PHILIPS COMPONENTS

DATA SHEET

Camera Tubes XQ4502/A

30mm/45mm diameter, Plumbicon® television camera tube with very high resolution lead-oxide photoconductive target, exclusively intended for use with X-ray image intensifiers in medical equipment.

Special features are:

- Large scan area,
- New photoconductive target for increased resolution,
- "Diode" electron gun for high beam reserve, improved beam acceptance, low lag,
- Low output capacitance for high signal-to-noise ratio,

QUICK REFERENCE DATA

"Diode" electron gun	notes, 1, 2
Diameter	47mm/30 mm
Length	≈ 216 mm
Focusing	magnetic
Deflection	magnetic
Useful target area, circle diameter	26 mm
Spectral response	
maximum at	≈ 500 nm
cut-off at	≈ 850 to 950 nm
Sensitivity, typ.	115 μA/lmF
Modulation depth at 400 TV lines (5 MHz)	95%
Heater	6.3 V, 190 mA

®Registered Trade Mark for television camera tube

OPTICAL DATA

		notes
Dimensions of quality area of target, circle of 26 mm diameter		3

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 index pin.

Faceplate

Thickness	3 mm
Refractive index	1.49 mm

Anti halation glass disc

Thickness	8 mm
Refractive index	1.52 mm

ACCESSORIES

Socket	type: 56021
Deflection and focusing coil unit,	type:AT1107/01

ELECTRICAL DATA

Deflection	magnetic	
Focusing	magnetic	

Heating

Indirect by a.c. or d.c.		
Heater voltage	V_f	6.3 V ± 5%
Heater current, nom.	I_f	190 mA

The heater voltage must never exceed 9.5 V (r.m.s.). For optimum performance stabilization of the heater voltage is recommended.

Capacitance

Signal electrode to all, typ.	C_{as}	5 pF

This capacitance increases when the tube is 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	V_{as}	max.	50 V	
Grid 4 voltage (mesh) voltage	V_{g4}	max.	1100 V	
Grid 3 voltage	Vg3	max.	800 V	
Voltage between grid 4 and grid 3	Vg4/g3	max.	450 V	5
Grid 2 voltage	Vg2	max.	350 V	
Grid 1 voltage, positive	Vg1	max.	20 V	
Grid 1 voltage, negative	-Vg1	max.	125 V	
Grid 1 current (≈ cathode current)	Ig1	max.	10 mA	4
Cathode to heater voltage, positive peak	Vkfp	max.	50 V	
Cathode to heater voltage, negative peak	-Vkfp	max.	125 V	
Cathode heating time before drawing cathode current	t_h min.	1	min	
External resistance between cathode and heater at Vkf > 10 V	R_{kf}	min.	2 kΩ	
Ambient temperature, storage and operation	T_{amb}	max. min.	50 °C -30°C	6
Faceplate temperature, storage and operation	T	max. min.	50 °C -30°C	
Faceplate illuminance	E	max.	500 lx	

OPERATING CONDITIONS AND PERFORMANCE

notes

Conditions

Cathode voltage	V_k	0 V	
Signal electrode voltage	V_{as}	45 V	
Beam current	I_b		8, 9
Grid 4 voltage	Vg4	960 V	5
Grid 3 voltage	Vg3	600 V	5
Grid 2 voltage	Vg2	360 V	
Grid 1 voltage	Vg1	0 to 20 V	
Blanking voltage on grid 1, peak to peak	Vg1p-p	25 V	
Focusing and deflection coil currents			10
Faceplate illuminance	E	0 to 10 lx	
Faceplate temperature	T_{as}	20 to 40°C	

Electron Gun Characteristics

Cut-off		
Grid 1 voltage for cut-off at Vg2 = 300V without blanking	Vg1	-10 to 0V
Grid 1 voltage for normal beam current	Vg1w	9 V
Blanking voltage with respect to		
Vg1w, peak-to-peak, on grid 1	Vg1p-p	25 V
on cathode	Vkp-p	25 V
Grid 1 current at normally required beam currents	Ig1	≤ 5 mA
Grid 2 current at normally required beam currents	Ig2	≤ 0.1mA

Performance

				notes
Dark current	Id	<	3 nA	

Sensitivity at colour temperature of 2856K		typ.	115 µA/lmF	11
Sensitivity with P20 light source		typ.	350 µA/lm	
Peak signal current with E+1 lx (P20)	Isp	typ.	420 nA	12
Peak signal current (26 mm dia.)			3500 nA	

Spectral response:
- max. response at ≈ 500 nm
- cut -off at 850 to 950 nm
- response curves see Fig. 2

Gamma of transer characteristic 0.95 ± 0.05

Resolution

Modulation depth i.e. uncompensated amplitude response at 400 TV lines at center of the picture

	XQ4502 /A
Highlight signal current I_s	400 nA
Beam current I_b	800 nA
Modulation depth at 400 TV lines (5 MHz)in % typ.	95
min.	90

Limiting resolution	2500 TV lines	
Modulation transfer charactersitic	see Fig. 5	13
Lag (typical values no light bias applied)		8,14,15,16

Light source with a color temperature of 2856 K. Appropriate filter inserted in light path. 11

Low key conditions (percentage) see Figs. 3 and 4

NOTES, see also General Section

1. 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, such as pulsed mode and rad mode. All other modes of operation should be normal I_b settings or have beam cut off.

