

HAMAMATSU

Electron Tube Products CONDENSED CATALOG

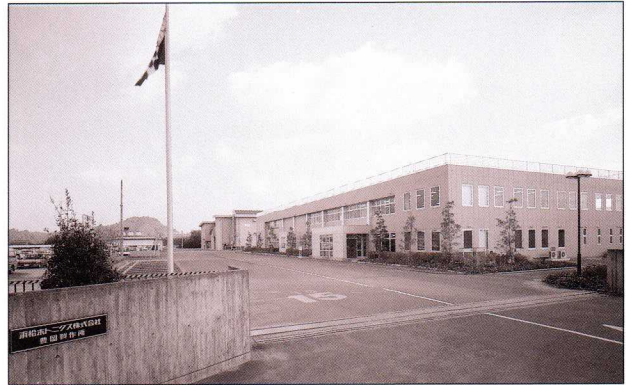
Photomultiplier Tube/Light Source/Camera Tubes/Image Intensifier/Stroke tube/Microchannel Plate



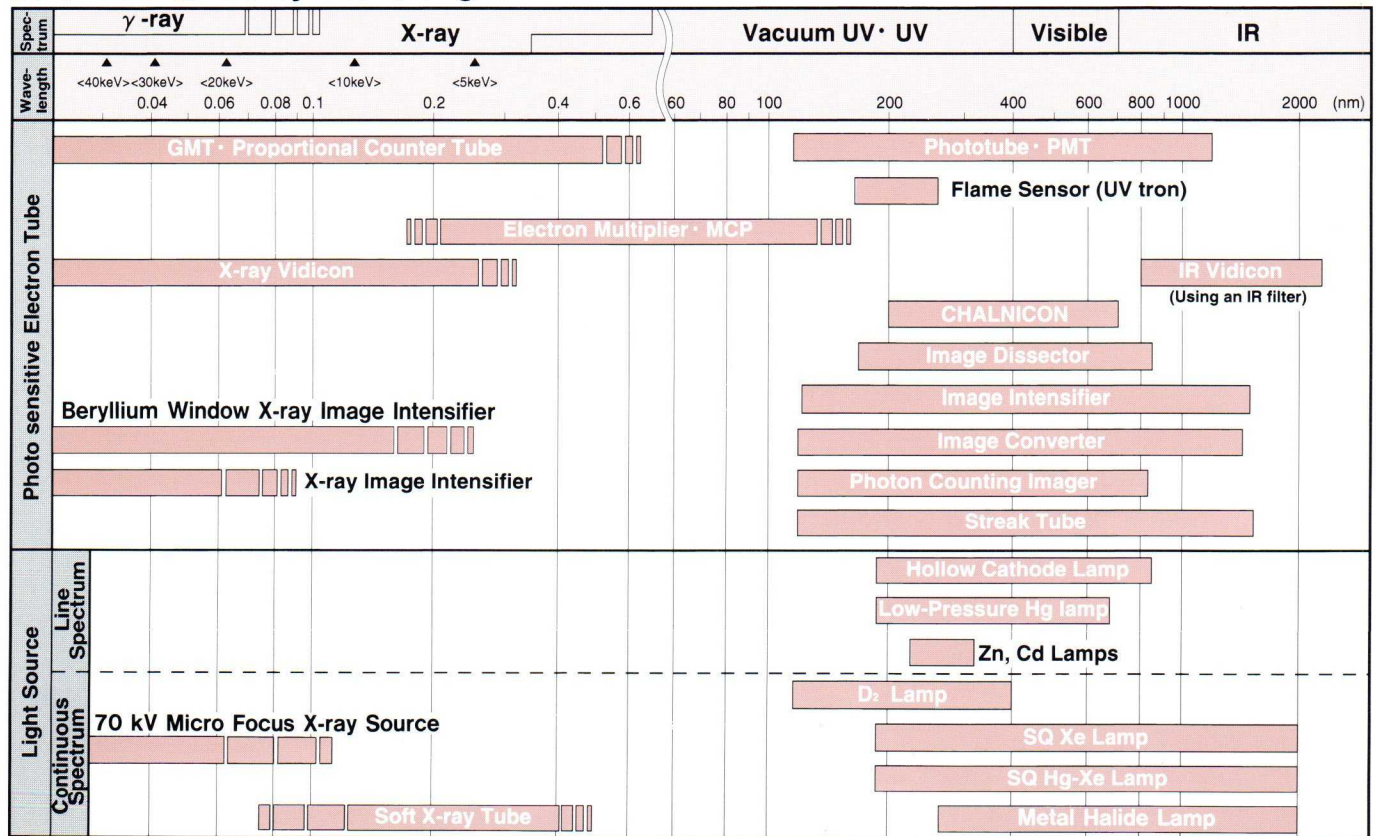
Selection Guide

Hamamatsu Photonics, a leading company in photonics technology, is engaged in the study and applications of light and light-related phenomena.

The Electron Tube Center, a part of Hamamatsu Photonics K.K. supports the progress in the most advanced photonics technologies, for example, ultra-high sensitivity and ultra-high speed metrology. The Electron Tube Center has developed and manufactured a variety of photonic devices and systems. They are widely used in spectroscopy, semiconductor industry, bio-technology and scientific research as well as in medical equipment such as diagnostic imaging systems and blood analyzers. This condensed catalog introduces major products available from Hamamatsu Photonics Electron Tube Center. For further information, please contact our sales office.



Selection Guide by Wavelength



| ■ Photosensitive Electron Tubes | | Features | Applications | Page |
|--|---|--|--------------|------|
| Photomultiplier Tubes | Super high sensitivity, Low noise, High speed response, Wide variety | Spectroscopy, High energy physics, Medical use, Space, Pollution monitoring, etc. | 2 | |
| Phototubes | High speed response, Low noise, Excellent linearity, Sensitive to UV | UV monitoring, Laser measurement, Spectroscopy, etc. | 6 | |
| Flame Sensors (UV TRON®) | Highly reliable sensor only responding to UV. | Flame detection, Flame monitor, etc. | 6 | |
| Electron Multipliers | Detection of electrons, ions, charged particles, vacuum UV and soft X-ray. | Mass spectroscopy, Solid surface analysis, etc. | 7 | |
| GM (Geiger-Müller) Tubes | Compact radiation counter tubes for γ -ray and high energy β -ray | Pocket surveymeters, etc. | 7 | |
| Proportional Counter Tubes | Radiation counter tubes for energy and dose measurement of X-ray and γ -ray | Fluorescent X-ray analyzer, Fluorescent film thickness measuring equipment, Sulfur meters, etc. | 7 | |
| Vidicons | TV camera tubes for IR, X-ray and UV. | Nondestructive inspection, Industrial TV camera, image processing, moisture imaging etc. | 8 | |
| CHALNICON® | Low dark current, Excellent color balance, High sensitivity, For visible range, etc. | Medical TV camera, Security or special observation, Radiation-resistant use, etc. | 8 | |
| Image Intensifiers | Image intensification more than 10^4 | Night time viewing, UV observation, Astronomical observation, etc. | 9 | |
| Image Converters | Invisible to visible conversion | Laser and LED observation, IR microscope, Semiconductor wafer inspection, etc. | 9 | |
| Photon Counting Imagers | Ultra high sensitivity imaging tubes which use photon counting technology. | Ultra high sensitivity microscope system, Low light level astronomical observation system, etc. | 9 | |
| X-ray Image Intensifier | Large area imaging tube which converts the very weak X-ray image into visible image. | Medical X-ray diagnostic system, non-destructive inspection, etc. | 10 | |
| Streak Tubes | Ultra-high speed photodetector with picosecond temporal resolution. | Raman spectroscopy, Measurement of explosion and impulse wave, Evaluation of laser, Analysis of laser fusion, etc. | 10 | |
| Image Dissectors | No lag, Random-access scanning, etc. | Displacement measurement, Random-access camera, Laser scanning microscope | 10 | |
| Microchannel Plates (MCP) | 2-D detection and multiplication of electrons, ions, charged particles, Vacuum UV, soft X-ray, etc. | Image intensifier, CRT, Mass spectroscopy, ESCA, etc. | 12 | |
| ■ Applied Product | | Features | Applications | Page |
| High Speed Gate Image Intensifier Unit | It can obtain the still image of very fast phenomena at any timing. | Analysis of high speed light emission phenomenon, Ultra low-light level imaging & observation of high speed moving object. | 11 | |
| CCD Camera with Fiber Optic Window | High resolution CCD camera with fiber optic input window. | For the read-out of high speed gate image intensifier unit. | 11 | |
| Built-in High Speed Electronic Shutter ICCD Camera Unit. | High speed phenomena is taken at high sensitivity with 1/10,000,000 shutter speed. | Analysis of high speed light emission phenomenon, Ultra low-light level imaging & observation of high speed moving object. | 11 | |
| ■ Optical Component | | Features | Applications | Page |
| Fiber Optic Plates (F.O.P.) | Transmitting visual images from the input surface to the output surface efficiently with high resolution. | Input/output windows for image tubes, High-resolution CRT, Facsimile, Medical imaging Diagnostic systems, etc. | 12 | |
| Fiber Optic Plates with X-ray Scintillator | X-ray imaging device that provides higher sensitivity and resolution. | Dental Diagnosis, Mammography, Non-destructive inspection of semiconductor devices | 12 | |
| ■ Functional Material | | Features | Applications | Page |
| Capillary Plates | 2-D regular array of glass tubes with a uniform pore diameter and superior linearity. | Flow control, Optical or X-ray collimator, differential pressure exhaust window, Particle filter, etc. | 13 | |
| ■ Light Source | | Features | Applications | Page |
| Hollow Cathode Lamps | Emitting characteristic line spectrum of each element. | Atomic absorption analysis. | 13 | |
| Deuterium Lamps | Continuous ultraviolet spectrum. | Spectroscopy, Fluorospectrophotometer, Liquid chromatography, Wafer process, etc. | 14 | |
| Super-Quiet Xenon Lamps-Continuous Mode | Continuous spectrum from ultraviolet to visible and infrared. Similar to sunlight. | Spectrophotometer, Liquid chromatography, Fluorospectrophotometer, Phosphorospectrophotometer, etc. | 15 | |
| Super-Quiet Mercury-Xenon Lamps | Continuous spectrum from ultraviolet to infrared including strong mercury line spectra. | Light sources for semiconductor photolithography, UV curing, Interferometers, etc. | 15 | |
| Super-Quiet Xenon Flash Lamps | Continuous spectrum from ultraviolet to visible and infrared. Pulse operation. | Spectroscopy, Medical inspection, Photosensitive material processing, High-speed camera light source, etc. | 16 | |
| UV Spot Light Source | Flexible light-guide allows UV illumination on confined area. | Gluing and fixation of optical and electronic parts using UV curing resin. | 16 | |
| Metal Halide Lamp | Approx. 4 times of luminous efficiency of xenon or halogen lamps. | OHP, LCD projector, Light source for optical fiber, Color printer, Microscope and General light illumination. | 17 | |
| Pen Type Low-Pressure Mercury Lamps | Line spectra in mainly ultraviolet region | Wavelength calibration for spectroscopy, Chromatography, Fluorospectrophotometer, etc. | 17 | |
| Micro Focus X-ray Source | Micro focusing feature of 10 μ m will allow the sample enlargement of more than 50 times without any image deterioration. | Non-destructive X-ray inspection system, Multi-layers PCS X-ray inspection system and X-ray analysis system. | 17 | |
| Photon Counters and Related Products | | | | 18 |
| Accessories for Photomultiplier Tubes | | | | 19 |

* This catalog provides general information and data regarding Hamamatsu major electron tube products. For more specific information please refer to our sectional catalogs or individual product data sheets which are available from our sales office or Hamamatsu representative. If the values shown on the specification sheet is not given as min. or max., it is typical (or medium) value.

