

ELECTRONIC TUBE REFERENCE

18511

Specialized - Radiation Counter electronic tube

CONSOLIDATED TECHNICAL DATA

1 SECTION

CONSTRUCTION

PROPORTIONALCOUNTER

Organic-quenched Philips proportional X-ray counter with a mica side window and xenon filling. Unlike the surrounding Geiger-Müller types, it operates proportionally so pulse amplitude retains information about deposited X-ray energy.

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 ProportionalCounter
No fixed ratings recorded.
Gas-filled radiation-counter section; counter-specific electrical characteristics are retained in TUBE_SECTION_PARAMETER.

18511 — Proportional X-Ray Counter Tube

Overview

The 18511 is an organic quenched proportional X-ray counter tube designed for radiation detection and measurement. It features a mica side window and is filled with xenon gas combined with an organic quenching agent. The tube is optimized for detecting low-energy radiation, such as Manganese (Mn) K-alpha radiation, and operates in the proportional region below its Geiger threshold.

Construction and Physical Dimensions

The 18511 is constructed with a cylindrical body and a specialized side window for radiation entry. The internal gas filling consists of xenon at a pressure of 25 cm Hg, mixed with an organic quenching agent to stabilize the discharge process.

The physical dimensions and window specifications are detailed below:

- **Overall Length:** 114 ± 3 mm
- **Maximum Diameter:** 27 mm at the body and ends, increasing to 27.5 mm at the window collar
- **Cathode Inside Diameter:** 21.5 mm
- **Effective Length:** 67 mm
- **Mica Window:**
 - **Thickness:** 2 to 2.5 mg/cm²
 - **Dimensions:** 7 mm × 18 mm
 - **Area:** 1.16 cm²

The tube has an anode-to-cathode capacitance of approximately 2 pF. To ensure reliable operation and prevent electrical leakage across the terminals, the tube must be kept dry and thoroughly cleaned.

Electrical and Operating Characteristics

The operating parameters of the 18511 are characterized at an ambient temperature of 25 °C using Manganese K-alpha radiation.

Voltage and Pulse Height

The tube operates within a high-voltage range, with the output pulse height depending directly on the applied anode voltage (V_b):

- **Operating Voltage (V_b):** 1500 V to 1850 V. To maximize the operating life of the tube, the anode voltage should be maintained as low as possible within this range.
- **Geiger Threshold (V_{b1}):** Greater than 1900 V. The tube must be operated below this threshold to remain in the proportional counting region.
- **Output Pulse Height (V_{op}):**
 - At $V_b = 1500$ V, the output pulse height is 1 mV.
 - At $V_b = 1850$ V, the output pulse height rises to 100 mV.

Resolution and Background Noise

- **Energy Resolution ($\Delta P/P$):** $\leq 22\%$, where P represents the average pulse height and ΔP is the width of the pulse height distribution at half of the maximum value (Full Width at Half Maximum, or FWHM).
- **Integrated Background:** When unshielded, the background count rate is approximately 15 counts per minute for pulses exceeding 50% of the average pulse height (P).

Absolute Maximum Ratings

Operating the tube outside its rated limits can cause permanent damage or severely degrade performance. The absolute limits for the 18511 are:

- **Maximum Anode Voltage (V_b):** 1850 V
- **Ambient Temperature Range (t_{amb}):** -50 °C to +75 °C

Circuit-Specific Operating Example

In a typical application circuit, the 18511 is integrated with an external amplifier stage to process the low-amplitude output pulses:

- The anode of the counter tube is coupled directly to the grid of an amplifier tube.
- A 0.1 M Ω resistor is placed in the grid/anode return path connected to the negative high-voltage supply ($-V_b$).
- The associated amplifier tube utilizes a 2.2 k Ω resistor in its anode circuit to develop the amplified signal.

Technical Summary

The **18511** is a proportional X-ray counter tube featuring a 1.16 cm² mica side window, a xenon-organic gas filling at 25 cm Hg, and an anode-to-cathode capacitance of 2 pF. It operates in the 1500 V to 1850 V range, producing output pulses from 1 mV to 100 mV under recommended circuit conditions. With an energy resolution of $\leq 22\%$ for Mn K-alpha radiation and a low unshielded background of 15 counts/min, it provides sensitive and resolved detection capabilities within an ambient temperature range of -50 °C to +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 · ProportionalCounter

CONSTRUCTION		
PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
Filling	Xenon with organic quenching agent	—
Mica window area	1.16 cm2	—

CAPACITANCE		
PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
Interelectrode capacitance	2 pF	—

OTHER		
PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
Operating voltage minimum	1500 V	—
Operating voltage maximum	1850 V	—
Absolute maximum operating voltage	1850 V	—

CHARACTERISTICS		
PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
Geiger threshold minimum	1900 V	—
Voltage for 1 mV mean pulse	1500 V	MnKaRadiation
Voltage for 100 mV mean pulse	1850 V	MnKaRadiation
Energy resolution	22 %	MnKaRadiation
Integrated unshielded background	15 counts/min	PulseHeight>50%Mean

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