LOW-LIGHT-LEVEL Measurement of Nir

NIR (NEAR INFRARED:1.4 μm/1.7 μm) PHOTOMULTIPLIER TUBES R5509-43/R5509-73

and EXCLUSIVE COOLERS

OVER VIEW

Hamamatsu near infrared photomultiplier tubes (NIR-PMT) R5509-43 and -73 have photocathodes with extended spectral response ranges to 1.4 μ m or 1.7 μ m where beyond 1.1 μ m have been the limit of conventional photocathodes.

The R5509-43 is recommended for detection up to 1.35 $\mu m,$ while the R5509-73 is up to 1.7 $\mu m.$





FEATURES

•High sensitivity enables accurate PL (Photoluminescence) measurement with a low excitation power that could not be obtained with a strong excitation.

High gain and low noise improve the detection limit.

•Flat response from visible to near IR minimizes spectral sensitivity correction.

The spectral response covers a wide range from 0.3 μm to 1.4 μm or 1.7 $\mu m.$

•Photoluminescence from a room temperature sample can be measured.

High sensitivity enables weak light emission measurement.

•Time resolved measurement in near IR is realized.

Fast time response (Rise time): 3 ns.

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	Parameter	R5509-43	R5509-73	Unit	
Spectral Response		300 to 1400	300 to 1700	nm	
Dhotooothodo	Material	InP / InGaAsP	InP / InGaAs	_	
Photocathode	Minimum Effective Area	3×8		mm	
Window	Material	Borosilic	_		
Dynode	Secondary Emitting Surface	Cu-l	_		
	Structure	Line focused			
	Number of Stage	1	_		
Socket	-	C9940-	_		
Operating Temperature		-90 te	°C		
Recommended Operating Temperature		-8-	°C		
Storage Temperatu	re	-90 to	°C		

MAXIMUM RATING (Absolute maximum values)

Parameter			Value	Unit
Supply Voltage	Bet	ween Anode and Cathode	-1750	V
Average Anode Current			2	μA

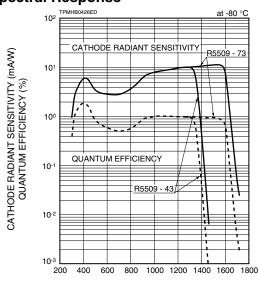
•CHARACTERISTICS (at -80 °C, supply voltage: -1500 V)

Parameter			R5509-43		R5509-73		Unit	
		Min.	Тур.	Max.	Min.	Тур.	Max.	Unit
Cathode Sensitivity	Quantum Efficiency a	0.48	—	—	0.29	—	—	%
Callioue Sensitivity	Radiant ^a	5	—	—	3.5	—	—	mA/W
Anode Sensitivity	Radiant ^a	1000	_	—	700	—	—	A/W
Gain		2 × 10 ⁵	1 × 10 ⁶	—	2 × 10 ⁵	1 × 10 ⁶	—	_
Anode Dark Current 6		_	4	10	—	40	100	nA
Anode Dark Counts ^(b)		—	1.6×10^{4}	—	—	$1.6 imes 10^{5}$	—	S ⁻¹
	Anode Pulse Rise Time	—	3	—	—	3	—	ns
Time Response	Electron Transit Time	—	23			23	—	ns
	Transit Time Spread	_	1.5	_	_	1.5	_	ns

NOTE: (a) at 1300 nm (R5509-43), at 1500 nm (R5509-73) (b) After 30 minutes storage in darkness The dedicated coolers C9940-01 and C9940-02 are shipped after adjusting the voltage divider circuit to provide the optimum voltage distribution ratio that best matches the PMT.

CHARACTERISTICS FIGURES

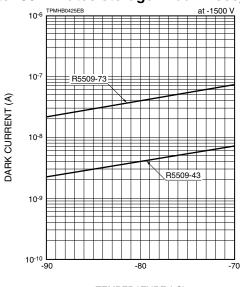
Spectral Response



WAVELENGTH (nm)

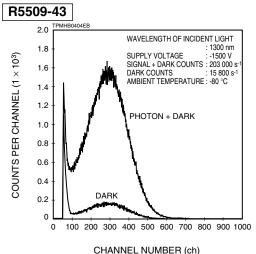
* Spectral response characteristics when used with the dedicated cooler

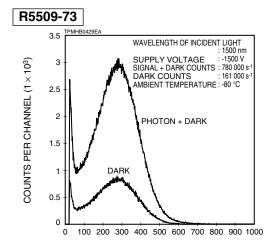
Temperature Characteristics of Dark Current (After 30 minutes storage in darkness)



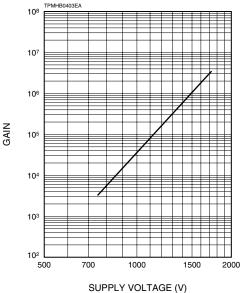
TEMPERATURE (°C)

•Single Photoelectron Pulse Height Distribution (PHD)

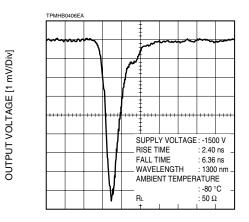




•Typical Gain (R5509-43, -73)



