7264

MULTIPLIER PHOTOTUBE

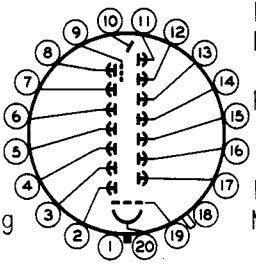
14-STAGE, HEAD-ON, SPHERICAL-FACEPLATE TYPE WITH 1.68"-DIA., SPHERICAL, SEMITRANSPARENT PHOTOCATHODE AND S-11 RESPONSE VERY SHORT TIME-RESOLUTION CAPABILITY

DATA

General:

Spectral Response		S-11
Wavelength of Maximum Response	4400 ± 500	angstroms
Cathode, Semitransparent:		
Shape		Spherical
Window:		
Area	2.2	sq. in.
Minimum diameter	1.68	in.
Index of refraction	1.51	
Direct Interelectrode Capacitances (Approx.):		
Anode to dynode No.14	2.4	μμf
Anode to all other electrodes	5.5	μμf
Dynode No.14 to all other electrodes	7.5	μμf
Maximum Overall Length		7.5"
Seated Length		6.69" ± 0.19"
Maximum Diameter		2.38"
Operating Position		Any
Weight (Approx.)		8 oz
Bulb		T16
Socket	Alden No.220FT with 20 contacts, or equivalent	
Base	Small-Shell Bidecal 20-Pin (JETEC No.B20-102)	
Basing Designation for BOTTOM VIEW		20D

Pin 1 - No Connection
Pin 2 - Dynode No.1
Pin 3 - Dynode No.3
Pin 4 - Dynode No.5
Pin 5 - Dynode No.7
Pin 6 - Dynode No.9
Pin 7 - Dynode No.11
Pin 8 - Dynode No.13
Pin 9 - Grid No.2 (Accelerating Electrode)
Pin 10 - Anode
Pin 11 - Dynode No.14
Pin 12 - Dynode No.12
Pin 13 - Dynode No.10



Pin 14 - Dynode No.8
Pin 15 - Dynode No.6
Pin 16 - Dynode No.4
Pin 17 - Dynode No.2
Pin 18 - No Connection
Pin 19 - Grid No.1 (Focusing Electrode)
Pin 20 - Photocathode
Metal Collar - No Connection (If used, connect only to photocathode)

ELECTRON TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

7264

7264

MULTIPLIER PHOTOTUBE

VERY-LOW-LIGHT-LEVEL, LOW-NOISE, HIGH-GAIN SERVICE

With supply voltage (E) across voltage divider providing electrode voltages shown in Table I—Column A

Maximum Ratings, *Absolute Values:*

SUPPLY VOLTAGE BETWEEN ANODE AND CATHODE (DC)	2400 max.	volts
SUPPLY VOLTAGE BETWEEN DYNODE No.14 AND ANODE (DC)	400 max.	volts
SUPPLY VOLTAGE BETWEEN CONSECUTIVE DYNODES (DC)	500 max.	volts
SUPPLY VOLTAGE BETWEEN ACCELERATING ELECTRODE AND DYNODE No.13 (DC)	±500 max.	volts
DYNODE-No.1 SUPPLY VOLTAGE (DC)	400 max.	volts
FOCUSING-ELECTRODE SUPPLY VOLTAGE (DC)	400 max.	volts
AVERAGE ANODE CURRENT●	2 max.	ma
AMBIENT TEMPERATURE	75 max.	°C

Characteristics Range Values for Equipment Design:

With E = 2000 volts (except as noted) and focusing-electrode as well as accelerating-electrode voltage adjusted to give maximum gain

	Min.	*Median*	*Max.*	
Sensitivity:				
Radiant, at 4400 angstroms	–	0.7	–	amp/μw
Cathode radiant, at 4400 angstroms	–	0.056	–	μa/μw
Luminous:#				
At 0 cps	120	875	4500	amp/lumen
With dynode No.14 as output electrode†	–	612	–	amp/lumen
Cathode luminous:				
With tungsten light source▲	50	70	–	μa/lumen
With blue light source**♦	0.05	–	–	μa
Current Amplification	–	12.5×10^6	–	
Equivalent Anode-Dark-Current Input⊕■	–	5×10^{-10}	2×10^{-9}	lumen
Equivalent Noise Input:★				
At +25° C	–	3.3×10^{-12}	1.5×10^{-11}	lumen
At −50° C	–	9×10^{-13}	–	lumen
Anode-Pulse Rise Time□	–	3	–	milliμsec

●, #, †, ▲, **, ♦, ⊕, ■, ★, □: See next page.