Photomultiplier Tubes

Side-on Photomultiplier Tubes

at 25°C

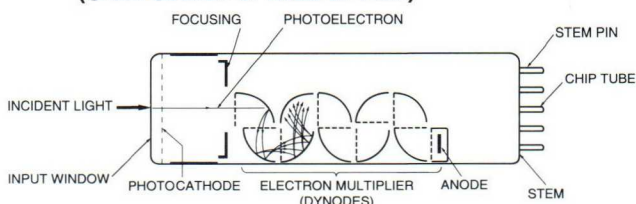
| Type No. | Diameter (mm) | Length Max. (mm) | Spectral Response | | Cathode Sensitivity | | Anode to Cathode Supply Voltage (Vdc) | Anode Sensitivity | | Current Amplification Typ. | Anode Dark Current (after 30min.) Typ. (nA) | Max. Supply Voltage (Vdc) | | | | | |
|----------|--|------------------------|-------------------|---|----------------------------------|-------------------------------------|---|---------------------------------|------------------------------------|----------------------------------|---|------------------------------------|-------------------|---|------|---|------|
| | | | Range (nm) | Peak Wavelength λ_p (nm) | Luminous ($\mu\text{A/lm}$) | Radiant at λ_p (mA/W) | | Luminous (A/lm) | Radiant at λ_p (A/W) | | | | | | | | |
| R5757 | $\phi 13$ (1/2") | 65 | 115 to 195 | 130 | - | 21 | 1000 | - | 2.1×10^4 | 1.0×10^6 | 0.5 | 1250 | | | | | |
| R5959 | | | 115 to 320 | 200 | | 55 | | | 3.8×10^5 | 7.0×10^6 | | | | | | | |
| R1657 | | 52 | 160 to 320 | | 40 (at 254nm) | - | | 1.0×10^5 (at 254nm) | 2.5×10^6 | | | | | | | | |
| R427 | | 65 | 185 to 650 | 340 | | | | 40 | 48 | 300 | 3.6×10^5 | | 7.5×10^6 | | | | |
| R1414 | | 50 | | | | | | | | | | | | | | | |
| R3810 | | 25 | 185 to 700 | 420 | 100 | 80 | | 500 | 4.0×10^5 | 5.0×10^6 | 1 | | | | | | |
| R300 | | 65 | | | 200 | 70 | | 1000 | 3.5×10^5 | | **20cps | | | | | | |
| R5785 | | 50 | 185 to 830 | 530 | 150 | 45 | | 200 | 5.9×10^4 | 1.3×10^6 | 1 | | | | | | |
| R4457P | | | | | 200 | 70 | | 1000 | 4.0×10^5 | 5.7×10^6 | | | | | | | |
| R3811 | | 25 | 185 to 850 | 600 | 350 | 70 | | 2000 | 4.0×10^5 | 5.7×10^6 | 1 | | | | | | |
| R3823 | | 50 | 185 to 900 | 600 | 350 | 70 | | 2000 | 4.0×10^5 | 5.7×10^6 | 1 | | | | | | |
| R1259 | | $\phi 28$ (1-1/8") | 94 | 115 to 195 | 120 | - | | 26 (at 122nm) | 1000 | - | 3.1×10^4 (at 122nm) | | 1.2×10^6 | 1 | 1250 | | |
| R1220 | 115 to 320 | | | 190 | - | 40 (at 254nm) | - | 4.0×10^5 (at 254nm) | | 1.0×10^7 | | | | | | | |
| R166UH | 160 to 320 | | | 200 | - | 40 (at 254nm) | - | 4.0×10^5 (at 254nm) | | 1.0×10^7 | | | | | | | |
| R106 | 160 to 650 | | | 340 | 40 | 60 | 48 | 300 | | 3.6×10^5 | 7.5×10^6 | | | | | | |
| R106UH | | | | | | | 60 | 1500 | | 1.5×10^6 | 2.5×10^7 | | | | | | |
| 1P28 | 185 to 650 | | | 340 | 40 | 48 | 48 | 400 | | 4.8×10^5 | 1.0×10^7 | 5 | | | | | |
| R212 | | | | | | | 48 | 300 | | 3.6×10^5 | 7.5×10^6 | 1 | | | | | |
| R4332 | 160 to 750 | | | 420 | 120 | 91 | 1200 | 9.1×10^5 | | 1.0×10^7 | 5 | | | | | | |
| 931A | 300 to 650 | | | 400 | 40 | 48 | 48 | 400 | | 4.8×10^5 | 1.0×10^7 | 10 | | | | | |
| 931B | | | | | | | 55 | 60 | | 600 | 6.6×10^5 | 1.1×10^7 | 5 | | | | |
| 1P21 | 300 to 650 | | | 400 | 40 | 48 | 48 | 250 | | 3.0×10^5 | 6.25×10^6 | 1 | | | | | |
| R105 | | | | | | | 40 | 48 | | 400 | 4.8×10^5 | 1.0×10^7 | 2 | | | | |
| R1527 | 185 to 680 | | | 390 | 60 | 60 | 400 | 4.0×10^5 | | 6.7×10^6 | 0.1 | | | | | | |
| 1P28A | 185 to 700 | | | 340 | 56 | 56 | 300 | 2.8×10^5 | | 5.0×10^6 | 5 | | | | | | |
| R4220 | 185 to 710 | | | 410 | 100 | 70 | 1200 | 8.4×10^5 | | 1.2×10^7 | 0.2 | | | | | | |
| R3788 | 185 to 750 | | | 420 | 120 | 90 | | 9.0×10^5 | | 1.0×10^7 | 5 | | | | | | |
| R2693 | 185 to 650 | | | 375 | 50 | 62 | 300 | 3.7×10^5 | | 6.0×10^6 | 0.5 | | | | | | |
| R2368 | | | | | | | 200 | 8.3×10^4 | | 1.3×10^6 | 5 | | | | | | |
| R4632 | 185 to 850 | | | 430 | 200 | 80 | 700 | 2.8×10^5 | | 3.5×10^6 | **50cps | | | | | | |
| R955 | 160 to 900 | | | 400 | 250 | 74 | 2500 | 7.4×10^5 | | 1.0×10^7 | 3 | | | | | | |
| R928 | 200 | | | 68 | **300cps | | | | | | | | | | | | |
| R2949 | 185 to 900 | | | 450 | 375 | 80 | 2000 | 6.8×10^5 | | 5.3×10^6 | 3 | | | | | | |
| R1477-06 | | | | | | | 4.2×10^5 | 9.5×10^6 | | 10 | | | | | | | |
| R3896 | 5000 | | | 8.6×10^5 | 9.5×10^6 | 10 | | | | | | | | | | | |
| R636-10 | 185 to 930 | | | 300 to 800 | 550 | 62 | 250 | 2.8×10^4 | | 4.5×10^5 | 0.1 (at 10A/lm) | | | | | | |
| R2658 | 185 to 1010 | | | 400 | 100 | 1 (at 1 μm) | 1250 | 16 | | 1.6×10^5 | 1 | | | | | | |
| R5108 | 400 to 1200 | | | 800 | 25 | 2.2 | 7.5 | 660 | | 3.0×10^5 | 350 (at 4A/lm) | | | | | | |
| R1923 | $\phi 38$ (1-1/2") (Dome Window Type) | | | 76.4* | 300 to 800 | 530 | 300 | 89 | | 1250 | 15 | 4.4×10^3 | 5.0×10^4 | | | 1 | 2000 |

* The length from the top of the tube to the end of the chip tube (exhaust glass pipe), excluding the length of the leads and temporary base.
 ** Dark counts per second.



Side-on Photomultiplier Tubes

● Operation Principle of Photomultiplier Tubes (Cross-Section of Head-on PMT)



When light enters a photocathode, the photocathode emits photoelectrons into the vacuum. These photoelectrons are then directed by the focusing electrode voltages towards the electron multiplier where electrons are multiplied by the process of secondary emission. The multiplied electrons are collected by the anode as an output signal. Because of secondary-emission multiplication, photomultiplier tubes are uniquely sensitive among photosensitive devices currently used to detect radiant energy in the ultraviolet, visible, and near infrared regions. The photomultiplier tube also features fast time response and low noise.

Head-on Photomultiplier Tubes

at 25°C

| Type No. | Diameter (mm) | Length Max. (mm) | Spectral Response | | Cathode Sensitivity | | Anode to Cathode Supply Voltage (Vdc) | Anode Luminous Sensitivity (A/lm) | Current Amplification Typ. | Anode Dark Current (after 30min.) Typ. (nA) | Anode Pulse Rise Time (ns) | Max. Supply Voltage (Vdc) | | | | | | | | | |
|----------|-----------------------|------------------------|-------------------|---|---------------------------|-------------------------------------|---|--|----------------------------------|---|-------------------------------------|------------------------------------|-------------------|-------------------|-------------------|-------------------|------------------------------|-------------------|------|-----|------|
| | | | Range (nm) | Peak Wavelength λ_p (nm) | Luminous (μ A/lm) | Radiant at λ_p (mA/W) | | | | | | | | | | | | | | | |
| R2496 | ϕ 10 (3/8") | 56.5 | 160 to 650 | 420 | 95 | 76 | 1250 | 100 | 1.1×10^6 | 5.0 | 0.8 | 1500 | | | | | | | | | |
| R1635 | | | 300 to 650 | | 120 | 51 | | | | | | | | | | | | | | | |
| R1894 | | | 300 to 850 | | 120 | 51 | | | | | | | | | | | | | | | |
| R1081 | ϕ 13 (1/2") | 86* | 115 to 200 | 140 | - | 9.8 (at 122nm) | 2000 | 9.8×10^2 A/W (at 122nm) | 1.0×10^5 | 0.03 | 1.8 | 2250 | | | | | | | | | |
| R759 | | 86 | 160 to 320 | 210 | - | 20 (at 254nm) | 1000 | 1.0×10^4 A/W (at 254nm) | 5.0×10^5 | 0.3 | 2.5 | 1250 | | | | | | | | | |
| R647 | | | 300 to 650 | 100 | 76 | 100 | | 100 | 1 | | | | | | | | | | | | |
| R760 | | | 160 to 650 | 420 | 100 | 76 | | 100 | 1 | | | | | | | | | | | | |
| R1463 | | | 185 to 850 | 120 | 51 | 120 | | 120 | 4 | | | | | | | | | | | | |
| R3478 | ϕ 19 (3/4") | 80 | 300 to 650 | 420 | 115 | 88 | 1700 | 200 | 1.7×10^6 | 30 | 1.3 | 1800 | | | | | | | | | |
| R1166 | | 103 | | | 105 | 85 | 1000 | 100 | 9.5×10^5 | 1 | 2.5 | 1250 | | | | | | | | | |
| R1450 | | | | | 115 | 88 | 1500 | 200 | 1.7×10^6 | 3 | 1.8 | 1800 | | | | | | | | | |
| R2801 | | | | | 375 | 45 | 55 | 1250 | 300 | 6.7×10^6 | ** 15cps | 2.2 | 1500 | | | | | | | | |
| R1617 | | | | | 420 | 120 | 51 | 1000 | 120 | 1.0×10^6 | 4 | 2.5 | 1250 | | | | | | | | |
| R632 | | | | | 300 to 850 | 420 | 120 | 51 | 1000 | 120 | 1.0×10^6 | 4 | 2.5 | 1250 | | | | | | | |
| R632 | | | | | 400 to 1200 | 800 | 20 | 1.9 | 1250 | 10 | 5.0×10^5 | 150 (at 4A/lm) | 2.2 | 1500 | | | | | | | |
| R1535 | ϕ 25 (1") | 113 | 300 to 650 | 420 | 115 | 88 | 1500 | 300 | 2.6×10^6 | 10 | 2.4 | 1800 | | | | | | | | | |
| R1924 | | 57.5 | | | 90 | 85 | 1000 | 100 | 1.1×10^6 | 3 | 2.0 | 1250 | | | | | | | | | |
| R3550 | | | | | 375 | 50 | | | 60 | 2.0×10^6 | | | ** 20cps | | | | | | | | |
| R5070 | | | | | 60.5 | 300 to 900 | | | 420 | 230 | | | 65 | 4.3×10^5 | 3 | | | | | | |
| R1459 | ϕ 28 (1-1/8") | 127 | 115 to 200 | 140 | - | 9.8 (at 122nm) | 2000 | 9.8×10^2 A/W (at 122nm) | 1.0×10^5 | 0.03 | 9 | 2500 | | | | | | | | | |
| R431S | | 107 | 160 to 320 | 210 | - | 20 (at 254nm) | 1000 | 1.0×10^4 A/W (at 254nm) | 5.0×10^5 | 0.3 | 12 | 1500 | | | | | | | | | |
| R6095 | | 127 | 300 to 650 | 420 | 95 | 88 | | 200 | 2.1×10^6 | 2 | 4 | | | | | | | | | | |
| R3998-02 | | 75 | | | 90 | 85 | | 120 | 1.3×10^6 | 3.4 | | | | | | | | | | | |
| R1355 | | 113 | | | 95 | 88 | | 1500 | 200 | 2.1×10^6 | 10 | | 2.0 | 1900 | | | | | | | |
| R1282 | | 112 | | | 375 | 40 | | 51 | 2000 | 400 | 1.0×10^7 | | 5 | 9 | 2500 | | | | | | |
| R374 | | 127 | | | 185 to 850 | 420 | | 150 | 64 | 1000 | 80 | | 5.3×10^5 | 3 | 15 | 1500 | | | | | |
| R5929 | | | | | 230 | 65 | | 180 | 7.8×10^5 | | 5 | | | | | | | | | | |
| R2228 | | | | | 300 to 900 | 650 | | 200 | 40 | | 150 | | 7.5×10^5 | 8 | | | | | | | |
| R316 | | | | | 400 to 1200 | 800 | | 20 | 1.9 | | 1250 | | 10 | 5.0×10^5 | | | 1000 (at 4A/lm) | 10 | | | |
| R980 | | | | | ϕ 38 (1-1/2") | 116 | | 300 to 650 | 420 | | 100 | | 90 | 1000 | | | 35 | 3.7×10^5 | 3 | 2.8 | 1250 |
| R580 | | | | | | 127 | | | | | 95 | | 88 | 1250 | | | 100 | 1.1×10^6 | 3 | 2.7 | 1750 |
| R1387 | | 116 | | | | 300 to 850 | | | | 150 | 64 | | 1000 | 50 | 3.3×10^5 | 4 | 2.8 | 1250 | | | |
| 7102 | 400 to 1200 | | | | | 800 | | | | 25 | 2.4 | | 1250 | 5 | 2.0×10^5 | 1500 (at 4A/lm) | 2.2 | 1500 | | | |
| R6231 | ϕ 51 (2") | 113 | | | 300 to 650 | 420 | 110 | 95 | 1000 | 30 | 2.7×10^5 | 2 | 5.0 | 1500 | | | | | | | |
| R1306 | | 137 | 7.0 | | | | | | | | | | | | | | | | | | |
| R1828-01 | | 192 | 90 | 85 | | | | | | | | | 2500 | | 1800 | 2.0×10^7 | 50 | 1.3 | 3000 | | |
| R2083 | | 136 | 80 | 80 | | | | | | | | | 3000 | | 200 | 2.5×10^6 | 100 | 0.7 | 3500 | | |
| R5496 | | | 2500 | 1000 | | | | | | | | | 1.3×10^7 | | 1.5 | 3000 | | | | | |
| R331-05 | | 141 | 90 | 85 | | | | | | | | | 1500 | | 120 | 1.3×10^6 | 18 cpm (Background noise) | 2.6 | 2500 | | |
| R329-02 | | 142 | 100 | 1.1 $\times 10^6$ | | | | | | | | | 6 | | 2.6 | 2700 | | | | | |
| R464 | | 141 | 50 | 50 | | | | | | | | | 1000 | | 300 | 6.0×10^6 | ** 5cps | 13 | 1500 | | |
| R375 | | 127 | 160 to 850 | 150 | | | | | | | | | 64 | | 1000 | 80 | 5.3×10^5 | 5 | | 9.0 | |

* The length from the input window to the end of the chip tube (exhaust glass pipe), excluding the length of the leads and temporary base.

