

# **PHILIPS**

Data handbook



Electronic components and materials

# Electron tubes

Part 6

July 1983

Geiger-Müller tubes

# **ELECTRON TUBES**

PART 6 - JULY 1983

GEIGER-MÜLLER TUBES

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Data sheets describing:

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## DATA HANDBOOK SYSTEM

Our Data Handbook System is a comprehensive source of information on electronic components, sub-assemblies and materials; it is made up of four series of handbooks each comprising several parts.

**ELECTRON TUBES** 

BLUE

**SEMICONDUCTORS** 

RED

INTEGRATED CIRCUITS

PURPLE

COMPONENTS AND MATERIALS

**GREEN** 

The several parts contain all pertinent data available at the time of publication, and each is revised and reissued periodically.

Where ratings or specifications differ from those published in the preceding edition they are pointed out by arrows. Where application information is given it is advisory and does not form part of the product specification.

If you need confirmation that the published data about any of our products are the latest available, please contact our representative. He is at your service and will be glad to answer your inquiries.

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## **ELECTRON TUBES (BLUE SERIES)**

The blue series of data handbooks is comprised of the following parts:

- T1 Tubes for r.f. heating
- T2 Transmitting tubes for communications
- T3 Klystrons, travelling-wave tubes, microwave diodes
- ET3 Special Quality tubes, miscellaneous devices (will not be reprinted)
- T4 Magnetrons
- T5 Cathode-ray tubes
  Instrument tubes, monitor and display tubes, C.R. tubes for special applications
- T6 Geiger-Müller tubes
- T7 Gas-filled tubes
  Segment indicator tubes, indicator tubes, dry reed contact units, thyratrons, industrial rectifying tubes, ignitrons, high-voltage rectifying tubes, associated accessories
- T8 Picture tubes and components

  Colour TV picture tubes, black and white TV picture tubes, colour monitor tubes for data graphic display, monochrome monitor tubes for data graphic display, components for colour television, components for black and white television and monochrome data graphic display
- T9 Photo and electron multipliers
  Photomultiplier tubes, phototubes, single channel electron multipliers, channel electron multiplier plates
- T10 Camera tubes and accessories, image intensifiers
- T11 Microwave semiconductors and components

# SEMICONDUCTORS (RED SERIES)

The red series of data handbooks is comprised of the following parts:

S1	Diodes Small-signal germanium diodes, small-signal silicon diodes, voltage regulator diodes(< 1,5 W), voltage reference diodes, tuner diodes, rectifier diodes
S2	Power diodes, thyristors, triacs Rectifier diodes, voltage regulator diodes ( $>$ 1,5 W), rectifier stacks, thyristors, triacs
S3	Small-signal transistors
S4	Low-frequency power transistors and hybrid IC modules
S5	Field-effect transistors
S6	R.F. power transistors and modules
S7	Microminiature semiconductors for hybrid circuits
S8	Devices for optoelectronics Photosensitive diodes and transistors, light-emitting diodes, displays, photocouplers, infrared sensitive devices, photoconductive devices.
S9	Taken into handbook T11 of the blue series
S10	Wideband transistors and wideband hybrid IC modules

## INTEGRATED CIRCUITS (PURPLE SERIES)

IC1 Bipolar ICs for radio and audio equipment IC2 Bipolar ICs for video equipment ICs for digital systems in radio, audio and video equipment IC3 IC4 Digital integrated circuits CMOS HE4000B family IC5 Digital integrated circuits - ECL ECL10 000 (GX family), ECL100 000 (HX family), dedicated designs IC6 Professional analogue integrated circuits IC7 Signetics bipolar memories

The purple series of data handbooks is comprised of the following parts:

Signetics Integrated Fuse Logic (IFL)

Signetics analogue circuits

Signetics TTL logic

IC8

IC9

IC10

# COMPONENTS AND MATERIALS (GREEN SERIES)

The green series of data handbooks is comprised of the following parts:

