Photonic Multichannel Analyzer

PMA-12

[Scientific applications]

- UV to visible spectroscopy
- Fluorescence spectroscopy
- Raman scattering
- Chemiluminescence analysis
- Liquid chromatography
- Gas chromatography
- ICP emission analysis
- Discharge spectrum analysis
- Combustion analysis
- Micro spectroscopy

[Industrial applications]

- Water quality testing
- Evaluation of light emitting devices and light sources
- Chromaticity measurements
- Impurities testing
- Film thickness measurements
- UV radiation measurements
- Plasma monitors
- Fruit testers
- Combustion monitoring
- Color filter evaluation

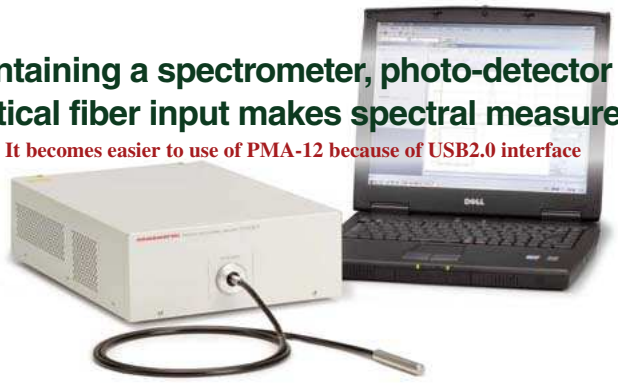
HAMAMATSU

PHOTON IS OUR BUSINESS

PMA
Photonic Multichannel Analyzer

A compact unit containing a spectrometer, photo-detector and power supply.
Use of an optical fiber input makes spectral measurements easy.

It becomes easier to use of PMA-12 because of USB2.0 interface



The PMA-12 is compact spectral measurement apparatus that combines a spectrometer and optical detector into one unit.
An optical fiber is used. Because of the high sensitivity, spectra can be obtained easily just by bringing the optical fiber close to the sample in normal applications, without a special light collection system. Since the spectrometer and photo-detector are fixed, the PMA-12 is stable and can be used with confidence for long periods of time. The wavelength axis and spectral response characteristics are already calibrated, so spectral measurements can be carried out easily and accurately.

C10544-01 / C10544-02 — High sensitivity superior cost-performance model

C10544-01, -02, which have the thermoelectric cooling type CCD linear image sensor that is used for astronomical observation, have realized both high performance and low price by rational design.the wavelength range for measurement is 300 nm to 800 nm for the C10544-01 and 340 nm to 830 nm for the C10544-02.

C10028-01 / C10028-02 — Near infrared model

These are models using InGaAs linear image sensors and capable of measurements of reflection and absorption spectra in the near infrared with a large dynamic range. The wavelength range for measurements is 900 nm to 1650 nm for the C10028-01 and 1600 nm to 2350 nm for the C10028-02.

C10027-01 / C10027-02 — Ultra-high sensitivity model

This model uses a thermoelectrically cooled, back-thinned CCD linear image sensor that with higher sensitivity and lower noise. The C10027-01 is an ultra-high sensitivity model that combines this sensor with a small Czerny-Turner spectrograph capable of measurements over a wide range from the ultraviolet to the near infrared with high wavelength resolution. The wavelength range for measurements is 200 nm to 950 nm for the C10027-01 and 350 nm to 1100 nm for the C10027-02.

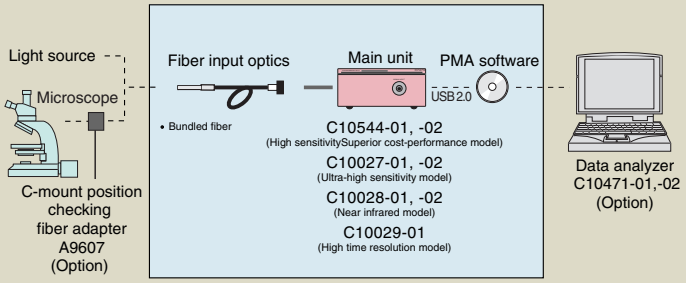
C10029-01 — High time resolution model

Coupling an image intensifier with a thermoelectrically cooled, back-thinned CCD linear image sensor, it is possible to have both high-speed gate measurements at a maximum of 10 ns and ultra-high sensitivity. This model is capable of high temporal resolution measurements in the nanosecond range and measurements of faint light.