** Dark counts per second.

● Applications

| | |
|---------------------------------|--|
| Spectroscopy | UV/Visible/IR Spectrophotometer, Atomic Absorption Spectrophotometer, Photoelectric Emission Spectrophotometer, Fluorescence Spectrophotometer, Raman Spectroscopy, Chromatography, etc. |
| Medical Applications | Radioimmunoassay, Fluorescence Immunoassay, Gamma Camera Positron CT, Liquid Scintillation Counter, X-ray Phototimer, etc. |
| High Energy Physics | Hodoscope, TOF Counter, Cherenkov Counter, Calorimeter, Air Shower Counter, etc. |
| Biotechnology | Cell Sorter, Fluorometer, etc. |
| Pollution Monitoring | Dust Counter, Turbidimeter, Door Monitor, etc. |
| Resource Inquiry | Oil Well Logging, etc. |
| Process Control | Thickness Meter, Laser Scanner, etc. |
| Photography and Printing | Color Scanner, Flying Spot Scanner, etc. |
| Others | Laser Radar, Measurement of Astronomical X-ray, Plasma Observation, etc. |



Head-on Photomultiplier Tubes

Photomultiplier Tubes

Head-on Photomultiplier Tubes

at 25°C

| Type No. | Diameter (mm) | Length Max. (mm) | Spectral Response | | Cathode Sensitivity | | Anode to Cathode Supply Voltage (Vdc) | Anode Luminosity (A/lm) | Current Amplification Typ. | Anode Dark Current (after 30min.) Typ. (nA) | Anode Pulse Rise Time (ns) | Max. Supply Voltage (Vdc) | |
|----------|-------------------|------------------------|-------------------|---|---------------------------|-------------------------------------|---|-------------------------------|----------------------------------|---|-------------------------------------|------------------------------------|------|
| | | | Range (nm) | Peak Wavelength λ_p (nm) | Luminous (μ A/lm) | Radiant at λ_p (mA/W) | | | | | | | |
| R550 | ϕ 51 (2") | 147 | 300 to 850 | 420 | 150 | 64 | 1000 | 100 | 6.7×10^5 | 10 | 9.0 | 1500 | |
| R649 | | 141 | | | 120 | 51 | | 800 | 6.7×10^5 | 200 cps*** | 13 | | |
| R669 | | 127 | 300 to 900 | 650 | 230 | 50 | | 75 | 3.3×10^5 | 7 | 9.0 | | |
| R943-02 | | 104 | 160 to 930 | 300~800 | 600 | 71 | | 1500 | 300 | 5.0×10^5 | 20 cps*** (at 20°C) | 3.0 | 2200 |
| R6232 | ϕ 60 | 101.5* | 300 to 650 | 420 | 110 | 95 | 1000 | 30 | 2.7×10^5 | 2 | 6.0 | 1500 | |
| R6091 | ϕ 76 (3") | 152 | | | 90 | 85 | 1500 | 450 | 5.0×10^5 | 10 | 2.6 | 2500 | |
| R1307 | | 150 | | | 110 | 95 | 1000 | 30 | 2.7×10^5 | 2 | 8.0 | 1500 | |
| R6233 | | 123 | | | | | | | | | 6.0 | | |
| R1911 | | 114* | | | 100 | 90 | 1500 | 3.0×10^5 | 5 | 11 | 1800 | | |
| R2238 | | 69.5* | | | 60 | 65 | 1250 | 5.0×10^5 | | 5.5 | 1500 | | |
| R877 | | ϕ 127 | | | 194 | 80 | 80 | 1250 | 40 | 5.0×10^5 | 10 | 10 | 1500 |
| R1250 | | (5") | | | 281 | 70 | 72 | 2000 | 1000 | 1.4×10^7 | 50 | 2.5 | 3000 |

Hemispherical Envelope Photomultiplier Tubes

| | | | | | | | | | | | | |
|----------|-----------------|-----|------------|-----|----|----|------|-----|-------------------|-----|-----|------|
| R5912 | ϕ 202(8") | 290 | 300 to 650 | 420 | 80 | 76 | 1500 | 800 | 1.0×10^7 | 50 | 3.0 | 2500 |
| R3600-02 | ϕ 508(20") | 683 | | | 60 | 65 | 2000 | 600 | | 200 | 10 | |

Special Envelope Photomultiplier Tubes

| | | | | | | | | | | | | |
|----------|----------------------|--------|------------|-----|-----|----|------|-----|-------------------|----|-----|------|
| R2248 | 9.8 x 9.8 | 56.5 | 300 to 650 | 420 | 95 | 76 | 1250 | 100 | 1.1×10^5 | 5 | 0.8 | 1500 |
| R2102 | 13.5 x 13.5 | 86 | | | 100 | | 1000 | | 1.0×10^5 | | 2.5 | 1250 |
| R2497 | 26 x 26 | 112.5* | | | 115 | 88 | 1500 | 300 | 2.6×10^5 | 50 | 2.4 | 1800 |
| R1548 | 24 x 24 | 85 | | | 80 | 76 | 1250 | 200 | 2.5×10^5 | 20 | 1.8 | 1750 |
| R6234-01 | ϕ 60 Hexagon | 101.5* | | | 110 | 95 | 1000 | 30 | 2.7×10^5 | 2 | 6.0 | 1500 |
| R6236-01 | 60 x 60 | 101* | | | | | | | | | | |
| R6235-01 | ϕ 76 Hexagon | 101.5 | | | | | | | | | | |
| R6237-01 | 76 x 76 | 101.5* | | | | | | | | | | |
| R1612 | 88 x 40 | 148 | | | | | | | | | | |

Microchannel Plate Photomultiplier Tube [Effective Area ϕ 11mm dia.]

| | | | | | | | | | | | | |
|-----------|-----------|------|------------|-----|-----|----|-------|----|-------------------|-----|------|-------|
| R3809U-50 | ϕ 45 | 70.2 | 160 to 850 | 430 | 150 | 60 | -3000 | 30 | 2.0×10^5 | 0.2 | 0.15 | -3400 |
| R3809U-51 | | | 160 to 900 | 600 | 350 | 40 | | 70 | | 1.0 | | |

Microchannel Plate Photomultiplier Tube with Gated Type [Effective Area ϕ 10mm dia.]

| | | | | | | | | | | | | |
|-----------|-----------|------|------------|-----|-----|----|-------|----|-------------------|-----|------|-------|
| R5916U-50 | ϕ 55 | 71.5 | 160 to 850 | 430 | 150 | 60 | -3000 | 30 | 2.0×10^5 | 0.2 | 0.18 | -3400 |
|-----------|-----------|------|------------|-----|-----|----|-------|----|-------------------|-----|------|-------|

Photomultiplier Tube for High Magnetic Environment

| | | | | | | | | | | | | |
|-------|-----------|------|------------|--------------|----|----|------|-----|-------------------|----|-----|------|
| R5505 | ϕ 25 | 54.5 | 300 to 650 | 420 \pm 50 | 80 | 76 | 2000 | 40 | 5.0×10^5 | 5 | 1.5 | 2300 |
| R5946 | ϕ 39 | 65 | | | | | | 80 | 1.0×10^6 | | 1.9 | |
| R5924 | ϕ 52 | | | | 70 | 72 | | 700 | 1.0×10^7 | 30 | 2.5 | |
| R5542 | ϕ 76 | 70 | | | 70 | 72 | | 80 | 2.9 | | | |

Position Sensitive Photomultiplier Tubes

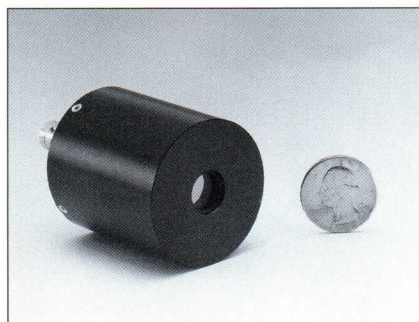
| | | | | | | | | | | | | |
|----------|---------------|---------|------------|-----|----|----|------|---|-------------------|----|-----|------|
| R2486-02 | ϕ 76(3") | 89.2** | 300 to 650 | 420 | 80 | 72 | 1250 | 8 | 1.0×10^5 | 20 | 5.5 | 1300 |
| R2487-02 | 78 x 78 | 103.2** | | | | | | | | 40 | 6.0 | |
| R3292-02 | ϕ 130 | 133 | | | | | | | | | | |

Ⓐ The regular hexagonal input window of 68mm in diagonal.

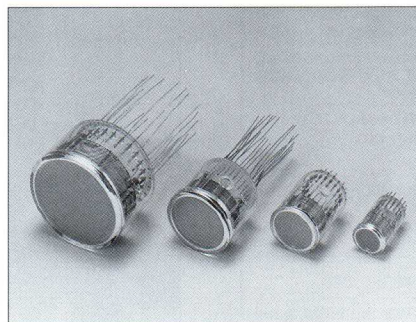
* The length from the input window to the end of the chip tube (exhaust glass pipe), excluding the length of the leads and temporary base.

** The length from the input window to the position signal output circuit board.

*** Values averaged per second.



MCP-PMT



PMT for High Magnetic Environment



Position Sensitive PMT

Metal Package Photomultiplier Tube

R5600U series is the world smallest photomultiplier tube made into TO-8 metal package.

at 25°C

| Type No. | Diameter (mm) | Length Max. (mm) | Spectral Response | | Cathode Sensitivity | | Supply Voltage (Vdc) | Anode Luminous Sensitivity (A/lm) | Current Amplification Typ. | Anode Dark Current (after 30min.) Typ. (nA) | Anode Pulse Rise Time (ns) | Max. Supply Voltage (Vdc) |
|-----------|------------------|------------------------|-------------------|---|---------------------------|-------------------------------------|----------------------------|--|----------------------------------|---|-------------------------------------|------------------------------------|
| | | | Range (nm) | Peak Wavelength λ_p (nm) | Luminous (μ A/lm) | Radiant at λ_p (mA/W) | | | | | | |
| R5600U | ϕ 15.9 | 11.5 | 300 to 650 | 420 | 70 | 70 | 800 | 21 | 3.0×10^5 | 0.5 | 0.65 | 1000 |
| R5600U-01 | | | 300 to 820 | | 100 | 52 | | 30 | | | | |
| R5600U-03 | | | 185 to 650 | | 70 | 70 | | 21 | | | | |
| R5600U-04 | | | 185 to 820 | | 100 | 52 | | 30 | | | | |
| R5600U-06 | | | 160 to 650 | | 70 | 70 | | 21 | | | | |

"P" types (ex.R5600P-suffix) selected for Photon Counting are available.

Photo Sensor Module

H5773/H5783/H5784 series is a new type of photo sensor which combines metal package PMT and high voltage power supply into one package. H5784 series have a low noise amplifier. at 25°C

| Type No. | Spectral Response | | Radiant at 420nm (at +0.8V) Note 1 | Anode Dark Current (at +0.8V) Note 2 | Anode Pulse Rise Time (at +0.8V) (ns) | Supply Voltage (Vdc) | Recommended Control Voltage Range (V) | Max. Supply Voltage (Vdc) | Max. Output Note 3 | Configuration |
|----------|-------------------|---|---|---|---|----------------------------|---|------------------------------------|--------------------------|---------------------------|
| | Range (nm) | Peak Wavelength λ_p (nm) | | | | | | | | |
| H5773 | 300 to 650 | 430 | 21 | 0.5 | 0.65 | +11.5 to +15.5 | +0.25 to +0.95 | +18 | 100 | PC-board mounting type |
| H5773-01 | 300 to 820 | | 15 | 1.0 | | | | | | |
| H5773-03 | 185 to 650 | | 21 | 0.5 | | | | | | |
| H5773-04 | 185 to 820 | | 15 | 1.0 | | | | | | |
| H5773-06 | 185 to 650 | | 21 | 0.5 | | | | | | |
| H5783 | 300 to 650 | 430 | 21 | 0.5 | 0.65 | +11.5 to +15.5 | +0.25 to +0.95 | +18 | 100 | Cable output type |
| H5783-01 | 300 to 820 | | 15 | 1.0 | | | | | | |
| H5783-03 | 185 to 650 | | 21 | 0.5 | | | | | | |
| H5783-04 | 185 to 820 | | 15 | 1.0 | | | | | | |
| H5783-06 | 185 to 650 | | 21 | 0.5 | | | | | | |
| H5784 | 300 to 650 | 430 | 21 | ± 3 | - | ± 11.5 to ± 15.5 | +0.25 to +0.95 | ± 18 | 10 | Cable output type |
| H5784-01 | 300 to 820 | | 15 | ± 3 | | | | | | |
| H5784-03 | 185 to 650 | | 21 | ± 3 | | | | | | |
| H5784-04 | 185 to 820 | | 15 | ± 3 | | | | | | |
| H5784-06 | 185 to 650 | | 21 | ± 3 | | | | | | |

"P" type (ex.H5783P-suffix) is available for H5773 & H5783 series. Incorporated PMT is selected for Photon Counting.

Note1: H5773/H5783 series...(μ A/nW) H5784 series...(V/nW)

Note2: H5773/H5783 series...(nA) H5784 series...Output Offset (mV)

Note3: H5773/H5783 series...(μ A) H5784 series...(V)

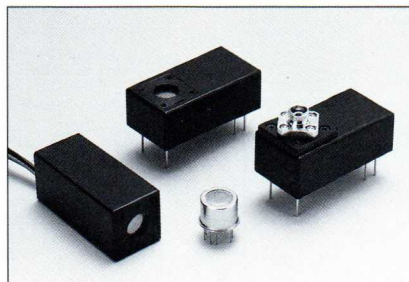
Photo Sensor Module

H5700 series is compact low light level detector module with built-in cockcroft-walton high voltage power supply and 13 mm diameter side-on photomultiplier into aluminum case. H5701/H5702 series further include amplifier which converts the PMT output current into voltage. The series features high sensitivity, low power consumption and excellent linearity.

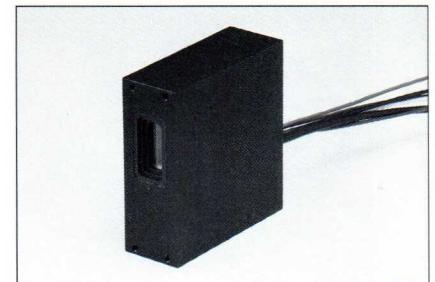
H5700 series is a current output type while H5701/H5702 series is a voltage output type.



LEFT: R5600 RIGHT: R5600U



LEFT: H5783 CENTER: H5773
RIGHT: H5773 with Fiber Adaptor
FRONT: R5600



H5700

Phototubes

at 25°C

| Type No. | Figure | Spectral Response | | Radiant Sensitivity at λ_p (mA/W) | Dark Current Max. (pA) | Operating Voltage (Vdc) | Max. Anode Supply Voltage (Vdc) |
|----------|---------------------|-------------------|-------------------------------------|--|---------------------------|----------------------------|------------------------------------|
| | | Range (nm) | Peak Wavelength λ_p (nm) | | | | |
| R727 | ϕ 21mm Head-on | 185 to 650 | 340 | 70 | 2.0 | 15 | 100 |
| R5764 | ϕ 15mm Head-on | 160 to 200 | 165 | 3 | | | |
| R765 | | 160 to 320 | 240 | 20 | | | |
| R1228 | | 185 to 320 | | | | | |

Biplanar Phototube/For Pulsed Laser Observation

at 25°C

| Type No. | Spectral Response | | Anode Supply Voltage (Vdc) | Luminous Sensitivity (μ A/lm) | Dark Current Max. (nA) | Rise Time (ps) | Fall Time (ps) | Max. Anode Supply Voltage (Vdc) |
|-----------|-------------------|-------------------------------------|-------------------------------|---------------------------------------|---------------------------|-------------------|-------------------|------------------------------------|
| | Range (nm) | Peak Wavelength λ_p (nm) | | | | | | |
| R1193U-51 | 300 to 1100 | 750 | 2500 | 20 | 50 | 270 | 100 | 2500 |
| -52 | 185 to 650 | 340 | | 50 | | | | |
| -53 | 300 to 850 | 400 | | 80 | | | | |
| -54 | 115 to 320 | 200 | | 15mA/W (at 254nm) | | | | |
| -55* | 180 to 350 | 220 | | 15 μ A/W (at 248nm) | | | 130 | |
| R1328U-51 | 300 to 1100 | 750 | 2000 | 20 | 100 | 60 | 55 | 2000 |
| -52 | 185 to 650 | 340 | | 50 | | | | |
| -53 | 300 to 850 | 400 | | 80 | | | | |
| -54 | 115 to 320 | 200 | | 15mA/W (at 254nm) | | | | |

* For waveform observation of excimer laser

High-Voltage Power Supply C3463-50 for Biplanar Phototubes

The C3463-50 is a high-voltage power supply specifically designed for biplanar phototubes. It provides a maximum of 2.5kV and is supplied with a high voltage cable (E1168).

