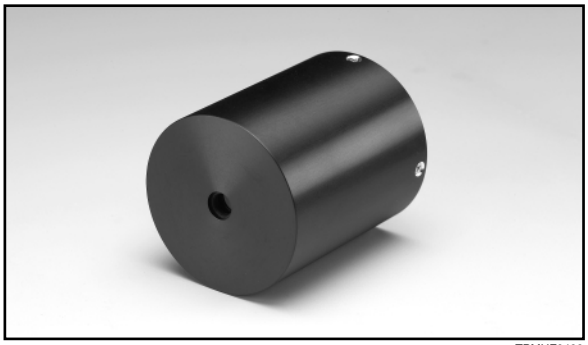
HAMAMATSU

NEAR INFRARED MICROCHANNEL PLATE-PHOTOMULTIPLIER TUBE WITH COOLER
R3809U-68/-69 WITH C10221

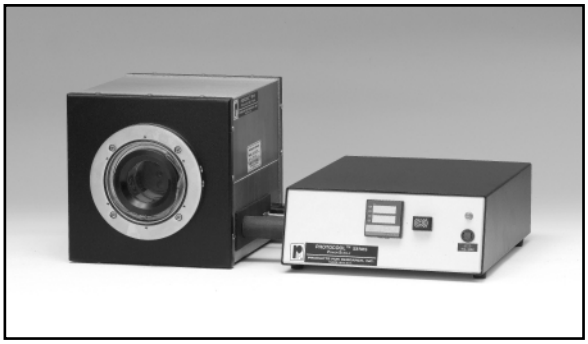
Compact NIR MCP-PMT Series Featuring with Fast Time Response

FEATURES

- **High Speed**
  Rise Time: 170 ps (Typ.)
  TTS (Transit Time Spread): ≦100 ps (FWHM) Ⓐ
- **Compact Profile**
  Effective Photocathode Area: 2 mm diameter
  (Overall length: 72.2 mm, Outer diameter: 45.0 mm)



▲R3809U-68/-69 TPMHF0499



▲C10221 TACCF0194

APPLICATIONS

- **Molecular Science**
  Analysis of Molecular Structure
- **Medical Science**
  Optical Computer Tomography
- **Biochemistry**
  Fast Gene Sequencing
- **Material Engineering**
  Semiconductor Analysis
  Crystal Research

Figure 1: Spectral Response

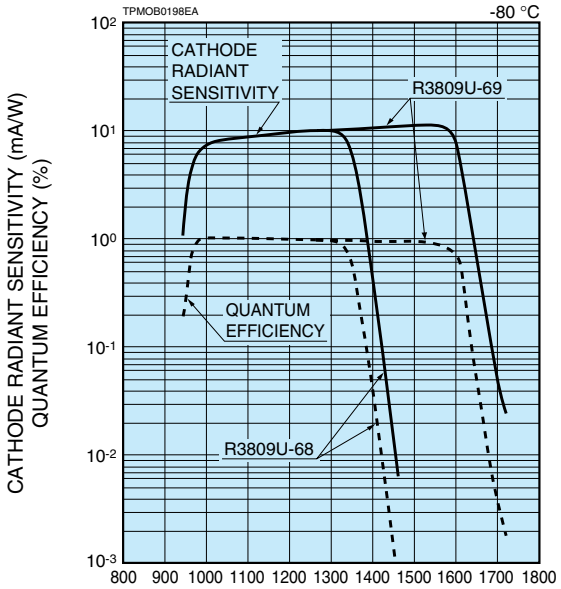
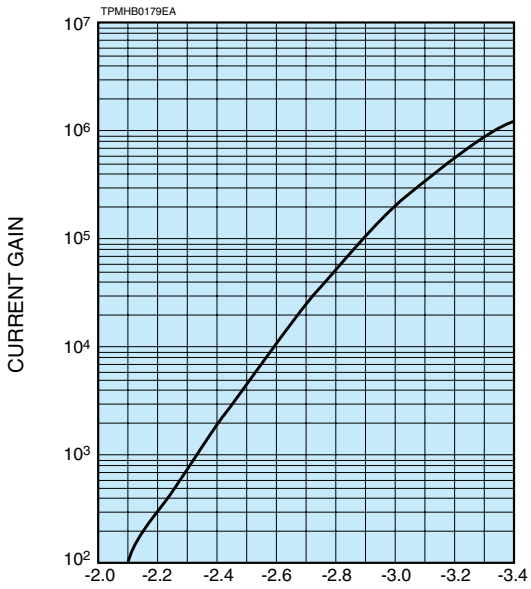