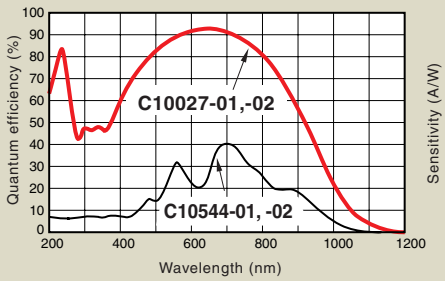
FEATURES

- Spectrometer, photo-detector and power supply in a compact unit
- Real-time measurements (Simultaneous measurement of multiple wavelengths possible)
- Easy measurements with optical fiber
- Spectral response and wavelength axis characteristics calibrated
- Wide range of variations

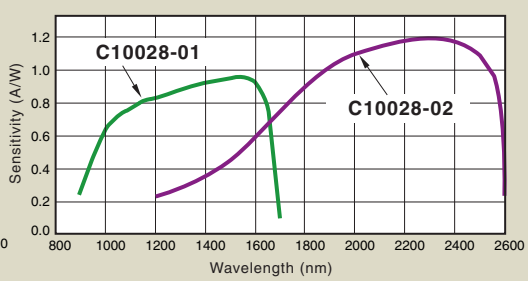
PMA-12 Standard Configuration



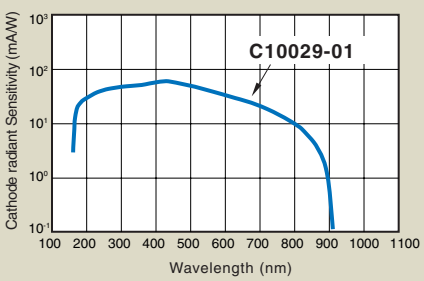
● CCD and BT- CCD linear image sensor



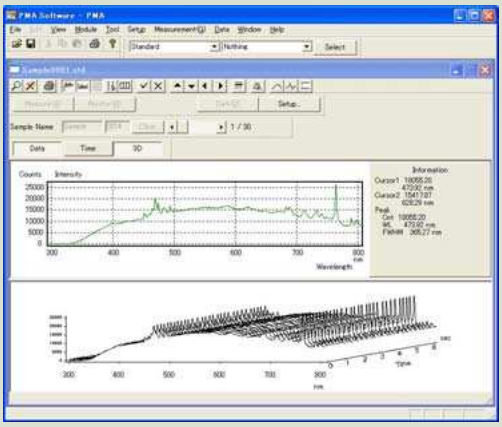
● InGaAs linear image sensor



● I.I. + BT- CCD linear image sensor



MEASUREMENT MODES



Standard measurements
This is the most basic measurement mode.
Applications: emission spectra for light sources, fluorescence, plasma and the like.

Reflective measurements
This is the measurement mode for finding spectral reflectance.
Applications: reflectance measurements for optical filters, coatings and the like.

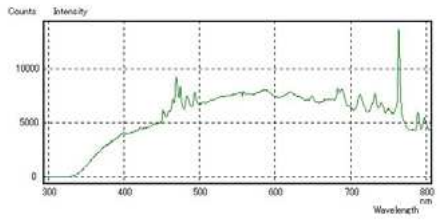
Transmittance and absorption measurements
This is the measurement mode for finding spectral transmittance and absorption.
Applications: measurements of transmittance and absorption in optical filters, films, solutions and the like.

Chromaticity measurements (light-source color)
This is the measurement mode for finding the light-source color for luminous bodies.
Applications: color evaluation in light sources for illumination, LEDs and the like.

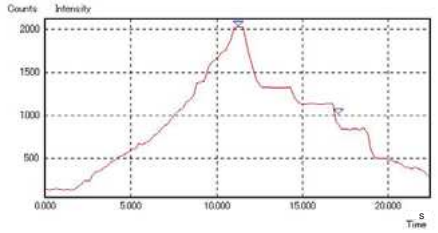
Chromaticity measurements (object color)
This is the mode for finding the color of objects that are either reflective or transmit light.
Applications: color evaluation of paint, fabric, printed matter and the like.