ND Filter E3331 for R1193U-55 Biplanar Phototube

The E3331 ND (neutral density) filter is provided for measurement of ArF (193nm) or KrF (248nm) excimer laser. It easily fits onto the R1193U-55 biplanar phototube and allows high laser power to directly enter the phototube.

Flame Sensors (UV TRON®)

at 25°C

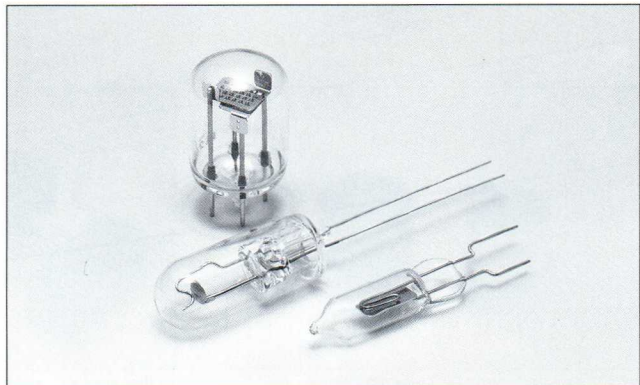
| Type No. | Spectral Response range (nm) | Maximum Ratings | | Recommended Operating Condition | | Characteristics (at 25°C) | | |
|----------|---------------------------------|-----------------------------------|-------------------------------|---------------------------------|--|--|---------------------------------------|-----------------------------------|
| | | Average Discharge Current (mA) | Operating Temperature (°C) | Operating Voltage (Vdc) | Average Discharge Current Max. (mA) | Discharge Starting Voltage Max. (Vdc) | Discharge Sustaining Voltage (Vdc) | Sensitivity ^A (cpm) |
| R2868* | 185 to 260 | 1 | -20 to +60 | 325 ± 25 | 0.1 | 280 | 185 | 5000 |
| R1753-01 | | 3 | -20 to +125 | | 0.3 | 260 | | 600 |
| R259 | | 5 | | | 0.5 | | 200 | |
| R259-01 | 185 to 300 | 5 | | | | | 200 | |

* The driving circuit C3704 series are available for the R2868.

^A Wavelength :200nm, Light intensity :10pW/cm²



Photo Tubes



Flame Sensors (UV TRON®)

Electron Multipliers

at 25°C

| Type No. | Dynode | | | Characteristics | | | Anode to All Other Electrode Capacitance (pF) | Maximum Ratings | | | | | |
|----------|-----------------|--------------|----------|------------------------|----------------------|-----------------------|---|-----------------|-------------------------------------|------------------------------------|----------------------------|------------------------|----------------------|
| | Number of Stage | Structure | Material | Radiation Opening (mm) | Supply Voltage (Vdc) | Current Amplification | | Rise Time (ns) | Anode of First Dynode Voltage (Vdc) | Anode to Last Dynode Voltage (Vdc) | Average Anode Current (μA) | Operating Vacuum Level | |
| R474 | 16 | Box-and-Grid | Cu-BeO | 8 × 6 | 2400 | 1 × 10 ⁶ | 9.3 | 5.0 | 4000 | 350 | 10 | 1.3 × 10 ⁻² | 1 × 10 ⁻⁴ |
| R515 | | | | 4.0 | | | | | | | | | |
| R596 | | | | 9.0 | | | | | | | | | |
| R595 | 20 | | | 12 × 10 | 3000 | 4 × 10 ⁷ | 12 | 9.0 | 5000 | 400 | | | |
| R2362 | 23 | Mesh | Cu-BeO | φ20 | 3450 | 5 × 10 ⁵ | 3.5 | 23 | 4000 | 350 | | | |

- Types with large opening of 58mm (R2363) and 105mm (R2364) in diameter are also available.
- Super-compact type R4146 is also available.

^A Average over any interval of 30 seconds maximum

GM (Geiger-Müller) Tubes

at 25°C

| Type No. | Dimensions Max. (mm) | Effective Length Min. (mm) | Filling Gas | Capacitance of Anode to Cathode (pF) | Starting Voltage Max. (V) | Plateau Voltage (V) | Plateau Slope Max. (%/V) | Background Max. (cpm) | Life Expectancy (counts) | Equivalent Tube |
|----------|----------------------|----------------------------|-----------------|--------------------------------------|---------------------------|---------------------|--------------------------|-----------------------|--------------------------------|-----------------|
| D3372 | φ6.2 × 37 | 16 | He, Ne, Halogen | 3 | 380 | 500 to 650 | 0.15 | 2 | 5 × 10 ¹⁰ (4500cps) | Philips 18509 |
| D3553 | φ6.2 × 27 | 8 | | 2.5 | 400 | 500 to 600 | 0.3 | 1 | 1 × 10 ¹⁰ (3200cps) | Philips 18529 |
| D3517 | φ6.2 × 24 | 5 | | — | | | | | | |

Compact GM Counter Tubes

| | | | | | | | | | | |
|-------|-----------|----|-----------------|-----|-----|------------|------|---|--------------------------------|---------------|
| D3372 | φ6.2 × 37 | 16 | He, Ne, Halogen | 3 | 380 | 500 to 650 | 0.15 | 2 | 5 × 10 ¹⁰ (4500cps) | Philips 18509 |
| D3553 | φ6.2 × 27 | 8 | | 2.5 | 400 | 500 to 600 | 0.3 | 1 | 1 × 10 ¹⁰ (3200cps) | Philips 18529 |
| D3517 | φ6.2 × 24 | 5 | | — | | | | | | |

High-Sensitivity GM Counter Tubes

| | | | | | | | | | | |
|-------|-----------|-----|-----------------|---|-----|------------|------|----|--------------------------------|---|
| D4345 | φ25 × 235 | 170 | He, Ne, Halogen | 9 | 420 | 500 to 650 | 0.15 | 80 | 1 × 10 ¹⁰ (1000cps) | — |
|-------|-----------|-----|-----------------|---|-----|------------|------|----|--------------------------------|---|

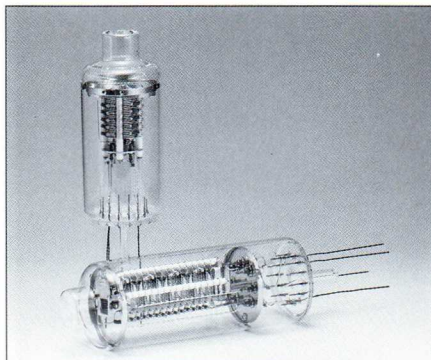
^A Shield with 50mm Pb and 3mm Al

Proportional Counter Tubes

at 25°C

| Type No. | Dimensions (mm) | Effective Area (mm) | Filling Gas | Path Length (mm) | Operating Voltage Range (Vdc) | Recommended Operating Voltage (Vdc) | Energy Resolution (%) | Capacitance (pF) |
|----------|-----------------|---------------------|----------------------|------------------|-------------------------------|-------------------------------------|-----------------------|------------------|
| D1286 | φ38 × 120 | 20 × 20 | Ne + CO ₂ | 30 | 1200 to 1400 | 1300 | 19 | 2.5 |

^A Measured with ⁵⁵Fe source (5.9keV)



Electron Multipliers



Compact GM Counter Tubes



Proportional Counter Tubes

Vidicons

at 25°C

| Type No. | Applications | Features | Diameter mm(inch) Length(mm) | Method | | Dark Current (nA) | Sensitivity | | Limiting Resolution at Center (TV lines) | Lag after 3TV fields (%) |
|----------|--------------|----------|--|---------------|-----------------|-----------------------------|-------------------------------|--------------------------------------|---|---------------------------------------|
| | | | | Focus- ing | Deflec- tion | | Signal Current (nA) | Faceplate Illuminance (lx) | | |

Infrared Vidicons

| | | | | | | | | | | |
|----------|---|--|--|------------------|-------------------|--------|-----|--|---------------------|-----|
| N2634 | Night Surveillance, Scientific Surveys, Temperature Measurement, Infrared Laser Monitoring, Semiconductor Inspection, Moisture Imaging | Wavelength Range 400 to 1800nm | 18 (2/3) | Electro-magnetic | Electro-magnetic | 5 | 150 | (On IR filter) 10lx | 550 | 40 |
| N2634-01 | | Wavelength Range 400 to 2000nm | 103 | | | | 60 | | | |
| N2635 | Semiconductor Inspection, Optical Fiber Inspection in Optical communications, Night Surveillance, Scientific Surveys, Temperature Measurement, Moisture Imaging | | High resolution Wavelength Range 400 to 1900nm | | | 25 (1) | 12 | 250 | (On IR filter) 10lx | 700 |
| N2635-50 | | 159 | | | | 8 | | | | |
| N2606 | | High resolution Wavelength Range 400 to 2200nm | 195 | | | 1 | 100 | 100R/min. (30kVp) | 380 | 25 |
| N2606-01 | | Moisture Imaging (1940nm) | | | | | | | | |
| N2606-02 | Moisture Imaging (1940nm) | 195 | 1 | 100 | 100R/min. (30kVp) | 380 | 25 | | | |
| N2606-06 | | | | | | | | High resolution Wavelength Range 400 to 2200nm | 195 | 1 |
| N2606-04 | Moisture Imaging (1940nm) | 195 | 1 | 100 | 100R/min. (30kVp) | 380 | 25 | | | |
| N4585 | Infrared laser monitoring | | | | | | | 1300 to 1600nm | 25 (1) | 159 |

X-ray Vidicons

| | | | | | | | | | | |
|------|---|---|-----------|------------------|------------------|---|-----|-------------------|-----|----|
| N603 | Nondestructive X-ray Inspection, X-ray Topography | Beryllium Faceplate, High Resolution | 25 (1) | Electro-magnetic | Electro-magnetic | 1 | 100 | 100R/min. (30kVp) | 380 | 25 |
| N400 | | Beryllium Faceplate, Wide Field of View | 38(1-1/2) | | | | | | | |

CHALNICON® /High-Sensitivity Camera Tubes

at 25°C

| Type No. | Applications | Diameter mm(inch) Length(mm) | Method | | Dark Current (nA) | Sensitivity | | Limiting Resolution at Center (TV lines) | Lag after 3TV fields (%) |
|-----------------------------|--|--|------------------|------------------|-----------------------------|-------------------------------|--------------------------------------|---|---------------------------------------|
| | | | Focus- ing | Deflec- tion | | Signal Current (nA) | Faceplate Illuminance (lx) | | |
| N3111 (X)•(D)/E5001 (X)•(D) | Industrial TV camera X-ray TV camera for Medical | 25 (1) | Electro-magnetic | Electro-magnetic | 0.7 | 160 | 0.5 | 900 | 25 |
| N3114 (X)•(D)/E5063 (X)•(D) | | 159 | | | | | | 850 | 10 |
| N3124/E5197A | Compact Industrial TV camera X-ray TV camera for Medical | 18 (2/3) | Electro-static | Electro-magnetic | 0.5 | 70 | 1 | 750 | 5 |
| N3113 (D)/E6061 (D) | | | | | | | | 103 | |
| N3127 | Radiation-tolerant Use | 103 | Electro-static | Electro-magnetic | 0.5 | 150 | 1 | 360 | 5 |
| N3128 | | | | | | | | 600 | |
| N4716 | | | | | | | | 750 | |
| N6068 | | | | | | | | 850 | |
| N6068 | | 25 (1) | 159 | | 0.7 | | 0.5 | 850 | 10 |

Ⓐ The suffix letters, (X) and (D), indicate recommended applications: (X) for X-ray TV cameras; (D) for general-purpose industrial use. They are mainly differentiated according to the spurious signal specifications.



Vidicons



CHALNICON®

Image Intensifiers

at 25°C

| Type No. | Spectral Response | | Photocathode | | Phosphor Screen | | High Voltage Power Supply | Photo-cathode Radiant Sensitivity (mA/W) | Limiting Resolution (Center) Typ. (lp/mm) | Distortion Typ. (%) | Gain | |
|----------|-------------------|----------------------|------------------------------|---|------------------------------|---|---------------------------|--|---|---------------------|----------------------------------|--|
| | Range (nm) | Peak Wavelength (nm) | Effective Diameter Min. (mm) | Window [Ⓐ] Material Thickness (mm) | Effective Diameter Min. (mm) | Window [Ⓐ] Material Thickness (mm) | | | | | Luminous (lm/m ² /lx) | Radiant [Ⓑ] (W/m ² /W/m ²) |
| | | | | | | | | | | | | |

Inverter Types

| | | | | | | | | | | | | |
|--------|------------|-----|-----|-------|-----|-----|----------|---------------|--------|---|---------------------|---|
| V1366P | 350 to 910 | 750 | φ25 | F/3.3 | φ25 | F/7 | Included | 50 (at 800nm) | 30 | 5 | 6 × 10 ⁴ | - |
| V3843U | | | φ20 | | φ13 | | | | Option | | | |

Proximity Focused Types

| | | | | | | | | | | | | | | | |
|----------|------------|-----|-----------|-------|-------|---|--------|-----------------|----|---|-----------------------|-----------------------|----|-----------------------|-----------------------|
| V5255U | 160 to 850 | 430 | φ11.3 | Q/4.9 | φ11.3 | F | Option | 60 [Ⓑ] | 30 | 0 | 1.2 × 10 ⁴ | 8.7 × 10 ³ | | | |
| V2697U | | | φ18 | | Q/5.5 | | | | | | φ18 | 47 [Ⓑ] | 25 | 1.1 × 10 ⁴ | 6.8 × 10 ³ |
| V3063U* | | | | | | | | | | | | | | 1.0 × 10 ⁴ | |
| V4323U** | | | φ25 | | Q/5.9 | | | | | | φ25 | 47 [Ⓑ] | 30 | 1.2 × 10 ⁴ | 8.7 × 10 ³ |
| V5548U** | | | | | | | | | | | | | | 5.0 × 10 ⁶ | 4.0 × 10 ⁶ |
| V4170U | | | φ40 | | Q/5.7 | | | | | | φ40 | 60 [Ⓑ] | 30 | 1.2 × 10 ⁴ | 8.7 × 10 ³ |
| V4183U* | | | | | | | | | | | | | | 4.0 × 10 ⁶ | 3.0 × 10 ⁶ |
| V3346U | | | φ40 | | Q/5.7 | | | | | | φ40 | 47 [Ⓑ] | 30 | 1.2 × 10 ⁴ | 8.7 × 10 ³ |
| V3347U* | | | | | | | | | | | | | | 1.1 × 10 ⁴ | 6.8 × 10 ³ |
| V5180U | | | 6.6 × 8.8 | | Q/5.5 | | | | | | 6.6 × 8.8 | 60 [Ⓑ] | 32 | 1.2 × 10 ⁴ | 8.7 × 10 ³ |
| V5181U* | | | | | | | | | | | | | | 1.1 × 10 ⁴ | 6.8 × 10 ³ |
| V4136U | | | | | | | | | | | | | | 7.0 × 10 ³ | 5.1 × 10 ³ |