7264

MULTIPLIER PHOTOTUBE

	Min.	Median	Max.	
Greatest Delay Between Anode Pulses: Due to position from which electrons are simultaneously released within a circle centered on tube face and having a diameter of—				
1.12"	–	0.5‡	–	milliμsec
1.5"	–	1‡	–	milliμsec

HIGH-OUTPUT-PULSE SERVICE

With supply voltage (E) across voltage divider providing electrode voltages shown in Table I—Column B

Maximum Ratings, *Absolute Values:*

SUPPLY VOLTAGE BETWEEN ANODE AND CATHODE (DC)	2800 max.	volts
SUPPLY VOLTAGE BETWEEN DYNODE No.14 AND ANODE (DC)	400 max.	volts
SUPPLY VOLTAGE BETWEEN CONSECUTIVE DYNODES (DC)	500 max.	volts
SUPPLY VOLTAGE BETWEEN ACCELERATING ELECTRODE AND DYNODE No.13 (DC)	±500 max.	volts
DYNODE-No.1 SUPPLY VOLTAGE (DC)	400 max.	volts
FOCUSING-ELECTRODE SUPPLY VOLTAGE (DC)	400 max.	volts
AVERAGE ANODE CURRENT●	2 max.	ma
AMBIENT TEMPERATURE	75 max.	°C

Characteristics Range Values for Equipment Design:

With E = 2400 volts (except as noted) and focusing-electrode as well as accelerating-electrode voltage adjusted to give maximum gain

	Min.	Median	Max.	
Sensitivity:				
Radiant, at 4400 angstroms	–	0.7	–	amp/μw
Cathode radiant, at 4400 angstroms	–	0.056	–	μa/μw
Luminous:#				
At 0 cps	–	875	–	amp/lumen
With dynode No.14 as output electrode†	–	612	–	amp/lumen
Cathode luminous:				
With tungsten light source▲	50	70	–	μa/lumen
With blue light source**◆	0.05	–	–	μa

●, #, †, ▲, **, ◆, ⊕, ■, ★, □, ‡: See next page.

ELECTRON TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

7264

MULTIPLIER PHOTOTUBE

	Min.	Median	Max.	
Current Amplification. . .	–	12.5×10^6	–	
Equivalent Anode-Dark-Current Input●⊕.	–	1.1×10^{-9}	–	lumen
Equivalent Noise Input:★★				
At +25° C.	–	4.6×10^{-12}	–	lumen
At −50° C.	–	1.2×10^{-12}	–	lumen

● Averaged over any interval of 30 seconds maximum.

\# Under the following conditions: The light source is a tungsten-filament lamp operated at a color temperature of 2870° K. A light input of 0.1 microlumen is used. The load resistor has a value of 0.01 megohm.

† An output current of opposite polarity to that obtained at the anode may be provided by using dynode No.14 as the output electrode. With this arrangement, the load is connected in the dynode-No.14 circuit and the anode serves only as collector.

▲ Under the following conditions: The light source is a tungsten-filament lamp 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 together as anode. The load resistor has a value of 0.01 megohm.

** Under the following conditions: Light incident on the cathode is transmitted through a blue filter (Corning, Glass Code No.5113 polished to 1/2 stock thickness) from a tungsten-filament lamp operated at a color temperature of 2870° K. The value of light flux on the filter is 0.01 lumen. The load resistor has a value of 0.01 megohm, and 200 volts are applied between cathode and all other electrodes connected together as anode.

♦ For spectral characteristic of this source, see sheet 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.

⊕ Measured at a tube temperature of 25° C and with the supply voltage (E) adjusted to give a luminous sensitivity of 2000 amperes per lumen. Dark current caused by thermionic emission may be reduced by the use of a refrigerant.

■ For maximum signal-to-noise ratio, operation with a supply voltage (E) below 2000 volts is recommended.

★ Under the following conditions: Supply voltage (E) is 2000 volts, 25°-C tube temperature, external-shield potential of −2000 volts, ac-amplifier bandwidth of 1 cycle per second, tungsten light source of 2870° K interrupted at a low audio frequency to produce incident radiation pulses alternating between zero and the value stated. The "on" period of the pulse is equal to the "off" period. The output current is measured through a filter which passes only the fundamental frequency of the pulses.

