



ELECTRONIC TUBE REFERENCE

18501

Specialized - Radiation Counter electronic tube

CONSOLIDATED TECHNICAL DATA

1 SECTION

CONSTRUCTION

GEIGERMULLERCOUNTER

Philips self-quenching Geiger-Müller counter for radiation measurement, with manufacturer specifications covering operating voltage, plateau behavior, background count, dead time, expected life, and detector construction.

GENERAL CHARACTERISTICS

BASE DESIGNATION	—	BASE PINS	—
NOMINAL HEATER	— / —	PARALLEL HEATER	— / —
HEATING	Indirect; cold cathode	SERIES OPERATION	Not specified
CATHODE ARRANGEMENT	Separate cathodes	SECTION CONSTRUCTION	Similar

SECTION RATINGS

SECTION 1 GeigerMullerCounter*No fixed ratings recorded.**Radiation-counter discharge tube.*

18501 — Non-Self-Quenching Radiation Counter Tube

The **18501** is a non-self-quenching Geiger-Müller radiation counter tube designed for the detection and measurement of beta, gamma, and neutron radiation. Utilizing an argon-hydrogen gas filling, this tube features a robust metal-glass construction with a chromium-iron cathode. Because it is a non-self-quenching design, the 18501 requires external quenching circuitry, such as a Neher-Harper configuration, to terminate the ionization discharge after each detection event.

Construction and Physical Dimensions

The 18501 is constructed as a cylindrical tube with a glass envelope housing a coaxial electrode structure. The cathode is composed of an alloy containing 28% chromium and 72% iron, with an inside diameter of 14.4 mm and an effective active length of 40 mm.

The physical envelope has a maximum overall length of 135 mm and an outer diameter ranging from 16 to 19 mm. Electrical connection to the anode is made via an M4 screw terminal located at the anode end (designated 'a'), while the cathode terminal is located at the opposite end (designated 'k'). The internal capacitance of the tube is exceptionally low, rated at 2 pF.

Operating and Plateau Characteristics

The electrical operation of the 18501 is defined by high-voltage parameters typical of argon-hydrogen filled Geiger-Müller tubes. The tube exhibits a starting voltage of 900 V and operates within a defined voltage range:

Parameter	Value
Minimum Operating Voltage	1000 V
Typical Operating Voltage	1050 V
Maximum Operating Voltage	1100 V
Plateau Beginning	950 V
Plateau Length	150 V
Maximum Plateau Slope	0.02% per V

The plateau region begins at 950 V and extends for 150 V, providing a stable operating range where the count rate remains highly independent of small fluctuations in the applied high voltage. The maximum slope of this plateau is extremely flat, restricted to 0.02% per volt.

Performance and Detection Capabilities

When properly shielded and operated within its specified voltage range, the 18501 exhibits high sensitivity and low background noise:

- **Cosmic Ray Efficiency:** The tube achieves a cosmic ray detection efficiency of 98.5%.
- **Background Count:** When shielded with 2 inches of lead (Pb) and 1/8 inch of aluminum (Al), the background count rate is limited to a maximum of 20 counts per minute.
- **Expected Life:** The tube is highly durable, with an expected operating life of 10^{10} counts.
- **Dead Time:** The inherent dead time of the tube is 75 μ s.

Applications and Circuit Integration

The 18501 is designed for measuring beta, gamma, and neutron radiation. For the detection of thermal neutrons, the tube must be wrapped in a cadmium foil of approximately 0.5 mm thickness.

Circuit Requirements

Because the argon-hydrogen fill gas does not provide self-quenching action, the tube must be operated with an external Neher-Harper quenching circuit. This circuit actively lowers the anode voltage below the starting potential immediately after an ionization event, allowing the tube to recover.

The output of the quenching circuit must be connected to an amplifier and scaler system characterized by:

- An input sensitivity of approximately 0.1 V.
- A resolving time of less than 5 μ s.

Mounting and Maintenance

To preserve the low internal capacitance (2 pF) and prevent parasitic circuit loading, low-capacity mounting is required, and all electrical connections must be kept as short as possible. Additionally, the tube must be kept dry and thoroughly cleaned to prevent surface leakage currents, which could otherwise degrade measurement accuracy or cause spurious counts.

Technical Summary

The **18501** is a cylindrical, non-self-quenching Geiger-Müller radiation counter tube filled with an argon-hydrogen gas mixture. Featuring a 28% chromium and 72% iron cathode with an inside diameter of 14.4 mm, it is optimized for measuring beta, gamma, and neutron radiation. Operating at a typical voltage of 1050 V, it features a 150 V plateau with a maximum slope of 0.02% per volt. Successful operation requires a Neher-Harper quenching circuit, short low-capacity connections, and clean, dry operating conditions to prevent leakage.

SOURCE OPERATING CONDITIONS

[SOURCE PDF](#)

1957 Philips Receiving and Amplifying Tubes

Published test conditions and operating points. Values on this page are preserved as reported by this source.

1957 PHILIPS RECEIVING AND AMPLIFYING TUBES

Section 1 · GeigerMullerCounter

CHARACTERISTICS		
PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
Starting Voltage	900 V	—
Operating Voltage	1050 V	—
Capacitance	2 pF	—
Plateau Length	150 V	—
Dead Time	75 us	—
Cosmic Ray Efficiency	98.5 percent	—

SOURCE OPERATING CONDITIONS

[SOURCE PDF](#)

1999 Philips 0-D

Published test conditions and operating points. Values on this page are preserved as reported by this source.

1999 PHILIPS 0-D

Section 1 · GeigerMullerCounter

CHARACTERISTICS		
PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
Capacitance	2 pF	Counter tube
Cosmic ray efficiency	98.5 %	Published counter efficiency

OTHER		
PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
Operating voltage minimum	1000 V	Geiger-Muller operation
Operating voltage maximum	1100 V	Geiger-Muller operation

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