



ELECTRONIC TUBE REFERENCE

18516

Specialized - Radiation Counter electronic tube

CONSOLIDATED TECHNICAL DATA

1 SECTION

CONSTRUCTION

GEIGERMULLERCOUNTER

Low-background halogen-quenched Geiger-Müller beta counter intended for use with an anticoincidence guard counter, enabling sensitive beta measurements with reduced cosmic-ray and environmental background.

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.

18516 — Low Background Beta Counter Tube

The **18516** is a halogen-quenched, end-window beta counter tube designed specifically for low-level radiation measurements. It is typically operated in combination with a cosmic-ray guard counter, such as the type [18518](#), to minimize background interference.

Construction and Physical Characteristics

The 18516 features a specialized construction optimized for detecting beta particles while maintaining low intrinsic background counts. The tube is filled with a mixture of neon, argon, and a halogen quenching agent.

Window and Cathode

The entry window is constructed from ferrochromium, with the following physical specifications:

- **Effective Diameter:** 27.8 mm
- **Effective Area:** 6.1 square centimeters
- **Thickness:** 10 mg/cm²

The cathode is composed of 28% chromium and 72% iron. Its physical dimensions are:

- **Wall Thickness:** 1.2 mm
- **Inside Diameter:** 27.8 mm
- **Effective Length:** 18 mm

Mechanical Dimensions and Capacitance

The physical envelope is compact, designed for integration into shielded counting assemblies.

- **Body Diameter:** 29.9 to 30.9 mm
- **Flange Diameter:** 33 to 34 mm
- **Maximum Body Height:** 22 mm
- **Maximum Overall Height:** 34 mm
- **Weight:** 27 g
- **Capacitance:** 1.3 pF

Electrical and Operating Characteristics

The electrical behavior of the 18516 is highly dependent on the selected anode resistance. Typical operating parameters are specified at an ambient temperature of 25°C under two distinct anode resistor configurations: 10 MΩ and 5 MΩ.

Parameter	Anode Resistor of 10 MΩ	Anode Resistor of 5 MΩ
Starting Voltage	max 375 V	max 375 V
Recommended Operating Voltage	600 V	600 V
Plateau Range	500 – 750 V	500 – 750 V
Maximum Plateau Slope	0.03 %/V	0.04 %/V
Maximum Dead Time (at 600 V)	70 microseconds	40 microseconds

The recommended operating voltage of 600 V is selected arbitrarily within the plateau, making it particularly suitable for anti-coincidence circuits.

Background Radiation Performance

When shielded with 10 cm of iron on the outside and 5 cm of mercury on the inside, the background count rates are extremely low:

- **Standard Operation:** Maximum of 9 counts per minute.
- **Anti-Coincidence Operation:** Maximum of 1.3 counts per minute when operated in an anti-coincidence circuit with a type [18518](#) guard counter.

Absolute Limiting Values

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

- **Maximum Operating Voltage:** 750 V
- **Minimum Anode Resistor:** 5 MΩ
- **Ambient Temperature Range:** -50°C to +75°C

Circuit Integration and Mounting Requirements

Proper circuit design and physical mounting are critical to achieving the low-noise performance for which the 18516 is designed.

Recommended Circuitry

The recommended circuit configuration utilizes a split anode resistor network consisting of Ra1 and Ra2, where the values are proportioned such that Ra2 is equal to 10% of Ra1 ($Ra2 = 0.1 * Ra1$). The output signal is coupled via a capacitor connected directly to the junction between Ra1 and Ra2.

Mounting and Maintenance

- **Anode Connections:** The physical connection between the anode pin and the anode resistor must be kept as short as possible.
- **Stray Capacitance:** The capacitance between the anode connection and earth must be minimized to prevent degradation of the pulse characteristics and dead time.
- **Environmental Maintenance:** The tube must be kept dry and thoroughly cleaned. This is essential to prevent leakage currents across the insulating surfaces, which could otherwise mimic radiation pulses or cause instability.

Performance Curves and Environmental Behavior

The operational characteristics of the 18516 exhibit specific trends across varying temperatures and voltages:

- **Starting Voltage vs. Temperature:** The starting voltage remains highly stable and flat at approximately 340 V across a wide temperature range from -20°C to +80°C. At lower temperatures, specifically down to -60°C, the starting voltage decreases to approximately 300 V.

- **Plateau Characteristics:** The tube exhibits a highly stable, flat plateau extending from 500 V to 850 V. This flat response is maintained for both the $R_a = 5 + 0.5 \text{ M}\Omega$ and $10 + 1 \text{ M}\Omega$ split-resistor configurations.
- **Dead Time vs. Voltage:** The dead time does not remain constant; it decreases non-linearly as the operating voltage is increased from 400 V up to 1000 V.

Technical Summary

The **18516** is a specialized halogen-quenched end-window beta counter tube designed for high-precision, low-background radiation detection. Featuring a ferrochromium window and a chromium-iron cathode, it provides a stable plateau from 500 V to 750 V with an extremely low plateau slope (0.03 %/V to 0.04 %/V depending on the anode resistance). When operated in an anti-coincidence configuration with a guard counter and appropriate shielding, its background count rate can be reduced to a maximum of 1.3 counts per minute. Safe and reliable operation requires a minimum anode resistance of 5 M Ω , minimal stray capacitance to earth, and strict adherence to cleanliness to prevent leakage currents.

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	1.3 pF	—

OTHER		
PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
Anode resistor	10 Mohm	—
Recommended anticoincidence operating voltage	600 V	—

CHARACTERISTICS		
PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
Starting voltage maximum	375 V	—
Plateau minimum	500 V	—
Plateau maximum	750 V	—
Plateau slope maximum	0.03 %/V	—
Dead time maximum	70 usec	Vp=600V
Shielded background maximum	9 counts/min	—
Anticoincidence background maximum	1.3 counts/min	WithGuardCounter

TUBE TINKER

An independent reference for electronic tubes, vacuum tubes, and their source documents.

