

25 mm (1") encapsulated photomultiplier 9110V15 series data sheet

1 description

The 9110V15 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 mumetal* 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

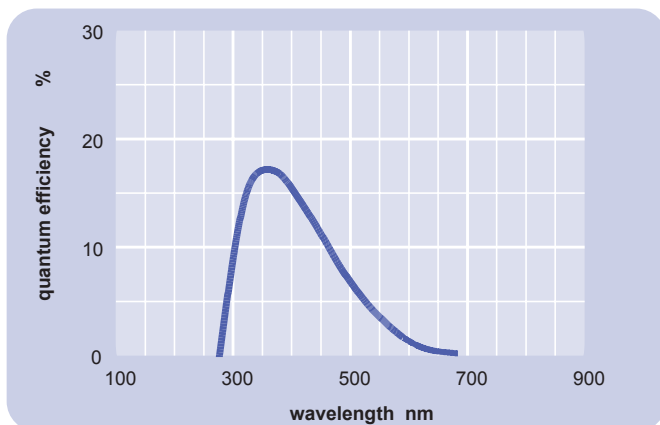
- rugged
- high temperature operation
- encapsulated in a mu-metal sleeve with an integral voltage divider

4 window characteristics

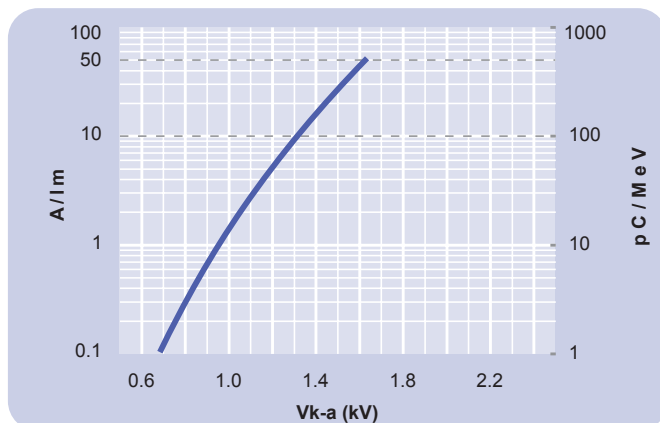
| | 9110V15 borosilicate |
|----------------------------|-------------------------|
| spectral range* (nm) | 280 - 630 |
| refractive index (n_d) | 1.49 |
| K (ppm) | 300 |
| Th (ppb) | 250 |
| U (ppb) | 100 |

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

5 typical spectral response curves



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 | $\mu\text{A}/\text{lm}$ | | 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)

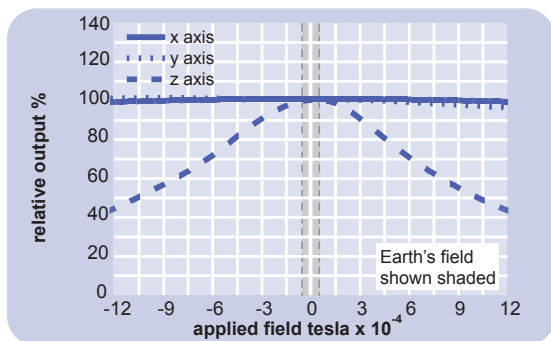
qualification shock & vibration levels (all 3 axes, non-operating)

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

microphony under random vibration (all 3 axes, operating)

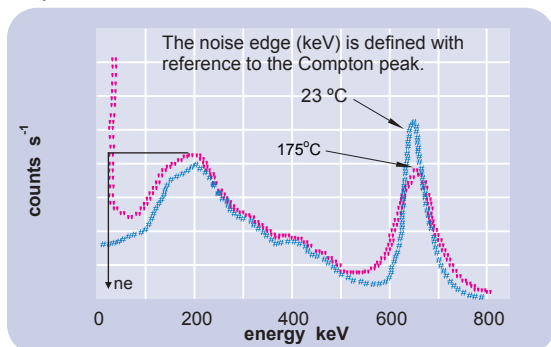
| | |
|---------------------------------------------------------------|------------------------------|
| random vibration: | |
| 20 to 100 Hz roll on | 6 dB/octave |
| 100 to 400 Hz | 0.103 g^2/Hz |
| 400 to 500 Hz roll off | 6 dB/octave |
| composite | 6.5 g rms |
| duration | 5 mins/axis |
| microphony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

