Narragansett imaging

Data Sheet

PLUMBICON IMAGING TUBE: XQ9002X

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Camera Tube: XQ9002X

25.4 mm (1 inch) diameter Plumbicon camera tube with high-resolution lead-oxide photoconductive target; for use in medical equipment with X-ray image intensifiers with P20 output phosphor. This tube is intended to be a replacement for the Saticon XQ1575.

QUICK REFERENCE DATA

Diameter	25.4 mm 1.0 inch	
Length (approx.)	162 mm	
Focusing	Magnetic	
Deflection	Magnetic	
Useful target area (diameter)	15 mm	
Spectral response	See figure 3	
Sensitivity at color temperature 2856K (typical)	485 μA/lm	
Resolution: Modulation depth at 20.3 I_p/mm	70 %	[14]
Heater requirements	6.3 V 95 mA	

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OPTICAL DATA

Dimensions of quality area on photoconductive target circle (diameter)	15 mm	
Faceplate Thickness	1.2 ± 0.1 mm	
Faceplate Refractive Index	1.49	

For correct orientation of the image on the target the vertical scan should be parallel to the plane passing through the tube axis and the mark on the tube base.

ACCESSORIES

Socket	Type 56098	
Deflection and focusing coil unit	Type AT1116S	

ELECTRICAL DATA

Deflection		Magnetic	
Focusing		Magnetic	
Heating		Indirect by a.c. or d.c.	
Heater Voltage	V_f	6.3 (±5%) V	

Heater Current (nominal at V_f = 6.3V)	I_f	95 mA	[1]
Capacitance: signal electrode to all	C_{as}	3 – 5 pF	[2]

LIMITING VALUES (Absolute maximum rating system)

All voltages are referred to the cathode, unless otherwise stated.

Signal electrode voltage (max)	V_{as}	50 V	
Grid 4 voltage (max)	V_{g4}	1100 V	
Grid 3 voltage (max)	V_{g3}	800 V	
Voltage between grid 4 and grid 3 (max)	$V_{g4/g3}$	450 V	
Grid 2 voltage (max)	V_{g2}	350 V	
Grid 1 voltage, positive (max)	V_{g1}	20 V	[3]
Grid 1 voltage, negative (max)	$-V_{g1}$	200 V	
Grid 1 current (≈cathode current) (max)	I_{g1}	10 mA	[4]
Cathode to heater voltage, positive peak (max)	V_{kfp}	50 V	
Cathode to heater voltage, negative peak (max)	$-V_{kfp}$	125 V	
Cathode heating time before drawing cathode current (min)	t_h	1 min	

External resistance between cathode and heater, at V_{kfp} > 10 V (min)	R_{kf}	2 kΩ	
Ambient temperature, storage and operation (max/min)	T_{amb}	50/-30 °C	
Faceplate temperature, storage and operation (max/min)	T	50/-30 °C	[5]
Faceplate illuminance (max)	E	100 lx	[6]

OPERATING CONDITIONS

Conditions for a scanned circular area with a diameter of 16.2mm [7]

Cathode voltage	V_k	0 V	
Signal electrode voltage	V_{as}	45 V	
Beam current	I_b		[8,9,10]
Grid 4 voltage	V_{g4}	960 V	[11]
Grid 3 voltage	V_{g3}	600 V	[11]
Grid 2 voltage	V_{g2}	300 V	
Grid 1 voltage	V_{g1}	0 – 20 V	
Blanking voltage on grid 1 (peak to peak)	$V_{g1\ p\text{-}p}$	30 V	

Focusing coil current			[7]
Deflection and alignment currents			[7]
Faceplate illuminance (P20 light source)	E	0 – 10 lx	
Faceplate temperature	T	20 – 40 °C	

Electron Gun Characteristics

Grid 1 voltage for cut-off at V_{g2} = 300V without blanking	V_{g1}	-10 – 0 V	
Grid 1 voltage for normal beam setting	V_{g1w}	≤ 20 V	
Grid 1 current at normally required beam currents	I_{g1}	≤ 5 mA	
Grid 1 current at normally required beam currents	I_{g2}	≤ 0.1 mA	
Blanking voltage (peak to peak) with respect to V_{g1w}	$V_{g1\ p\text{-}p}$	30 V	

Performance

Dark current	I_d	<3 nA	
Sensitivity at colour temperature of 2856K (min/typ)		400/485 μA/lm	[12]