C1	Assemblies for industrial use PLC modules, PC20 modules, HNIL FZ/30 series, NORbits 60-, 61-, 90-series, input devices, hybrid ICs
C2	Television tuners, video modulators, surface acoustic wave filters
C3	Loudspeakers
C4	Ferroxcube potcores, square cores and cross cores
C5	Ferroxcube for power, audio/video and accelerators
C6	Electric motors and accessories Permanent magnet synchronous motors, stepping motors, direct current motors
C7	Variable capacitors
C8	Variable mains transformers
C9	Piezoelectric quartz devices  Quartz crystal units, temperature compensated crystal oscillators, compact integrated oscillators quartz crystal cuts for temperature measurements
C10	Connectors
C11	Non-linear resistors  Voltage dependent resistors (VDR), light dependent resistors (LDR), negative temperature coefficient thermistors (NTC), positive temperature coefficient thermistors (PTC)
C12	Variable resistors and test switches
C13	Fixed resistors
C14	Electrolytic and solid capacitors
C15	Film capacitors, ceramic capacitors
C16	Piezoelectric ceramics, permanent magnet materials

## **CONVERSION TABLES**

actual type range	old type no.	old type no.	actual type no.
ZP1200	18503	18503	ZP1200
ZP1201	-	18504	ZP1400
ZP1210	18520	18505	ZP1410
ZP1220	18545	18506	ZP1431
		18507	ZP1600
ZP1300	18529 <sup>1</sup>	18509	ZP1310
ZP1301	-	18511	ZP1610
ZP1302	_	18515	ZP1441
ZP1310	18509	18518	ZP1700
ZP1313	_	18520	ZP1210
ZP1320	18550	18526	ZP1430
ZP1322	ZP13201	18529	ZP1300
ZP1330	18555	18536	ZP1451
		18545	ZP1220
ZP1400	18504	18550	ZP1320
ZP1401		18555	ZP1330
ZP1410	18505	MX123	ZP1470
ZP1430	18526	MX168	ZP1481
ZP1431	18506	MX168/01	ZP1480
ZP1441 <sup>3</sup>	18515		
ZP1442 <sup>4</sup>	18515/01 <sup>2</sup>		
ZP1451 <sup>3</sup>	18536		
ZP14524	18536/01 <sup>2</sup>	obsolete and replacing	g types
ZP14616	ZP1460 <sup>5</sup>	-11	100001-00001-0000
ZP1470	MX123	obsolete	replaced by
ZP1480	MX168/02	ZP1311	ZP13138
ZP1481	MX168	ZP1440 <sup>2</sup>	ZP1441.3 ZP14424
ZP1600	18507	ZP1450 <sup>2</sup>	ZP1451.3 ZP14524
ZP1600 ZP1610	18507	ZP1460	ZP1461 <sup>6</sup>
251010	10011	ZP1500	_
ZP1700	18518	ZP1501	_
		ZP1520	. —

### obsolete and replacing types

obsolete	replaced by
18515/01 <sup>2</sup>	ZP1441,3 ZP14424
18525	(ZP1520 <sup>5</sup> )
18536/01 <sup>2</sup>	ZP1451,3 ZP14524
18546/01	(ZP14605), ZP14616
18552	ZP13307
ZP1080	(ZP1501 <sup>5</sup> )
ZP1083	(ZP1500 <sup>5</sup> )
ZP1100	ZP1311,5 ZP13138

