HAMAMATSU

PHOTON IS OUR BUSINESS

PHOTON DETECTION UNIT
C13796

Makes it easy to measure low-light emission from living organisms, cells and foods


C13796 + A9859


C13796 + A9859-01


C13796 + A9861


C13796 +A9860 + A9861


C13796 +A10490 + A9861


C13796 + A9860 + A9861-01

The photon detection unit C13796 is a single photon counting unit that is designed for counting low light emission without special set-up. All users need to prepare the sample and a personal computer (PC) only. The USB interface built-in the C13796 allows simple plug & play set-up.
Six optional modular units (sold separately) are available. The users can select the best one meeting with the purpose/application. When combined with optional modular units, the C13796 is ideal for various measurements.

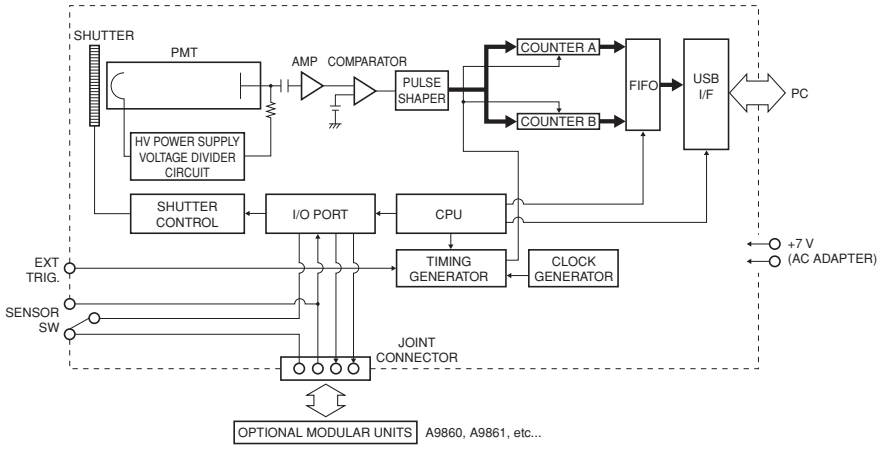
APPLICATIONS

- **Bioluminescence, chemiluminescence measurement**
- **Food oxidation, antioxidant activity luminescence measurement**
- **Activated cell luminescence measurement**
- **UV-excited (UV LED) delayed fluorescence measurement**
- **ATP monitors with reagent**
- **Other low-light-level measurements**

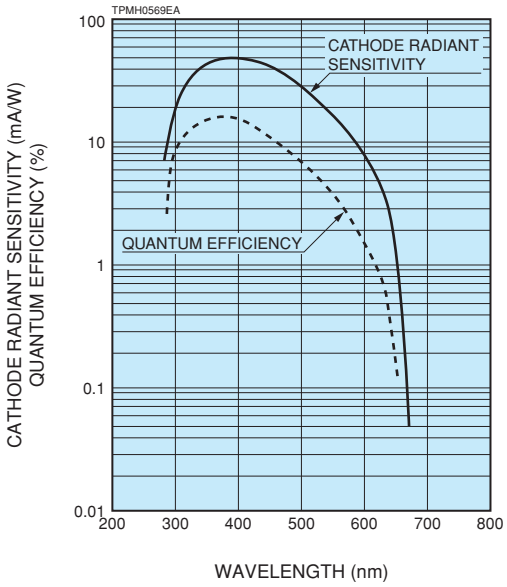
FEATURES

- **Photon counting with high SN ratio**
  Low noise: 50 s^{-1} (Typ. at +20 °C)
- **USB interface compatible**
- **Interlock function (C13796 + A9861)**
  Automatically closes optical shutter to prevent excessive light from entering PMT if sample compartment is accidentally opened during measurement.
- **Control sample software included**
- **Optical fiber (FC type) compatible (C13796 + A9859)**
- **UV excitation (C13796 + A9860 + A9861/-01)**
  Light source wavelength: 375 nm
  Output power: 10 mW/cm^2
  Irradiation time: 0.1 s to 3600 s
- **Reagent dispensing (C13796 + A10490 + A9861)**
- **Test tubes compatible (C13796 + A9860 + A9861-01)**

BLOCK DIAGRAM



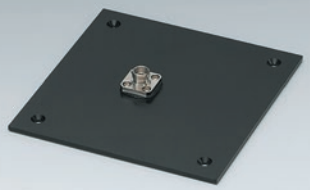
Typical spectral response



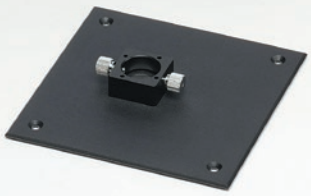
OPTIONAL MODULAR UNITS (sold separately)

Please select following options depending on the purpose application.