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Sensitivity with P20 light source (min/typ)		90/115 μA/lm	
Peak signal current with E=1 lx, P20 (min/typ)	I_{sp}	160/195 nA	[13]
Peak signal current (16.2mm diameter scanning)		2000 nA	[9]
Gamma of transfer characteristic		0.95 ± 0.05	
Spectral response		See figure 3	
Resolution: Modulation depth at 20.3lp/mm (typ)		70 %	[14]
Modulation transfer characteristic		See figure 4	
Decay lag: Residual signal after dark pulse of 50 ms (typ/max)		22/26 %	[15]
Decay Lag: Residual signal after dark pulse of 60 ms (typ/max)		20/24 %	[15]
Decay Lag: Residual signal after dark pulse of 200 ms (typ/max)		8/12 %	[15]
Blemishes			[16]

MECHANICAL DATA

Mounting Position	Any	
Mass (approx)	60 g	

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Base	IEC 67-1-33a (JEDEC E8-11)	
Dimensions	See figures 1 and 2	

FIGURES

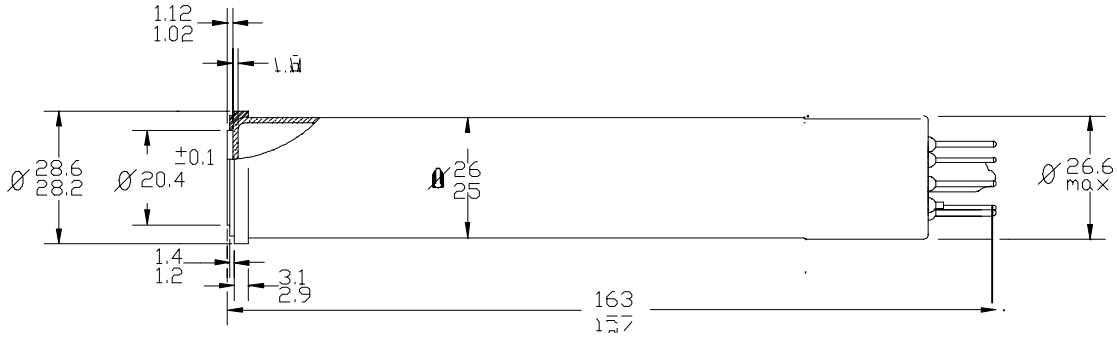
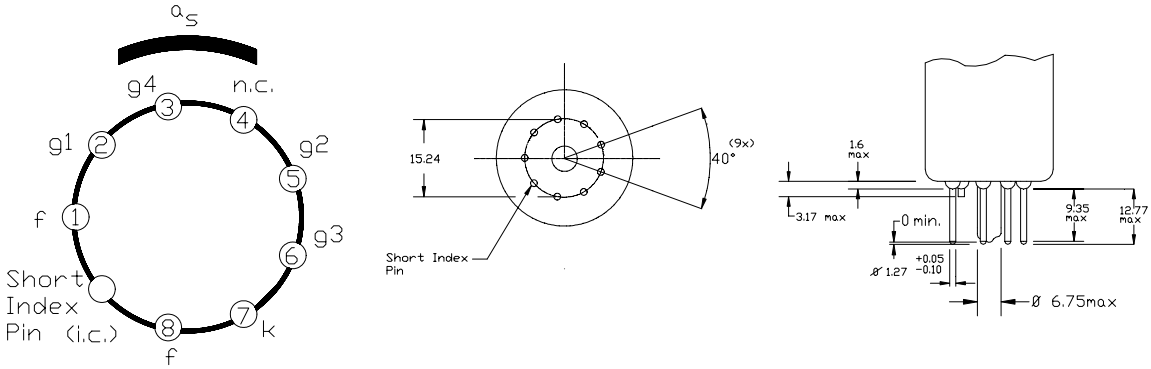


Figure 1. *Mechanical data for XQ9002X camera tube*



(a) (b) (c)