DISPLAY MODES

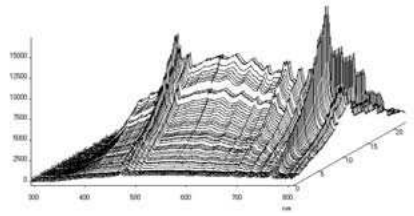
Spectrum display



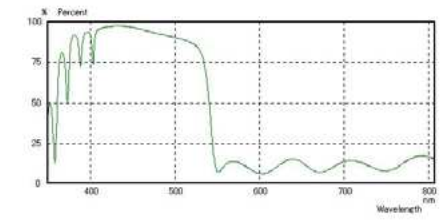
Display of changes over time



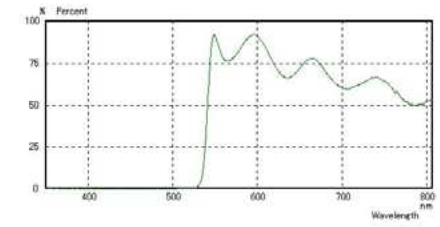
3-D display



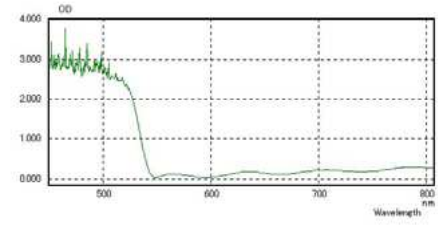
Reflectivity display



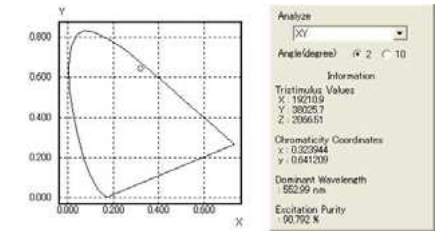
Transmittance display



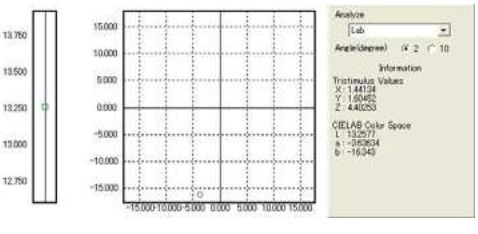
Absorbance display (OD)



Color coordinate display



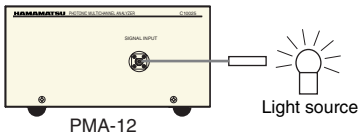
Spatial color coordinate display



SYSTEM EXAMPLES

Light source measurements

Measurement of emission spectra in light sources such as lamps and LEDs



<Configuration>

- Standard PMA-12 configuration (C10544, C10027, etc.)

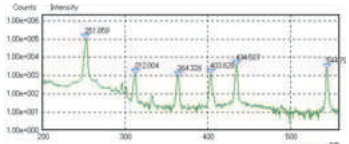
Option

- Data analyzer C10471-01,-02

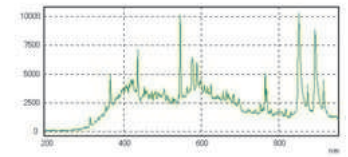
<Applications>

- Evaluation of color temperature and color rendering properties in light sources for illumination
- LED chromaticity evaluations
- Special applications of light source spectral evaluations

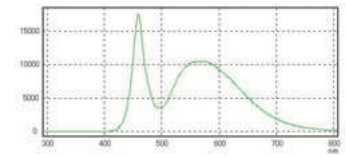
Germicidal lamp emission spectrum



Metal halide lamp emission spectrum

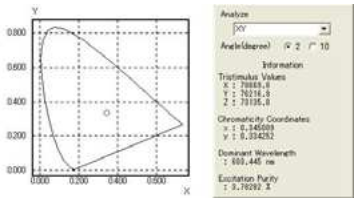


White LED emission spectrum

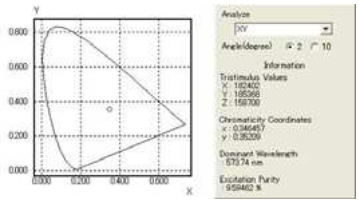


■ Analysis of light source color by emission spectrum
(chromaticity, color temperature, color rendering properties, etc., possible)