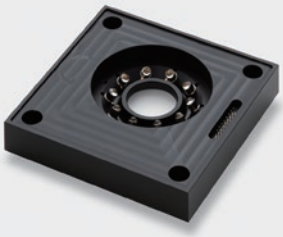
Optical fiber panel A9859



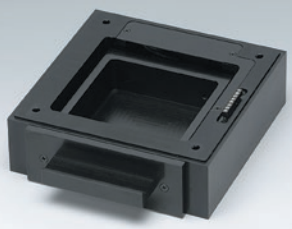
Optical block panel A9859-01 *



Excitation light source unit A9860



Sample holder unit A9861



Dispenser unit A10490

Test tube holder unit A9861-01
Test tube A17023-01

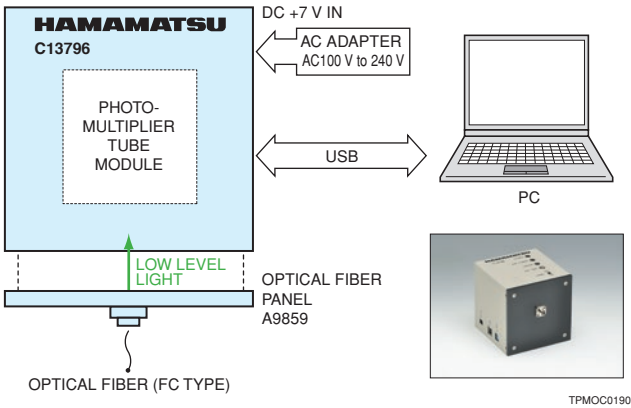
* Optical block panels can be combined with various types of optical blocks. Optical blocks are modular units that accommodate optical components such as band-pass filters designed for use with this C13796 photon detection unit.

https://www.hamamatsu.com/jp/en/product/optical-components/optical-blocks.html

SETUP DIAGRAMS

●C13796 + A9859

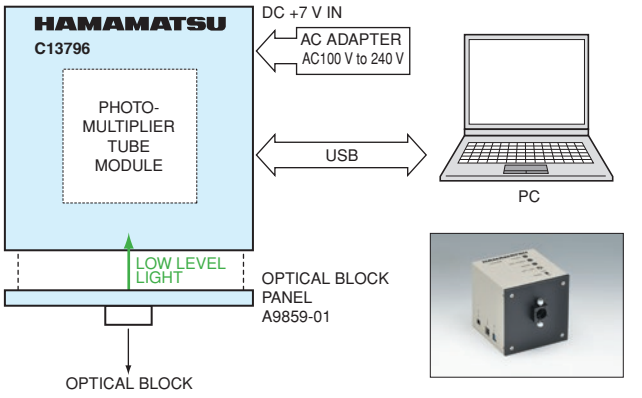
Major applications: Various measurements using optical fiber (FC type)



TPMOC0190EB

●C13796 + A9859-01

Major applications: Various measurements using optical blocks



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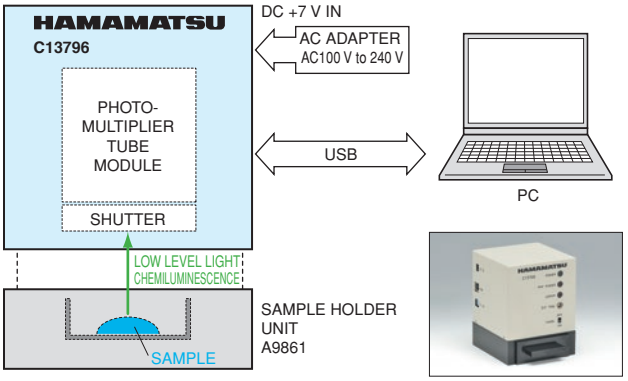
●C13796 + A9861

Major applications: Bioluminescence, chemiluminescence



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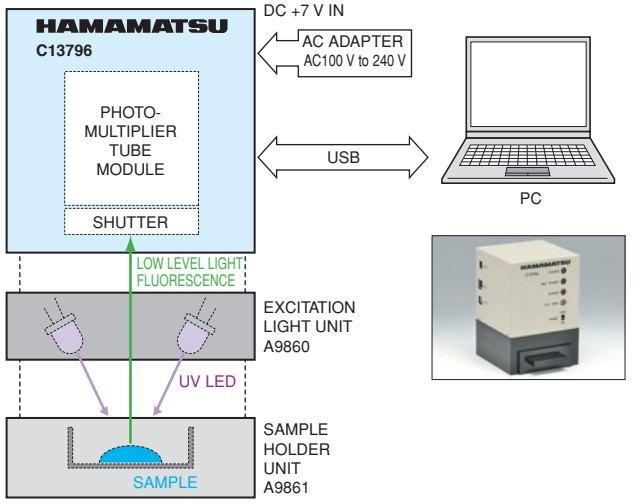
●C13796 + A9860 + A9861

