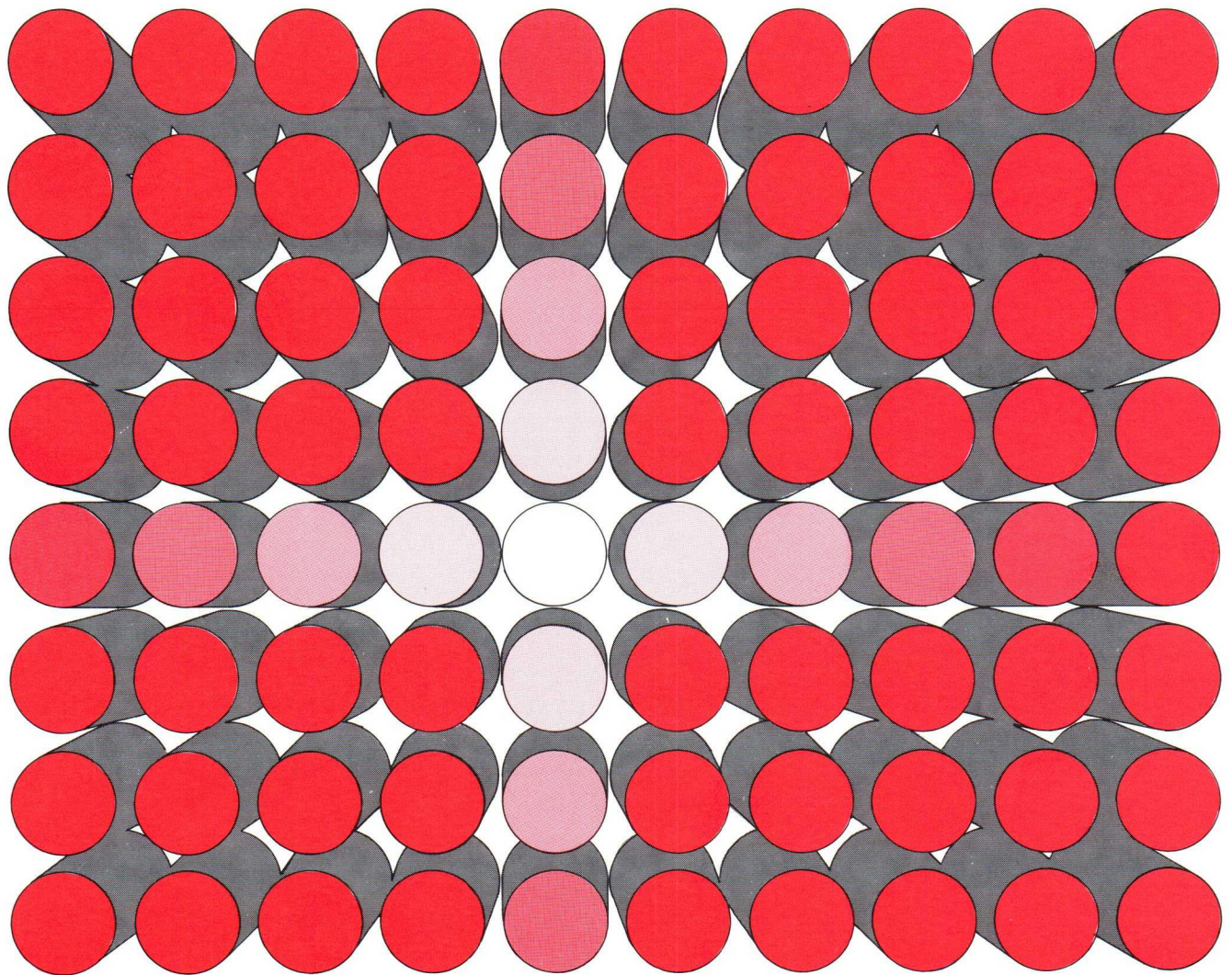
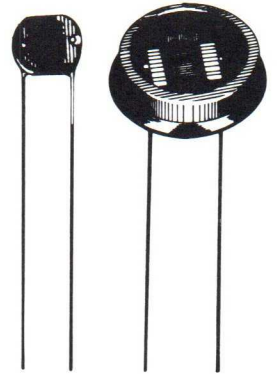


# HAMAMATSU

RADIATION SOURCE · DETECTORS  
PHOTOCONDUCTIVE CELLS  
INFRARED DETECTORS  
LIGHT SOURCES  
IMAGE PICKUP TUBES  
MEASURING TV SYSTEMS



**HAMAMATSU TV CO., LTD.**

# CONTENTS

	Page
INDEX .....	1
How to Select The Photosensitive Devices .....	2
<b>Radiation Source · Radiation Detectors</b>	
Proportional Counter Tube      D988 .....	3
GM Counter Tube                D1136 .....	3
X-Ray Source                    N890-09 .....	3
<b>Photoconductive Cells</b>	
CdS Cells .....	4 · 5
P347, P401, P227A, P227B, P320, P440, P441, P559, P930, P201A, P201B, P201C, P201D, P201E, P380, P501, P534, P552, P584, P467, P1024, P621, P586, P587, P201D-5R, P722-5R, P380-5R, P1095-06, P201D-7R, P722-7R, P380-7R, P722-10R, P1096-06, P577-04, P883, P884	
<b>Infrared Detectors</b>	
PbS Cells, PbSe Cells, InAs · InSb Detectors .....	6 · 7
P394A, P394R, P394, P397, P819, P1085, P1085-01, P1026, P791, P903, P838, P839S, P839A	
Photon Drag Detector .....	6 · 7
B749	
<b>Light Sources</b>	
Hollow Cathode Lamps .....	8
L233 Series, L733 Series	
Electrodeless Discharge Light Sources (EDL) .....	9
L978 Series, L1016, C977	
Deuterium Lamps .....	10
L544, L648, L591, L879, L879-01, L625, L656, L613, C704	
Low Pressure Mercury Lamps .....	11
L937 Series, C940,	
He-Ne Laser Systems .....	11
C965, C964	
<b>Image Pickup Tubes</b>	
Vidicons .....	12
7262A, 7735A, 8507, 8541, 8573, 8134, 8816, 25PE12, 8844, N887, 8480 N736, N747, N1062, N156, N157, N214, N743, N603, N371, N983	
Image Dissector Tubes .....	13
R571, R602, R658, R312	
Memory Tubes .....	13
N284, N333, N232, N319	
Vidicon Yoke Assemblies .....	13
KV-6A, KV-9L, KV-9G, KV-10, KV-12S, KV-12SB, KV-13J, KV-13M, KV-14CA KV-15A, KV-19G, KV-22B, KV-22C, E1164	
<b>Measuring TV Systems</b> .....	14 · 15
C1000, C158, C981, C863, C799, C995, C1098, C979, C701	
<b>Replacement Information for HAMAMATSU Obsolete Types</b> .....	16
<b>Warning and Warranty</b> .....	Inside back cover

# INDEX

Type	Classification	Page	Type	Classification	Page
N156	Infrared Vidicon	12	B749	Photon Drag Detector	6 · 7
N157	Infrared Vidicon	12	P791	PbSe Cell	6 · 7
C158	Infrared TV Camera	15	C799	Multipoint X-Y Tracker	15
P201A	CdS Cell	4 · 5	P819	PbS Cell	6 · 7
P201B	CdS Cell	4 · 5	P838	InAs Cell	6 · 7
P201C	CdS Cell	4 · 5	P839	InSb Cell	6 · 7
P201D	CdS Cell	4 · 5	C863	Digital Video Scale	15
P201D-5R	CdS Cell	4 · 5	L879	Deuterium Lamp	10
P201D-7R	CdS Cell	4 · 5	L879-01	Deuterium Lamp	10
P201E	CdS Cell	4 · 5	P883	Multichannel CdS Cell	4 · 5
N214	Infrared Vidicon	12	P884	Multichannel CdS Cell	4 · 5
P227A	CdS Cell	4 · 5	N887	Visible Vidicon	12
P227B	CdS Cell	4 · 5	N890-09	X-Ray Source	3
N232	Memory Tube	13	P903	PbSe Cell	6 · 7
L233	Hollow Cathode Lamp	8	P930	CdS Cell	4 · 5
N284	Image Memory Tube	13	L937	Mercury Lamp	11
R312	Image Dissector Tube	13	C940	Lamp Power Supply	11
N319	Memory Tube	13	C964	He-Ne Laser	11
P320	CdS Cell	4 · 5	C965	He-Ne Laser	11
N333	Image Memory Tube	13	C977	EDL Power Supply	9
P347	CdS Cell	4 · 5	L978	EDL	9
N371	UV Vidicon	12	C979	Temporaldisperser	15
P380	CdS Cell	4 · 5	C981	Image Dissector Camera	15
P380-5R	CdS Cell	4 · 5	N983	Ultraviolet Vidicon	12
P380-7R	CdS Cell	4 · 5	D988	Proportional Counter Tube	3
P394	PbS Cell	6 · 7	C995	Imagelyzer	15
P394A	PbS Cell	6 · 7	C1000	Vidicon Camera System	15
P394R	PbS Cell	6 · 7	L1016	EDL	9
P397	PbS Cell	6 · 7	P1024	CdS Cell	4 · 5
P401	CdS Cell	4 · 5	P1026	PbS Cell	6 · 7
P440	CdS Cell	4 · 5	N1062	EIC Vidicon	12
P441	CdS Cell	4 · 5	P1085	PbS Cell	6 · 7
P467	CdS Cell	4 · 5	P1085-01	PbS Cell	6 · 7
P501	CdS Cell	4 · 5	P1095-06	CdS Cell	4 · 5
P534	CdS Cell	4 · 5	P1096-06	CdS Cell	4 · 5
L544	Deuterium Lamp	10	C1098	Temporalanalyzer	15
P552	CdS Cell	4 · 5	D1136	GM Counter Tube	3
P559	CdS Cell	4 · 5	E1164	Vidicon York Assembly	13
R571	Image Dissector Tube	13	25PE12	Visible Vidicon	12
P577-04	CdS Cell	4 · 5	7262A	Visible Vidicon	12
P584	CdS Cell	4 · 5	7735A	Visible Vidicon	12
P586	CdS Cell	4 · 5	8134	Visible Vidicon	12
P587	CdS Cell	4 · 5	8480	Visible Vidicon	12
L591	Deuterium Lamp	10	8507	Visible Vidicon	12
R602	Image Dissector Tube	13	8541	Visible Vidicon	12
N603	X-ray Vidicon	12	8573	Visible Vidicon	12
L613	Deuterium Lamp	10	8816	Visible Vidicon	12
P621	CdS Cell	4 · 5	8844	Visible Vidicon	12
L625	Deuterium Lamp	10	KV-6A	Vidicon York Assembly	13
L648	Deuterium Lamp	10	KV-9G	Vidicon York Assembly	13
L656	Deuterium Lamp	10	KV-9L	Vidicon York Assembly	13
R658	Image Dissector Tube	13	KV-10	Vidicon York Assembly	13
C701	Video Data Corder	15	KV-12S	Vidicon York Assembly	13
C704	Deuterium Lamp Power Supply	10	KV-12SB	Vidicon York Assembly	13
P722-5R	CdS Cell	4 · 5	KV-13J	Vidicon York Assembly	13
P722-7R	CdS Cell	4 · 5	KV-13M	Vidicon York Assembly	13
P722-10R	CdS Cell	4 · 5	KV-14CA	Vidicon York Assembly	13
L733	Hollow Cathode Lamp	8	KV-15A	Vidicon York Assembly	13
N736	Silicon Vidicon	12	KV-19G	Vidicon York Assembly	13
N743	Infrared Vidicon	12	KV-22B	Vidicon York Assembly	13
N747	Silicon Vidicon	12	KV-22C	Vidicon York Assembly	13

# HOW TO SELECT THE PHOTONSENSITIVE DEVICES

## ■ Matching the Detector to the Light Source

The photosensitive devices, generally speaking, have not flat spectral response curve. So, it is necessary to select the detector making the best possible matching to get the maximum efficiency. If the light having wide wavelength more than required range is given to the detector and the detector has the sensitivity on it (so called stray light), it must be taken away with filters to protect from the detection error and noise increase.

