one year period. However, even if within the warranty period we accept absolutely no liability for any loss caused by natural disasters or improper product use.

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