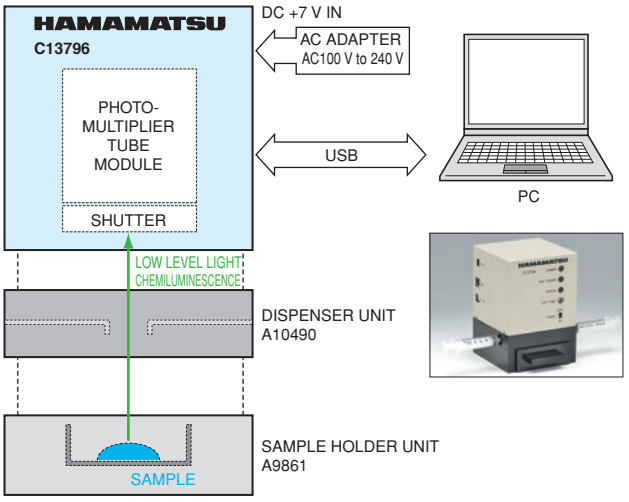
Major applications: Fluorescence life time, delayed fluorescence



TPMOC0188EB

●C13796 + A10490 + A9861

Major applications: Chemiluminescence using syringe



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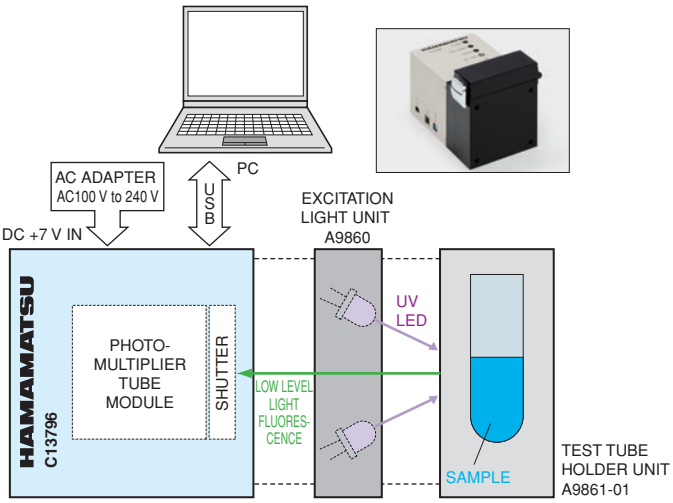
●C13796 + A9860 + A9861-01

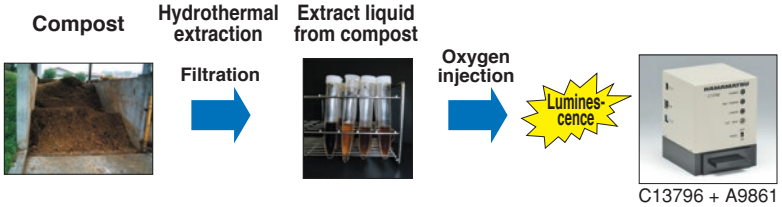
Major applications: Fluorescence life time, delayed fluorescence



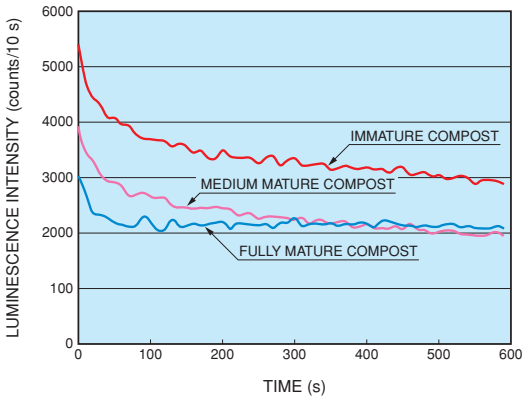
APPLICATIONS

●Evaluating compost maturity

Organic farming is the focus of much recent attention, and is a field where the market value of good quality compost is on the rise. To ensure that good quality compost can be quickly supplied when needed, photon detection units are used in research to develop techniques for determining compost maturity during the compost purification process.
Focusing on the fact that good quality compost is oxidized excrement, researchers added oxygen to liquid extracted from compost during the fermentation process to accelerate oxidation of residual organic matter and then rated the maturation from the intensity of low-level luminescence emitted during the oxidation process. Good quality compost has less unoxidized material and so emits low-level luminescence.