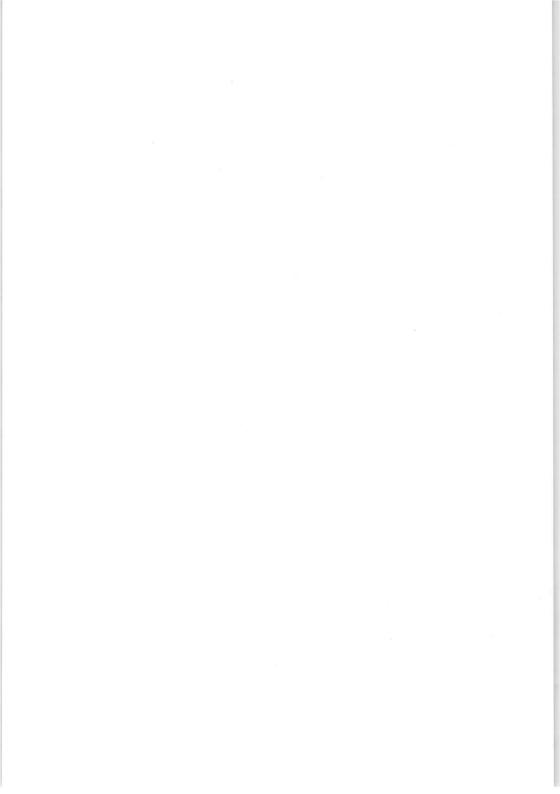
### Notes

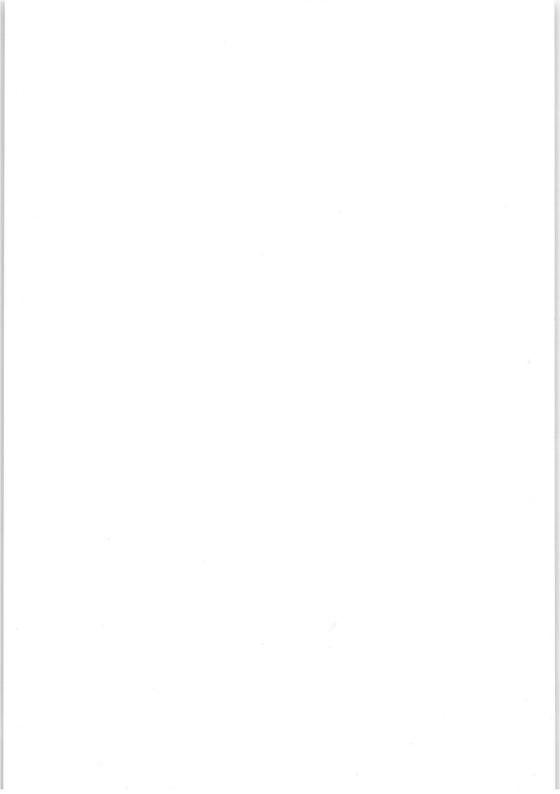
- 1. different anode length
- 2. alpha sensitive
- 3. alpha sensitive, low background
- 4. not alpha sensitive
- 5. obsolete, ( ) = not replaced
- 6. different plateau length, obsolescent
- 7. protective coating
- 8. improved compensating filter