Figure 2: Typical Average Gain



SPECIFICATIONS

●R3809U-68/-69

GENERAL

Parameter	R3809U-68	R3809U-69	Unit
Spectral Response	950 to 1400	950 to 1700	nm
Photocathode Material	InP / InGaAsP	InP / InGaAs	—
Window Material	Borosilicate Glass		—
Effective Area of PMT	ϕ2		mm
Stage of MCP Ⓑ	2		—
Operating Ambient Temperature	-90 to -70		°C
Storage Temperature	-90 to +50		°C

MAXIMUM RATING

Parameter	R3809U-68	R3809U-69	Unit
PMT Supply Voltage	-3400		V
Average PMT Anode Current	50		nA

CHARACTERISTICS (at -3000 V, -80 °C)

Parameter		R3809U-68			R3809U-69			Unit
		Min.	Typ.	Max.	Min.	Typ.	Max.	
Cathode Sensitivity Ⓒ	Quantum Efficiency	0.1	1.0	—	0.1	1.0	—	%
	Radiant	1.0	5.2	—	1.2	6.1	—	mA/W
Gain		1×10^5	2×10^5	—	1×10^5	2×10^5	—	—
Anode Dark Count Ⓓ		—	2×10^4	1×10^5	—	5×10^4	5×10^5	s^{-1}
Voltage Driver Current		—	—	100	—	—	100	μA
Time Response	Rise Time Ⓔ	—	170	—	—	170	—	ps
	Fall Time Ⓕ	—	450	—	—	450	—	ps
	Transit Time Spread Ⓐ	—	70	100	—	70	100	ps

Ⓐ Transit-time spread (TTS) is the fluctuation in transit time between individual pulse and specified as an FWHM (full width at half maximum) with the incident light having a single photoelectron state.
Ⓑ Two microchannel plates (MCP) are incorporated as a standard but we can provide it with either one or three MCPs as an option depending upon your request.
Ⓒ At 1300 nm (R3809U-68), at 1500 nm (R3809U-69)
Ⓓ At 30 minutes after high voltage is applied with shutter closed
Ⓔ This is the mean time difference between the 10 % and 90 % amplitude points on the output waveform for full cathode illumination.
Ⓕ This is the mean time difference between the 90 % and 10 % amplitude points on the tailing edge of the output waveform for full cathode illumination.
Ⓖ IRF stands for Instrument Response Function which is a convolution of the δ pulse function (H(t)) of the measuring system and the excitation function (E(t)) of a laser. The IRF is given by the following formula:

$$IRF = H(t) \times E(t)$$

We specify the IRF as an FWHM of the time distribution taken by using the measuring system in Figure 6 that is Hamamatsu standard IRF measurement. It can be temporary estimated by the following equation:

$$(IRF\ (FWHM))^2 = (TTS)^2 + (Tw)^2 + (Tj)^2$$

where Tw is the pulse width of the laser used and Tj is the time jitter of all equipments used. An IRF data is provided with the tube purchased as a standard.

CAUTION: R3809U-68/-69 must be operated with C10221

●C10221 (EXCLUSIVE COOLER)

GENERAL

Parameter		Description / Value	Unit
Coolant Medium		Liquid Nitrogen (LN_2)	—
Temperature Controllable Range		0 to -100 (continuously adjustable)	°C
Cool-down Time		About 2 (-80 °C setting)	h
Liquid Nitrogen Consumption		Approx. 0.75 (-100 °C setting)	L/h
Dry Nitrogen	Gas Pressure	35	kPa
	Consumption	47 L (14.7 MPa) / 10 h	—
Socket Assembly	-HV Connector	SHV-R	—
	Signal Connector	SMA-R	—
	Load Resistor	Open	—
Power Consumption		15	VA
Operating Ambient Temperature		Less than +30	°C
Weight	Cooling Chamber	Approx. 6	kg
	Controller, etc.	Approx. 11	kg
System Configuration		Chamber, Controller, Conductor Cable, Controller Solenoid, Rubber Tube, Insulated Transfer Hose, LN_2 Transfer Head	—