□ Measured between 10 per cent and 90 per cent of maximum anode-pulse height. This anode-pulse rise time is determined primarily by transit-time variations in the multiplier stages and 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.

⊕ For maximum signal-to-noise ratio, operation with a supply voltage (E) below 2300 volts is recommended.

★★ Same as (★) except the supply voltage (E) is 2400 volts, and the external-shield potential is −2400 volts.

7264

MULTIPLIER PHOTOTUBE

TABLE I

VOLTAGE TO BE PROVIDED BY DIVIDER

Between	COLUMN A 5.4% of Supply Voltage (E) multiplied by	COLUMN B 2.75% of Supply Voltage (E) multiplied by
Cathode and Focusing Electrode	♣	♣
Cathode and Dynode No.1	2	2
Dynode No.1 and Dynode No.2	1	1
Dynode No.2 and Dynode No.3	1	1
Dynode No.3 and Dynode No.4	1	1
Dynode No.4 and Dynode No.5	1	1
Dynode No.5 and Dynode No.6	1	1
Dynode No.6 and Dynode No.7	1	1.2
Dynode No.7 and Dynode No.8	1	1.5
Dynode No.8 and Dynode No.9	1	1.9
Dynode No.9 and Dynode No.10	1	2.4
Dynode No.10 and Dynode No.11	1	3
Dynode No.11 and Dynode No.12	1.25	3.8
Dynode No.12 and Dynode No.13	1.5	4.8
Dynode No.13 and Dynode No.14	1.75	6
Dynode No.14 and Anode	2	4.8
Anode and Cathode	18.5	36.4

♣ Focusing electrode is connected to arm of potentiometer between cathode and dynode No.1. Focusing-electrode voltage is adjusted to give maximum gain.

ELECTRON TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

7264

MULTIPLIER PHOTOTUBE

OPERATING CONSIDERATIONS

Exposure of the 7264 to strong ultraviolet radiation may cause an increase in anode dark current. After cessation of such irradiation, the dark current drops rapidly.

The *operating stability* of the 7264 depends on the magnitude and duration of the anode current. When the 7264 is operated at high average values of anode current, a drop in sensitivity (sometimes called fatigue) may be expected. The extent of the drop below the tabulated sensitivity values depends on the severity of the operating conditions. After a period of idleness, the 7264 usually recovers a substantial percentage of such loss in sensitivity.

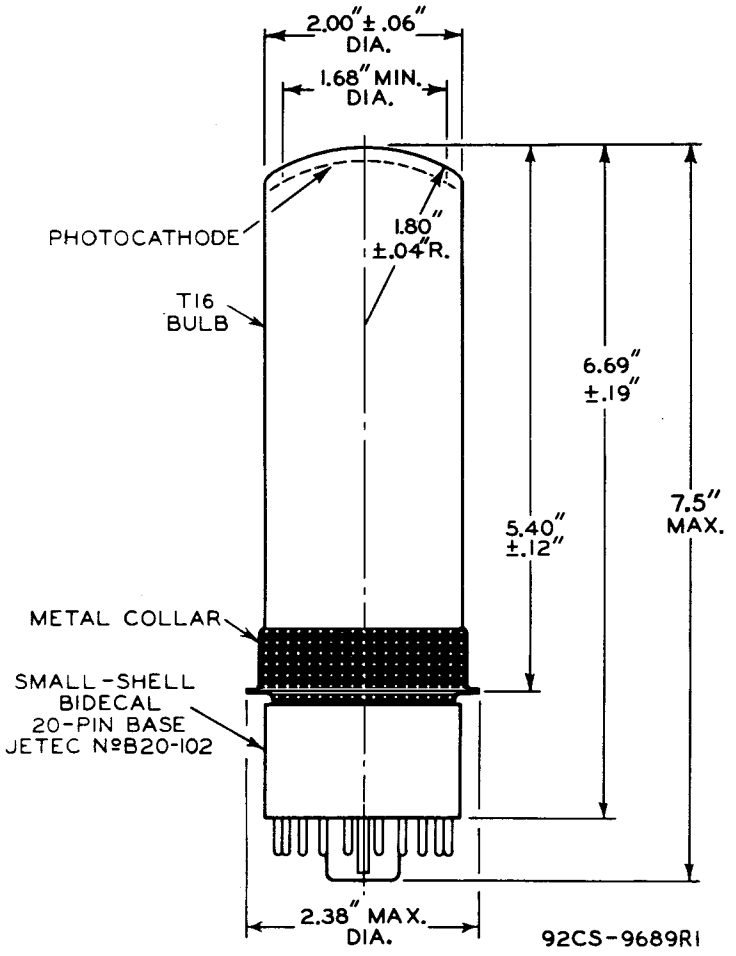
Operation at an average anode current well below the maximum rated value of 2 milliamperes is recommended when stability is important. When maximum stability is required, the anode current should not exceed 250 microamperes.

