



ELECTRONIC TUBE REFERENCE

18500

Specialized - Radiation Counter electronic tube

CONSOLIDATED TECHNICAL DATA

1 SECTION

CONSTRUCTION

GEIGERMULLERCOUNTER

Philips self-quenching Geiger-Müller radiation counter intended for ionizing-radiation measurement. Manufacturer data specify counting plateau, background, timing, life, and construction characteristics for laboratory instrumentation.

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.*

18500 — Non-Self-Quenching Geiger-Müller Radiation Counter Tube

The **18500** is a non-self-quenching, argon-hydrogen filled Geiger-Müller radiation counter tube. It is designed for the detection and measurement of ionizing radiation, including X-rays, gamma rays, and neutrons. Because it is a non-self-quenching design, it requires external circuitry to terminate the ionization discharge after each event.

Construction and Mechanical Specifications

The 18500 features a robust coaxial construction optimized for stable radiation detection. The cathode is fabricated from a specialized alloy consisting of 28% chromium and 72% iron.

Cathode and Physical Dimensions

- **Cathode Wall Thickness:** 250 mg/cm²
- **Cathode Inside Diameter:** 14.4 mm
- **Cathode Effective Length:** 40 mm
- **Main Body Length:** 47 mm
- **Overall Length:** Maximum 135 mm
- **Body Diameter:** 16 mm to 19 mm

Terminals and Mounting

Electrical connections to the tube are made via dedicated anode and cathode terminals:

- **Anode Connection:** An M4 threaded stud (screw) with a length of 15 ± 0.5 mm.
- **Cathode Connection:** A clip terminal with a width of 15 ± 0.5 mm, located 40 ± 0.5 mm from the non-anode end (with a cathode terminal length of 40 ± 0.5 mm).

To ensure proper operation and minimize parasitic effects, the tube requires a low-capacity mounting configuration utilizing short electrical connections. Additionally, the tube must be kept dry and thoroughly cleaned to prevent the formation of leakage currents across its surface.

Electrical and Operating Characteristics

The electrical behavior of the 18500 is characterized by a high operating voltage and a well-defined plateau region. The tube exhibits an internal electrical capacitance of 2 pF.

Voltage Parameters and Plateau

The tube begins to register counts at a starting voltage of 900 V. The plateau region, where the count rate remains relatively independent of the applied voltage, begins at 950 V and extends for a length of 150 V. Within this plateau, the slope is extremely flat, with a maximum change of 0.02% per Volt.

The recommended operating conditions are structured as follows:

- **Minimum Operating Voltage:** 1000 V
- **Recommended (Typical) Operating Voltage:** 1050 V
- **Maximum Operating Voltage:** 1100 V

Performance and Lifetime

When operated under specified quenching conditions, the tube has a dead time of 75 μ s. It exhibits high sensitivity and efficiency, with a documented cosmic ray efficiency of 98.5%. The expected operational

lifetime of the tube is 10^{10} counts.

When shielded with 2 inches of lead (Pb) and 1/8 inch of aluminum (Al), the background count rate is kept to a maximum of 20 counts per minute.

Circuit-Specific Operating Requirements

Because the 18500 is a non-self-quenching tube, it cannot terminate the gas discharge on its own. It must be operated in conjunction with an external quenching circuit. Specifically, a **Neher-Harper quenching circuit** must be utilized to quench the discharge and reset the tube for subsequent events.

The output of the tube and its quenching circuit must be connected to an external amplifier and scaler system. This processing system must meet the following minimum specifications:

- **Sensitivity:** Approximately 0.1 V
- **Resolving Time:** Less than 5 μ s (< 5 μ s)

Applications and Detection Methods

The 18500 is designed for the measurement of X-ray, gamma, and neutron radiation.

For the specific application of thermal neutron detection, the tube must be wrapped in a cadmium foil with a thickness of approximately 0.5 mm. The cadmium foil acts as a converter, interacting with thermal neutrons to produce secondary radiation that can be readily detected by the argon-hydrogen filled active volume of the tube.

Technical Summary

Parameter	Specification
Tube Type	Geiger-Müller counter tube (non-self-quenching)
Gas Filling	Argon-hydrogen
Cathode Composition	28% Cr, 72% Fe
Capacitance	2 pF
Starting Voltage	900 V
Operating Voltage Range	1000 V to 1100 V (1050 V typical)
Plateau Length	150 V (starting at 950 V)
Plateau Slope	Max. 0.02% per V
Dead Time	75 μ s
Cosmic Ray Efficiency	98.5%

Parameter	Specification
Expected Life	10 ¹⁰ counts
Required Quenching Circuit	Neher-Harper



SOURCE OPERATING CONDITIONS

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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	—



SOURCE OPERATING CONDITIONS

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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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