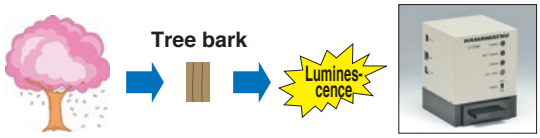
C13796 + A9861



Data courtesy of:
Nobuya Katayama, Shizuoka Prefectural Animal Husbandry Experiment Station
Mayuko Iwai, Graduate School for Creation of New Photonics Industries

●Diagnosing fungus-infected plants

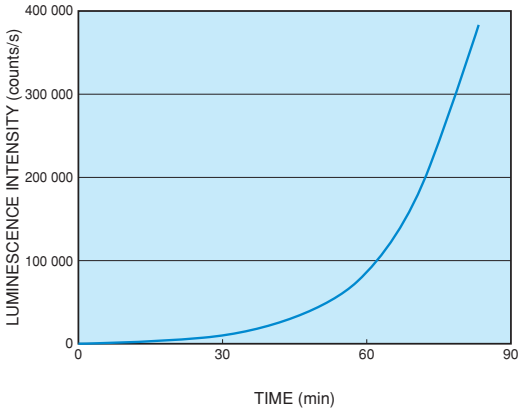
Photon detection units are utilized in research to develop techniques for detecting the low level luminescence emitted from honey fungus which is a type of mushroom that acts as a parasite and eats into road-side trees. These techniques will serve as tests to diagnose whether a tree is infected with fungal filaments (hypha).
Samples taken from the bark of the suspect tree are measured using a photon detection unit.
The material within the tree bark being eaten away by the fungus undergoes a temperature change due to fungal action so that the luminescence intensity rises with the passage of time. Utilizing these changes in low-level luminescence intensity reveals whether there is fungal infection or not.



C13796 + A9861

Upper: Honey fungus (fruited body: luminescence cannot be observed visually)
Left: Image observed on fungus culture under bright conditions
Right: Image observed on fungus culture under dark conditions (luminescence can be observed visually)

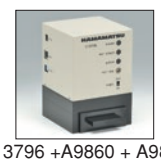
Results from measuring luminescence intensity on fruited body impossible to observe visually over elapsed time



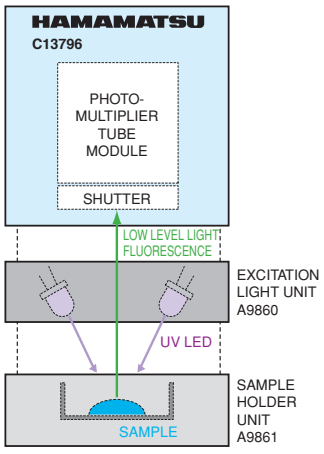
Data courtesy of:
Masaru Hiroi, Koriyama Women's University & College

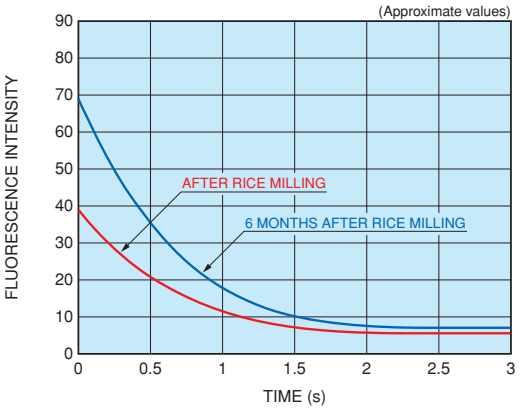
●Oxidization on one polished rice grain

The delayed fluorescence intensity from the surface of a single polished rice grain irradiated with UV light for 10 s is measured using a photon detection unit that contains an excitation light source and is operated with dedicated software.
This measurement yielded a specific value for progressive oxidation after rice milling with the passage of time.