Figure 2. *Mechanical data for XQ9002X camera tube*

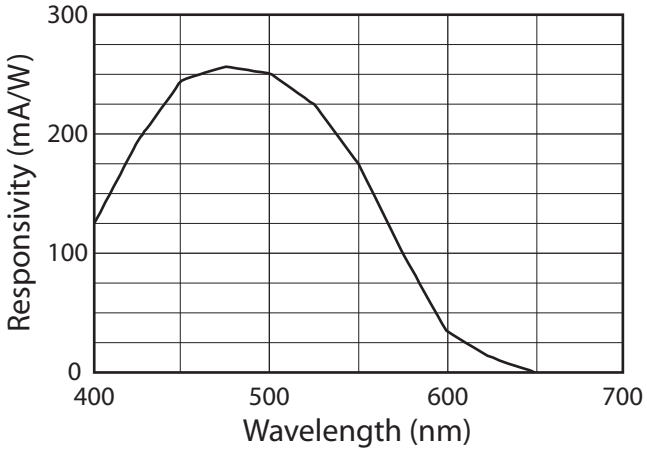


Figure 3. *Typical spectral response curve for XQ9002X camera tube*

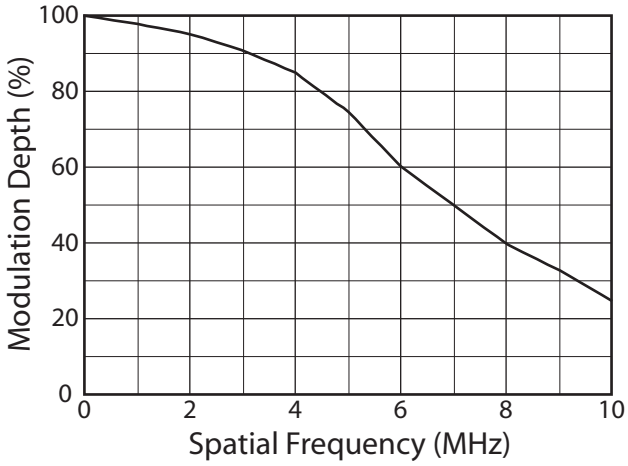


Figure 4. *Typical Square-wave response curve for XQ9002X camera tube*

NOTES

[1] The heater voltage must not exceed 9.5V r.m.s. For optimum performance stabilization of the heater voltage is recommended.

[2] This capacitance, which is effectively the output impedance, increases when the tube is inserted in the coil unit.

[3] The 'diode' gun operates with a positive grid 1 voltage and hence draws some grid current. The grid 1 voltage (d.c.) must be adjusted for correct beam current as described in [8].

[4] A current limiter must be incorporated to limit total cathode current to a maximum of 10mA.

[5]. The tube can withstand short excursions up to 70°C without any damage or irreversible degradation in performance.

[6] For short intervals. During storage the tube face shall be covered with the plastic hood provided; when the camera is idle the lens shall be capped, in stand-by also the beam will be cut-off

[7] The operating conditions and performance data quoted relate to operation of the tube in coil units AT1116S. See relevant data of deflection/focusing assemblies. Scanning amplitude should be adjusted such that the useful target area of 16.2mm is displayed on a standard monitor as a circular area with a diameter equal to the raster height.

[8] 'Diode' gun is a triode gun operating in a diode mode, providing a very high beam reserve. Continuous operation with a high beam setting is to be avoided since this will shorten tube life. High I_b settings should be used under high light intensity conditions only. All other modes of operation should be normal I_b settings or have then cut off.

[9] The maximum peak signal which can be handled is 3µA. Video amplifiers should be designed to accommodate this.

[10] The beam current I_b as obtained by adjusting the control grid voltage (grid 1) is set to at 400nA. I_b is not the total current available in the scanning beam, but is defined as the maximum amount of signal current, I_s, that can be obtained with this beam. In the performance figures, e.g. for resolution and lag, the signal and beam current conditions are given (e.g. as I_s/I_b = 20/300nA). This means: with a signal current of 20nA and a beam setting which just allows a signal current of 300nA.

[11] The optimum voltage ratio V_{g4}/V_{g3} to minimize beam-landing error (preferably ≤1V) depends on the type of coil unit used. For types At1116 and AT1126 a ratio of 1.6 is recommended. Under no circumstances should grid 4 (mesh) be allowed to operate at a voltage below that of grid 3 as this might damage the target.

[12] Measuring conditions: illuminance level 4.54lx at a color temperature of 2856K with Schott VG9 and Calflex B1/K1 filters inserted in the light path.

[13] The peak signal currents are measured on a waveform oscilloscope and with a uniform illumination on the 16.2mm diameter target area. When measured with an integrating instrument connected to the signal-electrode lead the average signal currents will be smaller by:

a) A factor α (α = [100-β]/100), β being the total blanking time in %. For the CCIR system α amounts to 0.75; for the NTSC system α amounts to 0.83.

b) A factor δ, where δ is the ratio of the active target area (circle with a diameter of 16.2mm) to the area which would correspond with the adjusted scanning amplitude (16.2mm x 21.6mm). This ratio amounts to $\delta = 0.59$.
The total ratio of integrated signal current, I_s, to the peak signal current, I_{sp}, is $\alpha \times \delta = 0.44$ for the CCIR system and 0.49 for NTSC system.

[14] Modulation depth is defined as the uncompensated amplitude response at 20.3lp/mm (scanned area 9.6 $\times$ 12.8mm) or 12lp/mm (scanned area 16.2mm diameter) at the center of the picture (5Mhz, 400 TV lines) with a BG18 filter.

[15] After a minimum of 5s of illumination of the target. Values shown relating to decay lag represent the residual signal currents in percentages of the original signal current as a function of time, after the illumination has been removed. Measured with a 20nA signal current and a beam current just sufficient to stabilize a signal current of 30nA.

[16] For details of test procedures for determining blemishes, see Narragansett Imaging document PLUMBICON IMAGING TUBES: TEST SPECIFICATION.