Electrostatic and/or *magnetic shielding* of the 7264 may be necessary. It is to be noted that the use of an external magnetic and/or electrostatic shield at high negative potential is a safety hazard unless the shield is connected to the potential source through an impedance in the order of 10 megohms. If the shield is not so connected, *extreme care should be observed in providing adequate safeguards to prevent personnel from coming in contact with the high potential of the shield.*

SPECTRAL-SENSITIVITY CHARACTERISTIC
of Phototube having S-11 Response
is shown at the front of this Section

7264

MULTIPLIER PHOTOTUBE



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

ELECTRON TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

7264

7264

TYPICAL ANODE CHARACTERISTICS

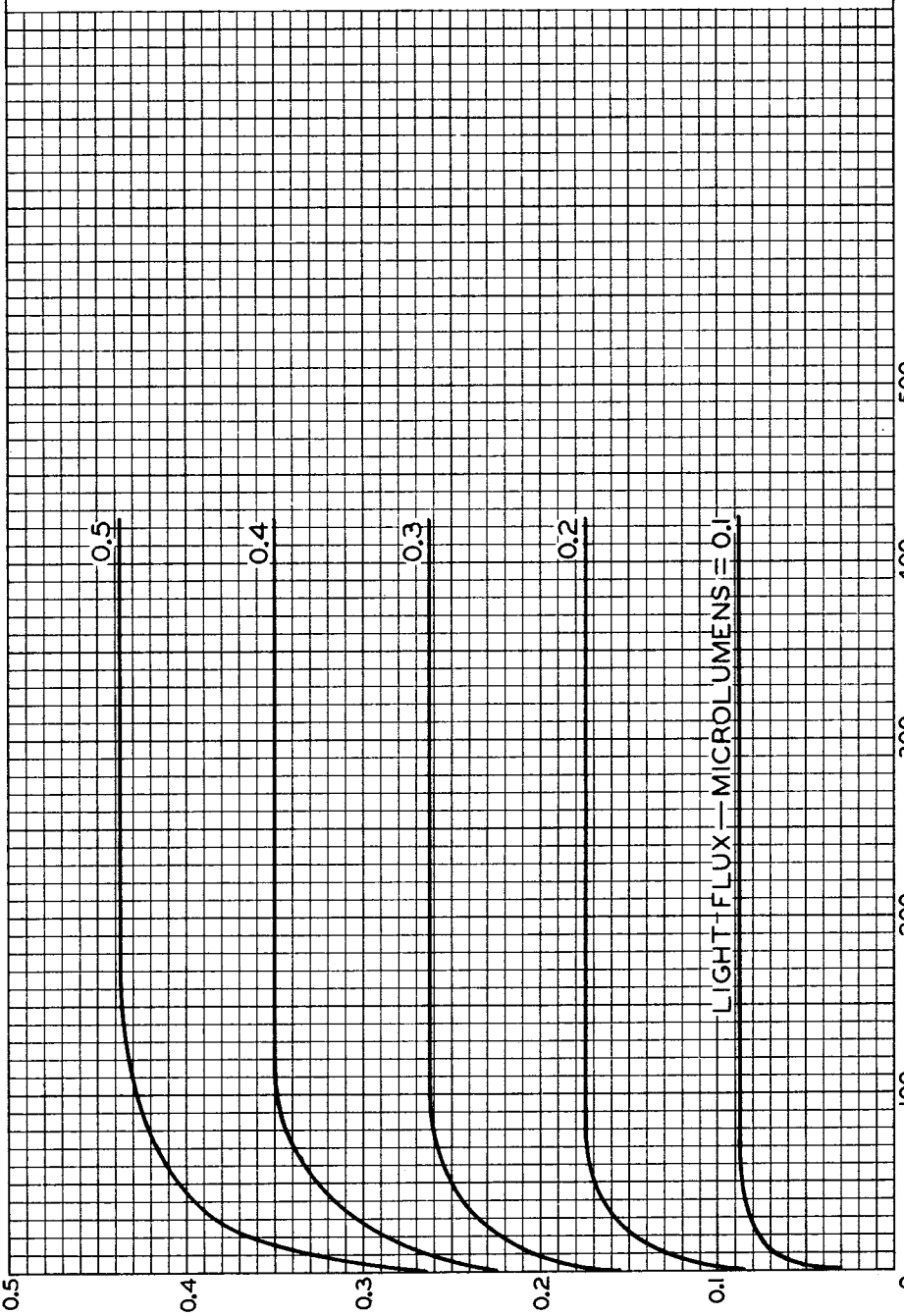
VERY-LOW-LIGHT-LEVEL, LOW-NOISE, HIGH-GAIN SERVICE

CATHODE-TO-GRID-Nº1 VOLTS = 108
GRID-Nº1-TO-DYNODE-Nº1 (DY_1) VOLTS = 108

DY_1 - TO - DY_2
DY_2 - TO - DY_3
ETC. TO
DY_{10} - TO - DY_{11}
} VOLTS = 108

DY_{11} - TO - DY_{12} VOLTS = 135