## ■ Detection Limit

In the light detection system, there is a limit in detection of light energy due to the noise and conversion efficiency of a detector, even if an amplifier, which follows the detector, has almost no noise. Also, in low level light, the light fluctuation can not be neglected, and it becomes very difficult to detect in precise value. Therefore, it should be considered to apply the methods such as cooling of detector, narrowing of system bandwidth, intergration method, in low level light detection.

## ■ Response Time

When the incident light is a form of pulse, the response time of the detector is the most important to reproduce the waveform of the input light in precisely. It is necessary to pay attention not only the response time characteristics of the detector but also the operating voltage and the following circuitry (mainly load resistor).

## ■ Maximum Output

Each detector has the limitation of output current or voltage individually. In general, the limitation value of a detector having high detectivity is placed at lower level, so the amplification by external amplifier may be needed. It would be better to use the detector at lower level of output than the maximum rating shown in specification, because the high output value gives deviation from linearity, spoils the output stability or shortens its life.

## ■ Maximum Rating

The maximum rating shown in this catalog is figured by system of absolute maximum rating. It is specified not exceeding any value than this figure in it, even for moment.

The more supply voltage than this figure is applied or measured higher current, the detector may be damaged, so please select the operating condition and design do not exceed maximum rate.

## ■ Storage

In the case the detector is exposed under direct sun light or strong light, even though no voltage is applied to, it causes growing dark current and deterioration of sensitivity, so the detector should be kept in dark room or box also kept in dry room does not go up the temperature.

SORTS	FEATURES	APPLICATIONS (suitable types)
Proportional Counter Tube	High resolution High stability Low noise	X-ray diffraction Sulfur analyzer Radiation counter
GM Counter Tube	Small size High stability	Compact radiation counter Survey meter Radiation monitor
CdS Cell	Small size Direct relay driving High sensitivity over visible region Low voltage operation Bipolar Low cost	Electronic musical instrument (P380) Sorting machine (P380-5R) Camera exposure meter (P201D-5R) Flame detection (P621, P930, P1024) Smoke detection (P201D) Illumination control (P722-10R, P380-5R, P201D-5R) Counter for conveyor (P380-5R) Level meter (P201D-5R) Safety unit for tooling machine (P380-5R) Automatic parts supplier Burglar alarm (P380-5R)
PbS PbSe, IR Detector	Photoconductive Usable at room temperature	IR spectrophotometer (P397) Pollution monitoring equipment (P903, P791) Thermometer (P394) Tracking system (P394R) Barner control (P394)
InAs · InSb IR Detector	Photovoltaic Fast response time With cooling Dewar flask	IR spectrophotometer (P838) Thermography (P839) Pollution monitoring equipment (P839)
Photon Drag Detector	Usable at room temperature Fast response time	CO <sub>2</sub> laser (10.6μm) detection (B749)
Hollow Cathode Lamp Electrodeless Discharge Light Source	Narrow spectrum line Stabilize in short period Less drift	Atomic absorption
Deuterium Lamp	Continuous UV spectral light source	UV spectrophotometer
Mercury Lamp	High stability High intensity	Wavelength calibration Ozon generator
Silicon Visible IR UV X-ray	} Vidicon	Industrial surveillance television Surveillance of thermal radiator (N214, N156, N157) UV microscope (N981, N371) Nondestructive inspection (N603) X-ray diffraction (N603)
Image Dissector Tube		
Image Memory Tube		Storage of optical image (N284, N333) Repeat recognition of optical image
Memory Tube	Nondestructive readout	Scan converter (N232, N319) Graphic display (N232)

# RADIATION SOURCE · RADIATION DETECTORS

## Proportional Counter Tube

Type	Outline	Window Material	Anode Material	Fill Gas	Maximum Ratings (Absolute Values)			Characteristics (@25°C)					Life (total counts) min (count)
					Applied Voltage (Vdc)	Storage Temperature (°C)	Storage Humidity (%)	Energy Resolution typ (%)	Output Pulse Height typ (mV)	Insulation Resistance min (Ω)	Operating Temperature (°C)	Operating Humidity (%)	
D988	1	Beryllium 0.1mm thick	Tungsten 0.05mmdia.	Ar:90% + CH <sub>4</sub> :10%	1800	-40~+90	0~90	20	200	10 <sup>15</sup>	-20~+60	0~70	10 <sup>11</sup>

- A** Source: <sup>55</sup>Fe (5.9keV)  
Applied Voltage: 1500V  
Count Rate: 1000cps  
**1** Equal to 18mg/cm<sup>2</sup>

Fig. 1 Resolution Measuring Circuit

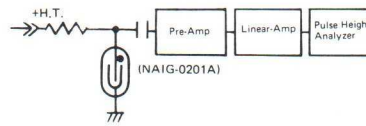
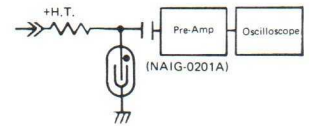


Fig. 2 Pulse Height Measuring Circuit



## GM Counter Tube

Type	Outline	Window Material	Fill Gas	Interelectrode Capacitance Cathode Anode typ (pF)	Maximum Ratings (Absolute Values)				Characteristics (@25°C) <b>B</b>				Life <b>D</b> (total counts) (count)
					Anode Resistance min (MΩ)	Applied Voltage (V)	Operating Temperature (°C)	Storage Temperature (°C)	Starting Voltage max (V)	Platear Voltage (V)	Platear Slope max (%/V)	Back-ground max (cpm)	
D1136	2	Cr-28% +Fe-72% 0.1mm thick	He + Ne + Halogen	1	2.2	650	-40~+50	-40~+75	350	500~650	0.15	2	5 × 10 <sup>10</sup>

- B** Measured with the Circuit Show in Fig. 1  
**C** Shield with 50mm thick Pb and 3mm thick Al at 575V  
**D** at 25°C  
Count Rate 4500cps

Fig. 1 Measuring Circuit

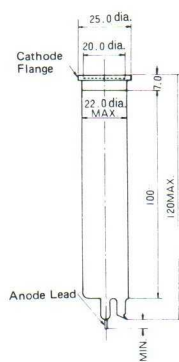


## X-Ray Source

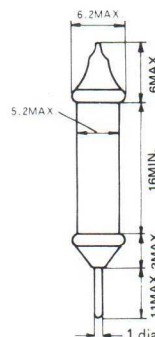
Type	Outline	Target		Window Material	Maximum Ratings (Absolute Values)			Characteristics (@ 25°C)	
		Material	Target Type		Target Power Dissipation (W)	Target Voltage (kVdc)	Target Current (μA)	Effective Focal Spot (mm dia.)	Radiation Angle (°)
N890-09	3	Titanium 8 μm thick	Transparent	Beryllium 0.5mm thick	0.12	10	30	6	90

unit : mm

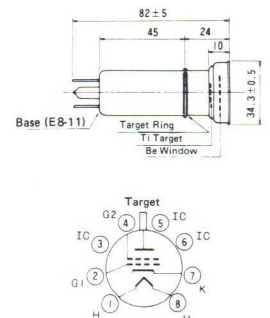
1 D988



2 D1136



3 N890-09



# PHOTOCONDUCTIVE CELLS

## CdS Cells

**A** ★ . . . New products

**B** Measured 10 seconds after removal of incident illumination of 10 lx.

**C** For conditions where the light source is a tungsten filament lamp operated at a color temperature of 2856K.

**D**  $\gamma$  Characteristics (100 ~ 10 lx)

$$\gamma_{10}^{100} = \frac{\log(R_{10}/R_{100})}{\log(100/10)}$$

$R_{10}, R_{100}$  . . . Cell resistance at 10 lx, 100 lx

Typical  $\gamma$  tolerance is  $\pm 0.1$

**E** The time required for conductance to rise to 63% of the peak value, or fall from the peak to 37% of the peak value.

**1** Dual element type.

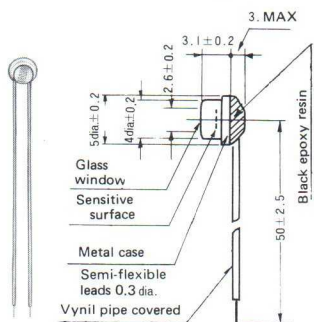
**2** Temporary data.