Metal halide lamp chromaticity evaluation

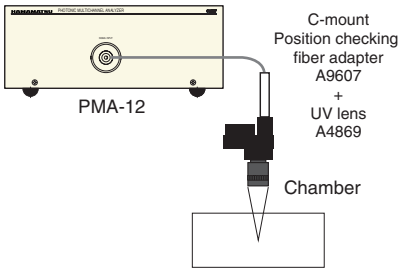


White LED chromaticity evaluations

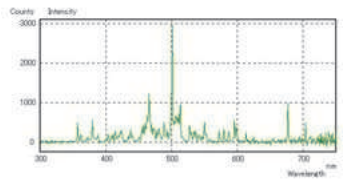


Emission spectrum measurements

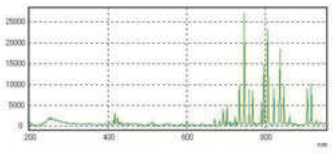
Emission spectrum measurements for plasma, electric discharge, ablation and the like



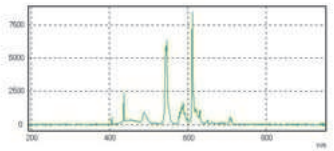
Electric discharge emission spectrum



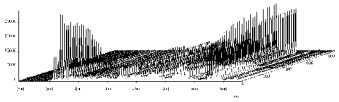
Emission spectrum during oxide film etching



Emission spectrum during nitride film etching



Temporal ch es in plasma emission spectra



<Configuration>

- Standard PMA-12 configuration (C10027, C10029, etc.)

Options

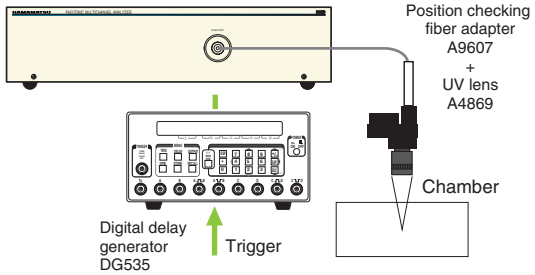
- Data analyzer C10471-01,-02
- C-mount position checking fiber adapter A9607
- UV lens A4869
- Digital delay generator (for gate operation) DG535

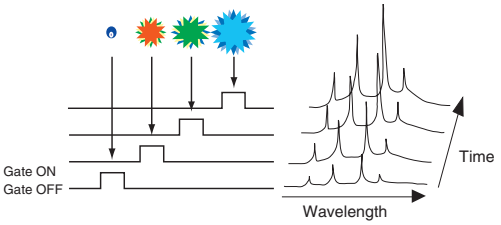
<Applications>

- Plasma component analysis
- Analysis of various emission phenomena

Example of temporal resolution (gate operation) measurements

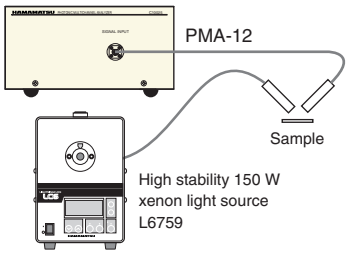
PMA-12 (C10029-01)





Reflective spectrum measurements

Measurement of spectral reflectance in optical filters, anti-reflective films (AR coatings) and the like



<Configuration>

- Standard PMA-12 configuration (C10544, C10027, etc.)

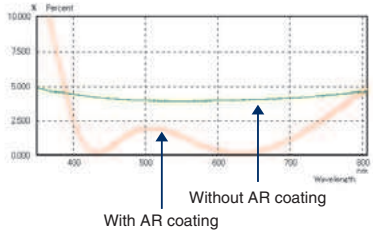
Options

- Data analyzer C10471-01,-02
- High stability 150 W xenon light source L6759

<Applications>

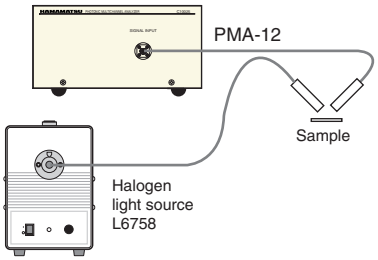
- Inspection of coatings
- Monitoring thin film growth

AR coating reflection spectrum



Object color measurements

Object color evaluation of paint,fabric, printed matter and the like



<Configuration>

- Standard PMA-12 configuration (C10544, C10027, etc.)

