

25 mm (1") encapsulated photomultiplier

9110V13 series data sheet

1 description

The 9110V13 encapsulated photomultiplier comprises a 25mm (1") diameter, compact, rugged, end window photomultiplier with a plano-concave window, high temperature blue-green sensitive bialkali photocathode and 10 BeCu dynodes of circular focused design.

The photomultiplier is encapsulated, together with a voltage divider, in a stainless steel sleeve.

This type will operate up to 175°C and has a minimum plateau length of 100 V at 175°C.

2 applications

- oil well logging including measuring while drilling (MWD)
- x-ray and gamma ray spectroscopy in harsh environments

3 features

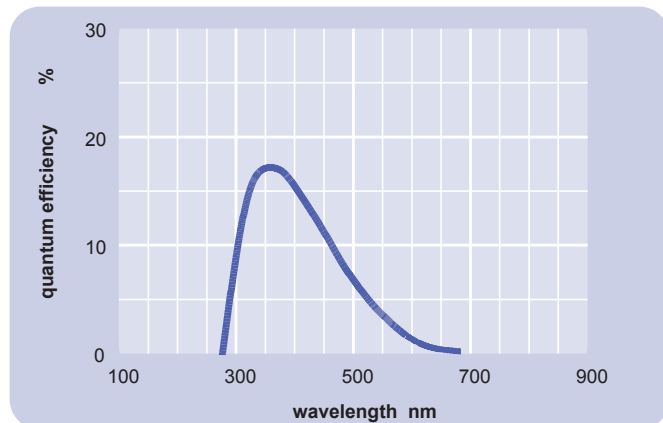
- rugged
- high temperature operation
- encapsulated in a stainless steel sleeve with an integral voltage divider

4 window characteristics

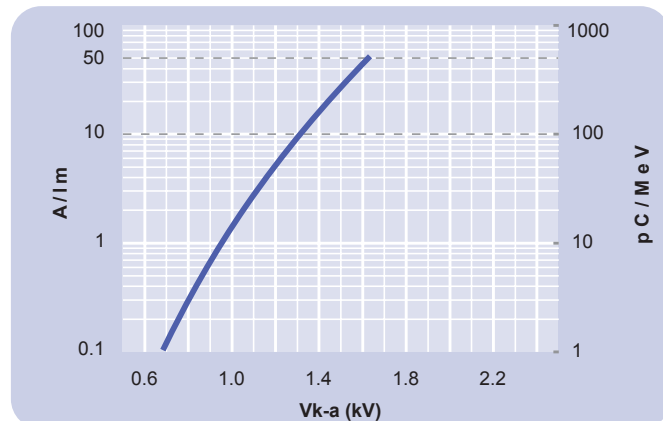
	9110V13 borosilicate
spectral range* (nm)	280 - 630
refractive index (n_d)	1.49
K (ppm)	300
Th (ppb)	250
U (ppb)	100

* wavelength range over which quantum efficiency exceeds 1 % of peak

5 typical spectral response curve



6 typical voltage gain characteristics



7 characteristics

	unit	min	typ	max
photocathode:				
high temperature bialkali				
active diameter	mm		22	
quantum efficiency at peak	%		17	
luminous sensitivity	$\mu\text{A/lm}$		50	
with CB filter		4	6	
with CR filter			5	
dynodes: 10CFBeCu				
anode sensitivity:				
nominal anode sensitivity	A/lm		10	
max. rated anode sensitivity	A/lm		50	
overall voltage for nominal A/lm	V		1350	1600
overall voltage for max. rated A/lm	V		1650	
gain at nominal A/lm	$\times 10^6$		0.2	
dark current at 20 °C:				
DC at nominal A/lm	nA		0.1	1
DC at max. rated A/lm	nA		0.5	
pulsed linearity (-5 % deviation):				
divider A	mA		20	
resolution:				
^{137}Cs with 1.0 " dia x 1.5 " NaI(Tl)			10	
temperature coefficient:				
	$\% \text{ } ^\circ\text{C}^{-1}$		-0.5	
timing:				
multi-electron rise time	ns		2	
multi-electron fwhm	ns		4	
single electron rise time	ns		1.8	
transit time	ns		15	
	g		64	
weight:				
maximum ratings:				
anode current	μA			100
cathode current	nA			20
gain	$\times 10^6$			1
sensitivity	A/lm			50
	pC/MeV			500
temperature	$^\circ\text{C}$	-55		175
V (k-a) ⁽¹⁾	V			2300
V (k-d1)	V			450
V (d-d) ⁽²⁾	V			300
ambient pressure (absolute)	kPa			202

(1) subject to not exceeding max. rated sensitivity (2) subject to not exceeding max rated V(k-a)

qualification shock & vibration levels (all 3 axes, non-operating)

random vibration: 5 Hz to 100 Hz roll on 50 Hz to 500 Hz 500 Hz to 1000 Hz roll off composite duration	6 dB/octave 0.89 g^2/Hz 6 dB/octave 25 g rms 60 mins/axis
sine vibration: amplitude frequency range sweep rate duration	30 g peak 50 Hz to 2000 Hz 2 octaves/min 60 mins/axis
shock (half sine wave): 0.5 ms duration 4 ms duration shocks per axis	1000 g peak 250 g peak 3 up, 3 down

microphony under random vibration (all 3 axes, operating)

