

ELECTRONIC TUBE REFERENCE

18513

Specialized - Radiation Counter electronic tube

CONSOLIDATED TECHNICAL DATA

1 SECTION

CONSTRUCTION

GEIGERMULLERCOUNTER

Self-quenching mica-window Geiger-Müller counter for alpha and beta particles and very-low-energy photons. Its thin window and high-rate design support sensitive counting of weakly penetrating radiation.

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

SECTION1 GeigerMullerCounter	
MAXIMUM PLATE VOLTAGE	575 V
Published ratings and characteristics promoted semantically from the approved Philips source.	

18513 — Self-Quenching Radiation Counter Tube

A self-quenching radiation counter tube featuring a thin mica window, designed for the detection of alpha and beta particles as well as low-energy photons.

Overview

The **18513** is a specialized, rare-gas-filled radiation counter tube designed for detecting alpha particles, beta particles, and low-energy photons. It is equipped with a thin mica window at one end to allow the entry of low-energy ionizing radiation. The tube is intended for use in laboratory, medical, and industrial tracer techniques, thickness measuring instruments, and general survey or laboratory instruments.

Construction and Physical Characteristics

The 18513 is constructed with a rare gas filling and a robust cathode wall. Its physical design is optimized for both protection and sensitivity:

- **Mica Window:** The tube features a circular mica window with a diameter of 6.35 mm and an effective area of 31.7 mm². The density of the mica window ranges from 1.6 to 2.1 mg/cm², which is uniform for each individual counter.
- **Cathode Wall:** The cathode wall has a thickness of 1 mm.
- **Enclosure and Accessories:** The tube is delivered inside a protective aluminium container that is electrically connected to the cathode. The tube can remain inside this container during testing or when measuring gamma radiation and high-energy particles. A V-groove is provided on the container, allowing it to be cut with a pen knife to remove the counter tube when necessary. A removable rubber cap is also provided to protect the delicate mica window when the tube is not being used to measure low-energy radiation.

Physical Dimensions and Weight

The physical specifications of the 18513 vary depending on whether the tube is operated alone or within its protective aluminium container:

Parameter	Tube Alone	In Container
Maximum Length	85.7 mm	110 mm
Maximum Diameter	14.2 mm	37 mm
Weight	18 g	70 g

Electrical Capacitance

The electrical capacitance of the device is also affected by the presence of the outer aluminium container:

- **Tube alone:** 1 pF
- **In container:** 5 pF

Operating Characteristics and Environmental Ratings

The 18513 operates as a Geiger-Müller style counter with the following electrical and operational parameters:

- **Threshold Voltage:** 575 V
- **Plateau Length:** 250 V (with a minimum limit of 150 V)
- **Plateau Slope:** Typically 0.06 %/V, with a maximum limit of 0.15 %/V (measured at 100 counts/sec)
- **Dead Time:** Ranges from 70 to 40 µs, depending on the applied working voltage
- **Counting Rate:** Maximum of 20,000 counts/sec

- **Background Noise:** Maximum of 6 counts/min when shielded with 1/4" of aluminium (Al) and 2" of lead (Pb)
- **Ambient Temperature Range:** -55 °C to +75 °C
- **Count Life Expectancy:** Minimum of 10^{10} counts

Detection Efficiency and Performance

The detection capabilities of the 18513 for different types of radiation are documented across different specifications, showing variations in sensitivity and window stopping power:

Radium Source Sensitivity (Gamma/Radium)

- **Specification A:** The tube exhibits a sensitivity of 1830 counts/min when exposed to a radium source of $2.39 \pm 1\%$ millicurie at 2.5 mR/hr (milli-röntgen per hour).
- **Specification B:** The sensitivity is listed as 7210 counts/min under the same exposure conditions ($2.39 \pm 1\%$ millicurie radium source at 2.5 mR/hr).

Particle Detection Thresholds

- **Beta Particles:**
 - Under one specification, beta particles are counted if they arrive at the window with an energy greater than 30 keV.
 - Under an alternative specification, they are counted if they arrive at the window with an energy greater than 50 keV.
- **Alpha Particles:**
 - Under one specification, the window stopping power is equivalent to 1.5 cm of air, and alpha particles are counted if they arrive at the window with an energy of approximately 2.5 MeV.
 - Under an alternative specification, the window stopping power is equivalent to 3 cm of air, and alpha particles are counted if they arrive at the window with an energy of approximately 5 MeV.

Circuit-Specific Operating Examples

To integrate the 18513 into radiation detection circuitry, typical operating configurations utilize the following component values:

Circuit Configuration 1

- **Cathode (k):** Connected to ground via a 2.7 MΩ resistor.
- **Anode (a):** Connected to the positive high-voltage supply via a 2.2 MΩ resistor.
- **Signal Coupling:** Coupled from the anode via a 300 pF capacitor to a 330 Ω grid resistor (grid stopper) of an amplifier tube.
- **Grid Leak Resistor:** 1 MΩ connected to ground.

Circuit Configuration 2

- **Cathode (k):** Connected in series with a 2.7 M Ω resistor.
- **Anode (a):** Connected to the positive high-voltage supply via a 2.7 M Ω resistor.
- **Signal Coupling:** Coupled via a 300 pF capacitor to the grid of an amplifier tube.
- **Grid Circuit:** Includes a 1 M Ω grid leak resistor to ground and a 330 Ω grid stopper resistor.

Technical Summary

The **18513** is a highly sensitive, self-quenching radiation counter tube featuring a 6.35 mm mica window and a rare gas filling. It is designed to detect alpha, beta, and gamma radiation across a wide temperature range of -55 °C to +75 °C, with an exceptional life expectancy of at least 10^{10} counts. With a threshold voltage of 575 V and a minimum plateau length of 150 V, the tube provides stable performance in laboratory, medical, and industrial applications. Its physical versatility is enhanced by a protective aluminium container and a detachable rubber cap, allowing it to be configured for either shielded high-energy measurements or open-window low-energy particle detection.

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

CHARACTERISTIC		
PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
Starting / Threshold Voltage Minimum	575 V	—
Plateau Length	250 V	—
Minimum Plateau Length	150 V	—
Plateau Slope Maximum	0.15 %/V	At published counting condition
Dead Time Maximum	70 us	—
Background Count Maximum	6 counts/min	Published shielding condition
Mica Window Area	31.7 mm ²	—
Count Life Expectancy Minimum	10000000000 counts	—

OTHER		
PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
Maximum Counting Rate	20000 counts/s	—
Maximum Ambient Temperature	75 C	—

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

CONSTRUCTION		
PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
Filling	Rare gas	—
Mica window diameter	6.35 mm	—
Mica window area	31.7 mm ²	—
Mica window areal density	1.6-2.1 mg/cm ²	—
Cathode wall thickness	1 mm	—

CAPACITANCE		
PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
Interelectrode capacitance	1 pF	—

CHARACTERISTICS		
PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
Threshold voltage	575 V	—
Plateau length	250 V	—
Plateau slope typical	0.06 %/V	At100CountsPerSecond
Plateau slope maximum	0.15 %/V	At100CountsPerSecond
Dead time minimum	40 usec	VoltageDependent
Dead time maximum	70 usec	VoltageDependent
Maximum counting rate	20000 counts/sec	—
Shielded background maximum	6 counts/min	1/4inAl;2inPb
Expected count life minimum	10000000000 counts	—