- [Ⓐ] F: Fiber optic Q: Synthetic silica [Ⓑ] at peak wavelength
- For proximity-focused types, other spectral responses are also available.
- * Nano second gating is possible.
- ** Subnano second gating is possible.
- The V4136U is designed for fiber-coupling to CCD cameras for high-resolution TV cameras.
- 1 (lm/m²/lx) = 1 (ft-L/ft-c)

Image Converters

at 25°C

| Type No. | Spectral Response | | Photocathode | | Phosphor Screen | | Limiting Resolution (Center) Typ. (lp/mm) | Distortion Typ. (%) | Conversion index (cd/m ² /lx) | Gain Radiant [Ⓑ] (W/m ² /W/m ²) |
|----------|-------------------|----------------------|------------------------------|---|------------------------------|---|---|---------------------|--|---|
| | Range (nm) | Peak Wavelength (nm) | Effective Diameter Min. (mm) | Window [Ⓐ] Material Thickness (mm) | Effective Diameter Min. (mm) | Window [Ⓐ] Material Thickness (mm) | | | | |

- [Ⓐ] B: Borosilicate glass [Ⓑ] at peak wavelength

Photon Counting Imagers

At ultra-low light levels, it is difficult to detect and measure light as an analog quantity and the technique of detecting light as particles (photons) is more effective. However, the signal resulting from individual photons is so weak that an image cannot be obtained directly from the photon signal. The photon counting imager is an ultra-high sensitivity imaging tube that can detect individual photons at such ultra-low light levels. It provides position information of the incident photons to create an image.

at 25°C

| Type No. | Spectral Response | | Photocathode | | Phosphor Screen | | Cathode Radiant Sensitivity at 400mm (mA/W) | Analog Mode (lp/mm) | Photon Counting Mode (lp/mm) | Distortion (%) | Gain | |
|----------|-------------------|----------------------|------------------------------|---|------------------------------|---|---|---------------------|------------------------------|----------------|----------------------------------|--|
| | Range (nm) | Peak Wavelength (nm) | Effective Diameter Min. (mm) | Window [Ⓐ] Material Thickness (mm) | Effective Diameter Min. (mm) | Window [Ⓐ] Material Thickness (mm) | | | | | Luminous (lm/m ² /lx) | Radiant [Ⓑ] (W/m ² /W/m ²) |
| | | | | | | | | | | | | |

Inverter Types

| | | | | | | | | | | | | |
|-----------|------------|-----|-----|-------|-----|---|----|----|----|---|--|---------------------|
| V2025U | 300 to 650 | 380 | φ15 | B/1.5 | φ15 | F | 70 | 18 | 15 | 5 | 10 ³ to 5 × 10 ⁶ | 1 × 10 ⁷ |
| V2025U-13 | 160 to 850 | | | Q/1.5 | | | 60 | | | | 5 × 10 ³ to 10 ⁷ | 9 × 10 ⁶ |

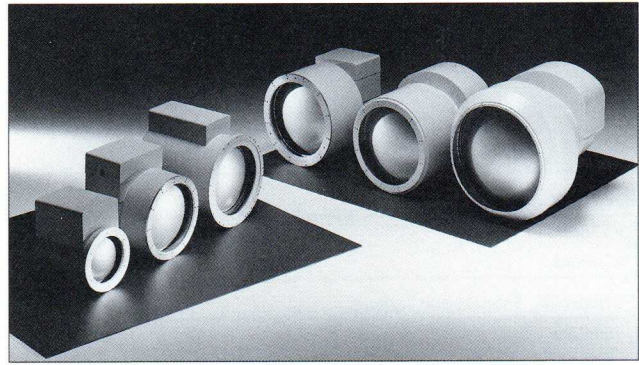
Proximity Focused Types

| | | | | | | | | | | | | |
|--------|------------|-----|-----|-------|-----|---|-----------------|----|---|---|-----------------------|-----------------------|
| V5102U | 160 to 850 | 430 | φ18 | Q/5.5 | φ18 | F | 60 [Ⓑ] | 20 | - | 0 | 7.2 × 10 ⁷ | 5.2 × 10 ⁷ |
| V5103U | | | | | | | 47 [Ⓑ] | | | | 6.4 × 10 ⁷ | 4.1 × 10 ⁷ |

- [Ⓐ] B: Borosilicate glass F: Fiber optic Q: Synthetic silica [Ⓑ] at peak wavelength
- V5103U is capable for nano second gate operation.
- 1 (lm/m²/lx) = 1 (ft-L/ft-c)

X-ray Image Intensifiers

X-ray image intensifiers are large diameter imaging tubes that convert low-contrast images into visible light images, and are used in medical X-ray TV systems and non-destructive X-ray inspection systems. Due to a newly developed CsI input phosphor screen, Hamamatsu X-ray image intensifiers provide high DQE (quantum detection efficiency) and high-quality images. Furthermore, the use of an aluminum input window and the improvement in the output phosphor screen achieve a very high contrast. In particular, the high definition types offer superior spatial resolution that assures an exceptionally clear image even for microstructures in a stomach mucous membrane that has previously been obtained only with high-sensitivity photographic film. In addition, the combination of new input/output phosphor screens and an electron lens designed by computer simulation allows high-quality images even in the digital imaging method.



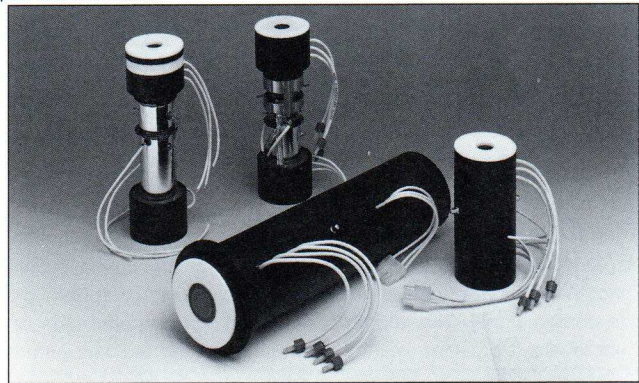
at 25°C

| Type No. | Input Window | | | Output Window | | Limiting Resolution (lp/cm) | Conversion Factor | | Contrast Ratio | QDE (%) | Distortion (%) | Background Max. (cd/m ²) |
|--|------------------------------|--------------------------------|---------------------------|------------------------------|--------------------------------|-----------------------------|-----------------------------------|--------------------------------|----------------|---------|----------------|--------------------------------------|
| | Effective Diameter Typ. (mm) | Input Phosphor Screen Material | Window Material Thickness | Effective Diameter Typ. (mm) | Input Phosphor Screen Material | | (cd/m ²) (μC/kg·s) | (cd/m ²) (mR/s) | | | | |
| V5445P | φ150 | CsI | Beryllium | φ25.0 | P-20 | 65 | 200 | 50 | 20 : 1 | — | 5 | 0.02 |
| V3732P <6",4"> | φ150 | CsI | Aluminum | φ14.5 | P-20 | 46 | 700 | 180 | 20 : 1 | 60 | 5 | 0.02 |
| | φ105 | | | | | 60 | — | — | — | | — | |
| V5914P <9"> | φ220 | CsI | Aluminum | φ20 | P-20 | 44 | 1100 | 280 | 25 : 1 | 60 | 5.5 | 0.02 |
| | φ213 | | | | | 44 | 1400 | 350 | — | | 5 | 0.02 |
| V2465P <9",6",4.5"> | φ155 | CsI | Aluminum | φ20 | P-20 | 50 | — | — | 25 : 1 | 60 | — | — |
| | φ115 | | | | | 60 | — | — | | | — | — |
| | φ293 | | | | | 70 | 180 | 45 | | | 35 : 1 | 10 |
| High Definition V3733P <12",9",7"> | φ235 | CsI | Aluminum | φ60 | P-20 | 75 | — | — | 60 | — | — | — |
| | φ185 | | | | | 83 | — | — | | — | — | |
| | φ360 | | | | | 55 | 250 | 65 | | 35 : 1 | 14.5 | 0.02 |
| High Definition V5213P <16",12",9",7"> | φ293 | CsI | Aluminum | φ60 | P-20 | 65 | — | — | 60 | — | — | — |
| | φ235 | | | | | 70 | — | — | | — | — | |
| | φ185 | | | | | 80 | — | — | | — | — | |
| | φ185 | | | | | 80 | — | — | | — | — | |

* Variant models such as integral power supply types and μ metal housing types are available.

Streak Tubes

The streak tube is an ultra-high speed photodetector which is capable of capturing ultra-short events on the scale of picoseconds. It can measure not only changes in light intensity with respect to time but also one-dimensional spatial information. For example, it can be used for time-resolved spectroscopy, spatially time-resolved measurement, and so on. Hamamatsu offers a wide variety of streak tubes. They are suitable for a wide range of applications with sensitivity from the X-ray to the ultraviolet, visible and near infrared range.



at 25°C

| Type No. | Spectral Response | | Effective Photocathode Area Min. | Effective Phosphor Screen Area Min. (mm) | Photocathode Sensitivity | | | Temporal Resolution (ps) | Limiting Resolution (Center) (lp/mm) | Gain MCP (at 900V) |
|----------|-------------------|-------------------------------------|----------------------------------|--|--------------------------|-------------------------|-------------------------|--------------------------|--------------------------------------|---------------------|
| | Range (nm) | Peak Wavelength λ _p (nm) | | | Luminous (μA/lm) | Radiant at 240nm (mA/W) | Radiant at 820nm (mA/W) | | | |
| N4320 | 200 to 900 | 420 | 0.07 × 6 | φ15 | 150 | 10 | 7 | <20 | 40 | 5 × 10 ³ |
| N5716 | | | 0.5 × 6 | | | | | <2 | 50 | |
| N3373 | | | φ3 | | | | | <0.6 | 75 | |

Image Dissectors/No Lag; For High-speed Tracking and Displacement Measurement

Unlike general camera tubes, the image dissector can offer no lag because it does not use the storage effect. It is possible to carry out random-access scanning by which any point on the photocathode can be read out at high-speed.

at 25°C

| Type No. | Diameter mm(inch) | Effective Photocathode Diameter (mm) | Focusing Method ^A Deflection Method ^B | Absolute Maximum Ratings | | | Typical Characteristics | | | | | |
|----------|-------------------|--------------------------------------|--|--|--------------------|----------------------------------|---------------------------|------------------------|------------------------|----------------|-------------------------------|------------------------|
| | | | | Photocathode Current Density (nA/mm ²) | Anode Current (μA) | Photocathode Sensitivity (μA/lm) | Anode Sensitivity (nA/lx) | Electron Amplification | Amplitude Response (%) | Distortion (%) | S/N rms 10lx (Δf=100kHz) (dB) | Aperture Diameter (μm) |
| N1070-01 | 25(1) | φ16 | M/M | 30 | 10 | 150 | 47 | 1 × 10 ⁶ | 65 (800 TV Lines/inch) | ±2.5 | 10 | φ20 |
| N2730 | 25(1) | φ15 | S/M | 10 | 10 | 150 | 46000 | 5 × 10 ⁶ | 50 (50 TV Lines/inch) | ±2.5 | 30 (at 1lx) | φ400 |

^A M: Electromagnetic focus S: Electrostatic focus

^B M: Electromagnetic deflection

High Speed Gate Image Intensifier Unit

C2925-01, C4078-01, C4273 & C4274 are the high speed gate image intensifier unit developed for low light level high speed phenomena imaging. Simply coupling the CCD camera at the unit head, it works as a high speed shutter camera. It can take a still image of any timing of high speed phenomena. It can be used for the applications such as observation of bioluminescence or discharge phenomena, and any other fast moving phenomena.

| Parameter | C2925-01 | C4078-01 | C4273 | C4274 | Unit |
|-----------|----------|----------|-------|-------|------|
|-----------|----------|----------|-------|-------|------|

Built-in Image Intensifier Characteristics

| | | | | | |
|-------------------------|-------------------|-------------------|-------------------|-------------------|---|
| Cathode Sensitivity | 150 | | | | $\mu\text{A}/\text{lm}$ (Typ.) |
| Luminous Emittance Gain | 7.0×10^3 | 1.0×10^6 | 7.0×10^3 | 1.0×10^6 | $\text{lm}/\text{m}^2/\text{lx}$ (Min.) |
| Limiting Resolution | 23 | 20 | 23 | 20 | lp/mm (Min.) |
| Effective Diameter | $\phi 17.5$ | | | | mm |

Function Mode/Protection

| | | | |
|-------------------------------------|-----------------------|----|---|
| Operation Mode | Normal Mode/Gate Mode | | — |
| Excessive Incident Light Protection | YES | NO | — |

Gate Signal Input

| | | | |
|----------------------|----------------------------------|-----------|------------|
| Level | TTL, Positive Logic (5Vp-p Max.) | | — |
| Input Impedance | 50 | | Ω |
| Pulse Width | 10 to DC | 100 to DC | ns |
| Repetition Frequency | 10 (with Limiting Circuit) | | kHz (Max.) |

Gate Output

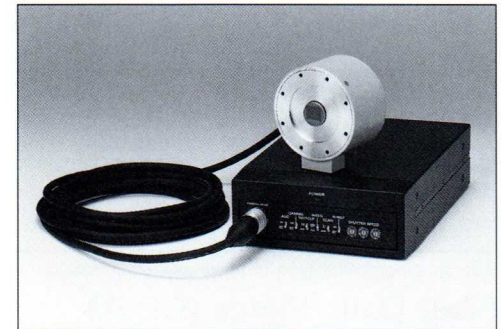
| | | | |
|-----------|---------|-----------|----|
| Gate Time | 3 to DC | 100 to DC | ns |
|-----------|---------|-----------|----|



CCD Camera with Fiber Optic Window

C5895 series employs high resolution CCD camera with fiber optic plate as an input window. It is designed for the read-out device for the fiber optic output image such as an image intensifier. Compared to the conventional lens coupling, it reduces the light loss so that the sensitivity can be increased by a factor of 3 to 10 times.

| Parameter | C5895 | C5895-01 | Unit |
|----------------------|---------------------|---------------------|------------------------------|
| Output Signal Method | EIA | CCIR | — |
| Image Area | 12.8 × 9.6 (1 inch) | | mm |
| Resolution | Horizontal | 570 | TV Lines |
| | Vertical | 485 (2:1 interlace) | 575 (2:1 interlace) TV Lines |



Built-in High Speed Electronic Shutter ICCD Camera Unit

Conventional high speed shutter camera had some limitation in taking a low light level image since the input light level reduces in proportion to the shutter speed. Accordingly, it can take the image only under high illumination other than strong light emissive objects. This ICCD unit employs the image intensifier carrying high speed shutter function (minimum shutter speed of 100ns.) so that it makes high sensitivity and fast time resolving image acquisition for the fast phenomena possible. The unit contains AGC and high incident light protection functions so that it allows fail-safe operation.



