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Mini-spectrometer

TG series | C11118GA

Long-wavelength type (to 2.55 µm) near-infrared mini-spectrometer

Hamamatsu TG series mini-spectrometers are polychromators integrated with optical elements and an image sensor. 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 from the USB port to a PC for data acquisition. The C11118GA has sensitivity extending to longer wavelengths (up to 2.55 µm) than the existing C9914GB (up to 2.2 µm). The C11118GA comes supplied with free evaluation software that allows setting measurement conditions, acquiring and saving data, and displaying graphs. Original measurement software can be designed on an end-user's side as DLL's function specification is disclosed.

Features

- **Spectral response range: 0.9 to 2.55 µm**
- **Compatible with USB 2.0 interface**
- **High throughput due to transmission grating made of quartz**
- **Highly accurate optical characteristics**
- **Low noise: cooled type**
- **Compact design for easy assembly**
- **Wavelength conversion factor*1 is recorded in internal memory**
- **Compatible with external trigger**

Applications

- **Measurement of C-H group absorption (2.3 µm band)**
- **Soil analysis and component analysis**
- **Plastic sorting**

*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.

Optical characteristics (Ta=25 °C)

Parameter	Specification	Unit
Spectral response range	0.9 to 2.55	µm
Spectral resolution (spectral response half width)*2	20 max.	nm
Wavelength reproducibility*3	-0.8 to +0.8	nm
Wavelength temperature dependence	-0.08 to +0.08	nm/°C
Spectral stray light*2*4	-30 max.	dB

*2: Depends on the slit opening. Values were measured with the slit listed in the table "Structure".
*3: Measured under constant light input conditions, etc.
*4: When monochromatic light of λ=1700 nm is input, spectral stray light is defined as the ratio of the count measured at the input wavelength, to the count measured at a wavelength 40 nm longer or shorter than the input wavelength.

Electrical characteristics (Ta=25 °C)

Parameter	Specification	Unit
A/D conversion	16	bits
Integration time*5	6 to 40000*6	µs
Interface	USB 2.0	-
USB bus power current consumption	250 max.	mA
Current consumption for cooling element (+5 V)*7	2.8 max.	A
Current consumption for cooling fan (+12 V)*7	0.2 max.	A

*5: Depends on the image sensor dark current.
*6: Excluding defective pixels
*7: Maximum value in steady state. Note that inrush current flows at start-up.

Structure

Parameter	Specification	Unit
Dimensions (W × D × H)	142 × 218 × 82	mm
Weight	1.7	kg
Image sensor	InGaAs linear image sensor (G9208-256W)	-
Number of pixels*8	256	pixels
Slit*9 (H × V)	140 × 500	µm
NA*10	0.22	-
Connector for optical fiber	SMA905D	-
Image sensor cooling temperature	-20	°C

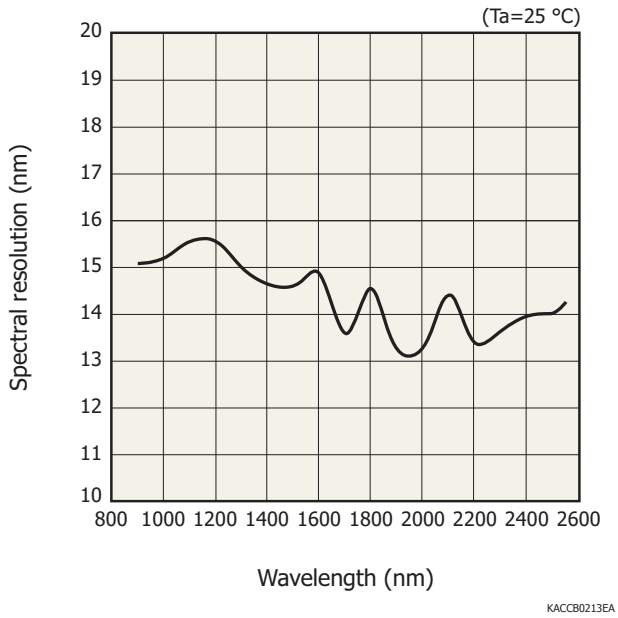
*8: Up to 3 discontinuous defective pixels might exist (when inspecting at low gain). Defective pixels are those whose electrical and optical characteristics do not meet our specifications.
*9: Entrance slit aperture size
*10: Numerical aperture (solid angle)