C13796 +A9860 + A9861

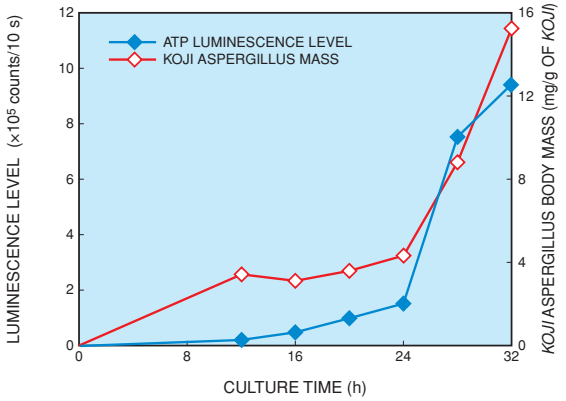




●Luminescence level in ATP method and changes in *koji* aspergillus body mass during cultivation of rice *koji*

Photon detection units were used to measure the luminescence level in the APT method and changes in *koji* aspergillus body mass of rice *koji* cultivated based on the standard *koji* making test.
Comparing the luminescence level in the APT method with the *koji* aspergillus body mass, they show similar changes up to 32 consecutive hours of rice *koji* cultivation. Changes in the rice body mass and enzymatic activity (alpha-amylase) are major quality indicators of *koji* aspergillus and mainly end during the logarithmic growth phase, so how both methods related was compared in a range of the culture time from 12 h to 32 h, which is a transition to the stationary phase. Although the number of data was small, the results clearly showed a high correlation.

C13796 + A9861

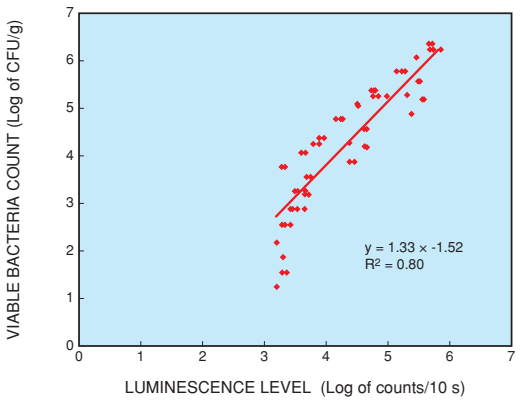


Data courtesy of:
Prof. Takahiro Saito, Faculty of Agriculture, Department of Environmental Engineering, Utsunomiya University

●Viable bacteria count versus luminescence level in ATP method on fresh produce

Photon detection units are used in research to find techniques using chemiluminescence for quickly and easily measuring the degree of purity in food.
About 3 leaves each taken from the outermost layer of several pieces of Boston lettuce were thoroughly crushed and diluted about 10 times with distilled sterile water for use as the sample fluid concentrate and the luminescence intensity measured by the ATP method using the photon detection unit. The number of viable bacteria cultured by the official analytical method was then found and the correlation with the luminescence level found.

C13796 + A9861



Data courtesy of: Prof. Takahiro Saito, Faculty of Agriculture, Department of Environmental Engineering, Utsunomiya University

●Evaluation of refined *sake* deterioration

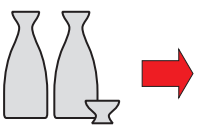
Refined *sake* (rice wine) oxidizes or in other words degrades after the container or bottle is opened. This oxidation was evaluated with photon detection units utilizing the following two methods.

Evaluation by XYZ measurement system (upper graph)
The degradation (or oxidation) occurring in refined *sake* was evaluated by ranking refined *sake* as reactive oxygen species (X) and using a mixture of anti-oxidation species (Y) and receptor species (Z).

Evaluation by oxidation reaction measurement system (lower graph)
The degradation (or oxidation) occurring in refined *sake* was evaluated using a mixture of 75 µL of hypochlorous natrium to 3 mL of refined *sake*.

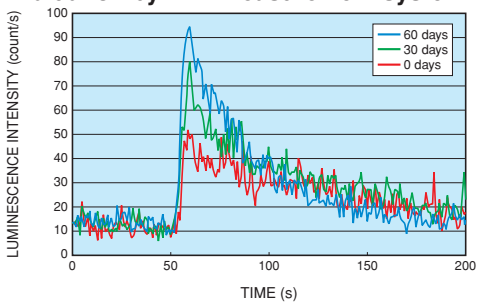
In both methods the luminescence intensity (degradation level) rose in proportion to the number of days in storage.

