Multiplier Phototube

S-20 RESPONSE

| S-20 RESPONSE | |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------|
| IO-STAGE, HEAD-ON FLAT-FACEPLATE TYPE For Photometry, Flying-Spot Scanning, an | VENETIAN-BLIND-TYPE DYNODE STRUCTURE |
| ter Equipment Requiring Low-Dark Curren Over a Wide Spectrum (Blue Visible Well | t and High Sensitivity |
| General: Spectral Response. Wavelength of Maximum Response. Cathode, Semitransparent. Shape. Minimum area. Minimum diameter. Window. Index of refraction at 5893 angstroms Dynode Material. Direct Interelectrode Capacitances (App Anode to dynode No.10. Anode to all other electrodes. Maximum Overall Length Seated Length. Maximum Diameter Operating Position Weight (Approx.) Bulb Socket Magnetic Shield. Perfection Magnetic Shield. Perfection Magnetic Shield. Pager | Flat, Circular |
| Base | [4-45], Non-hygroscopic 14AM |
| 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 6 - Dynode No.6 | DY7 DY8 DY9 © DY9 Z 2 2 X 0 DY10 |

DIRECTION OF LIGHT:

Pin 14 - Photocathode Metal

Collar-Do Not Use

Pin 13 - Focusing Electrode

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

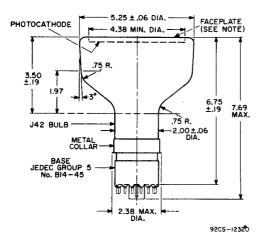
| Maximum Ratings, Absolum DC Supply Voltage: Between anode and cat Between anode and dyn Between consecutive of Between dynode No.1 a Between focusing elec Average Anode Current Ambient Temperature. | hode. lode Ne lynode: ind ca trode | o.10 s thode. | 2500 2500 300 300 600 1 hode 600 | max. max. max. max. max. max. | volts volts volts volts volts ma °C | | | |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------|---------------------|--------------------------------------------------------------------------------------|------------------------------------------------|-------------------------------------------------------|--|--|--|
| Characteristics Range V | alues' | , | | | | | | |
| 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 50 and 100 per cent of dynode-No.1 potential (referred to cathode) which provides maximum anode current. With E = 2000 volts (Except as noted) | | | | | | | | |
| #### E 2000 VOLES (EX | | | | | | | | |
| 0 111 1 | | Min. | Typ. | Max. | | | | |
| Sensitivity: Radiant, at 4200 angstroms Cathode radiant, at 4200 angstroms. Luminous, at 0 cpse. Cathode luminous: With tungsten light sourcef. With blue light sourcegeh With red light | . 1.2 | × 10 ⁻⁸ | 1.1 × 10 ⁴ 6.8 × 10 ⁻² 25 1.6 × 10 ⁻⁴ | - 240 - - | a/w a/w a/lm a/lm | | | |
| source ^{j,k} Current Amplification. Equivalent Anode-Dark- | | × 10 ⁻⁷ | 1.6×10^{5} | - | а | | | |
| Current Input at a luminous sensitivity of 12 a/lm. Equivalent Noise Input Anode-Pulse Rise Time? Electron Transit Time? With E = 1500 volts (Ex. | • | - | 4 × 10 ⁻¹⁰ 1 × - 3.8 1.65 × 10 ⁻⁸ 9.3 × 10 ⁻⁸ | < 10 ⁻⁹ × 10 ⁻¹² - | lm lm sec sec | | | |
| Type cours (Ex. | cept a | Min. | | ., | | | | |
| Sensitivity: Radiant, at 4200 angstroms Cathode radiant, | • . | - nin. | Typ. 2.1 × 10 ³ | Max. | a/w | | | |
| at 4200 angstroms. Luminous, at 0 cps ^e . | | _ | 6.8×10^{-2} | - | a/w a/lm | | | |

| | Min. | Typ. | Max. | |
|-------------------------------------------|----------------------|----------------------|--------------------|------|
| Cathode luminous: | | | | |
| With tungsten light sourcef | 1.2×10^{-4} | 1.6×10^{-4} | - | a/lm |
| With blue light source ^{g, h} | 5×10^{-8} | - | - | a |
| With red light source ^{j,k} | 3 × 10 ⁻⁷ | _ | _ | a |
| Current Amplification | - | 3.1×10^4 | - | |
| Equivalent Anode-Dark- | | | | |
| Current Input at a | | | | |
| luminous sensitivity | | | | _ |
| of 12 a/lm ^m | - | 4×10^{-10} | 1×10^{-1} | 9]m |

- a Corning No.0080 made by Corning Glass Works, Corning, New York, or equivalent.
- b Made by Cinch Manufacturing Company, 1026 South Homan Avenue, Chicago 24, Illinois.
- Magnetic shielding material in the form of foil or tape as available from the Magnetic Shield Division, Perfection Mica Company, 1322 Worth Ellston, Chicago 21, Illinois, or equivalent.
 - d 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 1 microlumen is used.
- f 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.
- 9 Under the following conditions: Light incident on the cathode is transmitted through a blue filter (corning C.S. No.5-58 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 28700 K. The value of light flux incident on the filter is O.1 lumen and 200 volts are applied between cathode and all other electrodes connected as anode.
- h 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.
- Junder the following conditions: Light incident on the cathode is transmitted through a red filter (corning C.S. No.2-62, manufactured by the Corning Glass Works, Corning, New York) from a tungsten-filamel 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.
- K See Spectral Characteristic of 2870° K Light Source and Spectral Characteristic of Light from 2870° K Source after passing through Indicated Red Pilter at front of this Section.
- $^{\text{M}}$ At a tube temperature of 25 $^{\text{O}}$ C. Dark current may be reduced by use of a refrigerant,
- Measured between 10 per cent and 90 per cent of maximum anode-pulse height. This anode-pulse rise time is primarily a function of transittime variation and is measured under conditions with the incident light fully illuminating the photocathode.
- P The electron transit time is the time interval between the arrival of a delta function light pulse at the entrance window of the tube and the time at which the output pulse at the anode terminal reaches peak amplitude. The transit time is measured under conditions with the incident light fully illuminating the photocathode.