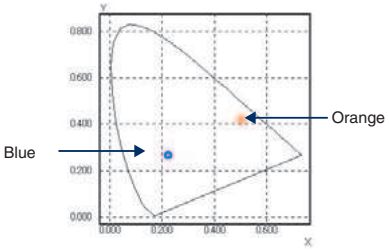
Options

- Data analyzer C10471-01,-02
- Halogen light source L6758

<Applications>

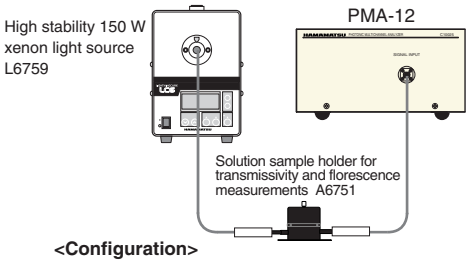
- Paint inspections
- Color evaluations in printed matter, fabric, plastics, etc.

Paper object color (chromaticity coordinates)



Absorption spectrum measurements

Spectral transmittance and absorption measurements in optical filters, films, solutions and the like



<Configuration>

- Standard PMA-12 configuration (C10544, C10027, etc.)

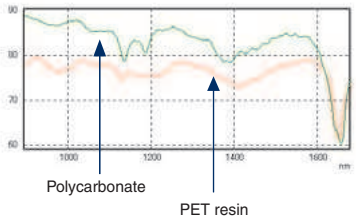
Options

- Data analyzer C10471-01,-02
- High stability 150 W xenon light source L6759
- Solution sample holder for transmissivity and florescence measurements A6751

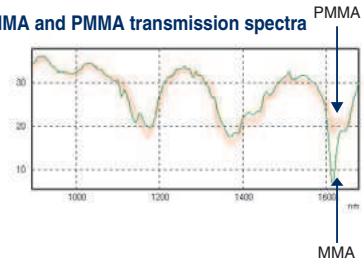
<Applications>

- Absorption spectrum evaluations for solutions and films
- Component analysis for samples
- Monitoring chemical changes

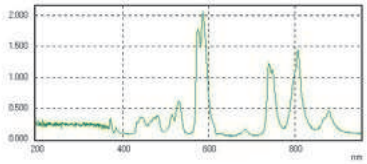
Component analysis of plastics using transmission spectra (polycarbonate and PET resins)



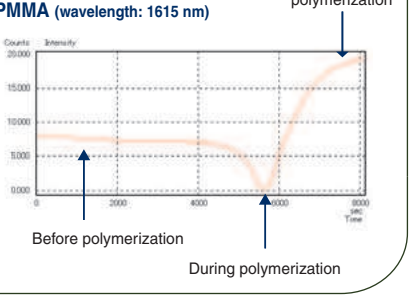
MMA and PMMA transmission spectra



Didymium film absorption spectrum

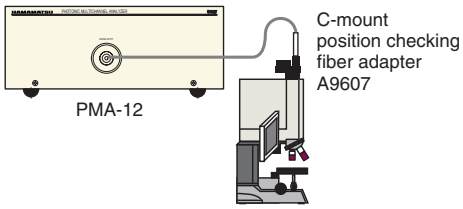


Changes in transmissivity in the polymerization from MMA to PMMA (wavelength: 1615 nm)



Microscopic spectral measurements

Spectral distribution measurements under a microscope



<Configuration>

- Standard PMA-12 configuration (C10027, C10029, etc.)

Options

- Data analyzer C10471-01,-02
- C-mount position checking fiber adapter A9607

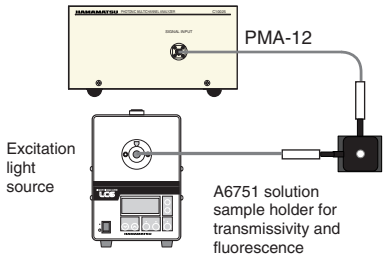
<Applications>

- Measurement of bioluminescence
- Measurements on semiconductor wafer, LCD and other microstructures

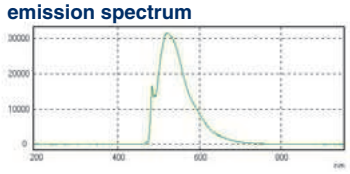
SYSTEM EXAMPLES

Emission spectrum measurements

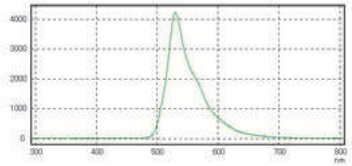
For fluorescent samples such as fluorescent lamps and EL devices



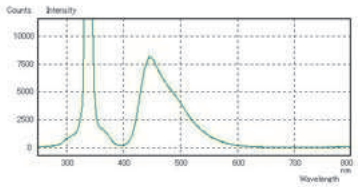
Fluorescence indicator (Fluorescein) emission spectrum



Chemiluminescence emission spectrum



Fluorescent lamp fluorescent body emission spectrum



<Configuration>

- Standard PMA-12 configuration (C10544, C10027, etc.)