Left standing in 30 °C environment

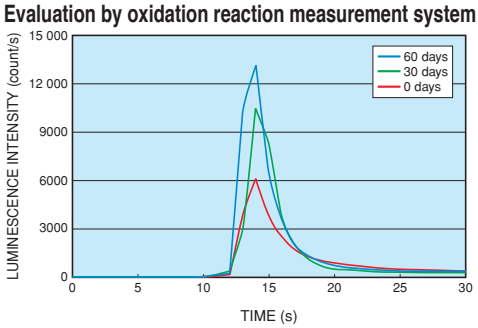


C13796 +A10490 + A9861

Evaluation by XYZ measurement system



Evaluation by oxidation reaction measurement system



Data courtesy of: Prof. Takahiro Saito, Faculty of Agriculture, Department of Environmental Engineering, Utsunomiya University

SPECIFICATIONS

C13796-A1/-A2/-A3* *A1: For Japan, A2: For North America, A3: For Europe (Difference in AC adapter specifications)

Parameter		Description / Value	Unit
Detection method		Photon counting method	—
Spectral response range		300 to 650 Ⓐ	nm
Photocathode size		ϕ22	mm
Max. count rate at 10 % count loss		3×10^6	s^{-1}
Counter gate time		0.001 to 10 (1, 2, 5 Steps)	s
Dark count (Typ. at +20 °C)		50 Ⓐ	s^{-1}
Counter capacity		32 bit/gate	—
Trigger section	Trigger signal input mode	External trigger, software trigger	—
	Trigger signal level	TTL edge Ⓑ	—
	Trigger signal pulse width	100 or longer	ns
Input voltage (DC)		+7 (supplied from AC adapter)	V
Input voltage (AC) to supplied AC adapter		100 V to 240 V (auto switchable), single phase 50 Hz/60 Hz	—
Operating	Temperature	+5 to +40	°C
	Humidity	Below 80 (no condensation)	%
Storage	Temperature	0 to +50	°C
	Humidity	Below 85 (no condensation)	%
OS		Windows® 10 Pro / 11 Pro	—
Interface		USB 1.1	—

NOTE: ⒶOption available for 300 nm to 850 nm spectral response range (Dark counts 5000 s^{-1} typical).
ⒷDefault is rise edge. Users can switch to fall edge in software control.

Accessories (Supplied): ●CD-ROM (control software) ●USB cable (2.0 m) ●AC adapter ●Cable for external trigger (1.5 m)

C13796 + A9859 (Optical fiber panel)

Parameter	Description / Value	Unit
Optical fiber adapter	FC type (HRFC-R1/Hirose)	—
Distance to photocathode	15.0 (from fiber end)	mm
Weight	Approx. 1.1	kg

C13796 + A9859-01 (Optical block panel)

Parameter	Description / Value	Unit
Suitable optical block	V-groove type	—
Distance to photocathode	17.3	mm
Weight	Approx. 1.1	kg

C13796 + A9861 (Sample holder unit)

Parameter	Description / Value	Unit
Effective size of sample compartment (W x D x H)	50 x 50 x 15	mm
Distance to photocathode	26.5 (from bottom of sample compartment)	mm
Weight	Approx. 1.4	kg

C13796 + A9860 + A9861 (Excitation light source unit + Sample holder unit)

Parameter		Description / Value	Unit
Excitation light source (UV LED)	Wavelength·Output power	375 nm·10 mW/cm²	—
	Irradiation time	0.1 to 3600	s
	Irradiation area	ϕ10 (center of sample compartment)	mm
Effective size of sample compartment (W x D x H)		50 x 50 x 15	mm
Distance to photocathode		43.5 (from bottom of sample compartment)	mm
Weight		Approx. 1.6	kg

C13796 + A10490 + A9861 (Dispenser unit + Sample holder unit)

Parameter	Description / Value	Unit
Suitable syringe capacity	5 (Terumo® syringe) Ⓑ	ml
Needle size	Outer diameter: 1 mm, inner diameter: 0.6 mm	—
Recommended gas flow tube	Outer diameter: 6 mm (Black tube is recommended for light shielding)	—
Distance to photocathode	43.5	mm
Weight	Approx. 1.6	kg

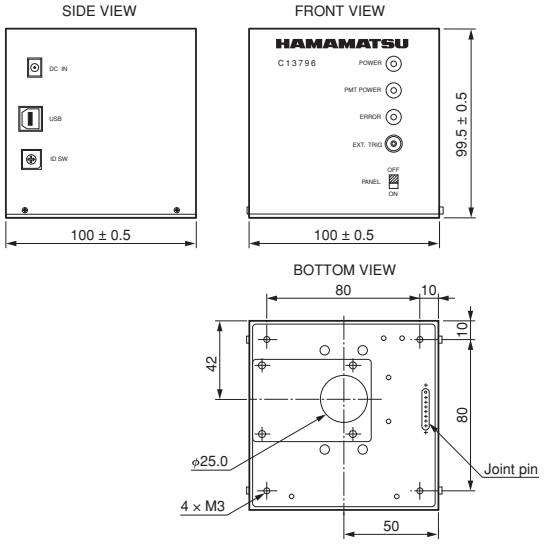
NOTE: ⒷPlease prepare at customer side

C13796 + A9860 + A9861-01 (Excitation light source unit + Test tube holder unit) *Test tube: A17023-01 (Sold separately)