NOTE: PMT is not included in C10221

Figure 3: Typical Output Waveform

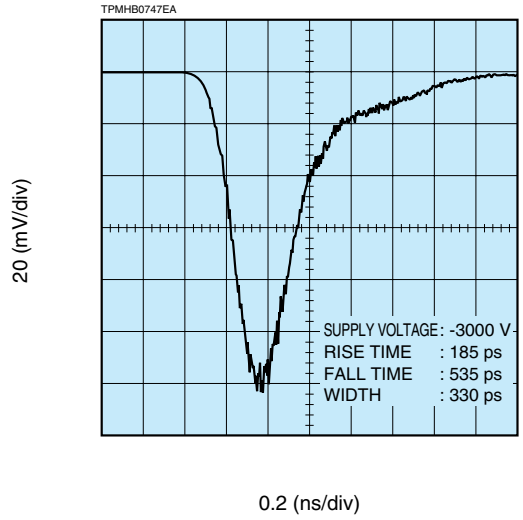


Figure 4: Block Diagram of Output Waveform Measuring System

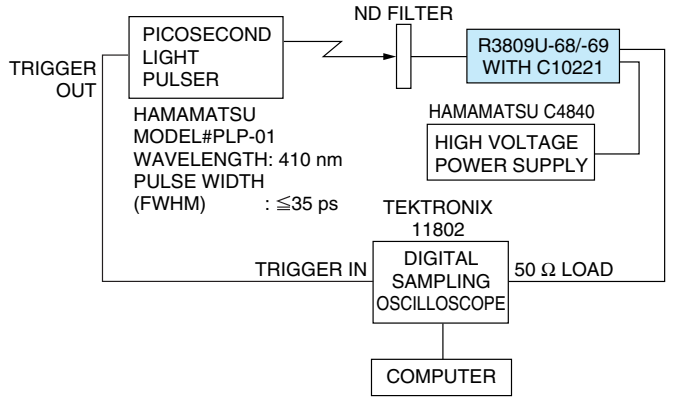


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Figure 5: Typical Instrument Response Function (IRF) ⓖ