DY_{12} - TO - DY_{13} VOLTS = 160
DY_{13} - TO - DY_{14} VOLTS = 189
GRID-Nº2 VOLTS ADJUSTED TO GIVE MAXIMUM GAIN.

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



ELECTRON TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

92CM-9684

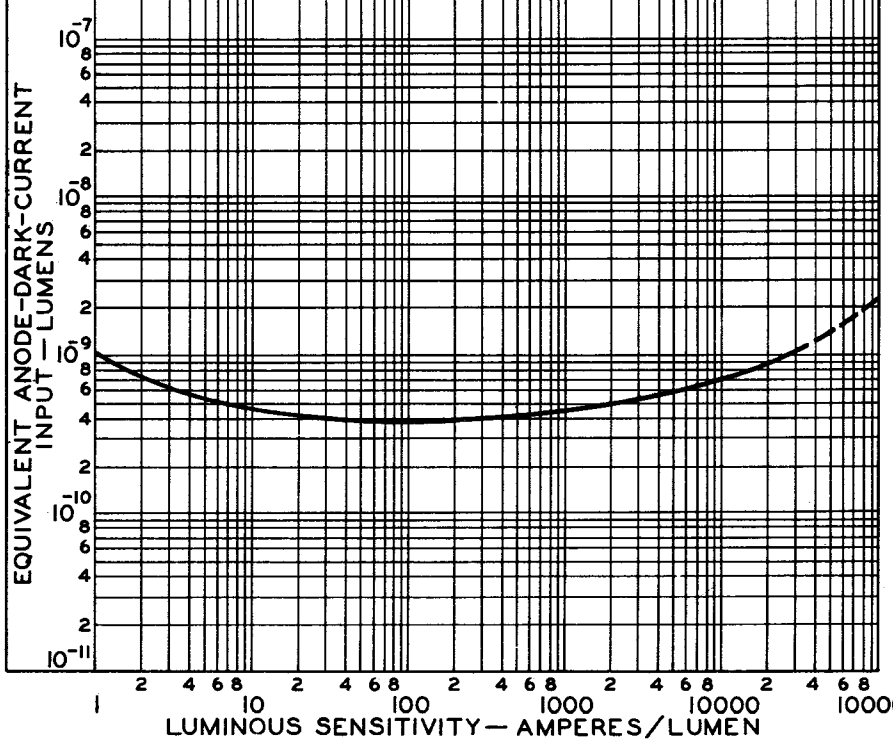
7264

TYPICAL ANODE-DARK-CURRENT CHARACTERISTIC
VERY-LOW-LIGHT-LEVEL, LOW-NOISE, HIGH-GAIN SERVICE

LUMINOUS SENSITIVITY IS VARIED BY ADJUSTMENT OF THE SUPPLY VOLTAGE (E) ACROSS VOLTAGE DIVIDER WHICH PROVIDES VOLTAGES AS FOLLOWS:

BETWEEN	5.4% OF E MULTIPLIED BY
CATHODE & GRID №1		
GRID №1 & DYNODE №1 (DY_1)		
DY_1 & DY_2		
DY_2 & DY_3		
DY_3 & DY_4		
DY_4 & DY_5		
DY_5 & DY_6		
DY_6 & DY_7		
DY_7 & DY_8		
DY_8 & DY_9		
DY_9 & DY_{10}		
DY_{10} & DY_{11}		
DY_{11} & DY_{12}	1.25
DY_{12} & DY_{13}	1.5
DY_{13} & DY_{14}	1.75
DY_{14} & ANODE	2.
ANODE & CATHODE	18.5

GRID-№2 VOLTS ADJUSTED TO GIVE MAXIMUM GAIN.
LIGHT SOURCE IS A TUNGSTEN-FILAMENT LAMP OPERATED AT A COLOR TEMPERATURE OF 2870° K.
TUBE TEMPERATURE = 25° C
DASHED PORTION INDICATES INSTABILITY.