Type	Outline	Material of Enclosure	Maximum Ratings (Absolute Values)			Characteristics (@ 25°C)								
			Voltage Between Terminals (@ 25°C (Vdc))	Power Dissipation (@ 25°C (mW))	Ambient Temperature Range (°C)	Spectral Peak typ. (nm)	Cell Resistance			$\gamma_{10}^{100}$ typ.	Response Time (E) (@ 10lx)			
							0 lx (E) min. (M $\Omega$ )	10 lx (C) min. (k $\Omega$ )	10 lx (C) max. (k $\Omega$ )		Rise typ. (ms)	Decay typ. (ms)		
P347	1	Metal Case	100	30	-30~+50	620	100	200	600	0.90	15	10		
P401			100	30	-30~+50	620	10	15	45	0.80	60	20		
P227A			100	50	-30~+50	560	1	4.3	12	0.75	170	130		
P227B	2	Metal Case	100	50	-30~+50	560	20	50	150	0.85	25	20		
P320			200	50	-30~+55	520	20	35	100	0.85	60	20		
P440			200	50	-30~+55	620	50	28	82	0.85	20	10		
P441			200	50	-30~+55	520	1	5.5	16	0.70	45	30		
P559			200	50	-30~+60	540	0.1	2.9	8.5	0.60	100	140		
P930★			150	50	-20~+70	560	0.5	10	23	0.68	100	100		
P201A			100	100	-30~+50	560	1	2.6	7.8	0.70	170	130		
P201B			200	100	-30~+50	560	20	21	63	0.85	25	20		
P201C			100	100	-30~+50	620	5	1.5	4.5	0.75	60	20		
P201D			200	100	-30~+60	520	10	20	60	0.90	30	10		
P201E	200	100	-30~+55	560	10	4.5	13	0.85	30	10				
P380	3	Metal Case	200	50	-30~+50	620	20	4.4	13	0.85	35	20		
P501			100	100	-30~+55	560	1	1.6	4.8	0.80	30	20		
P534			200	100	-30~+60	560	0.05	1.3	3.7	0.55	70	100		
P552			100	100	-30~+50	660	10	0.75	2.2	0.75	30	20		
P584 1			100	50	-30~+50	620	10	5	15	0.85	45	30		
P467			100	100	-30~+60	520	5	8	24	0.90	35	20		
P1024			250	100	-30~+60	470	10	80	250	0.7~1.0	150	150		
P621			150	300	-30~+60	540	0.1	1.3	3.7	0.75	80	40		
P586			5	Glass Enclosure	300	50	-30~+55	520	100	180	520	0.90	45	30
P587					200	50	-30~+55	520	100	44	130	0.90	45	30
P201D-5R	6	Plastic Coating	100	50	-30~+60	520	20	48	140	0.90	30	10		
P722-5R			100	70	-30~+60	560	0.5	5.3	15	0.70	70	100		
P380-5R			100	30	-30~+50	620	20	12	34	0.85	35	20		
P1095-06 2★			100	50	-30~+60	550	1	12	36	0.75	100	150		
P201D-7R	7	Plastic Coating	200	100	-30~+60	520	20	23	67	0.90	30	10		
P722-7R			200	150	-30~+60	560	0.5	2.5	7.5	0.70	70	100		
P380-7R			200	50	-30~+50	620	20	4.4	13	0.85	35	20		
P722-10R	8	Plastic Coating	300	300	-30~+60	560	0.5	12	36	0.70	70	100		
P1096-06 2★			100	100	-30~+60	550	0.5	2.8	8.4	0.75	100	150		
P577-04★			300	300	-30~+60	570	3	5	16	0.75	45	30		

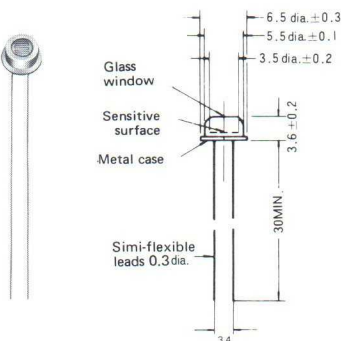
## Multichannel CdS Cells

Type	Outline	Terminal	Useful Sensitive Surface Area (mm <sup>2</sup> )	Number of Elements	Maximum Ratings (Absolute Values)			Spectral Peak typ. (nm)	Characteristics (@ 25°C)					
					Voltage Between Terminals (@ 25°C (Vdc))	Power Dissipation (@ 25°C (mW))	Ambient Temperature Range (°C)		Cell Resistance			$\gamma_{10}^{100}$ typ.	Response Time (E) (@ 10lx)	
									0 lx (E) min. (M $\Omega$ )	10 lx (C) min. (k $\Omega$ )	10 lx (C) max. (k $\Omega$ )		Rise typ. (ms)	Decay typ. (ms)
P 883	10	Independent	1.4 × 2.2	9	150	50	-30~+55	520	20	120	750	0.90	30	20
P 884				18										

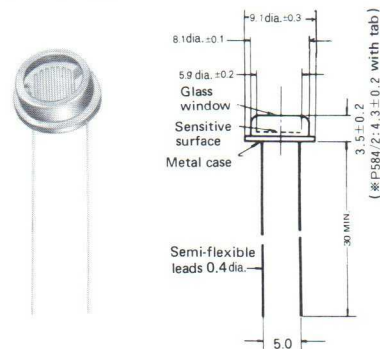
① P347 P401 (4M TYPE)



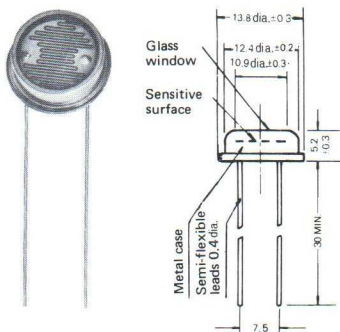
② P227 P320 etc. (6M TYPE)



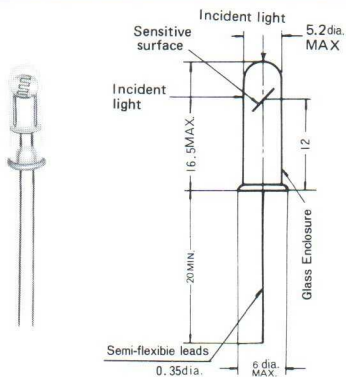
③ P201 P380 etc. (8M TYPE)



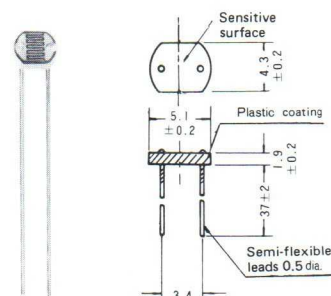
④ P621 (12M TYPE)



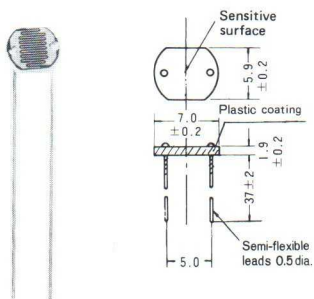
⑤ P586 P587 (5G TYPE)



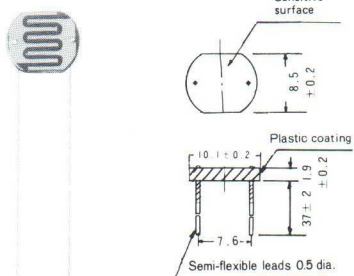
⑥ P201D-5R etc. (5R TYPE)



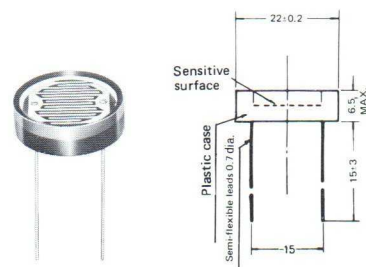
⑦ P201D-7R etc. (7R TYPE)



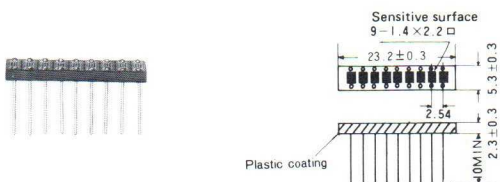
⑧ P722-10R (10R TYPE)



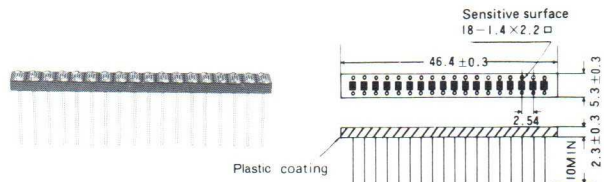
⑨ P577-04 (22J TYPE)



⑩ P883



⑪ P884



# INFRARED DETECTORS

## PbS Cells

**A** Responsivity of the cell is defined by  $\frac{IL - ID}{ID}$ ,

where IL is photocurrent including dark current and ID is dark current.

For conditions where the light source is a tungsten-filament lamp operated at a distribution temperature of 2856K, and light input power is  $5.3 \text{ mW/cm}^2$ .

**B** Light source: 3000K tungsten lamp + TOSHIBA IR-D80A filter (former name IR-D1A)

Chopping frequency: 900Hz

Light input power:  $15 \mu\text{W/cm}^2$ .

Bandwidth of amplifier: 124Hz

**C** The time required for the conductance to rise to 63% of the maximum value, with GaAs LED (920nm) as light source.

**D** Measured with the 1300K SiC as a light source. Chopping frequency: 100Hz, Bandwidth: 1Hz.

**E** Measured at the wavelength of peak response. Chopping frequency: 100Hz

Bandwidth of amplifier: 1Hz

**F** The cooling Dewar flask holds the liquid  $\text{N}_2$  for 4 hours (minimum).

**G** Light source: 500K black body

Chopping frequency: 900Hz

Bandwidth of amplifier: 1Hz

**H** Measured at the wavelength of peak response.

Chopping frequency: 900Hz

Bandwidth of amplifier: 1Hz

**I** Measured at  $10.6 \mu\text{m}$  ( $\text{CO}_2$  laser) with 50 $\Omega$  load resistance.

\*Storage temperature is  $0 \sim +60^\circ\text{C}$ . Do not keep in high temperature.

**1**  $2 \times 5$  or  $0.5 \times 5 \text{ mm}^2$  are available.

**2**  $3 \times 5$  or  $5 \times 5 \text{ mm}^2$  are available.

**3** \* at 196K.  
\*\* at 77K.

**4** It is also available which has less than 90 $\mu\text{s}$  response time.

**5** A Peltier cooler and thermister are enclosed with detector. Heat sink is required. Specified values are measured at  $-10^\circ\text{C}$ .