Options

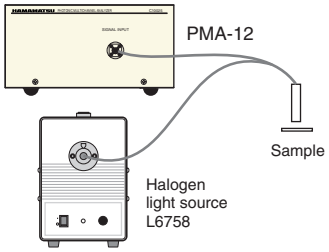
- Data analyzer C10471-01,-02
- Excitation light source: laser, xenon lamp, etc.
- Solution sample holder for transmissivity and florescence measurements A6751

<Applications>

- Fluorescence spectroscopy
- Monitoring chemical light emissions

Film thickness measurements

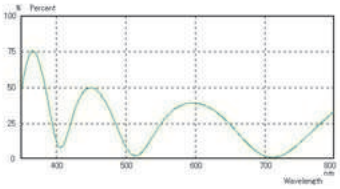
Film thickness measurements using spectral reflectance or transmittance



<Applications>

- Monitoring thin film growth
- Film thickness management
- Resist film thickness measurements

ITO film interference spectrum



<Configuration>

- Standard PMA-12 configuration (C10027)

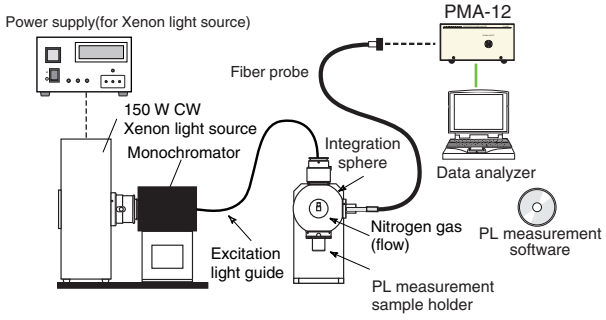
Options

- Data analyzer C10471-01,-02
- Halogen light source L6758

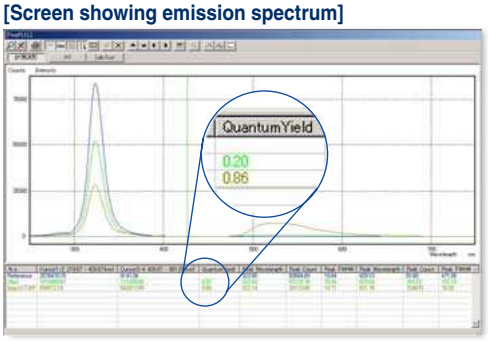
Optical Gauge series
C10178,C10323
We can offer specialized machine for film thickness measurement.
Please refer the detail in specific brochure.

Quantum yield measurement system

Measurement of quantum yield, external quantum effciency, brightness light distribution characteristics



[Screen showing emission spectrum]



<Applications>

- Research of fluorescence materials in physics or chemistry
- Quantum yield measurement of emission materials
- Internal quantum yield measurement of fluorescence materials

Absolute PL Quantum Yield Measurement System C9920-02,-02G,-03,-03G
External Quantum Efficiency Measurement System C9920-12
Brightness Light Distribution Characteristic Measurement System C9920-11
We can offer specialized machine for OLED measurement.
Please refer the detail in specific brochure.

OPTIONS

Solution sample holder for transmissivity and fluorescence measurements A6751

This is a dedicated holder with an integrated condensing lens for the use with vials.

Reflection measurement optics A9665

These are optics making it possible to illuminate the sample at 45˚ from the light source and measure the reflected light.

Variable angle reflection measurement optics A10687

These are optics making it possible to change the angle of input and output ports at maximum 60˚ and measure the reflected light and fluorescence.

Digital delay generator DG535

This outputs the gate pulse necessary for an external trigger and gate operation.

