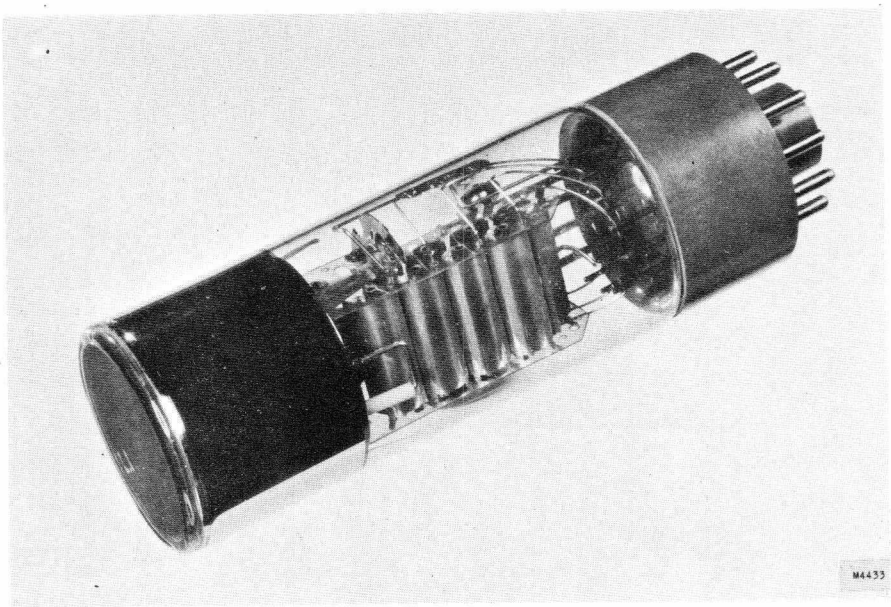
PHILIPS

XP1010

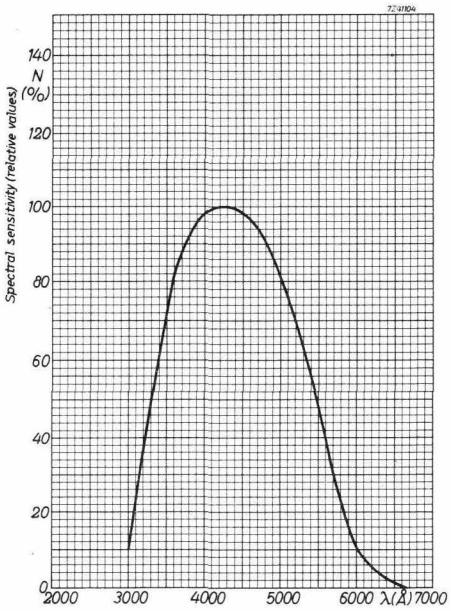
PHOTOMULTIPLIER



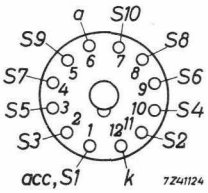
The XP1010 is a 10-stage photomultiplier tube provided with a caesium-antimony, semi-transparent flat cathode, which has a diameter of 32 mm.

The sensitive uniform photocathode has a typical sensitivity of 60 μA/lm and a spectral response that lies mainly in the visible region, with its maximum at 4200 Å, as shown in the spectral response curve.

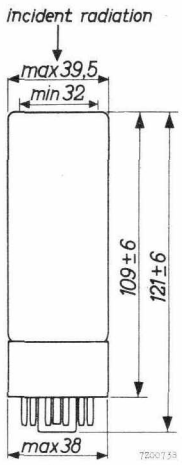
The tube is intended for use in applications such as X- and γ-ray spectrometry. With a 1" x 1" NaJ crystal the tube measures the Mn,K_α line (5.9 keV) with a plateau length of at least 70 V and a plateau slope of less than 8 % per 100 V (with the discriminator bias set at 0.2 V and at a counting rate of about 2500 c/s in the middle of the plateau). The background in the middle of the plateau is less than 50 c/s. As a rule the tube has an energy resolution of about 50 % for Cu,K_α (8 keV).