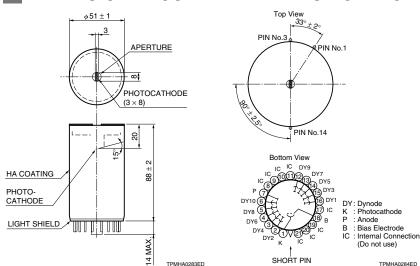
Output Waveform (R5509-43)



TIME [5 ns/Div]

CHANNEL NUMBER (ch)

DIMENSIONAL OUTLINE AND BASING DIAGRAM (Unit: mm)



[Cautions for operation] -

- •Operate the tube at the maximum average anode current of less than 2 μA while the entire photocathode is illuminated in order to avoid the photocathode damage due to excessive cathode current.
- •In order to protect the photocathode, the high voltage should be increased or decreased gradually.
- •When the R5509-43 or -73 shall be operated, do not supply the high voltage before the tube is cooled down to -70 °C at least.
- Use the exclusive cooler C9940-01 or C9940-02 for cooling.

[Warranty]

- A cooler other than specified may cause a trouble in the tube like loss of performance or a mechanical damage. Any trouble caused in association with a cooler other than specified shall not be subject to warranty.
- Hamamatsu photomultiplier tubes are warranted to the original purchase for a period of 12 months following the date of shipment. The warranty is limited to repair or replacement of any defective material due to defects in workmanship or materials used in manufacture.

RELATED PRODUCTS

Exclusive coolers C9940-01, C9940-02

The C9940-01, -02 are exclusive coolers for R5509 series photomultiplier tubes. To operate the R5509 series, it is necessary to cool it down to -70 °C to -90 °C range (recommended temperature: -80 °C). Cooling suppresses dark current and improves signal to noise ratio to make weak near infrared light measurements possible with high sensitivity.

Two types are available with different line voltage regulations, 100 V to 115 V (C9940-01) and 230 V (C9940-02) .

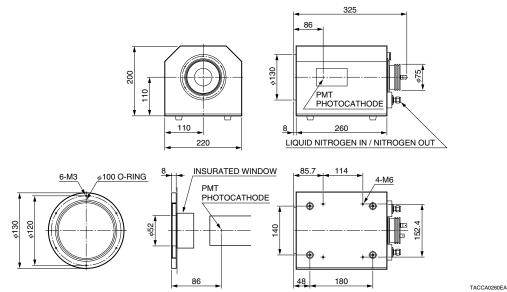
FEATURES

- ●Temperature range: -70 °C to -90 °C
- Voltage divider, Magnetic shield case included
- •Alarm with output when liquid nitrogen is running out
- No external dry nitrogen is required

■SPECIFICATIONS

	Parameter	C9940-01	C9940-02			
Input Voltage		AC 100 V to AC 115 V, 50 Hz / 60 Hz	AC 230 V, 50 Hz			
Power Consumption		60 VA				
Temperature Controllable Range		-70 °C to -90 °C				
Cool-down Time		Approx. 2 h (-80 °C setting)				
Liquid Nitrogen Consumption rate		0.5 L/h				
	Cooling Unit	5.5 kg				
Weight	Cooling Controller	6.1 kg				
	Liquid Nitrogen Drawing Pipe, etc.	0.8 kg				
Window Material		Borosilicate grass				
Alarm Output		DC 24 V, 100 mA Max.				
Operating Ambient Temperature		+10 °C to +40 °C				
Storage Temperature		-20 °C to +50 °C				
Accessory		100 k Ω Load Resistor (with BNC connector)				

DIMENSIONAL OUTLINE (Unit: mm)

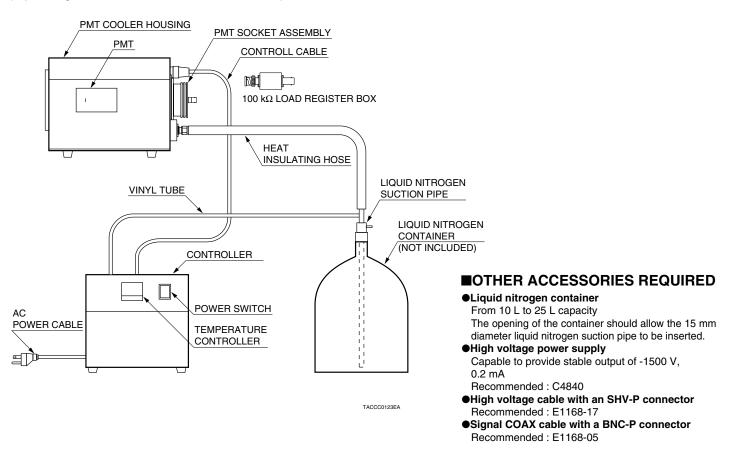


RELATED PRODUCTS

Exclusive coolers C9940-01, C9940-02

SYSTEM CONFIGURATION

PMT housing, Controller, Liquid nitrogen suction pipe, Heat insulating hose, PMT socket assembly, Controller cable, Vinyl tube, 100 k Ω load resistor box. (Liquid nitrogen container is not included in C9940-01/-02)



* Peripheral equipments such as the relay optics for connecting a monochromator (A8996) can be provided. For photon counting, preamplifier unit, photon counting unit and photon counting board or counter are necessary. Please consult with Hamamatsu for assistance.

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