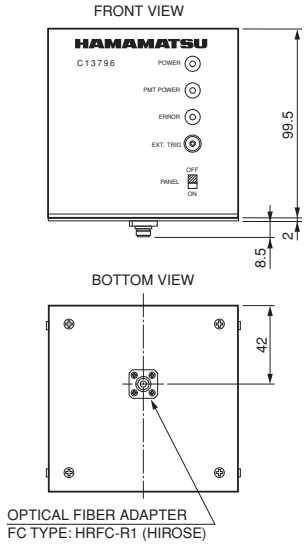
Parameter		Description / Value	Unit
Excitation light source (UV LED)	Wavelength • Output power	375 nm • 10 mW/cm²	—
	Irradiation time	0.1 to 3600	s
	Irradiation area	ϕ10 (center of test tube)	mm
Stowable test tube size		ϕ25.4 x 80 (H)	mm
Max. opening angle		120	°
Distance to photocathode		41.5 (from center of test tube)	mm
Weight		Approx. 1.8	kg

DIMENSIONAL OUTLINE (Unit: mm)

●C13796



●C13796 + A9859



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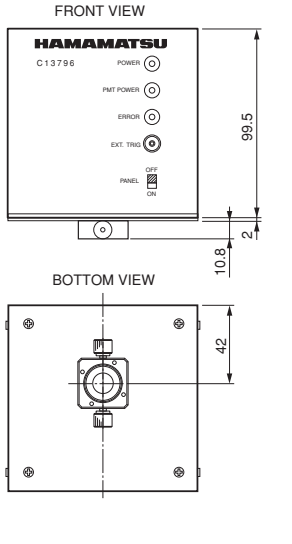
●C13796 + A9859-01



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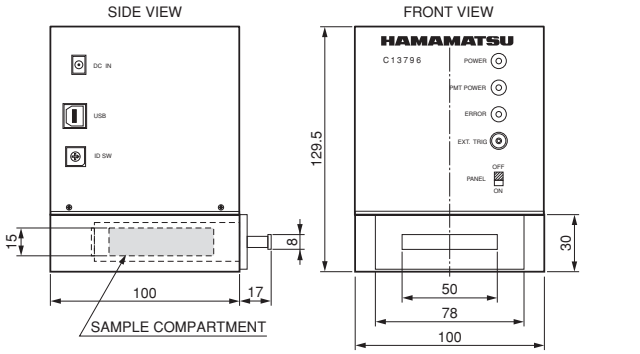
●C13796 + A9861



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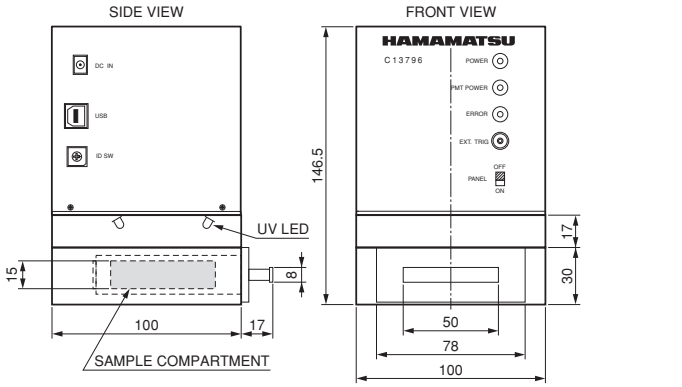
●C13796 + A9860 + A9861



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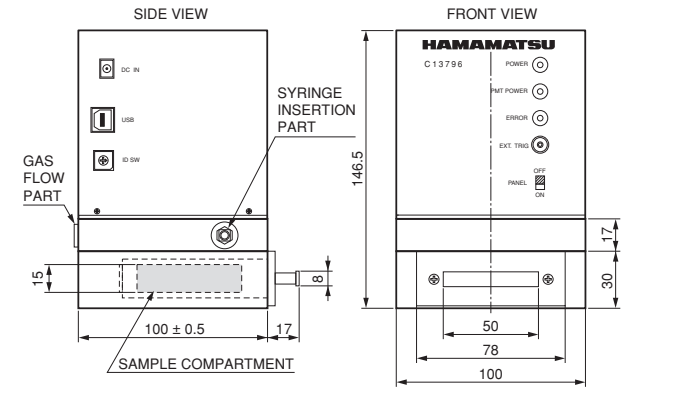
●C13796 + A10490 + A9861



