Multiplier Phototube

10-STAGE, HEAD-ON, FLAT-FACEPLATE

ELECTROSTATICALLY FOCUSED DYNODE STAGES

For Detection and Measurement of Nuclear Radiation and other Low-Level Light Sources in Scintillation Counters

DATA

General:
Spectral Response.......................... S-11
Wavelength of Maximum Response.......... 4400 ± 500 angstroms
Cathode, Semitransparent.................. Cesium-Antimony
Shape.......................................... Curved, Circular
Minimum area................................. 2.2 sq. in.
Minimum diameter......................... 1.68 in.
Window........................................ Lime Glass (Corning® No. 0080), or equivalent

Index of refraction.......................... 1.51
Dyne Material.................................. Copper-Beryllium
Direct interelectrode Capacitances (Approx.):
  Anode to dynode No.10...................... 4.4 pf
  Anode to all other electrodes............. 7.0 pf
Maximum Overall Length.................... 5.81"
Seated Length.................................. 4.87" ± 0.19"
Maximum Diameter......................... 2.31"
Operating Position......................... Any
Weight (Approx.).............................. 5.2 oz
Bulb............................................ 1.16
Socket......................................... Loranger® No. 2274, or equivalent
Magnetic Shield.............................. Millen® No. 80802B, or equivalent
Base............................................ Medium-Shell Dihedral 14-Pin,
                                        (JEDEC Group 5, No. B14-38), Non-hygrosopic
Basing Designation for BOTTOM VIEW........ 14AA

Pin 1 – Dynode No.1
Pin 2 – Dynode No.2
Pin 3 – Dynode No.3
Pin 4 – Dynode No.4
Pin 5 – Dynode No.5
Pin 6 – Dynode No.6
Pin 7 – Dynode No.7
Pin 8 – Dynode No.8
Pin 9 – Dynode No.9
Pin 10 – Dynode No.10
Pin 11 – Anode
Pin 12 – Do Not Use
Pin 13 – Focusing Electrode
Pin 14 – Photocathode

RCA
RADIO CORPORATION OF AMERICA
Electronic Components and Devices
Harrison, N. J.

DATA 1

6–66
Maximum Ratings, Absolute-Maximum Values

SUPPLY VOLTAGE BETWEEN ANODE AND
CATHODE (DC or Peak AC) ................ 1500 max. volts
SUPPLY VOLTAGE BETWEEN DYNOGE No.10
AND ANODE (DC or Peak AC) ............. 250 max. volts
SUPPLY VOLTAGE BETWEEN DYNOGE No.1
AND CATHODE (DC or Peak AC) ........... 400 max. volts
SUPPLY VOLTAGE BETWEEN FOCUSING
ELECTRODE AND CATHODE
(AC or Peak AC) ........................... 400 max. volts
AVERAGE ANODE CURRENT .......... 2 max. ma
AMBIENT TEMPERATURE ................ 75 max. °C

- Characteristics Range Values:

Under conditions with dc supply voltage (E) across a voltage divider providing 1/6 of E between cathode and dynode No.1; 1/12 of E for each succeeding dynode stage; and 1/12 of E between dynode No.10 and anode. Focusing-electrode voltage is adjusted to that value between 10 and 60 per cent of dynode No.1 potential (referred to cathode) which provides maximum anode current.

With $E = 1250$ volts (Except as noted)

<table>
<thead>
<tr>
<th>Min.</th>
<th>Typical</th>
<th>Max.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sensitivity:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Radiant, at</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4400 angstroms</td>
<td>$2.5 \times 10^4$</td>
<td>a/w</td>
</tr>
<tr>
<td>Cathode radiant at</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4400 angstroms</td>
<td>0.064</td>
<td>a/w</td>
</tr>
<tr>
<td>Luminous:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>At 0 cps</td>
<td>15</td>
<td>31</td>
</tr>
<tr>
<td>With dynode No.10 as output electrode</td>
<td>22</td>
<td>a/lm</td>
</tr>
<tr>
<td>Cathode Luminous:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>With tungsten light source</td>
<td>$5 \times 10^{-5}$</td>
<td>$8 \times 10^{-5}$</td>
</tr>
<tr>
<td>With blue light source</td>
<td>$5 \times 10^{-8}$</td>
<td>a</td>
</tr>
<tr>
<td>Current Amplification</td>
<td>$3.9 \times 10^5$</td>
<td></td>
</tr>
<tr>
<td>Equivalent Anode-Dark-Current Input</td>
<td>$2 \times 10^{-10}$</td>
<td>$2 \times 10^{-9}$</td>
</tr>
<tr>
<td></td>
<td>$2.5 \times 10^{-13}$</td>
<td>$2.5 \times 10^{-12}$</td>
</tr>
<tr>
<td>Equivalent Noise Input</td>
<td>$7 \times 10^{-12}$</td>
<td>$1.7 \times 10^{-11}$</td>
</tr>
<tr>
<td></td>
<td>$8.7 \times 10^{-15}$</td>
<td>$2.1 \times 10^{-14}$</td>
</tr>
<tr>
<td>Anode-Pulse Rise Time</td>
<td>$3 \times 10^{-9}$</td>
<td>sec</td>
</tr>
</tbody>
</table>

- Indicates a change.