**6** Cooling is not necessary. Magnetic stand is available as an option.

Type	Dimensional Outline	Enclosure	Window Material	Responsive Area (mm <sup>2</sup> )	Maximum Voltage Between Terminals (Vdc)	Spectral Response ( $\mu\text{m}$ )	Characteristics (@ 25°C)				
							Responsivity $\epsilon$ min. <sup>A</sup>	Dark Resistance Rd (M $\Omega$ )	Signal to Noise Ratio (dB) <sup>B</sup>	Response Time ( $\mu\text{s}$ ) <sup>C</sup>	D* (1300, 100, 1) (cmHz <sup>1/2</sup> /W) <sup>D</sup>
P 394 A	1	Metal Case	Borosilicate glass	2 x 5	90	0.8~2.5	1.0	0.1~1.5	55	100~400 <sup>4</sup>	2 x 10 <sup>10</sup>
P 394 R			Fused Silica	0.5 x 5	90	0.8~2.85	1.0	0.1~0.3		90~300 <sup>4</sup>	
P 394			Borosilicate glass	1 x 5 <sup>1</sup>	90	0.8~2.5	1.0	0.1~1.5		100~400 <sup>4</sup>	
P 819	6	Dewar Flask	Sapphire	1 x 10	90	0.8~2.5 0.8~3.1 * <sup>3</sup> 0.8~3.3 * *	0.6 20 * <sup>3</sup> 10 * *	0.1 5.0 * <sup>3</sup> 50 * *	55 65 * <sup>3</sup> 60 * *	100~500 3000 * <sup>3</sup> 4000 * *	2 x 10 <sup>10</sup> 3 x 10 <sup>11</sup> * <sup>3</sup> 1 x 10 <sup>11</sup> * *
P 397	5	Metal Case	Borosilicate glass	4 x 5 <sup>2</sup>	90	0.8~2.5	1.0	0.3~2.0	55	100~400 <sup>4</sup>	2 x 10 <sup>10</sup>
P 1085			Ceramic Base	Fused Silica	1 x 5	90	0.8~2.5	1.0	0.1~1.5		
P 1085-01		Fused Silica		1 x 5	90	0.8~2.85	1.0	0.1~1.0	55		
P 1026 <sup>5</sup>		Metal Case	Fused Silica	1 x 3	90	0.8~3.0	1.0	0.3~3.0	55		

## PbSe Cells

Type	Dimensional Outline	Enclosure	Window Material	Responsive Area (mm <sup>2</sup> )	Maximum Voltage Between Terminals (Vdc)	Characteristics (@ 25°C)			
						Spectral Response ( $\mu\text{m}$ )	Dark Resistance (M $\Omega$ )	Response Time ( $\mu\text{s}$ ) <sup>C</sup>	D $\lambda$ * ( $\lambda_p$ , 100, 1) (cmHz <sup>1/2</sup> /W) <sup>E</sup>
P 791	1	Metal Case	Sapphire	1 x 5	100	1.0~5.0	0.1~2.0	2	1.0 x 10 <sup>9</sup>
P 903 <sup>5</sup>	4			1 x 3	100	1.0~5.5	0.7~3.0	10	3.0 x 10 <sup>9</sup>

## InAs Infrared Detector

Type	Dimensional Outline	Enclosure	Window Material	Operating Temperature (K) <sup>F</sup>	Responsive Area (mm dia.)	Characteristics (1.5mm dia. FOV 60 degree)				
						Spectral Response ( $\mu\text{m}$ )	D* (500, 900, 1) min. <sup>G</sup> (cmHz <sup>1/2</sup> /W)	D $\lambda$ * ( $\lambda_p$ , 900, 1) min. <sup>H</sup> (cmHz <sup>1/2</sup> /W)	Dynamic Impedance ( $\Omega$ )	Response Time ( $\mu\text{s}$ ) <sup>C</sup>
P 838	6	Dewar Flask	Sapphire	196	0.05~2.0	1~3.5	1 x 10 <sup>9</sup>	5 x 10 <sup>10</sup>	1 x 10 <sup>3</sup> ~10 <sup>4</sup>	1
				77			2 x 10 <sup>9</sup>	1 x 10 <sup>11</sup>	1 x 10 <sup>4</sup> ~10 <sup>6</sup>	1

## InSb Infrared Detectors

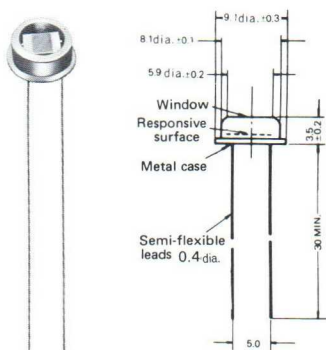
Type	Dimensional Outline	Enclosure	Window Material	Operating Temperature (K) <sup>F</sup>	Responsive Area (mm dia.)	Characteristics (0.5mm dia. FOV 60 degree)				
						Spectral Response ( $\mu\text{m}$ )	D* (500, 900, 1) min. <sup>G</sup> (cmHz <sup>1/2</sup> /W)	D $\lambda$ * ( $\lambda_p$ , 900, 1) min. <sup>H</sup> (cmHz <sup>1/2</sup> /W)	Dynamic Impedance (M $\Omega$ )	Response Time ( $\mu\text{s}$ ) <sup>C</sup>
P 839S	6	Dewar Flask	Sapphire	77	0.05~2.0	1~5.5	1.2 x 10 <sup>10</sup>	7.0 x 10 <sup>10</sup>	0.5~1	1
P 839A							9.0 x 10 <sup>9</sup>	5.0 x 10 <sup>10</sup>		

## Photon Drag Detector (CO<sub>2</sub> Laser Detector)

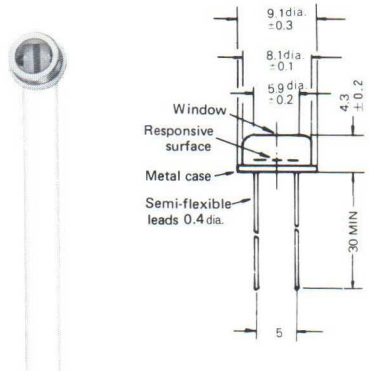
Type	Dimensional Outline	Material	Aperture size (mm dia.)	Responsivity (mV/kW) <sup>I</sup>	Response Time (ns) max. <sup>J</sup>	Impedance ( $\Omega$ )	Output Signal Polarity	Weight (g)
B 749 <sup>6</sup>	7	Ge (Antireflective coated)	5	1.2	1	50 $\pm$ 10	Positive	125



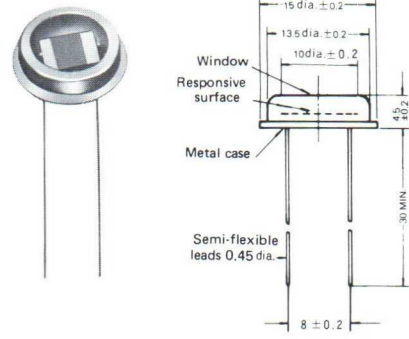
1 P394A P394R P79I



2 P394



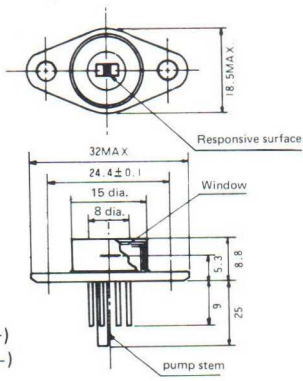
3 P397



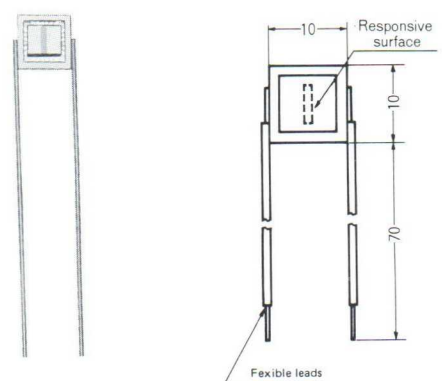
4 PI026 P903



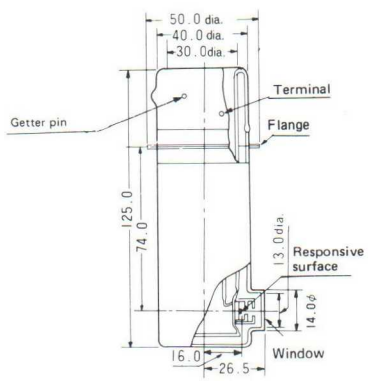
- Pin function  
 1. Thermo module (+)  
 2. Thermo module (-)  
 3 · 4. PbS or PbSe  
 5 · 6. Thermistor



