Narragansett imaging

Data Sheet

PLUMBICON IMAGING TUBE: XQ7002

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Camera Tube: XQ7002

25.4 mm (1 inch) diameter Plumbicon camera tube designed specifically for high-resolution fluoroscopy and digital imaging applications where both quantum noise and subtraction characteristics are required. The XQ7002 is a front loading tube with a metal ring. Special features are:

- Ultra high-resolution photoconductive target optimized for P20 phosphor
- Diode gun for high beam reserve and increased resolution
- Low output capacitance (LOC) for high signal-to-noise ratio

QUICK REFERENCE DATA

Diameter	25.4 mm 1.0 inch	
Length (approx.)	160 mm	
Focusing	Magnetic	
Deflection	Magnetic	
Useful target area (diameter)	16.2 mm	
Peak Wavelength Response (approx)	470nm	
Sensitivity at color temperature 2856K (typical)	425 μA/lm	
Resolution: Modulation depth at 20.3 I_p/mm	75 %	[12]
Heater requirements	6.3 V 95 mA	

OPTICAL DATA

Dimensions of quality area on photoconductive target circle (diameter)	16.2 mm	
Faceplate Thickness	1.2 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 56602	
Deflection and focusing coil unit	AT1102/01, AT1116S or equivalent	

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 (approx)	C_{as}	2.1 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}	340 V	
Grid 1 voltage, positive (max)	V_{g1}	25 V	
Grid 1 voltage, negative (max)	$-V_{g1}$	200 V	
Grid 1 current (≈cathode current) (max)	I_{g1}	10 mA	[3]
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	[4]
Faceplate illuminance (max)	E	500 lx	[5]

OPERATING CONDITIONS

Conditions for a scanned circular area with a diameter of 16.2mm [6]

Cathode voltage	V_k	0 V	
Signal electrode voltage	V_{as}	45 V	
Beam current	I_b		[7, 8]
Grid 4 voltage	V_{g4}	960 V	[9]
Grid 3 voltage	V_{g3}	600 V	[9]
Grid 2 voltage	V_{g2}	300 V	
Grid 1 voltage	V_{g1}	0 – 20 V	
Blanking voltage on grid 1 (peak to peak)	$V_{g1\ p\text{-}p}$	25 V	

Focusing coil current			[6]
Deflection and alignment currents			[6]
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}	≤ 15 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	<2 nA	
Sensitivity at colour temperature of 2856K (min/typ)		355/425 μA/lm	[10]

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Sensitivity with P20 light source (min/typ)		80/100 μA/lm	
Peak signal current with E=1 lx, P20 (min/typ)	I_{sp}	165/195 nA	[11]
Peak signal current (16.2mm diameter scanning)		2500 nA	
Gamma of transfer characteristic		0.95 ± 0.05	
Spectral response		See figure 3	
Peak wavelength response (approx)		430nm	
Resolution: Modulation depth at 20.3lp/mm (min/typ)		65/75 %	[12]
Resolution: Modulation depth at 12lp/mm (min/typ)		80/90 %	[12]
Decay lag: Residual signal after dark pulse of 50 ms (min/typ)		15/19 %	[13]
Decay lag: Residual signal after dark pulse of 60 ms (min/typ)		13/18 %	[13]
Decay Lag: Residual signal after dark pulse of 200 ms (typ/max)		4.5/7 %	[13]
Blemishes			[14]

MECHANICAL DATA

Mounting Position	Any	

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Mass (approx)	55 g	
Base	IEC 67-1-33a (JEDEC E8-11)	
Dimensions	See figures 1 and 2	