Difference Among Each Camera Unit

| Parameter | C4336 Series | C4206 Series | C4077 Series |
|-----------------------------------|-------------------------|-------------------------|--------------------------|
| Image Area | 12.8mm × 9.6mm (1 inch) | 12.8mm × 9.6mm (1 inch) | 8.8mm × 6.6mm (2/3 inch) |
| Minimum Photocathode Illumination | 2×10^{-5} lx | 4×10^{-7} lx | 4×10^{-5} lx |
| Limiting Resolution | 400 TV Lines | 380 TV Lines | 350 TV Lines |

Microchannel Plates (MCP)

The microchannel plate (MCP) consists of a two-dimensional array of millions of very-small diameter glass capillaries (6 μm to 25 μm) fused together and sliced in the shape of a thin disk. These capillaries are called channels and act as independent electron multipliers. The MCP can be used for the two-dimensional detection and amplification of electrons, ions, etc. at 25°C

| Type No. | Dimension | | Channel | | | Electrode Material | Electrical Characteristics ^A | | | | Maximum Ratings | |
|----------|--------------------|-------------------------|----------------------------|-------------------------------|---------------------|--------------------|---|--------------------------------|---------------------------|----------------------|---------------------|--|
| | Disk Diameter (mm) | Effective Diameter (mm) | Diameter (μm) | Bias Angle $\theta(^{\circ})$ | Open Area Ratio (%) | | Current Gain | Plate Resistance (M Ω) | Dark Current (A/cm 2) | Linear Output Signal | Applied Voltage (V) | Ambient Temperature ($^{\circ}\text{C}$) |

Circular MCPs

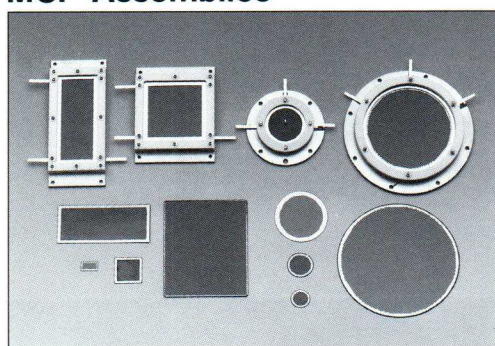
| | | | | | | | | | | | | |
|----------|-------------|-------------|------|-----------|----|------------------|-----------------|-----------|--------------------------------|-------------------------|------|------------|
| F1094-09 | $\phi 24.9$ | $\phi 20.0$ | 10 | 5 | 60 | Inconel or Ni-Cr | 10 4 or More | 50 to 500 | 5 \times 10 $^{-13}$ or Less | 7% of the strip current | 1000 | -50 to +70 |
| F1552-09 | $\phi 32.8$ | $\phi 27.0$ | | 12 | | | | 30 to 300 | | | | |
| F1217-01 | $\phi 50.0$ | $\phi 42.0$ | 5, 8 | 10 to 200 | | | | | | | | |
| F1942-04 | $\phi 86.7$ | $\phi 77.0$ | 8 | 10 to 100 | | | | 1200 | | | | |

Rectangular MCPs

| | | | | | | | | | | | | |
|----------|----------------|----------------|----|---|----|------------------|-----------------|-----------|--------------------------------|-------------------------|------|------------|
| F2805-03 | 60 \times 60 | 53 \times 53 | 20 | 8 | 60 | Inconel or Ni-Cr | 10 4 or More | 20 to 120 | 5 \times 10 $^{-13}$ or Less | 7% of the strip current | 1200 | -50 to +70 |
| F1943-02 | 88 \times 38 | 81 \times 31 | 15 | | | | | 20 to 200 | | | 1100 | |

^A at 1kV

MCP Assemblies



MCP assemblies are easy-to-use electron and ion detectors with integral leads for voltage application and signal readout devices. Various types of readout devices can be chosen according to applications.

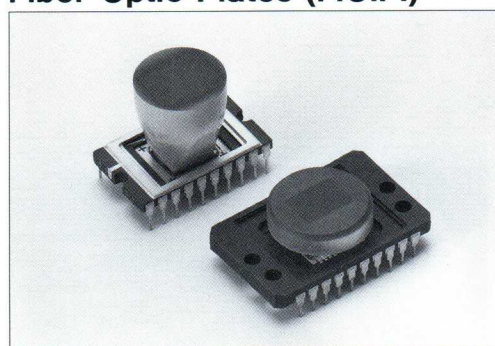
Applications

- Analytical Instrument**
- Electron Tubes**
- High Energy Physics**
- High-speed Line Width Measurement
- Image Intensifier
- Various Ion Detection
- FIM, AP-FIM
- High-speed Response PMT
- Electron, Positron Detection
- ESCA
- Streak Tubes
- High Energy Particle Detection
- MASS SPECTROSCOPY
- Space
- X-ray Detection
- TOF-MS
- Plasma Ion Detection
- LEED, MEED etc.
- Soft X-ray, VUV Detection

| Assembly Type | | MCP | Effective Diameter (mm) | No. of MCP | Readout Device* |
|------------------|----------------------|----------|-------------------------|------------|---|
| Demountable Type | Non-demountable Type | | | | |
| F2222 | F1094 | F1094-01 | $\phi 17$ | 1 to 3 | Single anode Phosphor screen Multianode High-speed detection anode CR-chain anode |
| F2226 | — | F1942-04 | $\phi 75$ | | |
| F2813 | — | F1943-02 | 80 \times 30 | | |
| F2814 | — | F2805-03 | 50 \times 50 | | |

* Depending on the type of assembly, some readout devices may not be combined. So, please consult Hamamatsu sales office.

Fiber Optic Plates (F.O.P.)



The fiber optic plate (FOP) is an optical image transmitting element consisting of a large number of optical fibers bundled and fused in the form of a plate, in which each of the thin optical fibers (core diameter: 3 to 25 μm) with high refractive index is covered with clad glass with low refractive index.

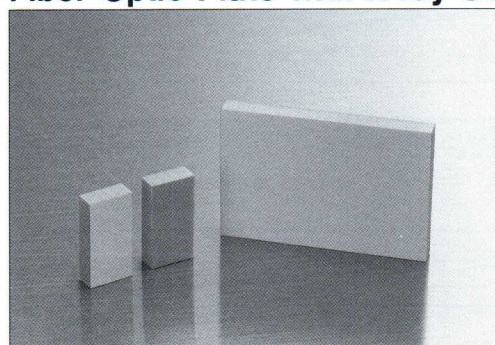
Applications

Optical windows for image intensifiers, CRT, imaging tubes and CCD.

| Type | Numeric Aperture (N.A.) | Fiber Size (μm) | Transmittance* [Collimated(%)] | Resolution (lp/mm) |
|-------|-------------------------|------------------------------|--------------------------------|--------------------|
| J3182 | 1.0 | 6 | 73 | 102 |
| J3280 | 0.35 | 25 | 68 | 28.5 |
| J3281 | 0.55 | | | |
| J3282 | 0.88 | | | |

* $\lambda = 550\text{nm}$, thickness = 3.0mm, including the surface reflection.

Fiber Optic Plate with X-ray Scintillator (F.O.S)



Fiber Optic Plate with X-ray scintillator (FOS) is an X-ray imaging device for the next generation that provides higher sensitivity and resolution than currently used phosphor screen. The FOS also allows real-time digital radiography when directly coupled to a CCD.

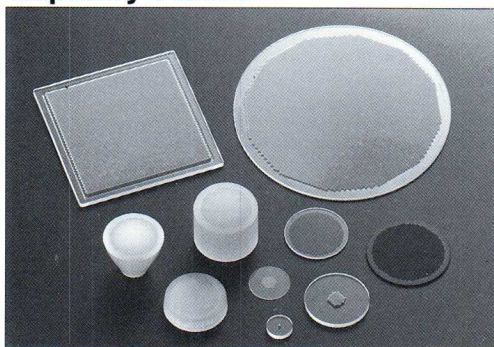
Applications

- Dental diagnosis
- Mammography
- Non-destructive inspection of semiconductor devices

| Type No. | Scintillator Type | Outer Dimension (mm) | Effective Area (mm) | Thickness (mm) | Relative Light Output (% Min.) ^A | Resolution (lp/mm Min.) |
|----------|----------------------|----------------------|---------------------|----------------|---|-------------------------|
| J6144 | Gd $_2$ O $_2$ S(Tb) | 30 \times 20 | 28 \times 18 | 3 | 120 | 14 |
| J6671 | CsI(Tl) | | 27 \times 17 | 3 | 105 | 22 |
| J6676 | Gd $_2$ O $_2$ S(Tb) | 50 \times 50 | 48 \times 48 | 3 | 120 | 14 |
| J6677 | CsI(Tl) | | 47 \times 47 | 3 | 105 | 22 |

^A Relative values, with 100% being equal to the light output from conventional sensitizer paper.

Capillary Plates



The capillary plate is a glass plate with a thickness of 0.4 to several tens of millimeters. It is comprised of a two-dimensional regular array of glass tubes with inner diameters ranging from a few to several hundred microns. Each glass tube has excellent linearity and accuracy, thus being useful in a wide range of applications including use in optical guide and flow control.

Applications

- Flow control and measurement equipment
- Optical and x-ray collimator
- Differential-pressure exhaust window
- Window material for VUV and X-ray
- Particle filter

| Type No. | Outer Dimension (mm) | Effective Dimension (mm) | Capillary diameter D (μm) | Thickness L (mm) | L/D |
|----------|----------------------|--------------------------|---------------------------|------------------|-----|
| J5022-01 | φ5 | φ0.8 | 12 | 1.0 | 83 |
| J5022-21 | φ87 | φ77 | 25 | | 40 |
| J5022-19 | 60×60 | 53×53 | 20 | | 50 |

Hollow Cathode Lamps/For atomic absorption analysis

Single-element Lamps :L233 Series (1.5" dia.), L1788 Series (2" dia. for Perkin-Elmer) :L2433 Series (S-H Method for Background Correction)

| Elements | Type No. (suffix) | Analysis Lines (nm) |
|---------------|-------------------|---------------------|
| Ag Silver | -47NB | 328.07 338.28 * |
| Al Aluminum | -13NB | 309.27 396.15 * |
| As Arsenic | -33NQ | 193.70 197.20 * |
| Au Gold | -79NQ | 242.80 267.59 * |
| B Boron | -5NQ | 249.68 249.77 } |
| Ba Barium | -56NB | 553.55 * |
| Be Beryllium | -4NQ | 234.86 * |
| Bi Bismuth | -83NQ | 223.06 306.77 * |
| Ca Calcium | -20NQ | 422.67 * |
| Cd Cadmium | -48NQ | 228.80 * |
| Co Cobalt | -27NQ | 240.73 346.58 * |
| Cr Chromium | -24NB | 357.87 425.44 * |
| Cs Cesium | -55NB | 852.11 * |
| Cu Copper | -29NB | 324.75 327.40 * |
| Dy Dysprosium | -66NB | 404.59 421.17 * |
| Er Erbium | -68NB | 400.79 415.11 * |
| Eu Europium | -63NB | 459.40 462.72 * |
| Fe Iron | -26NQ | 248.33 371.99 * |
| Ga Gallium | -31NQ | 287.42 294.36 * |
| Gd Gadolinium | -64NB | 407.87 422.58 * |
| Ge Germanium | -32NQ | 265.16 * |
| Hf Hafnium | -72NQ | 286.64 307.29 * |

| Elements | Type No. (suffix) | Analysis Lines (nm) |
|-----------------|-------------------|---------------------|
| Hg Mercury | -80NQ | 253.65 * |
| Ho Holmium | -67NB | 410.38 416.30 * |
| In Indium | -49NB | 303.94 325.61 * |
| Ir Iridium | -77NQ | 208.88 266.47 * |
| K Potassium | -19NB | 766.49 769.90 * |
| La Lanthanum | -57NB | 357.44 550.13 * |
| Li Lithium | -3NB | 610.36 670.78 * |
| Lu Lutetium | -71NB | 328.17 331.21 * |
| Mg Magnesium | -12NQ | 285.21 * |
| Mn Manganese | -25NQ | 279.48 403.08 * |
| Mo Molybdenum | -42NB | 313.26 320.88 * |
| Na Sodium | -11NB | 589.00 589.59 * |
| Nb Niobium | -41NB | 334.91 405.89 * |
| Nd Neodymium | -60NB | 463.42 492.45 * |
| Ni Nickel | -28NQ | 232.00 341.48 * |
| Os Osmium | -76NQ | 290.90 305.86 * |
| Pb Lead | -82NQ | 217.00 283.30 * |
| Pd Palladium | -46NQ | 244.79 247.64 * |
| Pr Praseodymium | -59NB | 495.13 513.34 * |
| Pt Platinum | -78NQ | 265.95 299.80 * |
| Rb Rubidium | -37NB | 780.02 794.76 * |
| Re Rhenium | -75NB | 346.05 346.47 * |

| Elements | Type No. (suffix) | Analysis Lines (nm) |
|--------------------------|-------------------|---------------------|
| Rh Rhodium | -45NB | 343.49 * |
| Ru Ruthenium | -44NB | 349.89 * |
| Sb Antimony | -51NQ | 217.58 231.15 * |
| Sc Scandium | -21NB | 390.74 391.18 * |
| Se Selenium | -34NQ | 196.03 * |
| Si Silicon | -14NQ | 251.61 288.16 * |
| Sm Samarium | -62NB | 429.67 484.17 * |
| Sn Tin | -50NQ | 224.61 286.33 * |
| Sr Strontium | -38NB | 460.73 * |
| Ta Tantalum | -73NQ | 271.47 275.83 * |
| Tb Terbium | -65NB | 431.88 432.64 * |
| Te Tellurium | -52NQ | 214.27 * |
| Ti Titanium | -22NB | 364.27 365.35 * |
| Tl Thallium | -81NQ | 276.78 377.57 * |
| Tm Thulium | -69NB | 371.79 410.58 * |
| V Vanadium | -23NB | 306.64 318.40 * |
| W Tungsten | -74NQ | 255.14 400.87 * |
| Y Yttrium | -39NB | 410.23 412.83 * |
| Yb Ytterbium | -70NB | 346.43 398.79 * |
| Zn Zinc | -30NQ | 213.86 307.59 * |
| Zr Zirconium | -40NB | 360.12 468.78 * |
| D ₂ Deuterium | -1DQ | 240.00 (peak) |

* The most sensitive absorption line of each element.

