

ELECTRONIC TUBE REFERENCE

152AVP

Specialized - Photo Tube electronic tube

CONSOLIDATED TECHNICAL DATA

1 SECTION

CONSTRUCTION

PHOTOEMISSIVE DETECTOR

Amperex ten-stage photomultiplier with at least a 14 mm useful photocathode diameter for sensitive light measurement.

GENERAL CHARACTERISTICS

BASE DESIGNATION	—	BASE PINS	—
NOMINAL HEATER	— / —	PARALLEL HEATER	— / —
HEATING	Indirect	SERIES OPERATION	Not specified
CATHODE ARRANGEMENT	Separate cathodes	SECTION CONSTRUCTION	Similar

SECTION RATINGS

SECTION 1 Photoemissive Detector	
MAXIMUM PLATE DISSIPATION	0.5 W
Amperex 10-stage photomultiplier tube with 14 mm minimum useful photocathode diameter.	

152AVP Photomultiplier Tube

The **152AVP** is a 10-stage photomultiplier tube designed for applications requiring high sensitivity and compact physical dimensions. It features a caesium-antimony semi-transparent flat photocathode and a rugged spherical dynode multiplier system. The tube is particularly suited for scintillation counting under limited dimensional constraints, such as in small medical probes, portable geological equipment, bore-hole logging probes, and optical measurements.

Construction and Physical Dimensions

The 152AVP is built with a head-on, flat-surface design. The photocathode is semi-transparent and composed of caesium-antimony (SbCs). The multiplier system consists of 10 stages utilizing silver-magnesium-oxygen-caesium (AgMgOCs) dynodes. Its rugged spherical dynode construction provides

mechanical stability, making the tube suitable for demanding environments such as geophysical and astronomical missile experiments.

The physical dimensions of the tube are highly compact:

- **Maximum tube diameter:** 19 mm
- **Minimum useful photocathode diameter:** 14 mm
- **Seated body length:** 88 ± 3 mm
- **Overall length (including pins):** 97 ± 1 mm

The tube is supplied with a specialized 12-pin socket. The pin connections for the socket are arranged as follows:

- **Pin 1:** Dynode 1 (S_1)
- **Pin 2:** Dynode 3 (S_3)
- **Pin 3:** Dynode 5 (S_5)
- **Pin 4:** Dynode 7 (S_7)
- **Pin 5:** Dynode 9 (S_9)
- **Pin 6:** Anode (a)
- **Pin 7:** Dynode 10 (S_{10})
- **Pin 8:** Dynode 8 (S_8)
- **Pin 9:** Dynode 6 (S_6)
- **Pin 10:** Dynode 4 (S_4)
- **Pin 11:** Dynode 2 (S_2)
- **Pin 12:** Cathode (k)

Electrical and Optical Characteristics

The 152AVP operates primarily in the visible spectrum, with its spectral response characteristics and sensitivities defined under specific operating conditions:

- **Spectral Response Range:** Lying mainly in the visible region, with a maximum response wavelength of 4200 ± 300 Å.
- **Photocathode Luminous Sensitivity:** Typically 40 $\mu\text{A/lm}$ (average) and 25 $\mu\text{A/lm}$ (minimum), measured using a tungsten ribbon lamp at a color temperature of 2850 K.
- **Photocathode Radiant Sensitivity:** Typically 30 mA/W at a wavelength of 4200 Å.
- **Cathode Dark Current:** Approximately 10^{-15} A/cm² at room temperature.
- **Anode Sensitivity:** At an overall supply voltage of 1800 V, the average anode sensitivity is 150 A/lm, with a minimum limit of 30 A/lm.
- **Anode Dark Current:** Less than 0.1 μA (100 nA) when operating at an anode sensitivity of 30 A/lm.
- **Total Gain:** Approximately 3.5×10^6 to 5×10^6 at an overall voltage of 1800 V.
- **Interelectrode Capacitances:**
 - Between anode and final dynode ($C_{a-S_{10}}$): 1.5 pF
 - Between anode and all other electrodes (C_a): 2.5 pF

Voltage Distribution and Operating Configurations

The tube can be operated using different voltage-divider configurations depending on the application requirements. Two standard voltage distribution types, Type A and Type B, are defined:

Voltage Distribution Between Electrodes	Type A	Type B
Cathode (PK) and Dynode 1 (D_1)	$1.5 V_0$	$2 V_0$
Dynode 1 (D_1) and Dynode 2 (D_2)	V_0	V_0
Dynode 2 (D_2) and Dynode 3 (D_3)	V_0	V_0
Consecutive Dynodes (D_{n-3} to D_{n-4})	V_0	V_0
Dynode 7 (D_7) and Dynode 8 (D_8)	V_0	$1.25 V_0$
Dynode 8 (D_8) and Dynode 9 (D_9)	V_0	$1.5 V_0$
Dynode 9 (D_9) and Dynode 10 (D_{10})	V_0	$1.75 V_0$
Dynode 10 (D_{10}) and Anode (a)	$0.75 V_0$	$2 V_0$

Note: $n = 10$ represents the final dynode stage for the 152AVP.