FIGURES

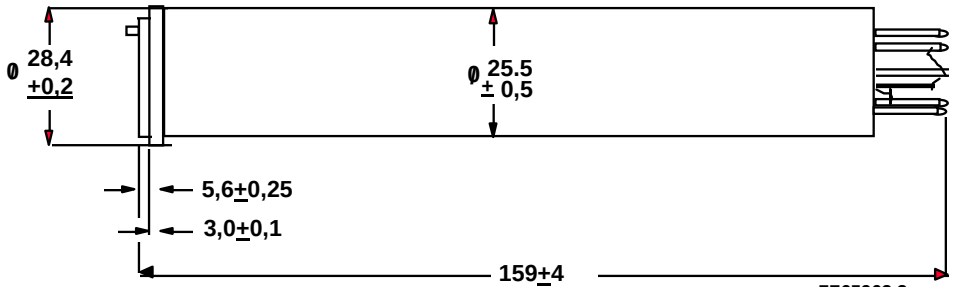
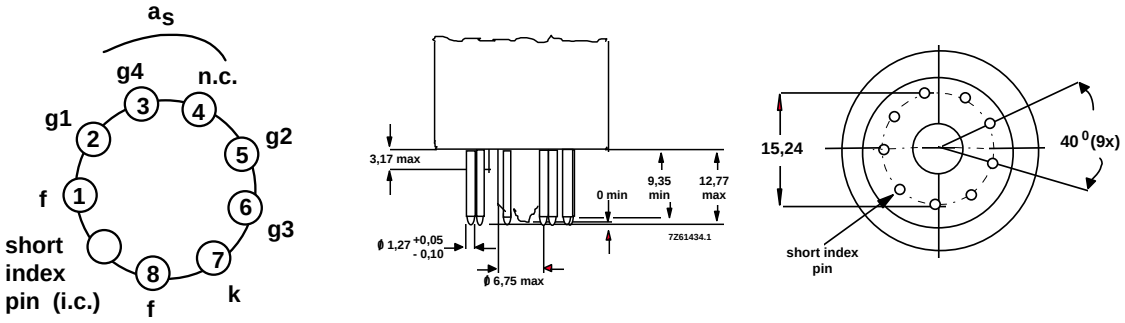


Figure 1. *Mechanical data for XQ7002 camera tube*



(a) (b) (c)

Figure 2. *Mechanical data for XQ7002 camera tube*

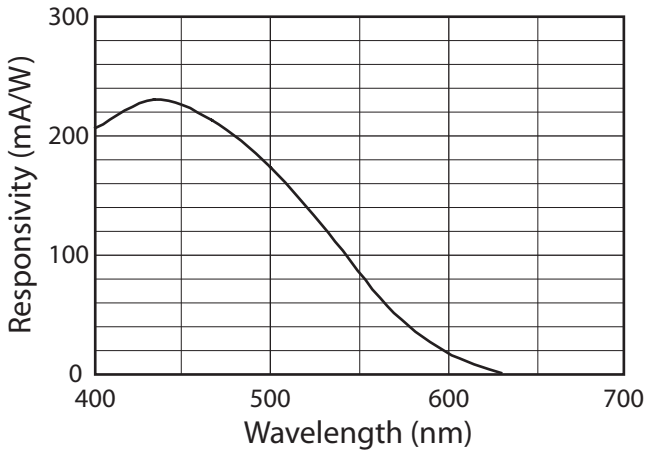


Figure 3. *Typical spectral response curve for XQ7002 camera tube*

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

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

[5] 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

[6] 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.

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

[8] 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. N.B. The signal currents are measured with an integrating instrument connected in the signal electrode lead and a uniform illumination of the scanned area – see note 11.

[9] 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.

[10] 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.

[11] 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 δ = 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.

[12] 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). As measured with a 50mm Leitz Summicron lens having a sine response of approximately 85% at 400 TV lines at f: 5.6. The published 75% (typical) is uncorrected. Tube resolution is higher. Measured with 200nA signal current and a beam current just sufficient to stabilize a signal current of 400nA. The horizontal amplitude response can be raised by means of suitable correction circuits, which affect neither the vertical resolution nor the limiting resolution.

[13] 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.

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