8 magnetic field sensitivity



9 pulse height resolution with NaI(Tl) crystal

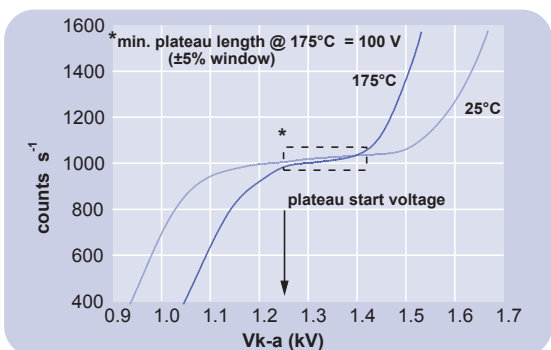
This pmt is tested for resolution at room temperature & at high temperature.



| 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 |

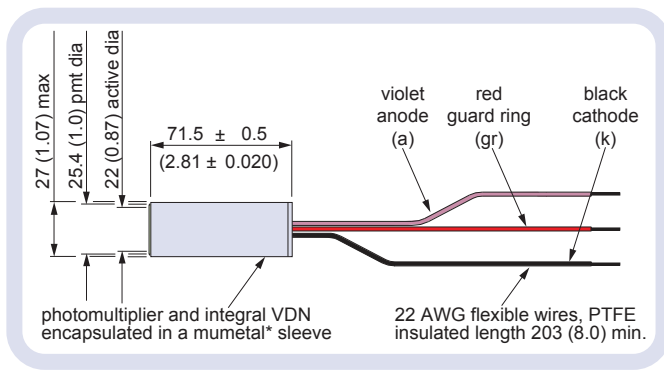
10 pulse counting with NaI(Tl) crystal

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

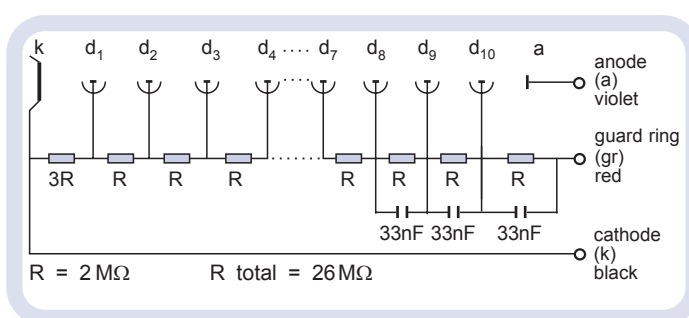


| plateau data | unit | min | 175°C typ | max |
|----------------------------------|------|-----|-----------|------|
| combined 25 °C / 175 °C: | | | | |
| plateau start (1.5 pC threshold) | V | | 1250 | 1500 |
| plateau length ±5 % | V | 100 | | |

11 external dimensions in mm (inches)



12 voltage divider distribution

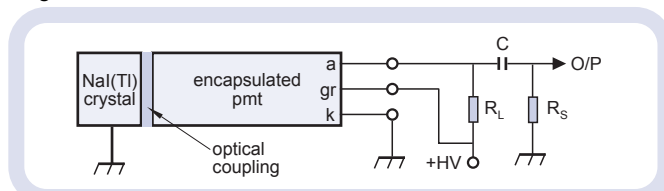


13 ordering information

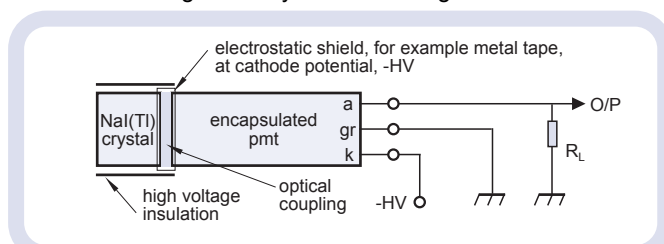
The 9110V15 meets the specification contained in this data sheet. For different specifications please then discuss your requirements with us. For customer specific requirements, **ET Enterprises** will change the 2 digit numeric suffix to indicate additional tests and selection.

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.

*mumetal is a registered trademark of Magnetic Shield Corporation

ET Enterprises Limited
45 Riverside Way
Uxbridge UB8 2YF
United Kingdom
tel: +44 (0) 1895 200880
fax: +44 (0) 1895 270873
e-mail: sales@et-enterprises.com
web site: www.et-enterprises.com

ADIT Electron Tubes
300 Crane Street
Sweetwater TX 79556 USA
tel: (325) 235 1418
toll free: (800) 399 4557
fax: (325) 235 2872
e-mail: sales@electron tubes.com
web site: www.electrontubes.com

choose accessories for this pmt on our website

an ISO 9001 and ISO 14001 registered company

The company reserves the right to modify these designs and specifications without notice. Developmental devices are intended for evaluation and no obligation is assumed for future manufacture. While every effort is made to ensure accuracy of published information the company cannot be held responsible for errors or consequences arising therefrom.

ET Enterprises
electron tubes

© ET Enterprises Ltd, 2018
DS_9110V15 Issue 7 (13/02/18)