Absolute maximum ratings

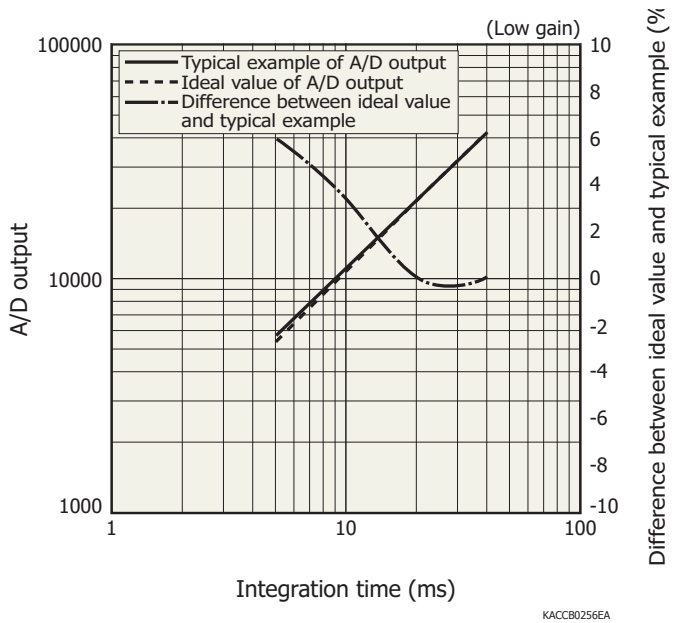
Parameter	Value	Unit
Operating temperature*11	+5 to +35 (+5 to +30*12)	°C
Storage temperature*11	-20 to +70	°C

*11: 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.
*12: Range capable of cooling control
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 (typical example)

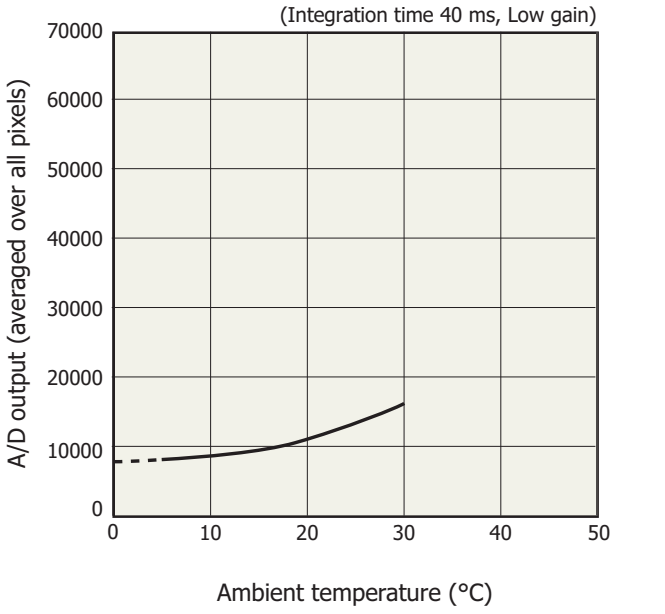


Linearity (typical example)



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.

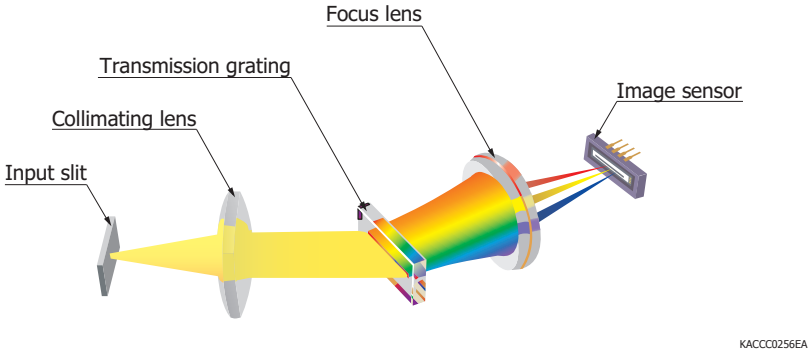
Dark output vs. ambient temperature (typical example)



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

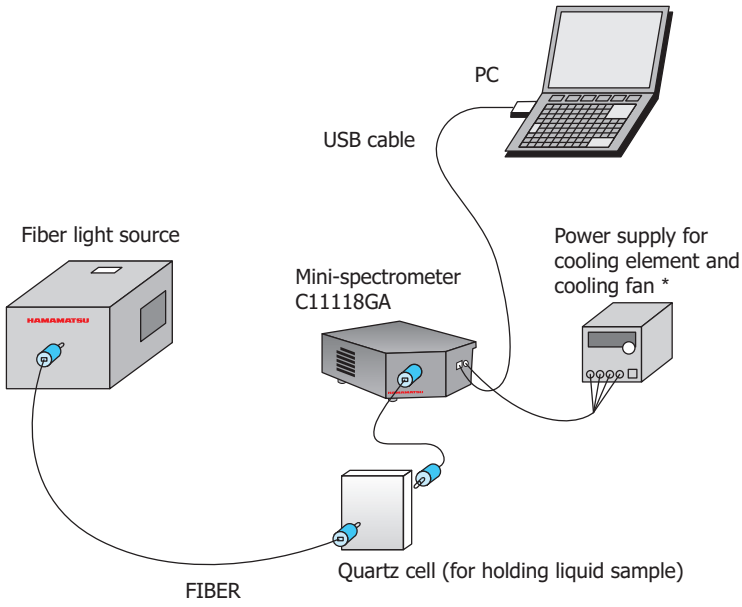
Optical component layout

TG 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.