2. The Diode gun requires a positive grid 1 voltage, and draws some grid current.

3. Underscanning of the specified target area (26mm diam.), or failure of scanning, should be avoided since damage to the target may occur. Cathode blanking should be used to provide a circular image. Video blanking could cause beam to scan mesh ring, with possible consequent degradation of tube life.

4. A current limiter must be incorporated to limit total cathode current to 10 mA maximum. Camera design should allow for 10 mA operation.

5. The optimum voltage ratio Vg4/Vg3 to minimize beam landing errors (preferable <1 V) depends on the type of coil used. For type AT1107/01, 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 may damage the target.

6. The tube can withstand short excursions to 70 °C wihtout any damage or irreversible degradation in performance.

7. This rating is for short intervals only. During storage the tube must be covered (a plastic hood is provided for this purpose) and when the camera is idle the lens must be capped. **If camera is in stand-by operation, the lens must be capped and the beams turned off.**

8. The beam current I_b, as obtained by adjusting the control grid voltage (grid 1) is set at 800 nA. I_b is not the total current available in the scanning beam, but is defined as the maximum amount of signal current I_s, with this particular beam setting. In the performance figures, e.g. for resolution and lag, the signal current and beam current conditions are given, e.g. as I_s / I_b = 400/800 nA. This means: with signal current of 400 nA and a beam setting which just allows a signal current of 800 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. The peak signal currents as measured on a waveform oscilloscope will be a factor α larger. See note 12.

9. The maximum peak signal which the XQ4502/A can handle is 4 µA. Video amplifiers should be designed to accommodate this.

10. See published data of deflection/focusing assemblies. The direction of the current through the focusing coil should be chosen such that a north-seeking pole will be attracked at the faceplate end of the coil.

11. Measuring conditions: Illuminance level 3.1 lx at a colour temperature of 2856K. Filters Schott VG9(1mm) and Calflex B1/K1 inserted in the light path. For transmission curves see General Section.

12. The peak signal currents are measured on a waveform oscilloscope and with a uniform illumination on the 26 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 EIA system α amounts to 0.83.

    b) By a factor δ, δ being the ratio of the active target area (circle with: 26 mmϕ) to the area which would correspond with the adjusted scanning amplitude (26 mm x 34.6 mm) this ratio amounts to δ = 0.59.

    The total ratio of integrated signal current, I_s, to the peak signal current, I_{sp}, amount to $\alpha \times \delta = 0.44$ for the CCIR system and 0.49 for EIA system.

13. As measured with a 50 mm Leitz Summicron lens having a sine response of approximately 96 % at 8 lp/mm (400 TV lines at 26 mm dia.) at f : 5.6. The published 95% typ. is uncorrected. Tube resolution is higher.

    The horizontal amplitude response can be raised by means of suitable correction circuits, which affect neither the vertical resolution nor the limiting resolution.

14. Measured with a 100 nA signal current and a beam current just sufficient to stabilize a signal current of 800 nA.

15. *Build-up lag*. After 10 seconds of complete darkness. Values and curves shown relating to build-up lag represent the typical percentages of the ultimate signal obtained as a function of time, after the illumination has been applied.

16. *Decay lag*. After a minimum of 5 seconds 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.

Mechanical Data

Diagrams

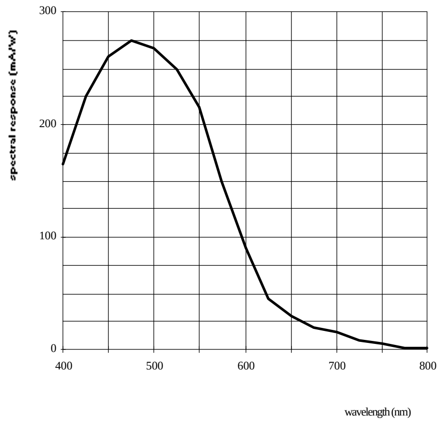

Fig. 1 Typical spectral response curve.

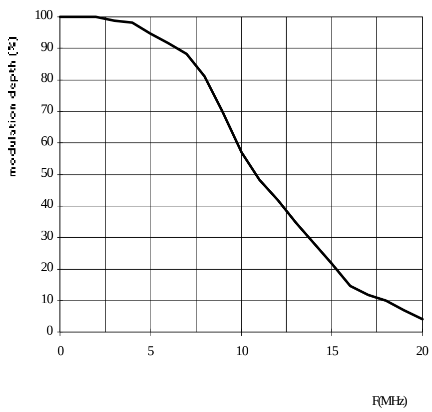

Fig. 2 Typical square-wave response curve.

Mechanical Data

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