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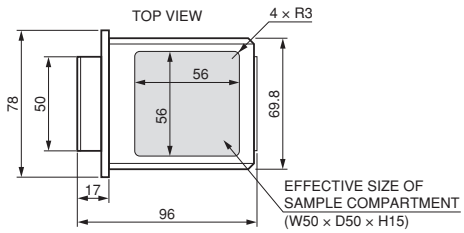
●A9861 Sample compartment tray



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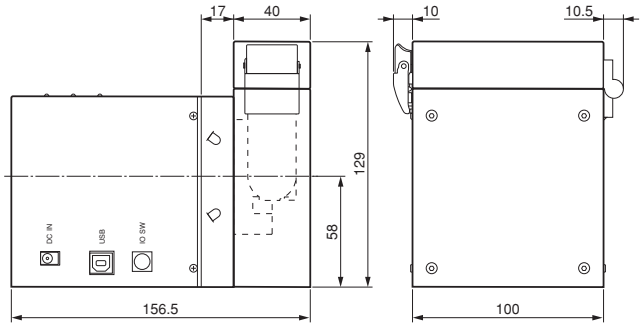
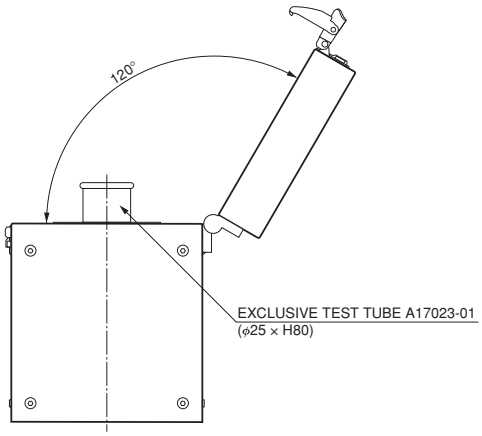
●C13796 + A9860 + A9861-01





PHOTON DETECTION UNIT C13796

CONTROL SAMPLE SOFTWARE

Sample software for controlling this unit is available.

●Repeat measurement

Repeat measurements "Dark count to excitation* to measurement" are possible, so it is possible to check the reproducibility and draw a calibration curve.

●Display measurement data in real time

Monitoring is possible by transferring the measurement results to the computer at any time.

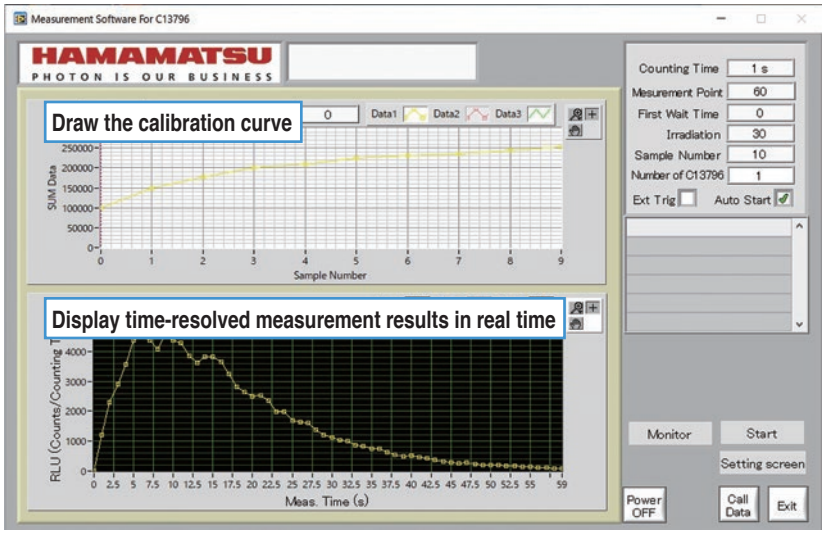
●Saving measurement results

Since measurement results are saved as a CSV file, it can be analyzed in various ways.

*It needs Excitation light source unit A9860 (Sold separately) for that.

By using the attached API library (DLL), it is also possible to create your own program according to your purpose.

[Main screen]



[Setting screen]

Setting range

Counting Time : 0.001 to 10 s, 1,2,5, step
Measurement Point : 10 to 1000 000
First Wait Time : 0 to 36 000 s
Sample Number : 1 to 250
Irradiation Time : 0.1 s to 100 s

HAMAMATSU PHOTONICS K.K. **www.hamamatsu.com**

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TPMZ1025E04
JUN. 2024 IP