



ELECTRONIC TUBE REFERENCE

18515

Specialized - Radiation Counter electronic tube

CONSOLIDATED TECHNICAL DATA

1 SECTION

CONSTRUCTION

GEIGERMULLERCOUNTER

Low-background halogen-quenched Geiger-Müller beta counter designed for anticoincidence measurement systems, where surrounding guard detection suppresses background events and improves sensitivity to weak beta activity.

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

No fixed ratings recorded.

Gas-filled radiation-counter section; counter-specific electrical characteristics are retained in TUBE_SECTION_PARAMETER.

18515 — Low Background Beta Counter Tube

An end-window, halogen-quenched Geiger-Müller counter tube designed for low-level beta radiation measurements, typically operated in anti-coincidence configurations.

Overview

The **18515** is a specialized, halogen-quenched Geiger-Müller (GM) counter tube designed for high-sensitivity, low-background beta detection. It features a cylindrical geometry with a thin, frontal mica window that allows low-energy beta particles to enter the active volume. The tube is filled with a mixture

of neon (Ne) and argon (Ar) gases, along with a halogen quenching agent to ensure stable, long-term operation without quench gas depletion.

To achieve the extremely low background count rates required for low-level radiation measurements, the 18515 is designed to be operated within a heavy shield and in combination with a cosmic-ray guard counter, such as the **18517**, in an anti-coincidence circuit.

Mechanical and Construction

The mechanical design of the 18515 is optimized for low-level counting applications, utilizing materials with minimal radioactive contamination.

Mica Window Specifications

The tube features a thin, delicate frontal mica window to minimize the absorption of incoming beta radiation:

- **Effective Diameter:** 19.8 mm
- **Effective Area:** 3.1 cm²
- **Thickness:** 1.5 to 2.0 mg/cm²

Cathode Construction

The cathode is a robust cylindrical structure made from a chromium-iron alloy:

- **Material Composition:** 28% chromium, 72% iron
- **Wall Thickness:** 1.2 mm
- **Inside Diameter:** 19.8 mm
- **Effective Length:** 13 mm

Physical Dimensions and Weight

- **Outer Diameter:** 21.8 to 22.8 mm (with a window flange diameter of 25 to 26 mm)
- **Maximum Length:** 30 mm
- **Maximum Base Width:** 23.5 mm
- **Net Weight:** 15 g

Mounting and Installation

To prevent electrical leakage and maintain high insulation resistance, the tube must be kept strictly dry and clean. The physical installation requires:

- The shortest possible electrical connection between the anode and the anode resistor.
- Minimal stray capacitance between the anode connection and earth.

Electrical and Operating Characteristics

The interelectrode capacitance of the 18515 is extremely low, documented at 1.5 pF in earlier specifications and 1.0 pF in later revisions.

The tube's operating parameters at an ambient temperature (T_{amb}) of 25 °C vary depending on the selected anode resistor (R) and the specific operating limits defined across different production eras.

Operating Parameters Comparison

The tube can be operated with either a 10 M Ω or a 5 M Ω anode resistor. The table below outlines the operating characteristics under these different configurations:

Parameter	1960 Specifications ($R = 10\text{ M}\Omega$)	1961 Specifications ($R = 10\text{ M}\Omega$)	1961 Specifications ($R = 5\text{ M}\Omega$)
Starting Voltage (V_{ign})	max. 400 V	max. 350 V	max. 350 V
Recommended Operating Voltage (V_b)	575 V	600 V (arbitrary within plateau)	600 V (arbitrary within plateau)
Plateau Range	500 to 650 V	500 to 700 V	500 to 700 V
Maximum Plateau Slope	0.03 %/V	0.03 %/V	0.04 %/V
Maximum Dead Time (τ)	150 μs (at 575 V)	70 μs (at 600 V)	35 μs (at 600 V)
Max. Background (N_0)*	6.5 counts/min	5 counts/min	5 counts/min
Max. Anti-Coincidence Background (N_0)**	—	1.2 counts/min	1.2 counts/min

* Shielded with 10 cm of iron (Fe) and 5 cm of mercury (Hg), with the iron layer on the outside. ** Measured in anti-coincidence with a type [18517](#) guard counter under the same shielding conditions.

Absolute Maximum Ratings

To prevent damage and ensure stable operation, the 18515 must be operated within the following absolute limits:

- **Anode Voltage (V_b):**
 - Maximum 650 V (under 1960 specifications with $R = 10\text{ M}\Omega$)
 - Maximum 700 V (under 1961 specifications)

- **Anode Resistor (R):**
 - Minimum 5 M Ω (1960 specifications)
 - Minimum 2 M Ω (1961 specifications)
- **Ambient Temperature (T_{amb}):** -50°C to $+75^{\circ}\text{C}$

Recommended Circuitry

The recommended operating circuit utilizes a series anode resistor network connected to the high-voltage supply ($+V_b$). This network consists of a primary anode resistor R (ideally 10 M Ω) in series with a secondary resistor valued at $1/10R$ (i.e., 1 M Ω). The output pulse is extracted via a coupling capacitor connected directly to the junction between R and $1/10R$. This configuration helps maintain the low-capacitance environment required at the anode.

Performance Curves and Environmental Stability

- **Starting Voltage vs. Temperature:** The starting voltage (V_{ign}) exhibits excellent thermal stability. It remains virtually constant at approximately 320 V over a wide temperature range from -20°C to $+80^{\circ}\text{C}$. At extreme low temperatures down to -60°C , the starting voltage drops slightly to approximately 290 V.
- **Plateau Characteristics:** The counting rate response is remarkably flat across the plateau region. At a nominal radiation intensity yielding approximately 100 counts per second, the plateau remains stable from 500 V to 700 V for both 5 M Ω and 10 M Ω anode resistors.
- **Dead Time Behavior:** The dead time (τ) of the tube increases in a nearly linear fashion with the applied operating voltage (V_b). At the recommended operating voltage of 600 V, the dead time is approximately 60 μs when using a 10 M Ω anode resistor, and decreases to approximately 30 μs when using a 5 M Ω anode resistor.

Technical Summary

The **18515** is a specialized, halogen-quenched Geiger-Müller tube designed for high-sensitivity, low-background beta detection. Featuring a 19.8 mm effective diameter mica end-window and a chromium-iron cathode, it provides a stable plateau from 500 V to 700 V. When properly shielded and paired with an **18517** guard counter in an anti-coincidence circuit, the background count rate can be reduced to a maximum of 1.2 counts per minute. Its robust design ensures stable starting voltage characteristics across a wide temperature range of -50°C to $+75^{\circ}\text{C}$.

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	Neon, argon and halogen quenching agent	—

CAPACITANCE

PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
Interelectrode capacitance	1.5 pF	—

OTHER

PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
Anode resistor	10 Mohm	—
Operating voltage	575 V	—

CHARACTERISTICS

PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
Starting voltage maximum	400 V	—
Plateau minimum	500 V	—
Plateau maximum	650 V	—
Plateau slope maximum	0.03 %/V	—
Dead time maximum	150 usec	V _p =575V
Shielded background maximum	6.5 counts/min	10cmFe;5cmHg

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