■ For the type No. of the L233, L2433 series, the last suffix is "NU" instead of "NQ" except that the L2433-26 (Fe) is designated L2433-26NQ.

○ marks indicate the L2433 series lamps. D₂ is available only for L233 series.

Multi-element Lamps*: L733 Series (1.5" dia.), L1788 Series (2" dia. for Perkin-Elmer)

| Elements | Type No. | Type No. (suffix) |
|----------|----------------------------|-------------------|
| Na-K | Sodium Potassium | -201NB |
| Ca-Mg | Calcium Magnesium | ■-202NQ |
| Si-Al | Silicon Aluminum | ■-203NQ |
| Fe-Ni | Iron Nickel | -204NQ |
| Sr-Ba | Strontium Barium | -205NB |
| Al-Ca-Mg | Aluminum Calcium Magnesium | ■-321NQ |
| Ca-Mg-Zn | Calcium Magnesium Zinc | -322NQ |

* Absorption lines comply with the wavelengths of single-element lamps.

■ For the L733 series, the last suffix is "NU" instead of "NQ".



Hollow Cathode Lamps

Deuterium Lamps

L2D2 Lamps

at 25°C

| Series | Type No. | Aperture Size (mm) | Spectral Distribution (nm) | Required Discharge Starting Voltage Min. (Vdc) ^A | Lamp Current (mAdc) | Lamp Voltage Typ. (Vdc) | Output Stability | | Heater Ratings | | | | | Guaranteed Life (h) ^B | | | | |
|----------------|----------|--------------------|----------------------------|---|---------------------|-------------------------|------------------|-------------------------|-------------------|------------------------|---------------|---------------|--------------------|----------------------------------|---------|----------|------------|------------|
| | | | | | | | Drift Max. (%/h) | Fluctuation Max. (%p-p) | Warm-up | | | Operating | | | | | | |
| | | | | | | | | | Voltage (Vdc, ac) | Current Typ. (Adc, ac) | Time Min. (s) | Voltage (Vdc) | Current Typ. (Adc) | | | | | |
| L2-4000 Series | L6565 | 1.0 | 185 to 400 | 350 | 300 ± 30 | 80 | ±0.3 | 0.05 | 2.5±0.25 | 4 | 20 | 1.0±0.1 | 1.8 | 4000 | | | | |
| | 3.0±0.3 | | | | | | | | 5 | 0 to 1 | | 0 to 1.6 | | | | | | |
| L2-2000 Series | L6301 | 0.5 | 185 to 400 | 400 | 300 ± 30 | 80 | ±0.3 | 0.05 | 2.5±0.25 | 4 | 20 | 1.0±0.1 | 1.8 | 2000 | | | | |
| | L6302 | 1.0 | | 350 | | | | | | | | 3.0±0.3 | 5 | | 1.7±0.2 | 3.3 | | |
| | L6303 | 0.5 | | 400 | | | | | | | | | | | 0 to 1 | 0 to 1.6 | | |
| | L6304 | 1.0 | | 350 | | | | | | | | | | | | | | |
| | L6305 | 0.5 | | 400 | | | | | | | | | | | 10±1 | 0.8 | 2.5 to 6.0 | 0.3 to 0.6 |
| | L6306 | 1.0 | | 350 | | | | | | | | | | | | | | |
| | L6307 | 0.5 | | 400 | | | | | 12 to 15 | 0.5 to 0.55 | | | | | 7.0±0.5 | 1.0 | | |
| | L6308 | 1.0 | | 350 | | | | | | | | | | | | | | |
| | L6309 | 0.5 | | 400 | | | | | 0 | 0 | | | | | | | | |
| | L6310 | 1.0 | | 350 | | | | | | | | | | | | | | |
| | L6311 | 0.5 | | 400 | | | | | 300±10 | 350 | | | | | | | | |
| | L6312 | 1.0 | | 350 | | | | | | | | | | | | | | |

Deuterium Lamps

at 25°C

| Type No. | Window Material | Spectral Distribution (nm) | Required Discharge Starting Voltage Min. (Vdc) ^A | Lamp Current (mAdc) | Lamp Voltage Typ. (Vdc) | Output Stability | | Heater Ratings | | | | | Guaranteed Life (h) |
|----------|-----------------|----------------------------|---|---------------------|-------------------------|------------------|-------------------------|-------------------|------------------------|---------------|---------------|--------------------|---------------------|
| | | | | | | Drift Max. (%/h) | Fluctuation Max. (%p-p) | Warm-up | | | Operating | | |
| | | | | | | | | Voltage (Vdc, ac) | Current Typ. (Adc, ac) | Time Min. (s) | Voltage (Vdc) | Current Typ. (Adc) | |

HB(High-Brightness) Types (Indirectly Heated Cathode)

| | | | | | | | | | | | | | |
|-------|-------------------|------------|-----|--------|----|------|------|------|-----|----|---------|---|-------------------|
| L2196 | Synthetic Silica | 160 to 400 | 350 | 300±30 | 80 | ±0.5 | 0.05 | 10±1 | 1.2 | 20 | 7.0±0.5 | 1 | 1500 ^B |
| L2541 | UV Glass (0.4mmt) | 185 to 400 | | | | | | | | | | | |

SQ(Super-Quiet) Types (Indirectly Heated Cathode)

| | | | | | | | | | | | | | |
|-------|-------------------|------------|-----|--------|----|------|------|----------|-----|----|---------|-----|-------------------|
| L1626 | Synthetic Silica | 160 to 400 | 350 | 300±30 | 80 | ±0.5 | 0.05 | 10±1 | 1.2 | 20 | 7.0±0.5 | 1 | 2000 ^B |
| L2526 | UV Glass (0.4mmt) | 185 to 400 | | | | | | | | | | | 1500 ^B |
| L1636 | Synthetic Silica | 160 to 400 | | | | | | 2.5±0.25 | 4 | | 1.7±0.2 | 3.3 | 2000 ^B |
| L1729 | UV Glass (0.4mmt) | 185 to 400 | | | | | | 10±1 | 1.2 | | 7.0±0.5 | 1 | 1500 ^B |

DH(Directly-Heated) Types

| | | | | | | | | | | | | | |
|---------|-------------------|------------|-----|--------|----|------|-----|----------|-----|----|---------|-----|-------------------|
| L544 | Fused Silica | 160 to 400 | 350 | 300±30 | 80 | ±0.5 | 0.1 | 10±1 | 0.8 | 20 | 3.5±0.5 | 0.3 | 1000 ^C |
| L1128 | Fused Silica | | | | | | | | | | | | 115 to 400 |
| L879 | MgF ₂ | 185 to 400 | | | | | | 2.5±0.25 | 4 | | 1.0±0.1 | 1.8 | 1000 ^C |
| L613 | UV Glass (0.8mmt) | 185 to 400 | | | | | | 300 | | | | | |
| L879-01 | MgF ₂ | 115 to 400 | | | | | | | 300 | | | | |

HP (High Performance • High Power • High Precision) types

| | | | | | | | | | | | | | |
|----------|-------------------|------------|-----|--------|----|------|------|----------|-------------|----|----------------|----------------|-------------------|
| L4505-50 | UV Glass (0.4mmt) | 185 to 400 | 370 | 300±10 | 85 | ±0.5 | 0.05 | 12 to 15 | 0.5 to 0.55 | 20 | - ^D | - ^D | 1500 ^B |
| L4510-50 | UV Glass (0.4mmt) | | 350 | | 80 | | | | | | | | |

^A A starting voltage of higher than these values is required to trigger the lamp discharge. It is recommended for secure triggering to apply a voltage between 500 and 600V. The maximum rating is 650V.

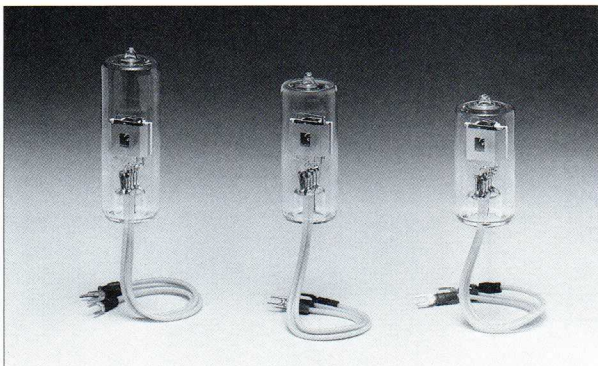
^B The life end is defined when the UV region intensity falls to 50% of its initial value or when fluctuation exceeds 0.05%p-p.

^C The life end is defined when the UV region intensity falls to 50% of its initial value or when fluctuation exceeds 0.1%p-p.

^D The lamp is designed such that during operation the discharge current flows into the heater to maintain the cathode temperature at an optimum level. It is therefore unnecessary to supply the heater with external power for heating.

^E Estimated Life

* In order to maximize the lamp performances, we recommend to operate the lamp along with exclusive power supply made by HAMAMATSU.



L2D2 Lamps



Deuterium Lamps

Super-Quiet Xenon Lamps

at 25°C

| Type No. | Power Consumption (W) | Arc Length (mm) | Window Material | Spectral Distribution (nm) | Lamp Current (Adc) | Lamp Voltage (Vdc) | Output Stability (after 20 min.) | | Life | |
|----------|-----------------------|-----------------|-------------------|----------------------------|--------------------|--------------------|----------------------------------|----------------------|-----------------------------|-------------|
| | | | | | | | Drift Max. (%/h) | Fluctuation Max. (%) | Guaranteed ^A (h) | Average (h) |
| L2173 | 35 | 1.0 | Fused Silica | 185 to 2000 | 3.5±0.5 | 11 | ±0.5 | ±0.5 | 1000 | 2000 |
| L2193 | | | Ozone-free Silica | 220 to 2000 | | | | | | |
| L2174 | 75 | 1.3 | Fused Silica | 185 to 2000 | 5.4±0.5 | 15 | | | | |
| L2174-01 | | | | | | | | | | |
| L2174-02 | | | | | | | | | | |
| L2194 | | | Ozone-free Silica | 220 to 2000 | | | | | | |
| L2194-01 | | | | | | | | | | |
| L2194-02 | | | | | | | | | | |
| L2175 | 150 | 2.5 | Fused Silica | 185 to 2000 | 7.5±0.5 | 20 | | | 1200 | 2500 |
| L2195 | | | Ozone-free Silica | 220 to 2000 | | | | | | |
| L2273 | | 2.0 (GS) | Fused Silica | 185 to 2000 | 8.5±0.5 | 18 | | | 1800 | 3000 |
| L2274 | | | Ozone-free Silica | 220 to 2000 | | | | | | |
| L2479 | 300 | 3.0 | Fused Silica | 185 to 2000 | 15.0±1.0 | 20 | 1000 | 2000 | | |
| L2480 | | | Ozone-free Silica | 220 to 2000 | | | | | | |

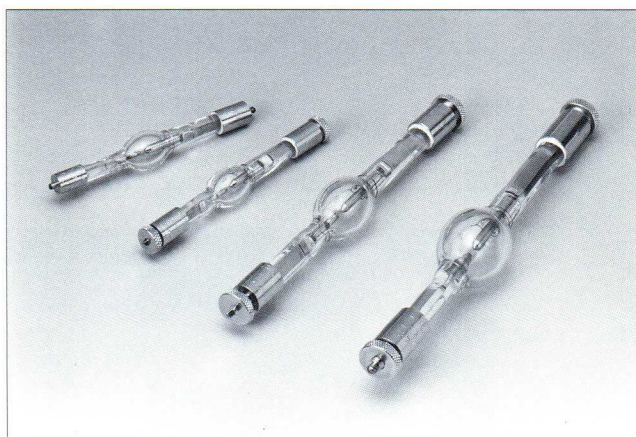
^A The life end is defined as the time when the radiant intensity falls to 50% of its initial value or when the output fluctuation exceeds 1%p-p.
 * In order to maximize the lamp performances, we recommend to operate the lamp along with exclusive power supply made by HAMAMATSU.

Super-Quiet Mercury-Xenon Lamps

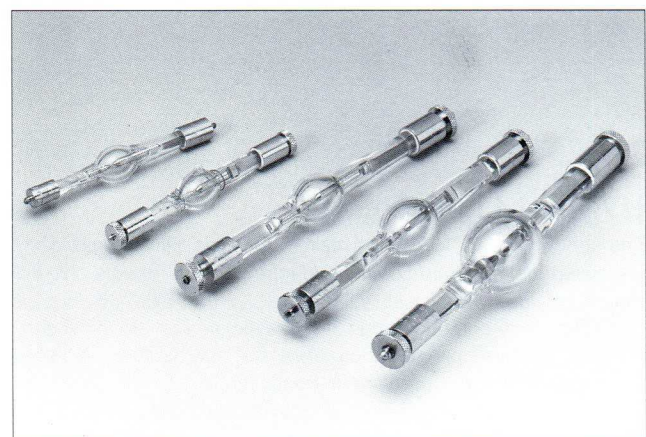
at 25°C

| Type No. | Power Consumption (W) | Arc Length (mm) | Window Material | Spectral Distribution (nm) | Lamp Current (Adc) | Lamp Voltage (Vdc) | Output Stability (after 20 min.) | | Life | | | |
|----------|-----------------------|-----------------|-----------------|----------------------------|--------------------|--------------------|----------------------------------|----------------------|-----------------------------|-------------|------|------|
| | | | | | | | Drift Max. (%/h) | Fluctuation Max. (%) | Guaranteed ^A (h) | Average (h) | | |
| L2421 | 50 | 1.0 | Fused Silica | 185 to 2000 | 3.5±0.5 | 14 | ±0.5 | ±1.0 | 500 | 1000 | | |
| L2481 | 75 | | | | 5.4±0.5 | 15 | | | | | | |
| L2481-01 | | | | | | | | | | | | |
| L2481-02 | | | | | | | | | | | | |
| L2422 | 100 | 1.3 | | | 5.5±0.5 | 18 | | | | | | |
| L2422-01 | | | | | | | | | | | | |
| L2422-02 | | | | | | | | | | | | |
| L2482 | 150 | 1.7 | | | 7.5±0.5 | 20 | | | | | | |
| L2423 | 200 | 2.0 | | | Ozone-free Silica | 220 to 2000 | | | 8.0±0.5 | 23 | 1000 | 2000 |
| L2423-01 | | | | | | | | | | | | |
| L2570 | | | | | | | | | | | | |
| L2570-01 | | | | | | | | | | | | |
| L2483 | 350 | 2.5 | Fused Silica | 185 to 2000 | 14.0±1.0 | 25 | 500 | 1000 | | | | |
| L2424 | 500 | 3.0 | | | 20.0±1.0 | | | | | | | |

^A The life end is defined as the time when the radiant intensity falls to 50% of its initial value or when the output fluctuation exceeds ±1%.