Comparison of Divider Types

- **Type A Divider:** Designed to provide the highest overall gain for a given total voltage. Under Type A, the linearity between the anode pulse amplitude and the input-light flux is maintained up to 5 mA.
- **Type B Divider:** Configured to deliver higher currents in the final stages of the multiplier system. While the total gain is lower than Type A at the same overall voltage, the linearity is extended up to 10 mA.

When operating at low supply voltages, specific minimum voltage thresholds must be maintained to ensure proper operation:

- The voltage between the photocathode and Dynode 1 must never fall below 180 V.
- The voltage between any other consecutive electrodes must never drop below 80 V.

Limiting Values and Operational Guidelines

To prevent damage and ensure stable operation, the following maximum and minimum limits must be strictly observed:

- **Maximum Total Voltage (V_b):** 2000 V
- **Maximum Continuous Anode Current (I_a):** 1 mA (to avoid overloading the tube)
- **Maximum Anode Dissipation (W_a):** 0.5 W
- **Voltage between Cathode and First Dynode (V_{k-S1}):** Minimum 120 V, Maximum 300 V
- **Voltage between Consecutive Dynodes ($V_{S_n-S_{n+1}}$):** Minimum 80 V, Maximum 200 V
- **Voltage between Dynode 10 and Anode (V_{a-S10}):** Minimum 80 V, Maximum 200 V

Practical Operational Considerations

1. **Stability:** To maintain a gain stability of approximately 1%, the current flowing through the voltage-divider bridge should be approximately 100 times greater than the current through the heaviest loaded stage of the tube. For moderate radiation intensities, a bridge current of approximately 0.5 mA is sufficient.
2. **Pulse Decoupling:** When extracting high-amplitude pulses from the anode, it is recommended to decouple the last stages of the divider using capacitors of a few hundred pF. This prevents transient voltage drops between these stages.
3. **Daylight Exposure:** If the tube is exposed to full daylight prior to mounting, it will exhibit a temporarily elevated dark current. The dark current will return to its normal specified level after several hours of operation in darkness.
4. **Anode Voltage Calculation:** When calculating the actual anode voltage, the voltage drop across the external load resistance (R_L) must be factored into the calculation.

Technical Summary

The **152AVP** is a highly compact, 10-stage photomultiplier tube featuring a 14 mm useful diameter caesium-antimony flat photocathode and a rugged spherical silver-magnesium-oxygen-caesium dynode structure. Operating with a maximum spectral response at 4200 Å, it provides an average photocathode sensitivity of 40 $\mu\text{A}/\text{lm}$ and a total gain of up to 5×10^6 at 1800 V. Designed for space-constrained and rugged applications, it supports flexible voltage-divider configurations (Type A and Type B) to optimize either overall gain or pulse linearity up to 10 mA, while requiring careful adherence to its 2000 V maximum voltage and 1 mA continuous anode current limits.

SOURCE OPERATING CONDITIONS

[SOURCE PDF](#)

1963 Amperex Condensed

Published test conditions and operating points. Values on this page are preserved as reported by this source.

1963 AMPEREX CONDENSED

Section 1 · PhotoemissiveDetector

OTHER		
PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
Minimum useful photocathode diameter	14 mm	—
Number of stages	10 count	—
Recommended supply voltage	1800 V	—
Maximum anode dissipation	0.5 W	—

CHARACTERISTIC		
PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
Maximum spectral response wavelength	4200 angstrom	—
Minimum photocathode sensitivity	25 uA/lm	—
Average photocathode sensitivity	40 uA/lm	—
Minimum anode sensitivity	30 A/lm	—
Minimum gain at 1800 V	500000	Source gives 5×10^5
Average anode sensitivity	150 A/lm	—
Maximum direct dark current	100 nA	—

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 · PhotoemissiveDetector

CONSTRUCTION		
PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
Multiplier stages	10	—
Useful photocathode diameter	14 mm	—

CHARACTERISTICS		
PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
Wavelength at maximum response	4200 angstrom	—
Typical anode sensitivity	50 A/lm	—
Maximum anode dark current	0.000005 mA	—
Linear-response anode pulse current	5 mA	VoltageDividerTypeA
Linear-response anode pulse current	10 mA	VoltageDividerTypeB
Typical photocathode sensitivity	40 uA/lm	—
Minimum photocathode sensitivity	25 uA/lm	—

OTHER		
PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
Maximum total voltage	2000 V	—
Maximum continuous anode current	1 mA	—
Maximum anode dissipation	0.5 W	—

CAPACITANCE		
PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
Anode-to-final-dynode capacitance	5 pF	—

PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
Anode-to-all-other-electrodes capacitance	12 pF	—