PHILIPS COMPONENTS

DATA SHEET

Camera Tubes XQ7002

25.4 mm (1 inch) diameter Plumbicon® television camera tube with high resolution fluoroscopy and digital imaging applications where both quantum noise and subtraction characteristics are required.

The XQ7002 is a front loading tube with 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

"Diode" electron gun	
Diameter	25.4 mm (1 in)
Length	approx. 160 mm
Focusing	magnetic
Deflection	magnetic
Useful target area, circle diameter	16.2 mm
Spectral response	
maximum at	≈ 470 nm
cut-off at	≈ 650 mm
Sensitivity at color temperature of 2856K	
XQ7002	typ. 425μA/lmF
Resolution	typ. 75%
Heater	6.3 V, 95 mA

®Registered Trade Mark for television camera tube

OPTICAL DATA

Dimensions of quality area on photoconductive target	circle, dia 16.2 mm

Orientation of image on target

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

Faceplate

thickness	1.2 mm
refractive index	1.49

ACCESSORIES

Socket	type 56605
Deflection and focusing coil unit,	AT1116S

ELECTRICAL DATA

Deflection	magnetic	
Focusing	magnetic	
Heating		
Indirect by a.c. or d.c.		
Heater voltage	Vf	6.3 V ± 5%
Heater current, at Vf = 6.3 V	If	95 mA

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

Capacitance

Signal electrode to all

XQ7002	CAS ≈2.1 pF

This capacitance, which are effectively the output impedances, increase when the tubes are inserted in the coil unit.

LIMITING VALUES (Absolute maximum rating system)

All voltages are referred to the cathode, unless otherwise stated.				notes
Signal electrode voltage	Vas	max.	50 V	
Grid 4 voltage (mesh)	Vg4	max.	1100 V	
Grid 3 voltage	Vg3	max.	800 V	
Voltage between grid 4 and grid 3	Vg4/g3	max.	450 V	
Grid 2 voltage	Vg2	max.	340 V	
Grid 1 voltage, positive	Vg1	max.	25 V	
Grid 1 voltage, negative	-Vg1	max.	200 V	
Grid 1 current (≈ cathode current)	Ig1	max.	10 mA	3
Cathode to heater voltage, positive peak	Vkfp	max.	50V	
Cathode to heater voltage, negative peak	-Vkfp	max.	125 V	
Cathode heating time before drawing cathode current	th	min.	1 min	
External resistance between cathode and heater at Vkfp > 10 V	Rkf	min.	2 kΩ	
Ambient temperature, storage and operation	Tamb	max. min.	50 °C -30 °C	
Faceplate temperature, storage and operation	T	max. min.	50 °C -30 °C	 4
Faceplate illuminance	E	max.	500 lx	5

OPERATING CONDITIONS AND PERFORMANCE			notes
Conditions			6
Cathode voltage	Vk	0 V	
Signal electrode voltage	Vas	45 V	
Beam current	Ib		7, 8
Grid 4 voltage	Vg4	960 V	9
Grid 3 voltage	Vg3	600 V	9
Grid 2 voltage	Vg2	300 V	
Grid 1 voltage	Vg1	0 to 20 V	
Blanking voltage on grid 1, peak to peak	Vg1 p-p	25 V	
Focusing coil current			6
Deflection and alignment currents			6
Faceplate illuminance (P20 light source)	E	0 to 10 lx	
Faceplate temperature	T	20 to 40 °C	
Electron Gun Characteristics			
Grid 1 voltage for cut-off at Vg2 = 300V	Vg1	-10 to 0 V	
Grid 1 voltage for normal beam setting	Vg1w	≤ 15 V	
Grid 1 current at normally required beam currents	Ig1	≤ 5 mA	
Grid 2 current at normally required beam currents	Ig2	≤ 0.1 mA	
Blanking voltage, peak to peak, with respect to Vg1w	Vg1 p-p	30 V	