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.



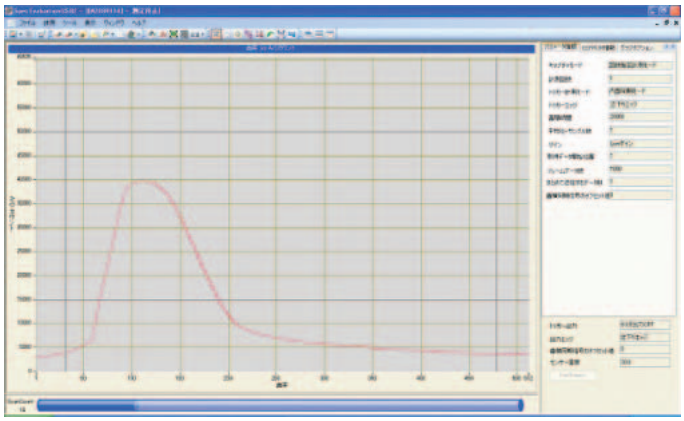
* External power supply should be prepared by the user.

KACCC0490EA

Evaluation software (supplied with unit)

Installing the evaluation software (SpecEvaluationUSB2.exe)*13 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 function
  Pixel number to wavelength conversion
  Comparison calculation with reference data
  (transmittance, reflectance)
  Dark subtraction
  Gaussian approximation
  (peak position and count, FWHM)

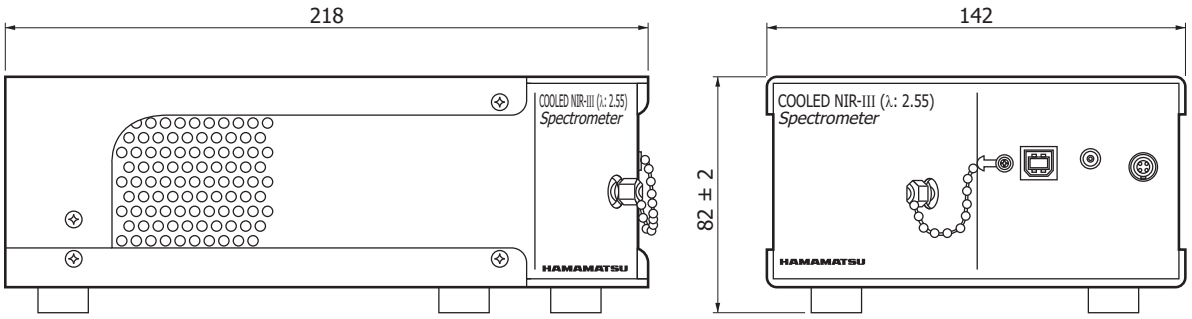


Note: Up to 8 mini-spectrometers can be connected and used with one PC.

*13: Compatible OS: Microsoft® Windows® 7 Professional SP1 (32-bit, 64-bit)
Microsoft Windows 8 Professional (32-bit, 64-bit)
Microsoft Windows 10 Professional (32-bit, 64-bit)

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++®
Microsoft Visual Studio 2008 (SP1) Visual Basic®

Dimensional outline (unit: mm)



Tolerance unless otherwise noted: ±1.0
Weight: 1.7 kg

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Accessories

· USB cable
· Dedicated software (evaluation software, DLL)
· Power supply connector for cooling element and cooling fan (FGG0B304CLAD56 made by LEMO S.A.)

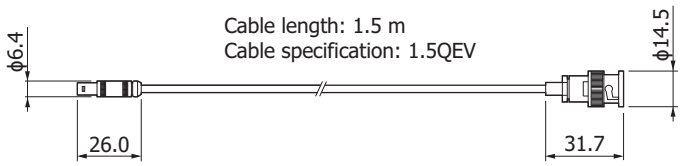
Options (sold separately)

· Optical fiber for light input

Type no.	Product name	Core diameter (μm)	Specification
A15363-01	Fiber for visible/near infared range	600	NA=0.22, length 1.5 m, connectorized SMA905D at both ends

· Coaxial cable for external trigger input A10670

Dimensional outline (unit: mm)



LEMO connector
FFA.00.250 (made by LEMO)

BNC connector
BNC-P-1.5 (40) (made by HIROSE or equivalent)

KACCA0220EB

Related information

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

■ Precautions

· Disclaimer
· Mini-spectrometers

■ Technical information

· Mini-spectrometers

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