Spectral response



12-pins socket
type No. B8 700 42



Dimensions (in mm) and
electrode connections

μ-metal screening cylinder type No. 56127			
length	90	± 1	mm
diameter	42	+ 1 / − 0	mm

PHOTOCATHODE

Semi-transparent, head-on, flat surface

Cathode material		SbCs	
Minimum useful diameter		32	mm
Wavelength at max. response		4200±300	Å
Luminous sensitivity [1]	avg.	60	μA/lm
	min.	35	μA/lm
Radiant sensitivity [2]	avg.	50	mA/W
Dark current (at room temperature)		10^{-15}	A/cm^2

MULTIPLIER SYSTEM

Number of stages		10	
Dynode material		AgMgOCs	
Capacitance between anode and final dynode	C_{a-S10} =	3	pF
Capacitance between anode and all other electrodes	C_a =	5	pF

[1]) Measured with a tungsten ribbon lamp with a colour temperature of 2850 °K.

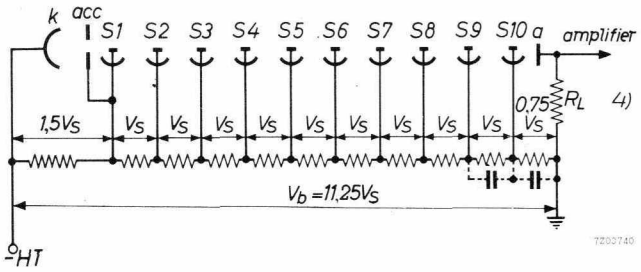
[2]) At a wavelength of 4200 Å.

TYPICAL CHARACTERISTICS (voltage divider type A)

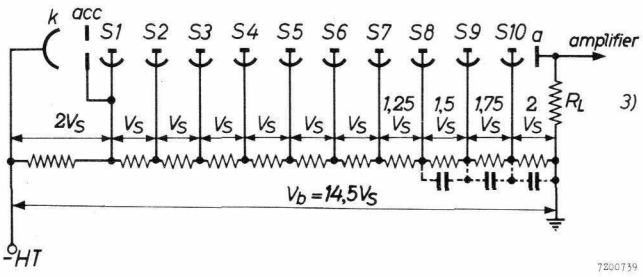
Anode sensitivity (at a total voltage of 1800 V)	N_a =	avg. 1250	A/lm
		min. 100	A/lm
Anode dark current (at N_a = 60 A/lm)		max. 0.05	μA
Plateau length (Mn,K_α line 5.9 keV)[3]		min. 70	V
Plateau slope [3]		max. 8 % per 100	V
Background in middle of plateau [3]		avg. 30	c/s
		max. 50	c/s
Linearity between anode pulse amplitude and input-light flux:			
- with voltage divider type A		up to 30	mA
- with voltage divider type B		up to 100	mA

OPERATING CONDITIONS

Voltage divider type A



Voltage divider type B



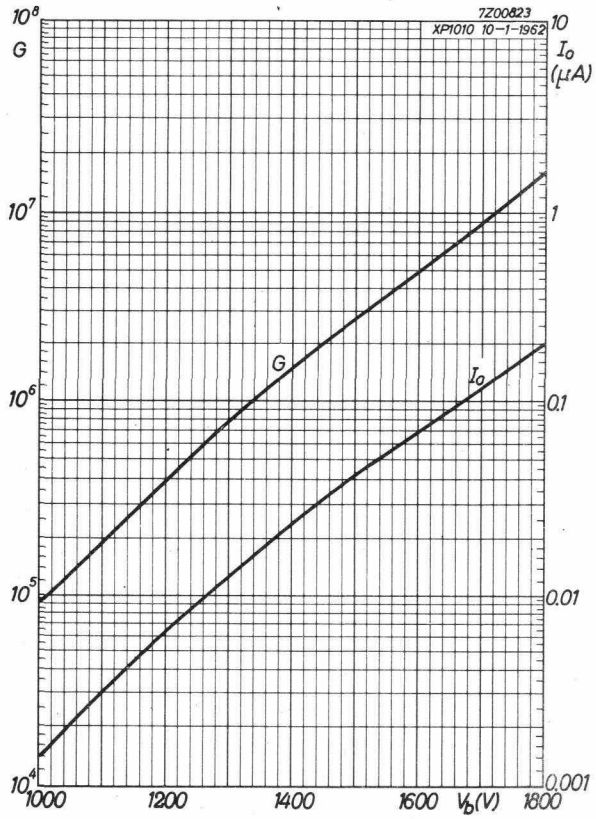
k = cathode
acc = accelerating electrode
S_n = dynode No. *n*
a = anode