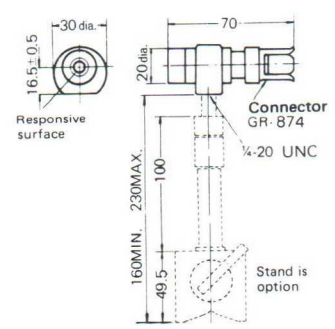
5 PI085 PI085-01



6 P819 P838 P839



7 B749



# LIGHT SOURCES Hollow Cathode Lamps

## L233 Series (Outline ①)

Element	Type <sup>Ⓐ</sup>	Tube Drop Voltage (V)	Recommended Current (mA) <sup>Ⓑ</sup>	Maximum Current (mA) <sup>Ⓒ</sup>	Optimum PMT	Analysis Line (nm) <sup>Ⓓ</sup>	PMT Output (nA) <sup>Ⓔ</sup>	Flame	
Ag	Silver	L233-47NB	155	10	20	R106	328.07* 338.28	680 410	Air-C <sub>2</sub> H <sub>2</sub>
Al	Aluminium	-13NB	150	10	20	R106	309.27* 396.15	420 330	N <sub>2</sub> O-C <sub>2</sub> H <sub>2</sub>
As	Arsenic	-33NQ	200	7~10 <sup>①</sup>	12	R106	193.70* 197.20	2.4 2.7	Air-H <sub>2</sub> Ar-H <sub>2</sub>
Au	Gold	-79NQ	200	10	16	R106	242.80* 267.59	55 70	Air-C <sub>2</sub> H <sub>2</sub>
B	Boron	-5NQ	190	10	20	R106	249.68* 249.77	20	N <sub>2</sub> O-C <sub>2</sub> H <sub>2</sub>
Ba	Barium	-56NB	135	10	20	R106	553.55*	20	N <sub>2</sub> O-C <sub>2</sub> H <sub>2</sub>
Be	Beryllium	-4NQ	170	10	20	R106	234.86*	200	N <sub>2</sub> O-C <sub>2</sub> H <sub>2</sub>
Bi	Bismuth	-83NQ	195	10	12	R106	223.06* 306.77	50 600	Air-C <sub>2</sub> H <sub>2</sub>
Ca	Calcium	-20NU	145	10	18	R106	422.67*	335	Air-C <sub>2</sub> H <sub>2</sub> N <sub>2</sub> O-C <sub>2</sub> H <sub>2</sub>
Cd	Cadmium	-48NQ	210	10	15	R106	228.80*	45	Air-C <sub>2</sub> H <sub>2</sub> Air-H <sub>2</sub>
Co	Cobalt	-27NU	185	10	20	R106	240.73* 346.58	70 270	Air-C <sub>2</sub> H <sub>2</sub>
Cr	Chromium	-24NB	160	10	20	R106	357.87* 425.44	730 540	Air-C <sub>2</sub> H <sub>2</sub>
Cs	Cesium	-55NB	180	10	20	R446	852.11* <sup>②</sup>	2.6	Air-Coal gas Air-Propan
Cu	Copper	-29NB	225	10	20	R106	324.75* 327.40	2300 1600	Air-C <sub>2</sub> H <sub>2</sub>
Fe	Iron	-26NU	175	10	20	R106	248.33* 371.99	65 380	Air-C <sub>2</sub> H <sub>2</sub>
Ga	Gallium	-31NU	170	4	6	R106	287.42 294.36*	95 180	Air-C <sub>2</sub> H <sub>2</sub>
Ge	Germanium	-32NU	180	10	20	R106	265.16*	35	N <sub>2</sub> O-C <sub>2</sub> H <sub>2</sub>
Hg	Mercury	-80NU	170	4	6	R106	253.65*	150	Flameless
K	Potassium	-19NB	165	10	15	R446	766.49* 769.90	② 40 30	Air-C <sub>2</sub> H <sub>2</sub>
La	Lanthanum	-57NB	130	10	20	R106	357.44 550.13*	30 25	N <sub>2</sub> O-C <sub>2</sub> H <sub>2</sub>
Li	Lithium	-3NB	230	10	20	R106	610.36 670.78*	100 870	Air-C <sub>2</sub> H <sub>2</sub>
Mg	Magnesium	-12NU	145	10	18	R106	285.21*	380	Air-C <sub>2</sub> H <sub>2</sub>
Mn	Manganese	-25NU	170	10	20	R106	279.48* 403.08	290 900	Air-C <sub>2</sub> H <sub>2</sub>
Mo	Molybdenum	-42NB	140	10	20	R106	313.26* 320.88	110 25	N <sub>2</sub> O-C <sub>2</sub> H <sub>2</sub>
Na	Sodium	-11NB	165	10	15	R106	589.00* 589.59	140 110	Air-C <sub>2</sub> H <sub>2</sub>
Nb	Niobium	-41NB	160	20	30	R106	334.91* 405.89	90 210	N <sub>2</sub> O-C <sub>2</sub> H <sub>2</sub>
Ni	Nickel	-28NQ	180	10	20	R106	232.00* 341.48	85 230	Air-C <sub>2</sub> H <sub>2</sub>
Pb	Lead	-82NQ	220	10	15	R106	217.00* 283.30	15 330	Air-H <sub>2</sub> Air-C <sub>2</sub> H <sub>2</sub>
Pd	Palladium	-46NQ	160	10	20	R106	244.79* 247.64	75 60	Air-C <sub>2</sub> H <sub>2</sub>
Pt	Platinum	-78NU	190	10	20	R106	265.95* 299.80	20 25	Air-C <sub>2</sub> H <sub>2</sub>
Rb	Rubidium	-37NB	165	10	20	R446	780.02* 794.76	② 25 5	Air-Coal gas Air-Propan
Re	Rhenium	-75NB	140	20	25	R106	346.05* 346.47	430 330	N <sub>2</sub> O-C <sub>2</sub> H <sub>2</sub>
Ru	Ruthenium	-44NB	155	20	25	R106	349.89*	300	Air-C <sub>2</sub> H <sub>2</sub>
Sb	Antimony	-51NQ	190	10	15	R106	217.58* 231.15	10 10	Air-C <sub>2</sub> H <sub>2</sub>
Se	Selenium	-34NQ	235	20	25	R106	196.03*	2.0	Air-H <sub>2</sub> Ar-H <sub>2</sub>
Si	Silicon	-14NU	175	10	20	R106	251.61* 288.16	10 10	N <sub>2</sub> O-C <sub>2</sub> H <sub>2</sub>
Sn	Tin	-50NQ	280	10	15	R106	224.61* 286.33	10 35	Air-H <sub>2</sub> Air-C <sub>2</sub> H <sub>2</sub>
Sr	Strontium	-38NB	130	10	20	R106	460.73*	125	Air-C <sub>2</sub> H <sub>2</sub> N <sub>2</sub> O-C <sub>2</sub> H <sub>2</sub>
Ta	Tantalum	-73NU	145	10	20	R106	271.47* 275.83	10 5	N <sub>2</sub> O-C <sub>2</sub> H <sub>2</sub>
Te	Tellurium	-52NQ	220	10	15	R106	214.27*	5	Air-C <sub>2</sub> H <sub>2</sub>
Ti	Titanium	-22NB	165	10	20	R106	364.27* 365.35	100 95	N <sub>2</sub> O-C <sub>2</sub> H <sub>2</sub>
V	Vanadium	-23NU	185	10	20	R106	306.64 318.40	30 210	N <sub>2</sub> O-C <sub>2</sub> H <sub>2</sub>
W	Tungsten	-74NU	130	10	25	R106	255.14* 400.87	10 80	N <sub>2</sub> O-C <sub>2</sub> H <sub>2</sub>
Zn	Zinc	-30NQ	215	7	15	R106	213.86* 307.59	80 230	Air-H <sub>2</sub> Air-C <sub>2</sub> H <sub>2</sub>
Zr	Zirconium	-40NB	135	20	30	R106	360.12* 468.78	180 240	N <sub>2</sub> O-C <sub>2</sub> H <sub>2</sub>
D <sub>2</sub> <sup>③</sup>	Deuterium	IDQ	380	30	35	R106	240.00 (Peak value)	40	—

## L733 Series (Outline ①)

Na-K	Sodium Potassium	L733-201NB	165	10	15	R446	Na589.00* K 766.49* <sup>②</sup>	140 40	Air-C <sub>2</sub> H <sub>2</sub>
Ca-Mg	Calcium Magnesium	-202NU	145	10	18	R106	Ca422.67* Mg285.21*	335 380	Air-C <sub>2</sub> H <sub>2</sub>
Si-Al	Silicon Aluminium	-203NU	180	10	20	R106	Si 251.61* Al 309.27*	10 95	N <sub>2</sub> O-C <sub>2</sub> H <sub>2</sub>
Fe-Ni	Iron Nickel	-204NQ	215	10	20	R106	Fe248.33* Ni 232.00*	70 60	Air-C <sub>2</sub> H <sub>2</sub>
Sr-Ba	Strontium Barium	-205NB	150	10	20	R106	Sr 460.73* Ba553.55*	40 30	N <sub>2</sub> O-C <sub>2</sub> H <sub>2</sub>

- A** B : Borosilicate Glass  
 U : UV-Transmitting Glass  
 Q : Fused Silica  
 N : Neon Gas  
 D : Deuterium
- B** DC or peak values
- C** \* . . . the most sensitive line.
- D** Hamamatsu Photomultiplier Tube (PMT) Type.  
 R106 . . . .Sp=190A/lm  
 R446 . . . .Sp=240A/lm  
 Ebb: 600V, SBW: 0.16nm  
 Equipment: Nippon Jarrell-Ash  
 Model AA-1E

- ①** As lamp is furnished with individual data. Please use it at indicated current values.
- ②** R106 can not detect. It is recommended to use R446, R456, R955.
- ③** For compensation of background.

### Warranty:

(See Warranty on inside back cover.)

All lamps are guaranteed for one year.

Rated Life Time:

As, Ga, Hg

. . .3000mA-hrs  
min.

Other elements

. . .5000mA-hrs  
min.

### Warning:

(See Warning on inside back cover.)

Cares must be taken in handling these lamps, especially the types containing harmful elements.

### Replacement:

Hamamatsu Hollow Cathode Lamps can be replaced with Hitachi, Westinghouse, Varian Techtron, Hanau or Evants Types. For Perkin-Elmer types, adapter E753 is available.

# Electrodeless Discharge Light Source (EDL)

The Electrodeless Discharge Light Sources (EDL) are designed for Atomic Absorption (AA) System and other instruments. These Light Sources are usable on most AA equipment with the constant power supply C977. The output intensity is up to several ten times that of Hollow Cathode Lamps.

## ■ L978 Series (For Atomic Absorption · Atomic Fluorescence · Fluorochemistry)

☞ Type ⑤	Analysis Line (nm)	PMT Output (nA) ⑥	Operating Power Mode: CW (W)	Output Intensity compared with HCL (EDL/HCL) ⑦
L978-As (Arsenic)	189.1	25	10	
	193.7	100	10	40 / 1
-Br (Bromine) ★	447.3	12	10	—
	447.8	25	10	—
-Hg (Mercury)	253.7	5000	5	35 / 1
-I (Iodine) ★	206.2	5600	5	—
-P (Phosphorus)	213.6	150	10	—
-S (Sulfur)	190.0	8 ~ 30	1 ~ 5	—
-Sb (Antimony) ★	217.6	200	10	20 / 1
-Se (Selenium)	196.0	70	10	35 / 1
-Te (Tellurium)	214.3	200	10	35 / 1

⑤ ★ . . . New products

⑥ Hamamatsu PMT:  
R106 . . . Sp = 190A/lm  
Ebb: 600V  
Equipment:

Nippon Jarrell-Ash Model AA-1E  
Slit Width { Entrance . . . 0.1 mm  
Exit . . . . . 0.15 mm  
(S.B.W. 0.16nm)

⑦ Comparison with Hamamatsu Hollow Cathode Lamp

※ The values of L978-Br.I.S are temporary data.

## ■ L1016 (For Molecular Absorption)

L1016-NO (Nitric Oxide)	214.9	25	10	—
	226.3	30	10	—

## Stabilized Power Supply C977 (RF Exciter for EDL)

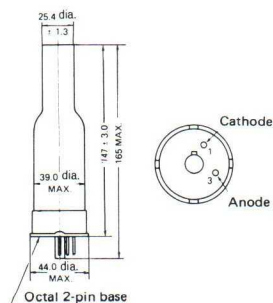


### Specifications

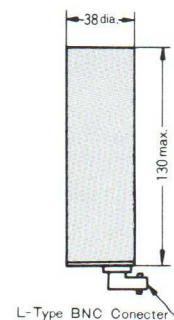
- Line Voltage: 115V, 230V 50/60 Hz, 200VA
- RF Output
  - Frequency: [27.12 MHz International Radio Regulations] No. 225
  - Power: Continuous (CW) Mode . . . . 50W  
Square-wave Modulated (Chop) Mode . . . . 50Wp-p
  - Power Regulation: Less than ±0.3%  
for change of ±10% of Line Voltage
  - Drift: Less than ±1%/hr (after 30 min. warm-up)
- External Modulation Input  
CW, HCA, NEG, POS, CHOP
- Size: 230(W) x 130(H) x 300(D) mm
- Weight: approx. 8.5 kg

unit : mm

① L233 L733



② L978 L1016



# LIGHT SOURCES

## Deuterium Lamps

Type	Outline	Window Material	Emission Spectrum (nm)	Starting Voltage (Vdc)	Supply Voltage (Vdc)	Anode Current in Operation (Adc)	Tube Drop Voltage (Vdc)	Stability of Emission Energy (%/hr)	Filament					Life Expectancy (hrs)
									Warm-up			in Operation		
									Voltage (Vdc, ac)	Current (Adc, ac)	Time (s)	Voltage (Vdc, ac)	Current (Adc, ac)	
L 5 4 4	①	Fused Silica	160~400	350max	160~180	0.3 ± 10%	70~95	±0.5max	10	0.8	10	3.5	0.3	500 min
L 6 4 8	②													
L 5 9 1	③	UV-glass	185~400											
L 8 7 9	—	MgF <sub>2</sub>	115~400											
L879-01	—													
L 6 2 5	①	Fused Silica	160~400	350max	160~180	0.3 ± 10%	70~95	±0.5max	2.5	4	10	0~1.5	0~3	500 min
L 6 5 6	②													
L 6 1 3	③	UV-glass	185~400											

**A** The anode supply voltage without load.

**B** Maximum value.

**C** Measured with HTV Phototube, using regulated power supply Model C704.

Stability of Emission energy is dependent on operating conditions such as anode and filament current, temperature, and draft. To obtain high stability of the lamp operation a constant current power supply must be used for filament DC.