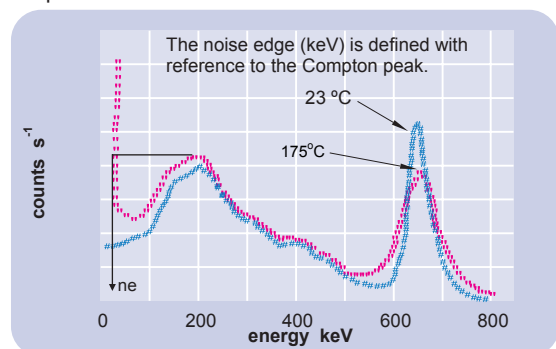
random vibration: 20 to 100 Hz roll on 100 to 400 Hz 400 to 500 Hz roll off composite duration microphony at 100 pC/MeV above a threshold of 5.5 pC (55 keV)	6 dB/octave 0.103 g^2/Hz 6 dB/octave 6.5 g rms 5 mins/axis < 1 cps
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8 magnetic field sensitivity

TBC

9 pulse height resolution with NaI(Tl) crystal

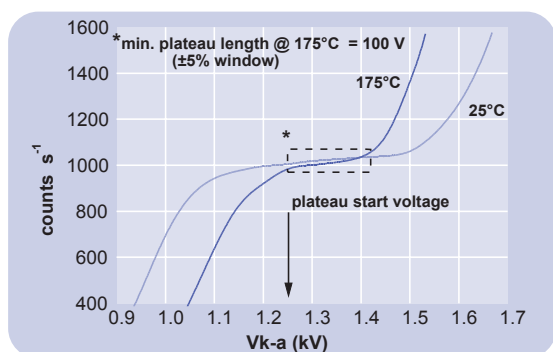
This pmt is tested for resolution at room temperature & at high temperature.



output data	unit	typ	20 °C max	175 °C typ
operating voltage for 13 pC/MeV	V	1050	1300	1200
operating voltage for 100 pC/MeV	V	1350	1600	1500
pulse height resolution	%	10		14
noise edge	keV	<10		35

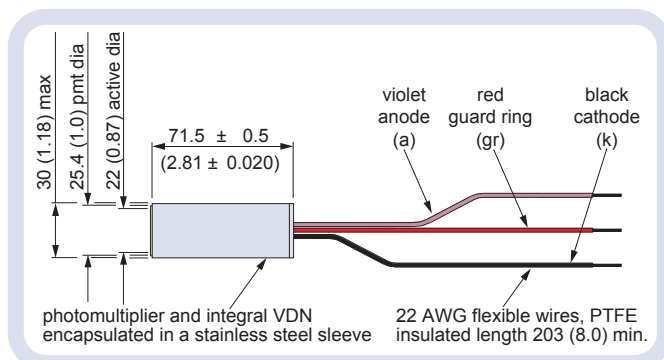
10 pulse counting with NaI(Tl) crystal

Pulse counting plateau with ¹³⁷Cs and NaI(Tl) crystal (1.0" dia. x 1.5")

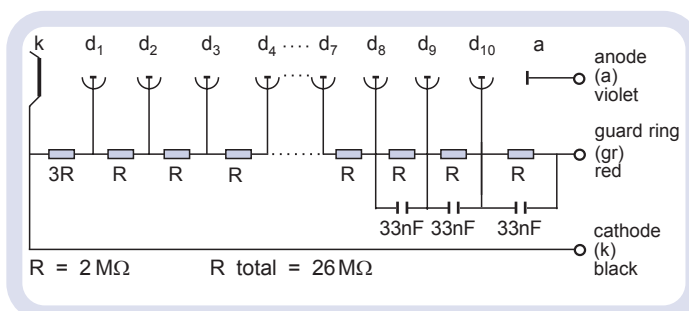


plateau data	unit	min	175 °C typ	max
combined 25 °C / 175 °C:				
plateau start (1.5 pC threshold)	V		1250	1500
plateau length ±5 %	V	100		

11 external dimensions in mm (inches)



12 voltage divider distribution

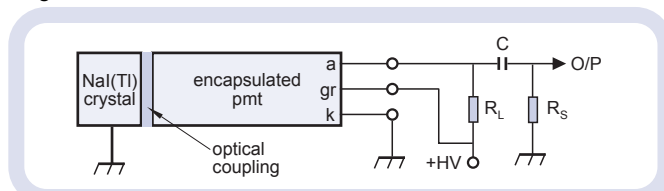


13 ordering information

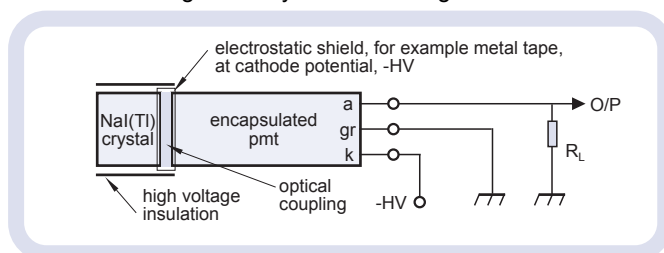
The 9110V13 meets the specification contained in this data sheet. For different specifications please discuss your requirements with us. For customer specific requirements, **ET Enterprises** will change the 2 digit numeric suffix to indicate additional tests and selection.

14 applications with NaI(Tl) crystals

The use with positive HV is recommended, as shown in the diagram below:



With negative HV, as shown in the next diagram, any material in contact with the window, for example the NaI(Tl) crystal, **must** be maintained at cathode potential and insulated for safety. The interface between the NaI(Tl) crystal and the pmt window **must** be shielded along the body of the housing.



These precautions are essential to prevent erratic behaviour.

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