7264

7264

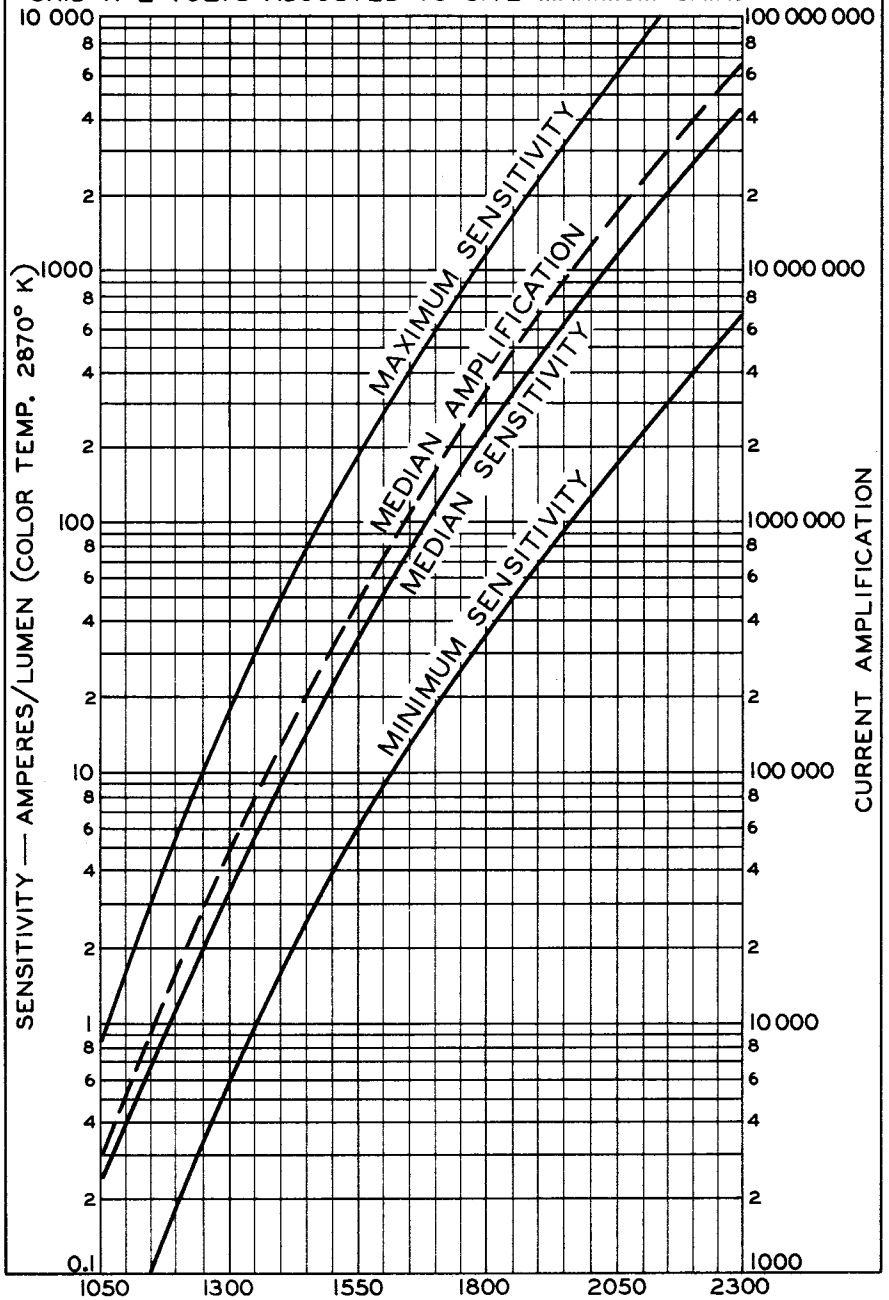
CHARACTERISTICS

VERY-LOW-LIGHT-LEVEL, LOW-NOISE, HIGH-GAIN SERVICE

THE SUPPLY VOLTAGE (E) ACROSS VOLTAGE DIVIDER WHICH PROVIDES VOLTAGES AS FOLLOWS:

BETWEEN	5.4% OF E MULT. BY	BETWEEN	5.4% OF E MULT. BY
CATHODE & GRID №1	1	DY_{11} & DY_{12}	1.25
GRID №1 & DYNODE №1	1	DY_{12} & DY_{13}	1.5
DYNODE №1 (DY_1) & DY_2	1	DY_{13} & DY_{14}	1.75
ETC. THRU DY_{10} & DY_{11}		DY_{14} & ANODE	2

GRID-№2 VOLTS ADJUSTED TO GIVE MAXIMUM GAIN.