**C** Minimum rated life still retaining 50% of the initial total Emission energy.

Guaranteed life except L879, L879-01 which are expected life.

① Minimum value required for starting the lamp discharge. The starting voltage should not exceed 650 Vpeak. In any case resistor of 50 ~ 100 kΩ must be connected in series to trigger circuit.

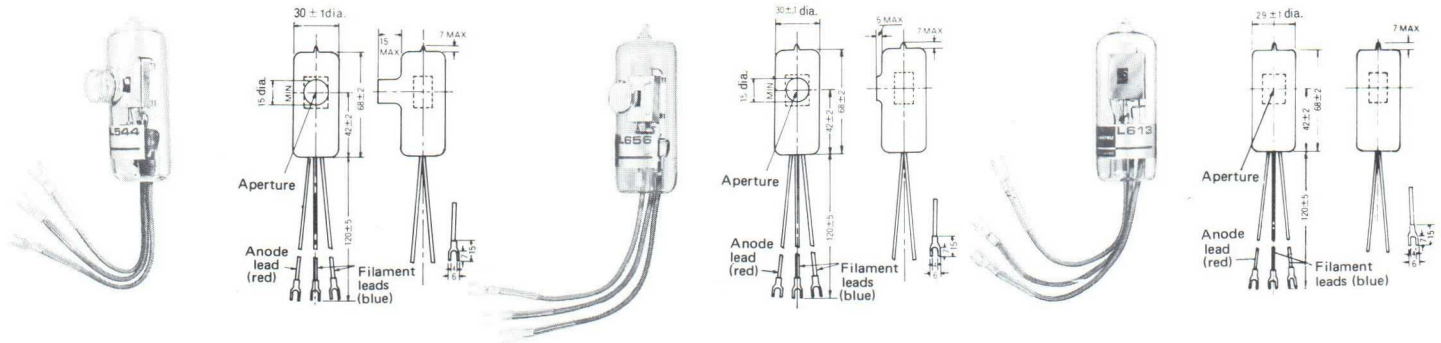
② Adjust to give 2.5V of warm-up voltage across the lamp filament leads.

unit : mm

① L544 L625

② L648 L656

③ L591 L613



## Deuterium Lamp Power Supply C704

This ideal constant current power supply Model C704 is designed to provide a very stable operation for deuterium lamps. The C704 allows the use of any deuterium lamp listed above.

### Specifications

Anode Circuit	Output Current	300 ± 50 mA DC (Adjustable)	Filament Circuit	Output Voltage (I) 10 ± 1 VDC (0.8A)
	Output DC Voltage	200 VDC max. with no load		(II) 2.5 ± 0.5 VAC (4A)
		85 ± 25 VDC at lamp operated		Output Voltage (I) 3.5 ± 1 VDC (0.3A)
	Output Trigger Voltage	600 ± 50V peak		(operation) (II) 0V
	Line Regulation	±0.1% max. for ±10% change		Line Regulation (I) ±3% max. for ±10% change
	Load Regulation	±0.1% max. for full load change		Over Load Protection (I) 1A fuse for 10 volts
	Ripple	0.3 mA p-p max.		note: It is not employed for 2.5 volts circuit.
	Drift	±0.1%/h max. after 30 minutes warm-up		Input 115 ± 10 VAC 50/60Hz 70VA
	Over Load Protection	0.5A fast blow fuse		Ambient Temperature For Storage 0 ~ +40°C
				For Operation +5 ~ +35°C
				Size 200 (W) x 120 (H) x 250 (D) mm
				Net Weight Approx. 6.5 kg

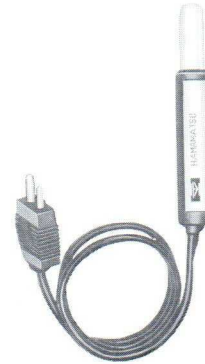
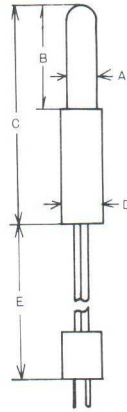
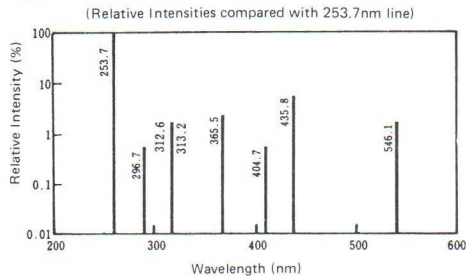


# Low Pressure Mercury Lamps L937 Series

L937 is a low pressure mercury lamp with small sized, light weight and high intensity output. It is suited to use calibration of monochrometer, chemical reaction and ozon generation.

Type	Envelope	Starting Voltage (Vrms)	Operating Current (mArms)	Operating Voltage (Vrms)
L 937-01	Fused Silica	800 (Typical)	18	200
-02				270
-03	Vycor			200
-04				270

Main Mercury Lines



UNIT: mm

Type	A	B	C	D	E
L 937-01	6.5	25	85	10	445
-02		54	114		
-03	9	29	89		
-04		57	117		

# Power Supply for L937 Series C940-01, -02

## Specifications

- Line Voltage C940-01 . . . . . 118Vac 50/60Hz 40VA
- C940-02 . . . . . 230Vac 50/60Hz 40VA
- Output Voltage . . . . . 1600Vrms (at no load)
- Output Current . . . . . 18mArms
- Operating Ambient Temperature . . . . . 15 ~ 35°C
- Size . . . . . 156(W) x 79(H) x 114(D) mm
- Net Weight . . . . . approx. 1.4kg

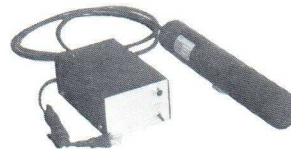


# He-Ne Laser System C964, C965

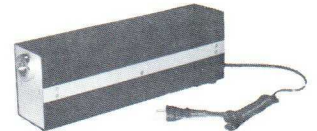
C964 and C965 are TEM<sub>00</sub> mode He-Ne Laser Systems, which have completely glass sealed and inner-mirror laser tube. Therefore, it is not necessary to adjust troublesome mirror and Laser Systems are not influenced by their environment. C964 is one body type and C965 is a separate type; the other specifications are the same.

## Specifications

- Wavelength . . . . . 632.8 nm
- Output Power . . . . . 1.0 mW min.
- Spacial Mode . . . . . TEM<sub>00</sub>
- Beam Diameter . . . . . 0.9 mm
- Beam Divergence. . . . . 0.8 mrad
- Operating Life . . . . . 10,000h
- Operating Temperature . . . . . 0 ~ 40°C
- Storage Temperature . . . . . -20 ~ 70°C



C965




C964

# IMAGE PICKUP TUBES


## Vidicons

Type	Applications	Diameter (mm) (inch)	Overall Length (mm)	Focusing Method	Deflection Method	Characteristics	
						Signal Output Current (nA)	Center Resolution (TV lines)


### Vidicons (for Visible Light)

 7262A 7735A	7262A	Compact, Industrial Transistorized TV Cameras	25 (1)	130	M	M	200 (10 Lx)	700  750 900 (High Resolution Operation)			
	7735A	Live TV and Industrial Cameras		159							
	8507	Transistorized Cameras for Broadcast, Film Pickup, Industrial TV Cameras (High Resolution)		130							
	8541										
	8573	Live TV and Industrial Transistorized Cameras, Color TV Film Pickup		159					S	700 · 800 (High Resolution Operation)	
	8134	Transistorized Cameras for Broadcast Film pickup (Low Distortion), Industrial TV Cameras (Ultra High Resolution).		159					C	800 · 1,000 (High Resolution Operation)	
	8816										
	25PE12	Compact, Transistorized Industrial TV Cameras for Special Scanning Systems		100 (5 Lx)					S	450	
	8844	Compact Industrial TV Cameras		18 ( $\frac{2}{3}$ )					M	200 (15 Lx)	750
	N887								M	600	
8480	8480	Transistorized Cameras for Broadcast Film Pickup and Data Transmission Applications	38 ( $1\frac{1}{2}$ )	260	S	350 (10 Lx)	1,200				



### Silicon Vidicons (Silicon Diode Array Target Vidicon)

 N736	N736 (25PE16)	TV Telephones Compact, Industrial Special TV Cameras	25 (1)	159	M	M	250 (0.5 Lx)	550
	N747		18 ( $\frac{2}{3}$ )	100			250 (1 Lx)	400

### EIC Vidicon

 N1062	N1062	Industrial TV Cameras for Low Light Level	55 (2)	188	M	M		550
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### Vidicons (for IR, X-Ray, UV)

 N743 N156	Infrared Vidicon		25 (1)	159	M	M	200 (10Lx+ IR-D80A)	600  700
	N156	Observation and measurement of temperature of higher than 200°C. Observation of the dislocation, laser pattern and hydrogen flame under sun light.		130				
	N214			159				
	N743	Infrared TV Cameras (Low Lag)		100 (10 Lx+ IR-D80A)				
 N603 N371	X-Ray Vidicon		25 (1)	159	M	M	160 (100 R/min)	500
	N603	Direct image conversion of X-ray. Non-destructive inspection X-ray diffraction.						
	Ultraviolet Vidicon		25 (1)	159	M	M	200 (30 Lx)	700
N371	UV Microscope UV TV Cameras	160 (0.5 Lx)					750 · 900 (High Resolution Operation)	
N983	Two Dimensional Spectrophotometry (200 ~ 700nm)							