RADIO CORPORATION OF AMERICA
Electronic Components and Devices Harrison, N. J.
Min. Typical Max.
1-1/8" . . . . . . . . . . . . . . . . 1.3 x 10⁻⁹ sec
1-9/16" . . . . . . . . . . . . . . . . 4 x 10⁻⁹ sec

- Made by Corning Glass Works, Corning, New York.
- Made by James Millen Manufacturing Company, 150 Exchange Street, Waiden, Massachusetts.
- Averaged over any interval of 30 seconds maximum.
- Under the following conditions: The light source is a tungsten-filament lamp having a lime-glass envelope. It is operated at a color temperature of 2870°K and a light input of 10 micromoiems is used.
- An output current of opposite polarity to that obtained at the anode may be provided by using dynode No.10 as the output electrode. With this arrangement, the load is connected in the dynode No.10 circuit and the anode serves only as a collector. The curves under Typical Anode Characteristics do not apply when dynode No.10 is used as the output electrode.
- Under the following conditions: The light source is a tungsten-filament lamp having a lime-glass envelope. It is operated at a color temperature of 2870°K. The value of light flux is 0.01 lumen and 200 volts are applied between cathode and all other electrodes connected as anode.
- Under the following conditions: Light incident on the cathode is transmitted through a blue filter (Corning C.S. No.3-5B, Glass Code No.5153 polished to 1/2 stock thickness—Manufactured by the Corning Glass Works, Corning, New York), from a tungsten-filament lamp operated at a color temperature of 2870°K. The value of light flux incident on the filter is 0.01 lumen and 200 volts are applied between cathode and all other electrodes connected as anode.

For maximum signal-to-noise ratio, operation with a supply voltage (E) below 1250 volts is recommended.

- Measured at a tube temperature of 25°C and with a supply voltage (E) adjusted to give a luminous sensitivity of 20 amperes per lumen. Dark current may be reduced by use of a refrigerant.

- Determined at 4400 angstroms.

- Determined under the same conditions shown under (p) except that use is made of a monochromatic source having radiation at 4400 angstroms.

- Measured between 10 per cent and 90 per cent of maximum anode-pulse height. This anode-pulse rise time is primarily a function of transit-time variations in the multiplier stages and is measured under conditions with an incident-light spot approximately 1 millimeter in diameter centered on the photocathode.

- These values also represent the difference in time of transit between the photocathode and dynode No.1 for electrons simultaneously released from the center and from the periphery of the specified areas.

- See Spectral Characteristic of 2870°K Light Source and Spectral Characteristic of Light from 2870°K Source after Passing through Indicated Blue Filter at front of this Section.

SPECTRAL-SENSITIVITY CHARACTERISTIC OF PHOTOSENSITIVE DEVICE HAVING S-11 RESPONSE is shown at the front of this Section.
FACEPLATE (SEE NOTE)

PHOTOCATHODE

BASE
JEDEC GROUP 5,
NO. BI4-38

2.00 ± 0.06
DIA.

1.68 MIN.
DIA.

4.87 ± 0.19

5.81 MAX.

T BULB

2.31 MAX.
DIA.

92CS-8109R6

ALL DIMENSIONS IN INCHES

CENTER LINE OF BULB WILL NOT DEVIATE MORE THAN 2° IN ANY DIRECTION FROM THE PERPENDICULAR ERECTED AT THE CENTER OF BOTTOM OF THE BASE.

NOTE: WITHIN 1.68" DIAMETER, DEVIATION FROM FLATNESS OF EXTERNAL SURFACE OF FACEPLATE WILL NOT EXCEED 0.010" FROM PEAK TO VALLEY.
TYPICAL ANODE CHARACTERISTICS

Dynode No. 1 → Cathode Volts = 208
Each succeeding dynode stage volts = 104
Light source is a tungsten filament lamp operated at color temperature of 2870°K.

RADIO CORPORATION OF AMERICA
Electronic Components and Devices
Harrison, N. J.

DATA 3
6-66
Characteristics

Supply voltage (E) across voltage divider providing 1/6 of E between cathode and dynode No. 1; 1/12 of E for each succeeding dynode stage; and 1/12 of E between dynode No. 10 and anode. Focusing—Electrode voltage adjusted to give maximum anode current.

Sensitivity — Amperes/Lumen (color temperature 2870° K)

Supply Volts (E) between anode and cathode

Typical Amplification

Maximum Sensitivity

Typical Sensitivity

Minimum Sensitivity

92CM-0125R5

Radio Corporation of America
Electronic Components and Devices
Harrison, N. J.
TYPICAL ANODE-DARK-CURRENT CHARACTERISTIC

LUMINOUS SENSITIVITY IS VARIED BY ADJUSTMENT OF THE SUPPLY VOLTAGE (E) ACROSS VOLTAGE DIVIDER WHICH PROVIDES $\frac{1}{6}$ OF E BETWEEN CATHODE AND DYNODE N=1; $\frac{1}{12}$ OF E FOR EACH SUCCEEDING STAGE; AND $\frac{1}{12}$ OF E BETWEEN DYNODE N=10 AND ANODE. FOCUSING-ELECTRODE VOLTAGE ADJUSTED TO GIVE MAXIMUM ANODE CURRENT.

LIGHT SOURCE IS A TUNGSTEN-FILAMENT LAMP OPERATED AT A COLOR TEMPERATURE OF 2870° K. DASHED PORTION INDICATES INSTABILITY.

TUBE TEMPERATURE=25° C

EQUIVALENT ANODE-DARK-CURRENT INPUT—LUMENS

LUMINOUS SENSIVITY—AMPERES/LUMEN

92CS-8124RI

RADIO CORPORATION OF AMERICA

Electron Tube Division

Harrison, N. J.