ELECTRON TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY
92CM-9687

RCA

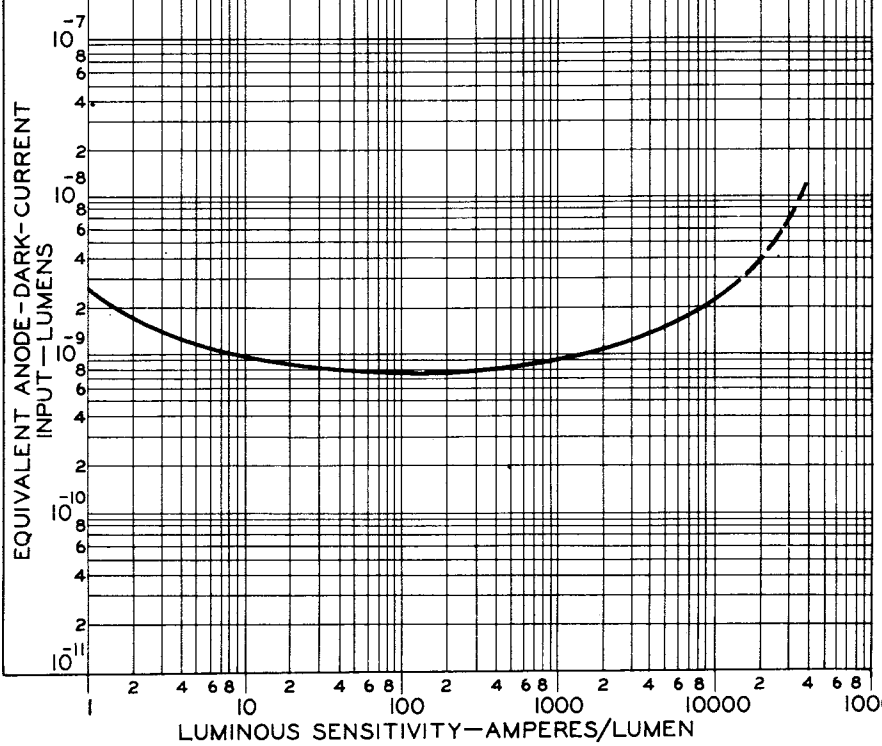
7264

TYPICAL ANODE-DARK-CURRENT CHARACTERISTIC
HIGH-OUTPUT-PULSE SERVICE

LUMINOUS SENSITIVITY IS VARIED BY ADJUSTMENT OF THE SUPPLY VOLTAGE (E) ACROSS VOLTAGE DIVIDER WHICH PROVIDES VOLTAGES AS FOLLOWS:

BETWEEN	2.75% OF E MULTIPLIED BY
CATHODE & GRID Nº 1	1
GRID Nº 1 & DYNODE Nº 1 (DY_1)	1
DY_1 & DY_2	1
DY_2 & DY_3	1
DY_3 & DY_4	1
DY_4 & DY_5	1
DY_5 & DY_6	1
DY_6 & DY_7	1.2
DY_7 & DY_8	1.5
DY_8 & DY_9	1.9
DY_9 & DY_{10}	2.4
DY_{10} & DY_{11}	3
DY_{11} & DY_{12}	3.8
DY_{12} & DY_{13}	4.8
DY_{13} & DY_{14}	6
DY_{14} & ANODE	4.8
ANODE & CATHODE	36.4

GRID-Nº 2 VOLTS ADJUSTED TO GIVE MAXIMUM GAIN.
LIGHT SOURCE IS A TUNGSTEN-FILAMENT LAMP OPERATED AT A COLOR TEMPERATURE OF 2870° K.
TUBE TEMPERATURE = 25° C
DASHED PORTION INDICATES INSTABILITY.