2 split fiber A10193-01,-02

It is very useful for reflectance measurement or film thickness measurement. We have two kind of fiber. One is A10193-01 for visible range and the other is A10193-02 for from visible range to near infrared range.

C-mount fiber adapter A6399

This is an adapter for securing the fiber input optics to the C-mount of a microscope or the like. This option is useable over a wide wavelength range from UV to NIR.

C-mount position checking fiber adapter A9607

In addition to the function of the C-mount fiber adapter, the measurement position can be checked. This option is useable over a wide wavelength range from UV to NIR.

Data analyzer C10471-01,-02

A data analyzer is provided. There are the C10471-01 notebook model and the C10471-02 desktop model .

UV lens A4869

Condensing lens for UV. f=50 mm, F3.5
(A6399 or A9607 required)

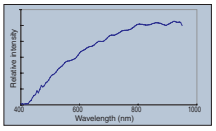
Integrating sphere A5640

This is the integrating sphere for getting complete diffuse light. You can get even intensity light without spread of light source or influence of directional characteristics.

Halogen light source L6758

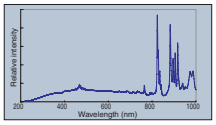
This is a halogen light source with output wavelengths from 400 nm to 1000 nm for excitation and absorption measurements.

* Light guide connector A10194-01 is needed to connect with 2 split fiber.



High stability 150 W xenon light source L6759

This is a high stability xenon light source with output wavelengths from 250 nm to 1000 nm for excitation and absorption measurements.



Fading light adaptor A10474-01

This adaptor is used when the light power is too strong. It can reduce the input light power by using a pinhole.
(fading rate approx 1 /20 to 1 /500)

PMA software library U10472-01

This is the software library which controls the PMA-12 series.

PMA color measurement library U10473-01

This is the software library which controls the PMA-12 series and calculates the chromaticity.

SPECIFICATIONS

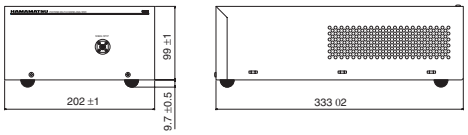
Model	C10544-01	C10544-02	C10027-01	C10027-02	C10028-01	C10028-02	C10029-01
Photo-detector	CCD linear image sensor		BT- CCD linear image sensor		InGaAs linear image sensor		I.I. + BT- CCD linear image sensor
Wavelength (nm)	300 to 800	340 to 830	200 to 950	350 to 1100	900 to 1650	1600 to 2350	200 to 860
Wavelength resolution (FWHM)*1	< 3 nm		< 2 nm	< 2.5 nm	< 9 nm		< 3 nm
Exposure time (Exposure Start Mode)	19 ms to 64 s (1 ms to 64 s)		19 ms to 64 s (1 ms to 64 s)		5 ms to 64 s (1 ms to 64 s)	5 ms to 50 ms (1 ms to 64 s)	19 ms to 64 s (1 ms to 64 s)
Gate time*2	–		–		–	–	≧ 10 ns
Gate repetition	–		–		–	–	≦ 200 kHz
Number of photosensitivedevice channels	1024 ch		1024 ch		256 ch		900 ch
Pixel size	24 µm × 3.07 mm		24 µm × 2.928 mm		50 µm × 250 µm		24 µm × 2.928 mm*3
Device cooling temperature	0 ˚C		-15 ˚C		-10 ˚C		-15 ˚C*3
Read-out noise (electrons)	18		16		12 500		16*3
Dark current (electrons/scan)	400 (0 ˚C : 20 ms)		75 (-15 ˚C : 20 ms)		20 000 (-10 ˚C : 20 ms)	2.5×10^7 (-10 ˚C : 20 ms)	75*3 (-15 ˚C : 20 ms)
AD resolution	16 bit						
Spectrograph	Concave spherical grating type		Czerny-Turner type				
Spectrograph F number	3		4				
Fiber receiving area	ϕ1 mm						
Fiber type	Bundled fiber ϕ12 mm SUS tube						
Fiber length	1.5 m*4						
External trigger input	TTL level / High impeadance						
Interface	USB 2.0						
Power supply	AC 100 V to AC 240 V, 50 Hz / 60 Hz (Power supply voltage variation ±10 %)						

*1 Confirmed with mercury and argon atomic beams. *2 The gate time is controlled by the external gate pulse width. *3 I.I. characteristics are not included. *4 A 1.5 m cable is included as standard.