LIMITING VALUES

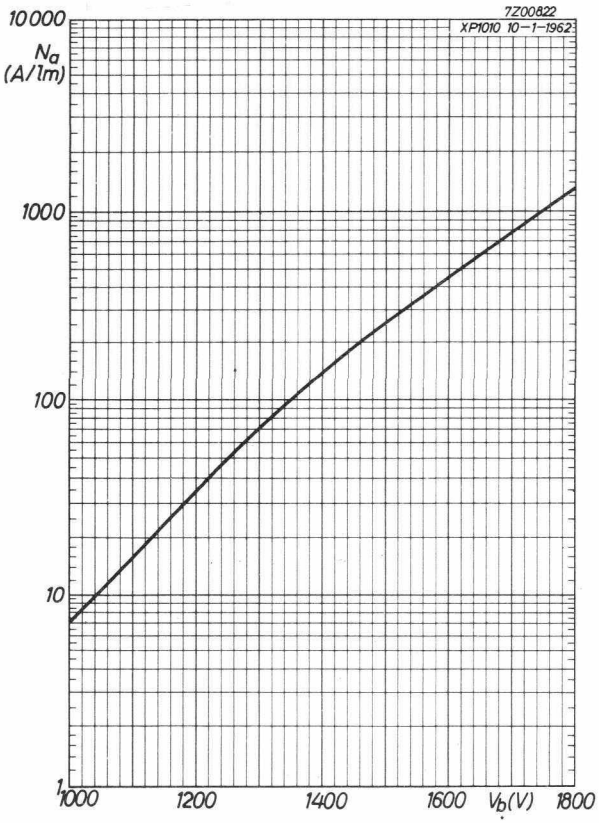
Total voltage	V_b =	max. 1800	V
Anode current at continuous operation (in order not to overload the tube)	I_a =	max. 1	mA
Anode dissipation	W_a =	max. 0.5	W
Voltage between cathode and first dynode	V_{k-S1} =	min. 120	V
		max. 500	V
Voltage between two consecutive dynodes	$V_{Sn-Sn+1}$ =	min. 80	V
		max. 300	V
Voltage between S_{10} and anode	V_{a-S10} =	min. 80	V [4]
		max. 300	V

[3]) Measured with a 1" x 1" NaJ crystal, at a counting rate of about 2500 c/s in the middle of the plateau, and with the discriminator bias set at 0.2 V.

[4]) When calculating the anode voltage the voltage drop in the load resistance R_L should not be overlooked.



Gain and dark current



Overall sensitivity

OPERATIONAL CONSIDERATIONS

To achieve a stability of about 1 % the ratio of the current through the voltage-divider bridge to that through the heaviest loaded stage of the tube should be approx. 100.

For moderate intensities of radiation a bridge current of approx. 0.5 mA will be sufficient.

Different kinds of voltage dividers are possible. A circuit of type A results in the highest gain of the tube at a given total voltage; a circuit of type B gives higher currents in the last stages, but the total gain is less at the same total voltage.

When pulses with high amplitudes are taken from the anode, it is useful to decouple the last stages as indicated in the circuit by means of capacitors of a few hundred pF, to avoid a voltage drop between these stages.

When the tube has been exposed to full daylight just before mounting, it will probably show an increased dark current, which will be back at its normal value after several hours of operation.

It is advisable to screen the tube with a mu-metal cylinder against the influence of magnetic fields.