Super-Quiet Xenon Lamps



Super-Quiet Mercury-Xenon Lamps

Super-Quiet Xenon Flash Lamps

at 25°C

| Type No. | Arc Size (mm) | Window Material | Spectral Distribution (nm) | Recommend Supply Voltage (Vdc) | Trigger Voltage (kV) | Max. Average Power (W) | Max. Input Energy per Flash (J/Flash) | Repetition Rate Max. (Hz) | Output Stability ^A | Guaranteed Life Min. (Number of Flashes) ^A |
|----------|------------------|--------------------|----------------------------------|---|----------------------------|---------------------------------|---|---------------------------------|---|--|
| | | | | | | | | | Output ^B Fluctuation Max. (%) | |

26mm Diameter SQ (Super-Quiet) Types

| | | | | | | | | | | |
|-------|-----|------------------|-------------|-------------|--------|----|------|-----|-----|-------------------|
| L2187 | 8.0 | Synthetic Silica | 160 to 2000 | 700 to 1000 | 5 to 7 | 15 | 0.15 | 100 | 2.5 | 1.2×10^9 |
| L2188 | | UV Glass | 185 to 2000 | | | | | | | |
| L2189 | | Borosilicate | 240 to 2000 | | | | | | | |
| L2358 | 3.0 | Synthetic Silica | 160 to 2000 | 700 to 1000 | 5 to 7 | 15 | 0.15 | 100 | 2.5 | 1.2×10^9 |
| L2359 | | UV Glass | 185 to 2000 | | | | | | | |
| L2360 | | Borosilicate | 240 to 2000 | | | | | | | |
| L2435 | 1.5 | Synthetic Silica | 160 to 2000 | 700 to 1000 | 5 to 7 | 15 | 0.15 | 100 | 3.5 | 1.2×10^9 |
| L2436 | | UV Glass | 185 to 2000 | | | | | | | |
| L2437 | | Borosilicate | 240 to 2000 | | | | | | | |

20mm Diameter HQ (High-Quality) Types

| | | | | | | | | | | |
|-------|-----|--------------|-------------|-------------|--------|----|------|-----|-----|-----------------|
| L4644 | 3.0 | UV Glass | 185 to 2000 | 700 to 1000 | 5 to 7 | 10 | 0.10 | 100 | 3.0 | 1×10^9 |
| L4646 | | | 280 to 2000 | | | | | | | |
| L4645 | | Borosilicate | 240 to 2000 | | | | | | | |
| L4647 | | | 240 to 2000 | | | | | | | |

High-Power Types (Built-in Reflector Types)

| | | | | | | | | | | |
|-------|-----|--------------|-------------|-------------|--------|----|------|-----|---|-----------------|
| L4633 | 1.5 | Borosilicate | 240 to 2000 | 700 to 1000 | 5 to 7 | 15 | 0.15 | 100 | 5 | 5×10^8 |
| L4634 | | | | | | | | | | |

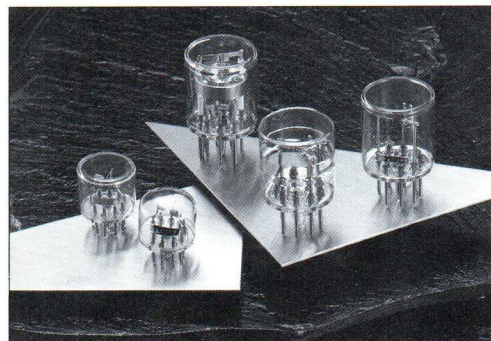
^A Measured under the following conditions. Supply voltage: 1000V, Main capacitor Cm: 0.1μF, Repetition rate: 50Hz

^B (Max. radiant output - Min. radiant output / Average radiant output) × 100(%)

* Various trigger sockets and exclusive power supplies are available.

SQ types are available in 22mm & 28mm bulb diameter as well.

HQ types are available in 20mm bulb diameter as well.



Xenon Flash Lamp Module (HQ Type)

The xenon flash lamp module puts high stability xenon flash lamp (option), power supply and trigger socket into one unit for easy use and compact in its size as 1/4 of volume (comparison to other Hamamatsu models). No extra internal wiring is required thus simple to built into the system.

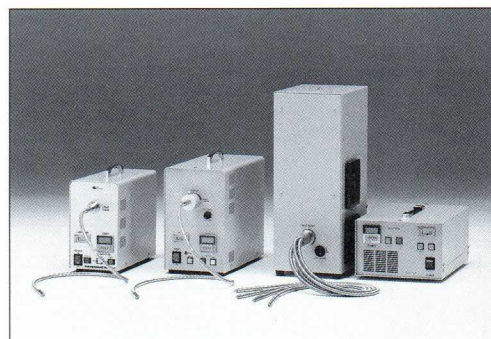


UV Spot Light Source

The light source for UV curing resin. It employs Hg-Xe lamp, which has high UV irradiation, and high quality cold mirror, which reflects only UV radiation, thus it provide low thermal radiation UV light. It, also, employs fiber bundle guide for light output so that UV irradiation can be limited to the area required. Various configurations, area size and numbers of bundle of fiber, are prepared to meet the various applications.

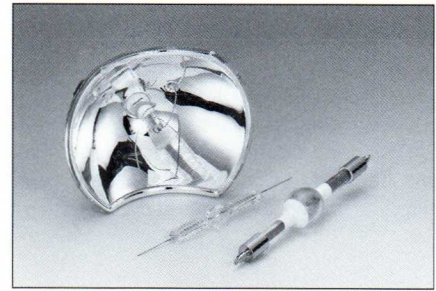
The lamp is supplied in cartridge configuration with pre-aligned for optical axis, which allows easy lamp mount.

Various external functions such as on-off, manual/auto shutter, etc., as standard. Hamamatsu offers this UV spot light source in series of 100W, 200W and 500W.



Metal Halide Lamp

Metal halide lamp provide approx. 4 times of luminous efficiency than xenon or halogen lamps. It also overcomes the problem of short life due to compact short arc gap. The color temperature is very close to it of day light which is suited for the use in light source of various projectors, color printer and microscope as well as general illumination purpose.



| Type No. | Overall Max. (mm) | Lamp Power (W) | Lamp Voltage (Vac) | Lamp Current (Aac) | Luminous Flux (lm) | Luminous Efficiency (lm/W) | Color Temperature (K) | Arc Gap (mm) | Average Life (h) |
|----------|-------------------|----------------|--------------------|--------------------|--------------------|----------------------------|-----------------------|--------------|------------------|
| L4342 | 78 | 150 | 80 | 1.9 | 11400 | 76 | 7500 | 5.0 | 3000 |
| L6046 | 85 | 250 | 70 | 3.6 | 20000 | 80 | 6000 | 4.0 | 1000 |
| L5431 | 140 | 575 | 95 | 6.1 | 49000 | 85 | 6000 | 7.0 | 3000 |

Pen Type Low-Pressure Mercury Lamps/UV to Visible line spectra

The L937 series lamps are compact pen-shape low-pressure mercury lamps which produce a highly pure line spectra with good stability and repeatability. These features make them useful in wavelength calibration for monochromators, ozone detectors, chromatographs, as well as in ozone generation, sterilizing lamps and water pollution analyzers. These lamps also feature an easy-to-use, single-ended configuration and are available with ozone generating or ozoneless types. Specially designed power supplies are also available.



at 25°C

| Type No. | Glass Material | Dimensions | | | | | | Weight (including cable) (g) | Characteristics | | | | | |
|----------|-------------------------|--|------------------------------------|---------------------|---------------------------------------|-------------------|-----------------------------------|------------------------------|--|---|--|--|---------------|---|
| | | Outer Bulb Diameter of Discharge Area (mm) | Bulb Length of Discharge Area (mm) | Overall Length (mm) | Outer Diameter of Handle Section (mm) | Cable Length (mm) | Discharge Starting Voltage (Vrms) | | Discharge Current (Lamp Current) (mAmps) | Discharge Maintaining Voltage (Lamp Voltage) (Vrms) | Radiant Output Intensity at 254 nm ($\mu\text{W}/\text{cm}^2 \cdot \text{nm at lm}$) | Optimum Operating Temperature Range (°C) | Life Min. (h) | |
| L937-01 | Quartz Glass | φ6.5 | 25 | 85 | φ10 | 445 | 37 | 800 | 18 | 200 | 2.5 | 40 to 55 | 5000 | |
| L937-02 | Quartz Glass | | 54 | 114 | | | 38 | 900 | | 270 | 5 | | | |
| L937-03 | Vycor Glass (Ozoneless) | φ9 | 25 | 89 | φ13 | 47 | 800 | 200 | | 2 | | | | |
| L937-04 | Vycor Glass (Ozoneless) | | 57 | 117 | | 49 | 900 | 270 | | 4 | | | | |
| L937-05 | Vycor Glass (Ozoneless) | | 25 | 73 | | φ11 | 225 | 12 | | 800 | 200 | | | 2 |

^A The life end is defined as the time when the radiant intensity falls to 50% of its initial value. The C940 series power supplies are also available.

70kV Micro Focus X-ray Source

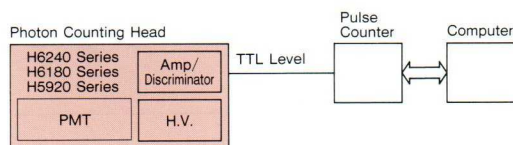
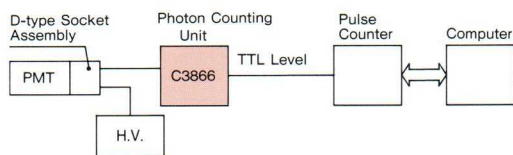
L5486 series, 70kV micro focus X-ray source, employs a micro focus X-ray tube having 10 μm focus length and is natural air-cooled X-ray source. Since its X-ray focus length is as small as 10 μm, it is almost like a point source. Therefore, it doesn't de-focus even the sample image is enlarged. It is suited for high resolution enlarged X-ray transmissive imaging for micro-defect or non-destructive internal observation by combined with high sensitivity X-ray camera.



Photon Counting Heads H6180, H5920, H6240 Series

H6180 series is a compact photon counting head adding a high voltage power supply into a conventional photon counting head, but still making the total length shorter. The high voltage to the PMT and the discrimination voltage are pre-adjusted, therefore, it can be ready to perform the photon counting measurement by simply providing 5V power and connecting to a pulse counter.

SET UP EXAMPLES



Photon Counting Unit C3866

The C3866 converts the output pulse from a photomultiplier tube into a 5V digital signal. Connecting a pulse counter to the C3866 allows photon counting with a high S/N ratio. Also, because of the built-in prescaler (division by 10), the C3866 can be operated without using a high-speed counter.



LEFT: C3866 RIGHT: C3589 FRONT: H6180-01



C5410 (PMT and socket assembly will be sold separately as an option.)

Photon Counter C5410

The C5410 Photon Counter includes an amplifier, discriminator and high-voltage power supply. By simply connecting a photomultiplier tube inserted into a D-type socket assembly, photon counting measurement can be made without any other troublesome setup.

The C5410 has added a time-resolved measurement function with no dead time which exists in the conventional single-gate measurement function. The large liquid crystal screen on the main unit allows display and analysis of the measured data. In addition, the RS232C interface facilitates connection to a commercially available computer, thus permitting data transfer and computer control for the main unit.

Accessories for Photomultiplier Tubes

(In addition to the products listed below, Hamamatsu provides a variety of accessories for photomultiplier tubes. Please contact our sales office for more information.)

Socket Assembly Series

Operating a photomultiplier tube requires a voltage divider. For easy and reliable use of photomultiplier tubes, Hamamatsu provides a complete line of socket assemblies which integrate a photomultiplier tube socket and a voltage divider into a compact package. The socket assemblies are classified into three types by function: the D type containing only a voltage divider; the DA type further including a preamplifier; the DP type having a voltage divider and a high-voltage power supply.



Magnetic Shield Case E989 Series

The E989 series magnetic shield cases were developed to protect photomultiplier tubes from the influence of magnetic fields. The E989 series is made of permalloy, a material of very high permeability (approximately 10^5). The magnetic field intensity within the shield case with respect to the external magnetic field can be attenuated down to 1/1000 to 1/10000, thus assuring stable output of photomultiplier tubes.



High-Voltage Power Supplies

A variety of high-voltage power supplies are available, ranging from bench-top types to modular types which can be mounted on a PC board. In addition, newly added to our product line are miniature high-voltage modules designed for compact equipment. They are smaller than one-sixth the cubic size of the conventional modular power supplies.



Thermoelectric Coolers C2761, C2773

Regardless of the presence of incident light, thermionic electrons are emitted from the photocathode and dynodes of a photomultiplier tube. This is a major factor that produces dark current. Therefore, cooling the photomultiplier tube can reduce these thermionic emissions and improve the S/N ratio.

The C2761 is a thermoelectric cooler using Peltier elements that allow temperature settings in the range from -30°C to 0°C . The housing is designed to minimize the influence of external electrostatic or magnetic field.

The C2773 thermoelectric cooler is also provided for exclusive use with an MCP-PMT.



C2761

CE Marking

This catalog contains products which are subject to CE Marking of European Union Directives. For further details, please consult HAMAMATSU sales offices.

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Position Sensitive Detectors
Image Sensors
Infrared Detectors
Solid State Emitters
CdS Photoconductive Cells
Pyroelectric Detectors
Photocouplers
Photointerrupters, Photoreflectors

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Photomultiplier Tubes
Radiation Detectors
Light Sources
Image Pick-up Tubes
Image Intensifiers
X-Ray Image Intensifiers
Microchannel Plates
Fiber Optic Plates

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Video Cameras for Measurement
Image Processing Systems
Streak Cameras
Optical Oscilloscopes
Optical Measurement Systems
Imaging and Analysis Systems

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