ELECTRON TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

92CM-9356

7264

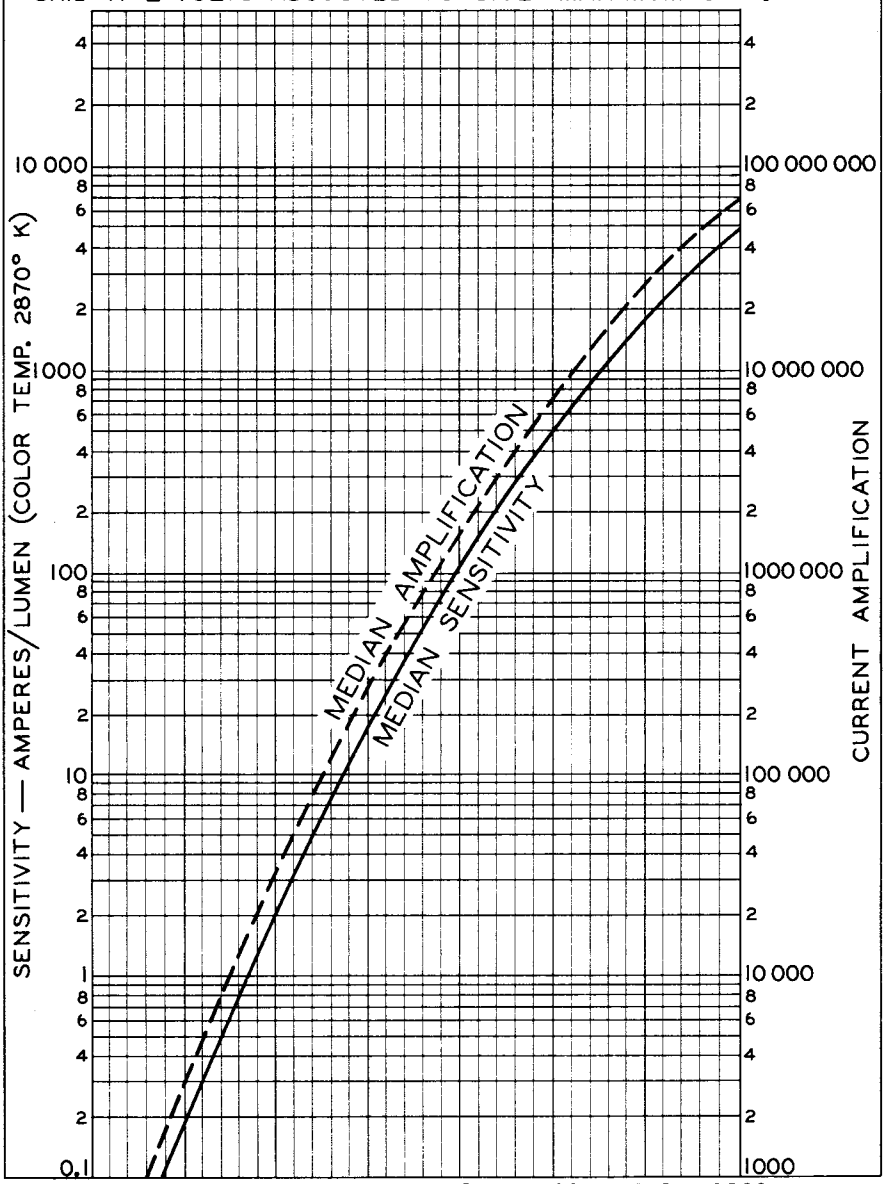
7264

CHARACTERISTICS
HIGH-OUTPUT-PULSE SERVICE

THE SUPPLY VOLTAGE (E) ACROSS VOLTAGE DIVIDER WHICH PROVIDES VOLTAGES AS FOLLOWS:

BETWEEN	2.75% OF E MULT. BY	BETWEEN	2.75% OF E MULT. BY
CATHODE & GRID No 1	1	DY_8 & DY_9	1.9
GRID No 1 & DYNODE No 1 (DY_1)	1	DY_9 & DY_{10}	2.4
DY_1 & DY_2 ETC. THRU DY_5 & DY_6	1	DY_{10} & DY_{11}	3
		DY_{11} & DY_{12}	3.8
		DY_{12} & DY_{13}	4.8
DY_6 & DY_7	1.2	DY_{13} & DY_{14}	6
DY_7 & DY_8	1.5	DY_{14} & ANODE	4.8

GRID-No 2 VOLTS ADJUSTED TO GIVE MAXIMUM GAIN.



ELECTRON TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY
92CM-9685