## Image Dissector Tubes

Type	Applications	Diameter (mm) (inch)	Overall Length (mm)	Focusing Method	Deflection Method	Characteristics		Operating Condition				
						Photo-cathode Sensitivity ( $\mu A/lm$ )	Current Amplification	Photo-cathode Voltage (V)	Grid No. 4 Voltage (V)	Dynode No. 1 Voltage (V)	Anode Voltage (V)	Focusing Field Strength (gauss)



### Image Dissector Tubes

Type	Applications	Diameter (mm) (inch)	Overall Length (mm)	Focusing Method	Deflection Method	Photo-cathode Sensitivity ( $\mu A/lm$ )	Current Amplification	Photo-cathode Voltage (V)	Grid No. 4 Voltage (V)	Dynode No. 1 Voltage (V)	Anode Voltage (V)	Focusing Field Strength (gauss)
 R571	R571	38 (1 1/2)	182	M	M	100	5 × 10 <sup>4</sup>	0	250	200	1,000	35
	R602	57 (2 1/4)	232									45
	R658	75 (3)	300									26
	R312	38 (1 1/2)	222	S	S	1 × 10 <sup>4</sup>	1,500	—				

## Memory Tubes

Type	Applications	Diameter (mm) (inch)	Overall Length (mm)	Focusing Method		Deflection Method	Typical Characteristics				
				Image Section	Scanning Section		Center Resolution (TV lines)	Gradation (Grades)	Time for Erasing and Priming (TV frames)	Time for Writing (TV frames)	Storage Time

### Memory Tubes

Type	Applications	Diameter (mm) (inch)	Overall Length (mm)	Image Section	Scanning Section	Deflection Method	Center Resolution (TV lines)	Gradation (Grades)	Time for Erasing and Priming (TV frames)	Time for Writing (TV frames)	Storage Time	
 N284	Image Memory Tubes		38 (1 1/2)	208	M	M	M	350	8	2	—	2 min
	N333	Optical information storage and retrieval systems. Space applications.	50 (2)	280				600				10 hr
 N319	Memory Tubes		25 (1)	210	—	M	M	400	8	2	1	2 min
	N232	Scan converter. Alphanumeric display system. Interactive graphic displaying. Educational TV console. Information storage and reproduction systems.	38 (1 1/2)	263				600				10 hr

<sup>a</sup>Continuous readout

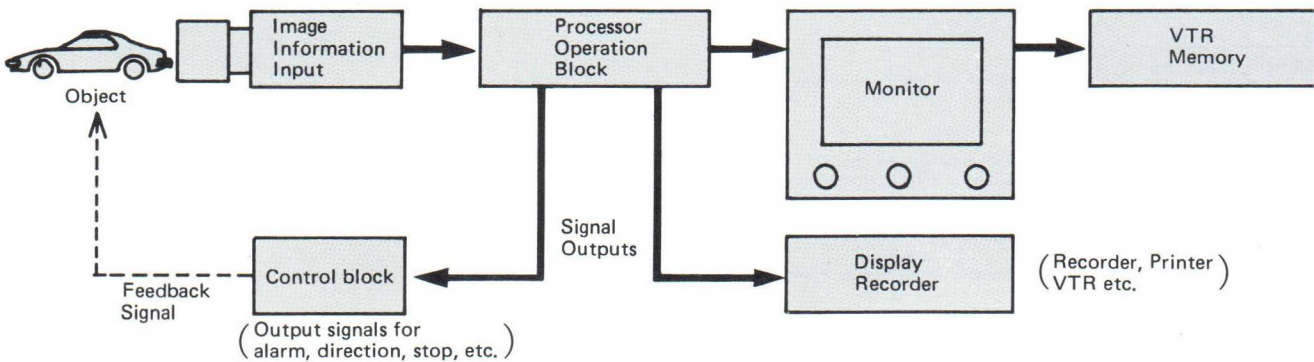
## Vidicon Yoke Assemblies

Type	For Use With	Tube Size (mm) (inch)	Focusing Method	Deflection Method	Deflection Coil		Deflection Current	Focusing Coil		Alignment						
					Horizontal L (mH) / R ( $\Omega$ )	Vertical L (mH) / R ( $\Omega$ )	Horizontal/Vertical (mA p-p)	R ( $\Omega$ )	mA/Gauss	R ( $\Omega$ )	max./min. (gauss)					
KV-6A	Cylindrical	8134	S	M	0.45/2.0	18/88	140/13	—	—	130	4 (50mA)					
KV-9L	Square	8507, 8541, 8573, N736, N214, N983									M	1.6/4.4	70/120	150/33	100	90/40
KV-9G		7262A, 7735A, N156, N157, N371	4 / 1													
KV-10		8844, N747		0.88/2.9	32/146	150/20	55	120/50	—	4 / 1						
KV-12S			0.88/3.2													
KV-12SB	Cylindrical	7262A, 7735A, N156, N157, N371	25 (1)	M	1.6/4.4	70/120	150/33	100	90/40	—	4 / 1					
KV-13M		8507, 8541, 8573, N736, N214, N983														
KV-14CA	Square	8816	C	M	1.2/5.1	28/195	140/25	400	30/26	170	4 (50mA)					
KV-15A	Cylindrical	8480	S		1.7/5.8	31/46	100/15	—	—	—	160	4 (50mA)				
KV-19G		N887		0.9/4.4									26/145	100/16	—	—
KV-22B		8844, N747	M		0.88/2.9	32/146	150/20	50	120/50	—	4 / 1					
KV-22C				175								65/50	—			
E1164	Square	N603	25 (1)	M	1.0/4.6	55/200	170/35	120	110/55	148	4 (50mA)					

# MEASURING TV SYSTEMS

## • Measuring Systems using TV technique

ILLUSTRATION OF SYSTEM



### Image information inputting devices

High-precision vidicon cameras	VIDICON CAMERA FOR COMPUTER
Random access TV cameras	DISSECTOR CAMERA FOR COMPUTER
High-speed TV cameras	IMAGE DISSECTOR CAMERAS, HIGH-SPEED SHUTTER CAMERAS
Special wavelength TV cameras	INFRARED, ULTRAVIOLET, X-RAY CAMERAS
Ultra High-sensitive TV cameras	SIT CAMERAS
Ultra High-speed photometry cameras	TEMPORAL DISPERSER
Solid state image sensor cameras	DIGITAL VIDEO SCALE

### Image processing devices

Pattern recognition, processing (minicomputer processing)	COMPUTER PROCESSORS
Analysis of particle distribution and others (microcomputer processing)	IMAGELYZER, DIGITAL PROCESSOR, PARTICLE COUNTER

### TV systems

Displacement measurement (vibration, bending, distortion)	1D ANALYZER
Width measurement (width, height, distance)	WIDTH ANALYZER
Area measurement (2-dimensional configuration)	AREA ANALYZER, IRISCORDER
Position measurement (2-dimensional, 3-dimensional)	X-Y TRACKER, MULTIPOINT X-Y TRACKER
Particle measurement (counting)	PARTICLE COUNTER

### Photometric measurement

Photometric measurement (pattern, distribution)	INFRARED CAMERA, HIGH-SPEED SHUTTER CAMERA
Ultra High-speed photometric measurement (discharge, illumination, absorption, fluorescence)	TEMPORAL ANALYZER
Photon counting (Number of photon)	PHOTON COUNTER

### Data recording and reproducing

Multi-data recording and reproducing (data analysis)	EXTERNAL MULTIPLEXER
Video and data recording, and reproducing (simultaneous)	VIDEO DATA CODER

### Special systems

Substance checking	Medicine, glass, material
Defect checking	Metal, glass sheet, crack, pin-hole
Shape checking	H steel, parts,
Pattern recognition	Moire, holography, robot
Pattern comparison	Parts inspection,
Counting	Aerosol, emulsion
Gait analysis	Gait analysis of handicapped
Space application	Rocket tracking, Space TV, Vacuum UV TV



## VIDICON CAMERA FOR COMPUTER SYSTEM C1000

### For Image Analyzer

HTV C1000 is image information input system for computer with high resolution (1000 TV lines max.), less distortion (0.2% when corrected) and high stability ( $\pm 0.2\%$  at  $+10\sim+40^{\circ}\text{C}$ ). The various optional modules are provided to facilitate interfacing.



## INFRARED TV CAMERA C158

### For the infrared range.

- Utilizing the infrared sensitive vidicon tube (N156).
- Video signal level on a selected vertical scanning line position is displayed on the monitor.



## IMAGE DISSECTOR CAMERA C981

### High speed random access, video analyzing

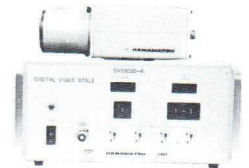
- Employing an electromagnetic focusing-electrostatic deflection type image dissector.
- High speed random access to any point within the field.
- Highly stable drive deflection circuit repeatability, and fast settling time.



## DIGITAL VIDEO SCALE C863

### For 1-Dimensional Measurement

- High speed 1-dimensional (width and vibration) measurement.
- Using a semiconductor linear array as image pickup element.



## MULTIPOINT X-Y TRACKER C799

### For High-Speed Measurement

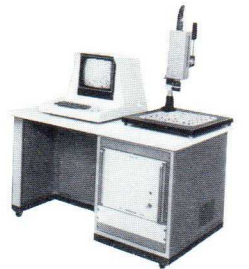
- Using the Image Dissector Tube for the image pickup tube. High speed measurement up to 4 points is possible.
- Simultaneous measurement and observation of the object on the TV monitor with very high sampling speed.



## IMAGELYZER C995

### Image information analyzing system

- Newly developed Image analyzing system with multifunctions required for fundamental measurement.
- System commands are interactive, in which the user and system engage in a dialogue to perform desired functions.
- Area of a particle, area ratio, height, width, maximum diameter, number of particles, etc. are measured and displayed as histogram or to be outputted on a teletype.



## TEMPORALANALYZER C1098

### Optical information analyzing

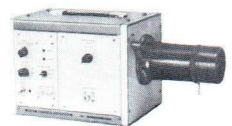
- Analyzes optical information from TEMPORALDISPERSER as well as spectrophotometers with a degree of high accuracy and reliability.
- Conversational processing allow the user to do easy operation.



## TEMPORALDISPERSER C979

### For ultra high-speed time-resolving photometry

- Using newly developed Streak Tube which incorporated a micro channel plate.
- Time resolution better than 10 picoseconds.
- Ultra high-speed phenomena which occur such as in the field of molecule and atom by excitation of a picosecond pulse laser can be measured with high accuracy and reliability.