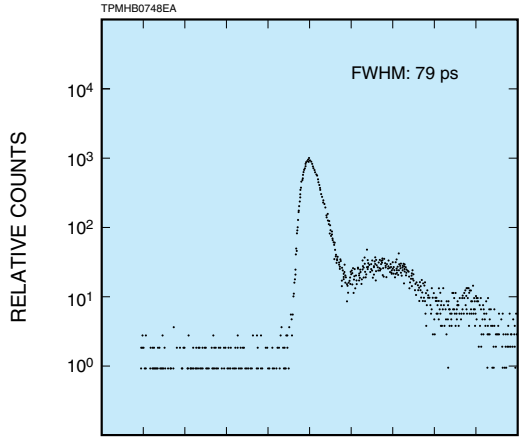

Figure 6: Block Diagram of IRF Measuring System

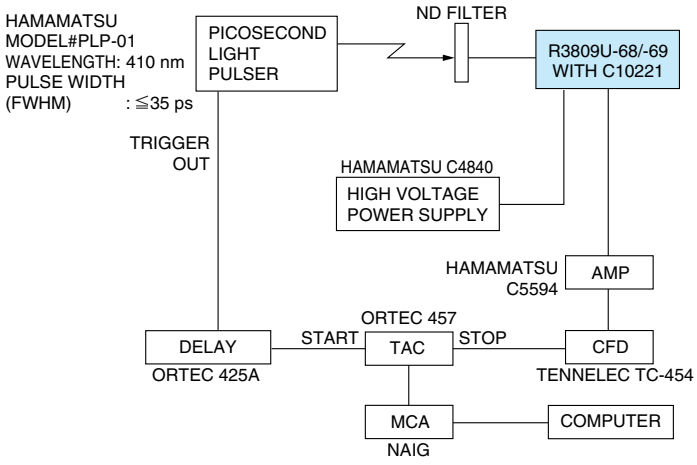

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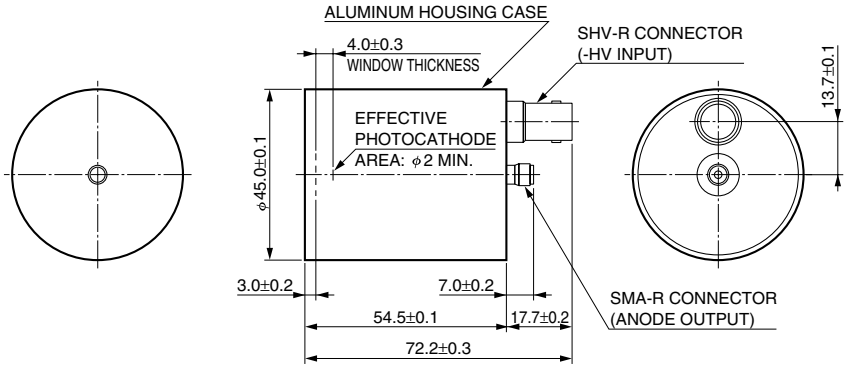
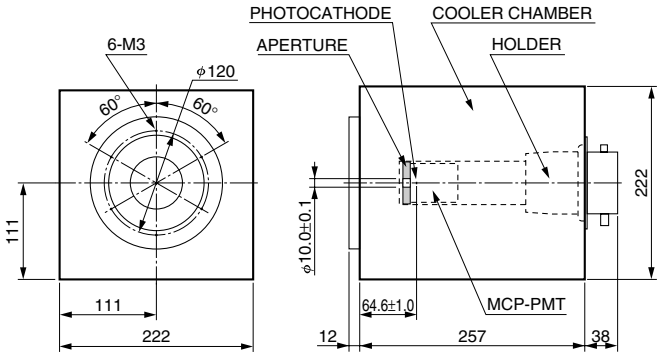
Figure 7: Dimensional Outlines (Unit: mm)

●R3809U-68/-69



●C10221

• COOLING UNIT



• CONTROLLER

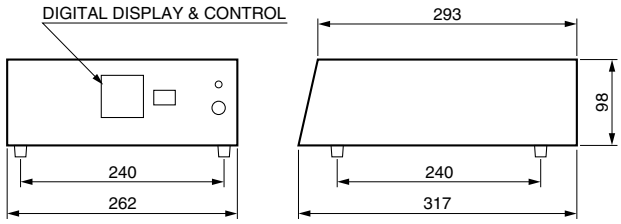


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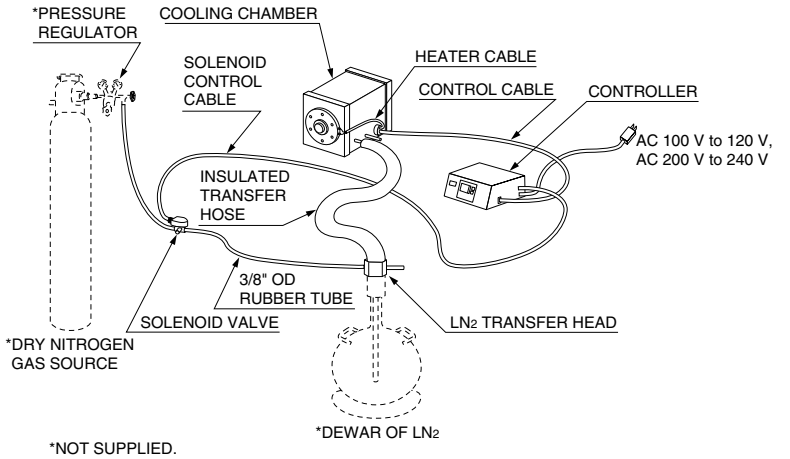
Figure 8: System Configuration

■OTHER ACCESSORIES REQUIRED

●Liquid nitrogen dewar
Non-pressurized dewar having a capacity of 10 to 50 litters, and the neck outer diameter between 35 and 40 mm.

●High voltage power supply for the photomultiplier tube (negative high voltage)
Output voltage: more than -3400 V
Output current: more than 0.2 mA
Low ripple, High stability

●Dry nitrogen gas, pressure regulator (secondary pressure 35 kPa), pressure gauge
In order to supply a proper amount of liquid nitrogen to the cooling unit, an external pressure needs to be added to the dewar. A pressure regulator capable of reducing a secondary pressure to 35 kPa is necessary when used with a dry nitrogen gas container. Connect the 3/8" rubber tube to the exit of the pressure regulator.



*NOT SUPPLIED.
ALL OTHERS ARE INCLUDED IN C10221.

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