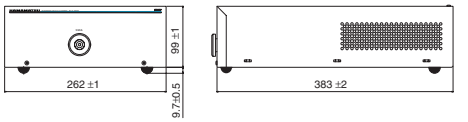
DIMENSIONAL OUTLINES (Unit :mm)

Main unit

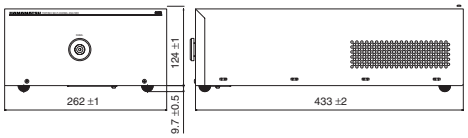
• C10544-01, -02



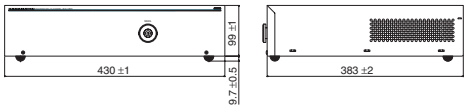
• C10027-01, -02



• C10028-01, -02

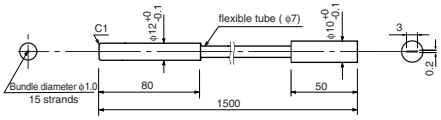


• C10029-01



Fiber input optics for C10544, C10027, C10028, C10029

(approx.100 g)



PMA SOFTWARE U6039-01

• Measurement functions	Monitoring measurement Data measurement
• Temporal resolution measurement functions	Temporal fluctuation of spectra Temporal fluctuation in reflectivity and transmissivity
• Data acquisition condition settings	Exposure time settings Memory integration count assignment
• Calibration/correction	Wavelength axis calibration Sensitivity inconsistency calibration Dark current correction
• Display functions	Spectrum display Display temporal waveform fluctuations
• Wavelength axis display	Wavelength, Wave number, Raman shift, energy (eV)
• Brightness axis display	Linear, Logarithm
• Cursor analysis functions	Wavelength (wave number, etc.) vs. Intensity Peak detection FWHM measurement Integrated intensity
• Other analytical functions	Smoothing Differential waveform Color calculation (XYZ, xy, uv, Lab)

HAMAMATSU PHOTONICS K.K. www.hamamatsu.com

HAMAMATSU PHOTONICS K.K., Systems Division
812 Joko-cho, Higashi-ku, Hamamatsu City, 431-3196, Japan, Telephone: (81)53-431-0124, Fax: (81)53-435-1574, E-mail: export@sys.hpk.co.jp

U.S.A.: Hamamatsu Corporation: 360 Foothill Road, P. O. Box 6910, Bridgewater. N.J. 08807-0910, U.S.A., Telephone: (1)908-231-0960, Fax: (1)908-231-1218 E-mail: usa@hamamatsu.com
Germany: Hamamatsu Photonics Deutschland GmbH: Arzbergerstr. 10, D-82211 Herrsching am Ammersee, Germany, Telephone: (49)8152-375-0, Fax: (49)8152-2658 E-mail: info@hamamatsu.de
France: Hamamatsu Photonics France S.A.R.L.: 19, Rue du Saule Trapu, Parc du Moulin de Massy, 91882 Massy Cedex, France, Telephone: (33)1 69 53 71 00, Fax: (33)1 69 53 71 10 E-mail: infos@hamamatsu.fr
United Kingdom: Hamamatsu Photonics UK Limited: 2 Howard Court, 10 Tewin Road Welwyn Garden City Hertfordshire AL7 1BW, United Kingdom, Telephone: 44-(0)1707-294888, Fax: 44(0)1707-325777 E-mail: info@hamamatsu.co.uk
North Europe: Hamamatsu Photonics Norden AB: Smidesvägen 12, SE-171-41 SOLNA, Sweden, Telephone: (46)8-509-031-00, Fax: (46)8-509-031-01 E-mail: info@hamamatsu.se
Italy: Hamamatsu Photonics Italia: S.R.L.: Strada della Moia, 1/E, 20020 Arese, (Milano), Italy, Telephone: (39)02-935 81 733, Fax: (39)02-935 81 741 E-mail: info@hamamatsu.it
China: Hamamatsu Photonics (China) Co., Ltd.: 1201 Tower B, Jiaming Center, No.27 Dongsanhuan Beilu, Chaoyang District, Beijing 100020, China, Telephone: (86)10-6586-6006, Fax: (86)10-6586-2866 E-mail: hpc@hamamatsu.com.cn

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