## VIDEO DATA CODER C701

### For simultaneous recording of a video signal and data.

- This system allows to record a video signal of a TV camera and the relating data as digital into a video tape simultaneously.
- When two units are used, the video signal and the data can be transmitted between the two by connecting a coaxial cable.



## VARIOUS MEASURING UNITS

### Various measuring units to be used with TV camera are available.

- X-Y Tracker
- Width Analyzer
- Area Analyzer
- Displacement Analyzer

These measuring units were designed to be used with the C1000, but any TV camera may be used with some loss of information.



# REPLACEMENT INFORMATION FOR HAMAMATSU OBSOLETE TYPES

The following list shows the products which were sold before but not listed in this catalog.

- Marked
- : We will supply only upon your request.
  - △ : The same as above but will be discontinued in the near future.
  - x : We can not supply any more, please consider other replacement.
  - \* : The same dimensional outline, base connection and electric characteristics.
  - \*\* : The similar electric characteristics and the same dimensional outline and base connection.
  - \*\*\* : The same electric characteristics, but different dimensional outline or different base connection.
  - \*\*\*\* : The similar electric characteristics, but different dimensional outline or different base connection.

Types	Supply	Sort	Replacement	Types	Supply	Sort	Replacement
P109	x	CdS Cell		P487	x	CdS Cell	P201E (**)
P113	○	CdS Cell		P489	x	CdS Cell	
P124	x	IR Detector	P394 (***)	P506	x	IR Detector	P819 (***)
P141	x	CdS Cell	P621 (***)	C527	○	Measuring TV	
N177	△	Vidicon		P536	x	CdS Cell	P320 (**)
P179	x	CdS Cell	P621 (***)	P537	x	CdS Cell	
P199B	△	CdS Cell		L544M	○	Light Source	
P201B-5R	△	CdS Cell	P201D-5R (***)	P551	△	CdS Cell	
P201B-7R	△	CdS Cell	P201D-7R (***)	N553	△	Vidicon	
P202	x	CdS Cell	P621 (****)	P558B	x	CdS Cell	
P202A	x	CdS Cell	P621 (****)	P558C	x	CdS Cell	
P202B	x	CdS Cell		P558D	x	CdS Cell	
P202C	x	CdS Cell	P621 (****)	P560	△	CdS Cell	
P203	○	CdS Cell		P561	x	CdS Cell	
P204	○	CdS Cell		P575-3	x	CdS Cell	P1095-06 (***)
P227C	△	CdS Cell		P576-6	x	CdS Cell	P1096-06 (***)
P227D	○	CdS Cell		P577-3	x	CdS Cell	P577-04 (***)
P227E	x	CdS Cell	P320 (**)	P579-6	△	CdS Cell	P1096-06
R231	x	Image Dissector Tube	R571 (*)	P589	x	CdS Cell	P380 (**)
L238	x	Light Source	L656 (***)	L591	○	Light Source	
P240	x	CdS Cell		R612	x	Image Dissector Tube	
N248	x	Vidicon		L613K	x	Light Source	L613 (*)
P255	△	CdS Cell		P618	x	CdS Cell	
P273	x	CdS Cell		L625K	x	Light Source	L625 (*)
P285	x	CdS Cell		L656K	x	Light Source	L656 (*)
P295	x	CdS Cell		L661	○	Light Source	L591 (***)
P322	x	CdS Cell	P621 (****)	L662	○	Light Source	L613 (***)
P322A	x	CdS Cell	P621 (****)	L662K	x	Light Source	L613 (***)
P328	○	CdS Cell		P673-2	○	CdS Cell	
N337	△	Image Memory Tube	N284 (***)	C681	○	Measuring TV	
P346	○	CdS Cell		C703-01	○	Measuring TV	
P368	○	CdS Cell		P722	x	CdS Cell	
P398	x	PbS Cell	P1085 (***)	C845	○	Measuring TV	
P398R	x	PbS Cell	P1085-01 (***)	C846	○	Measuring TV	
N400	○	Vidicon	N603 (****)	C861	○	Measuring TV	
P411	△	CdS Cell	P552 (**)	C862	○	Measuring TV	
C426	○	Measuring TV					
R442	○	Image Dissector Tube					
N451	x	Vidicon					
P467	○	CdS Cell					
C469	○	Measuring TV					

# WARNINGS

## PERSONAL SAFETY HAZARD

### General:

Some HAMAMATSU products listed in this catalog require that they are handled by qualified personal that have been instructed safety procedures in handling high voltage, ultraviolet light, and highly intense radiation from lasers. Appropriate caution should be paid at all times.

### Laser Radiation:

#### Lasers

These devices emit electromagnetic radiation which may be harmful to eyes and skin. They should be used with appropriate eye protection and interlocks.

High voltages may also present a shock hazard.

### High Voltage Hazard:

Photomultipliers, Electron Multipliers, High Voltage Power Supplies, Biplanar Phototubes, Vidicons, Image Dissector Tubes, Pickup Tubes and Memory Tubes.

The high voltage used by these devices may present a shock hazard. They should be installed and handled only by qualified personal that have been instructed in handling of high voltage. Designs of equipment utilizing these devices should incorporate appropriate interlocks to protect the operator and service personal.

### Ultraviolet Radiation:

#### Low Pressure Mercury Lamps and Deuterium Lamps

The light emitted by these lamps may be harmful to the eyes and skin. Eye protection should be worn and skin should be covered. Also high voltage is used on these devices and the precautions shown in high voltage hazard should be paid. Interlocks are recommended on all equipment designs.

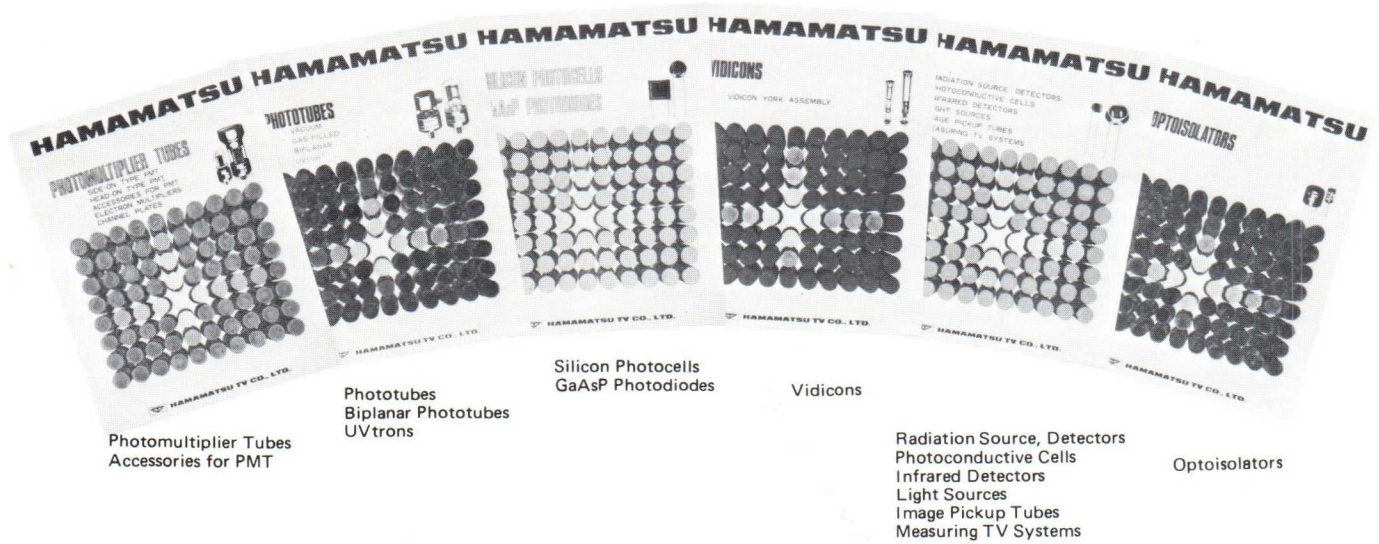
# WARRANTY

All Hamamatsu photosensitive devices except vidicons and other hot filament type detectors are warranted to the original purchaser for a period of 12 months following the date of shipment. The warranty is limited to repair or replacement of any defective material due to defects in workmanship or materials used in manufacture.

All Hamamatsu vidicons and other hot filament type detectors are warranted to the original purchaser for a period of 12 months following the date of shipment. The warranty is limited to repair or replacement of any defective material due to defects in workmanship or materials used in manufacture. Should any manufacturing defect show up within 90 days, the detector will be replaced free of charge. After 90 days, they will be replaced with cost prorated on the basis of one year.

All Hamamatsu Deuterium Lamps are warranted to the original purchaser for a period of 12 months following the date of shipment, or for 500 hours of operation, whichever comes first. The warranty is limited to repair or replacement of any defective material due to defects in workmanship or materials used in manufacture. Should any manufacturing defect show up in the first 90 days, or 125 hours of operation, the lamp will be replaced free of charge. After 90 days, or 125 hours of operation, the lamp will be replaced with the cost prorated on the basis of one year, or 500 hours.

- A: Any claim for damage of shipment must be made directly to the delivering carrier within five days.
- B: Customers must inspect and test all detectors and lamps within 30 days after shipment. Failure to accomplish said incoming inspection shall limit all claims to 75% of invoice value.
- C: No credit will be issued for broken detectors or lamps unless in the opinion of HTV the damage is due to a seal crack or a crack in a graded seal traceable to a manufacturing defect.
- D: No credit will be issued for any detector or lamp which in the judgement of HTV has been damaged, abused, modified, or which the serial number or the type numbers have been obliterated or defaced.
- E: No detectors or lamps will be accepted for return unless permission has been obtained from HTV in writing, the shipment has been returned prepaid and insured, the detectors or lamps are packed in their original box and accompanied by the original datasheet furnished to the customer with the tube, and a full written explanation of the reason for rejection of each detector or lamp.
- F: This warranty gives you specific legal rights and you may also have other rights which vary from state to state.



Photomultiplier Tubes  
Accessories for PMT

Phototubes  
Biplanar Phototubes  
UVtrons

Silicon Photocells  
GaAsP Photodiodes

Vidicons

Radiation Source, Detectors  
Photoconductive Cells  
Infrared Detectors  
Light Sources  
Image Pickup Tubes  
Measuring TV Systems

Optoisolators

FOR OTHER HAMAMATSU PRODUCTS' INFORMATION, OUR LATEST CATALOGS ILLUSTRATED ABOVE ARE AVAILABLE ON REQUEST.

PHOTON  
IS OUR  
BUSINESS



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2680 Bayshore Frontage Road  
Mountain View, Calif. 94043 U. S. A.  
Phone: (415) 965-2300 Telex: 345-594

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