SPECTRAL-SENSITIVITY CHARACTERISTIC OF PHOTOSENSITIVE DEVICE HAVING S-20 RESPONSE is shown at the front of this Section

TYPICAL VOLTAGE-DIVIDER ARRANGEMENT shown under Type 4463 also applies to Type 4465



DIMENSIONS IN INCHES

Center line of bulb will not deviate more than $2^{\rm O}$ in any direction from the perpendicular erected at the center of bottom of the base.

NOTE: Within 4.38" diameter, deviation from flatness of external surface of faceplate will not exceed 0.010" from peak to valley.

TYPICAL ANODE CHARACTERISTICS

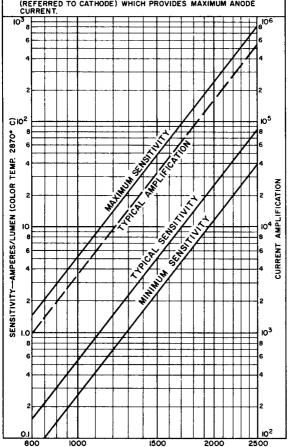
DYNODE No. I-TO-CATHODE VOLTS = 250 EACH SUCCEEDING DYNODE-STAGE VOLTS = 125 FOCUSING-ELECTRODE VOLTAGE IS ADJUSTED TO THAT VALUE BETWEEN 50 AND 100 PER CENT OF DYNODE No.1 POTENTIAL (REFERRED TO CATHODE) WHICH PROVIDES MAXIMUM ANODE CURRENT LIGHT SOURCE IS A TUNGSTEN-FILAMENT LAMP OPERATED AT A COLOR TEMPERATURE OF 2870° K. ž. FLUX-I

ANODE MICROAMPERES

92CM-123I0

SENSITIVITY AND CURRENT AMPLIFICATION **CHARACTERISTICS**

DYNODE No. 1-TO-CATHODE VOLTS = 1/6 E EACH SUCCEEDING DYNODE-STAGE VOLTS = 1/12 E ANODE-TO-DYNODE No. 10 VOLTS # 1/12 E FOCUSING-ELECTRODE VOLTAGE IS ADJUSTED TO THAT VALUE BETWEEN 50 AND 100 PER CENT OF DYNODE No. I POTENTIAL (REFERRED TO CATHODE) WHICH PROVIDES MAXIMUM ANODE



SUPPLY VOLTS (E) BETWEEN ANODE AND CATHODE

92CM-12312

TYPICAL OUTPUT CURRENT AS A FUNCTION OF DYNODE-No.5 VOLTS CHARACTERISTIC

DYNODE No.1-TO-CATHODE VOLTS = 200
VOLTS PER SUCCEEDING DYNODE STAGE EXCEPT FOR DYNODE-No. 5 STAGE = 100 ANODE-TO-DYNODE No. 10 VOLTS = 100
FOCUSING-ELECTRODE VOLTAGE IS ADJUSTED TO THAT VALUE
BETWEEN 50 AND 100 PER CENT OF DYNODE No. 1 POTENTIAL
(REFERRED TO CATHODE) WHICH PROVIDES MAXIMUM ANODE CURRENT.
ANODE IS AT GROUND POTENTIAL. 100 8 6 RELATIVE ANODE CURRENT 2 10 2

> -600 DYNODE No.5 VOLTS (REFERRED TO ANODE)

> > 92CM-11078R1

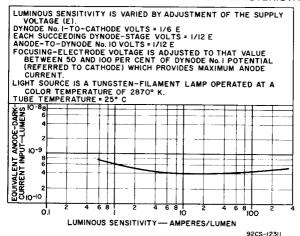
-500

-800

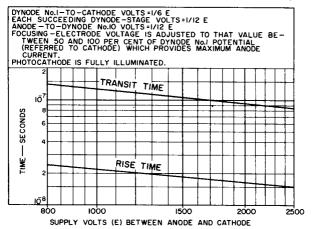
-700

-400

TYPICAL ANODE-DARK-CURRENT CHARACTERISTIC



TYPICAL TIME RESOLUTION CHARACTERISTICS



9205-12313

TYPICAL EFFECT OF MAGNETIC FIELD ON ANODE CURRENT CHARACTERISTIC

DYNODE No.1-TO-CATHODE VOLTS = AS INDICATED EACH SUCCEEDING DYNODE-STAGE VOLTS = 125 ANDE TO DYNOBE NO.10 VOLTS = 125
FOCUSING = ELECTRODE VOLTAGE IS ADJUSTED TO THAT VALUE
BETWEEN 50 AND 100 PER CENT OF DYNODE No.1 POTENTIAL REFERRED TO CATHODE WHICH PROVIDES MAXIMUM ANODE CURRENT.
PHOTOCATHODE FULLY ILLUMINATED BY A POINT LIGHT SOURCE
POSITIONED APPROX. I FOOT FROM CENTER OF TUBE FACE,
MACNETIC FIELD PARALLEL TO MAJOR AXIS OF TUBE. DYNOOE CURRENT 6 No.1-TO-CATHODE 4 VOLTS = 375 2 10 250 125 6 RELATIVE 4 2 20 10 15

MAGNETIC FIELD INTENSITY ---- GAUSS

92CS-III87R2