Performance				notes
Dark current		Id	< 2 nA	
Sensitivity at colour temperature of 2856K		min. 355	typ. 425 µA/lmF	10
Sensitivity with P20 light source		min. 80	typ. 100 µA/lmF	
Peak signal current with E=1 lx (P20)	Isp	min. 165	typ. 195 µA	11
Peak signal current (16.2 mm dia scanning)			2500 nA	
Gamma of transfer characteristic		0.95 ± 0.05		
Spectral response:				
max. response at		≈ 4700 mm		
cut -off at		≈ 650 mm		
response curves		see Fig. 4		
Resolution				12
Modulation depth i.e. uncompensated amplitude response at 20.3 lp/mm (scanned area 9.6 x 12.8 mm) at the centre of the picture (5 Mhz, 400 TV lines)		min. 65%	typ. 75%	
Modulation depth at 12 lp/mm (scanned area 16.2mm diameter) at the centre of the picture (5MHz, 400 TV lines)		min. 80%	typ. 90%	
Modulation transfer characteristic, see Fig. 7				
Residual signal after dark pulse (decay lag):				13,14
of 50 ms		min. 15	typ. 19%	
of 60 ms		min. 13	typ. 18%	
of 200 ms		max. 7	typ. 4.5%	

NOTES

1. The "Diode" gun operates with a positive grid 1 voltage, hence draws some grid current. The grid 1 voltage (d.c.) must be adjusted for correct beam current as described in note 8.

2. "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 Ib setting should be used under high light intensity conditions only. All other modes of operation should be normal Ib settings or have them cut off.

3. A current limiter must be incorporated to limit total cathode current to 10 mA maximum.

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 AT1116 or AT1126. See relevant data of deflection/focusing assemblies.
   Scanning amplitude should be adjusted such that the useful target area of 16.2 mm dia. 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 3 μA. Video amplifiers should be designed to accommodate this.

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

   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 Vg4/Vg3 to minimize beam landing error (preferable ≤1 V) depends on the type of coil unit used. For types AT1116 and AT1126 a ratio of 1.6 is recommended. Grid 4 (mesh) should under no circumstances be allowed to operate at a voltage below that of grid 3 as that might damage the target.

10. Measuring conditions: illuminance level 4.54 lx at a colour temperature of 2856K and filters. Schott VG9 and Calflex B1/K1 inserted in the light path.

11. The peak signal currents are measured on a waveform oscilloscope and with a uniform illumination on the 16.2 mm φ target area.
    When measured with an integrating instrument connected in the signal-electrode lead the average signal currents will be smaller:

    a) By a factor α ($\alpha = \frac{100-\beta}{100}$), 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) By a factor δ, δ being the ratio of the active target area (circle with: 16.2 mm φ) to the area which would correspond with the adjusted scanning amplitude (16.2 mm x 21.6 mm) this ratio amounts to $\delta = 0.59$.
    The total ratio of integrated signal current, Is, to the peak signal current, Isp, amount to $\alpha \times \delta = 0.44$ for the CCIR system and 0.49 for NTSC system.

12. As measured with a 50 mm Leitz Summicron lens having a sine response of approximately 85 % at 400 TV lines at f : 5.6. The published 70% typ. is uncorrected. Tube resolution is higher. Measured with 200 nA signal current and a beam current just sufficient to stabilize a signal current of 400 nA. The horizontal amplitude response can be raised by means of suitable correction circuits, which affect neither the vertical resolution nor the limiting resolution.

13. Measured with a 20 nA signal current and a beam current just sufficient to stabilize a signal current of 300 nA.

14. Decay lag. After a minimum of 5 s of illumination of the target. Values and curves 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.

fig.1 Typical spectral response curve.

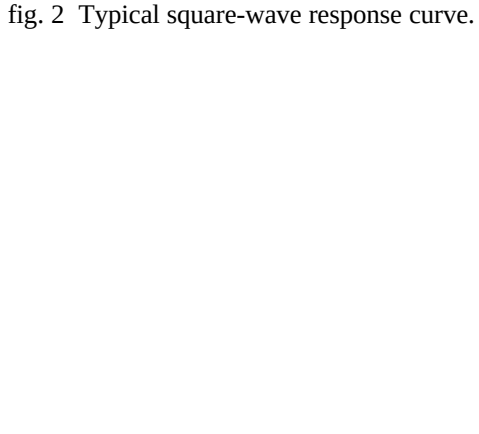

fig. 2 Typical square-wave response curve.

Philips Camera Tubes Sales Offices

Philips Components
Att: Kent Holston
4546 B10 El Camino Real #189
Los Altos, CA 94022
Tel: (650) 960-3893
Fax: (650) 960-3892

Philips Components
Att: Mark Reinhardt
123 Nashua Road, Suite 244
Londonderry, NH 03053
Tel: (603) 425-7440
Fax: (603) 425-7416

Philips Components
100 Providence Pike
Slatersville, RI 02876-2078
Tel: (401) 762-3800
Fax: (401) 767-4493

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