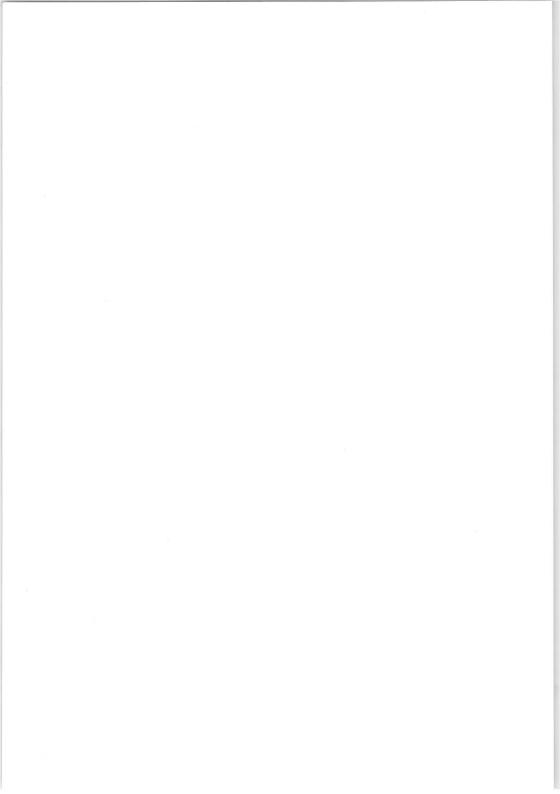
# SELECTION GUIDE

cylinder	tubes

type	se	nsitiv	е	counting rate	sensitive	plateau	plateau	plateau	dead	background	dose rate
number	α	for β	γ	at 10 <sup>-1</sup> mGy/h <sup>1</sup> count/s	length mm	threshold V	length V	%/V	time² µs	shielded count/min	range mGy/h
ZP1200			•	230	40	400	200	0.04	90	10	10 <sup>-3</sup> - 10
ZP1201 <sup>3</sup>				210	40	400	200	0.04	110	10	$10^{-3} - 10$
ZP1210				1200	140	400	100	0.15	200	70	$10^{-3} - 2$
ZP1220			•	1600	240	400	100	0.15	210	90	10 <sup>-3</sup> - 1
ZP1300				2500²	8	500	100	0.30	11	1	10 <sup>-1</sup> – 2 × 10
ZP1301 <sup>3</sup>				3400 <sup>2</sup>	8	500	100	0.30	13	1	$10^{-1} - 2 \times 10^{-1}$
ZP1302 <sup>3</sup>				3400 <sup>2</sup>	8	500	100	0.30	13		$10^{-1} - 2 \times 10^{-1}$
ZP1310				11000 <sup>2</sup>	16	500	150	0.15	15		$4 \times 10^{-3} - 3 \times 10^{-3}$
ZP1313 <sup>3</sup>			•	13000 <sup>2</sup>	16	500	150	0.15	15		$4 \times 10^{-3} - 3 \times 10^{-3}$
ZP1320		0		230	28	500	150	0.08	45		$10^{-3} - 10^2$
ZP1322		0		230	28	500	150	0.08	45		$10^{-3} - 10^{2}$
ZP1330		0	•	1200	75	450	350	0.02	70		$3 \times 10^{-4} - 10$
cosmic ray	guar	d tub	e								
ZP1700					_	800	400	903	1000	70	3 x 10 <sup>-4</sup> - 3 x 10
window tu	bes										
type		ensiti	VP.	counting rate	window	plateau	plateau	plateau	dead	background	dose rate
number		for		at 10 <sup>-1</sup> mGy/h <sup>1</sup>	φ/type	threshold	length	slope	time <sup>2</sup>	shielded	range
namber	α	β	γ	count/s	mm	V	V	%/V	μs	count/min	mGy/h
ZP1400		•	•	210	9 c	400	200	0.04	90	10	10 <sup>-3</sup> – 10
ZP1401	•		0	210	9 a	400	200	0.04	90	10	$10^{-3} - 10$
ZP1410		•	0	320	19.8 a	450	250	0.02	175	15	$10^{-3} - 3 \times 10$
ZP1430			0	540	27.8 a	450	250	0.04	190	25	$10^{-3} - 2 \times 10$
ZP1431			0	540	27.8 c	450	250	0.04	190	25	$10^{-3} - 2 \times 10$
ZP1441			0	200	19.8 a	500	200	0.09	65	5	$10^{-3} - 10^{2}$
ZP1442			0	200	19.8 c	500	200	0.09	65	8	$10^{-3} - 10^{2}$
ZP1451			0	400	27.8 a	500	250	0.07	60	9	$10^{-3} - 3 \times 10$
ZP1452			0	400	27.8 c	500	250	0.07	60	18	$10^{-3} - 3 \times 10$
ZP1461			0	1100	51 f	700	200	0.04	45	45	$3 \times 10^{-4} - 1$
ZP1470				340	24.1 b	550	150	0.15	70	25	$10^{-3} - 2 \times 10$
ZP1480			0	270	17 d	400	100	0.13	120	30	$10^{-3} - 2 \times 10^{-3}$
ZP1481		•	0	270	17 d	400	100	0.20	120	30	$10^{-3} - 2 \times 10^{-3}$
X-ray sens	itive	tubes									
ZP1600	6	- 20	keV	660	19.8 e	1600	400	0.07	110	25	-
ZP1610	2.5	<b>- 40</b>	keV	-	7 x 18 b	1900	wor	king voltage	1460 to	1850 V	-
	. 1	R = 8						w thickness	-		
	_	<ol> <li>Counting rate at 10<sup>2</sup> mGy</li> </ol>									
				ate at 10 <sup>2</sup> mGy ensating filter				to 2.0 to 2.5	d: e:	2.5 to 3.0 2.5 to 3.5	







## RADIATION QUANTITIES AND UNITS

In previous issues of this handbook, the (exposure) dose rate has been given as  $r\ddot{o}$ ntgen/hr (R/hr), but this unit is being phased out internationally.

Absorbed dose will be used in future, expressed in the new unit gray (Gy).

Absorbed dose is a measure of energy deposition in any medium by all types of ionizing radiation and

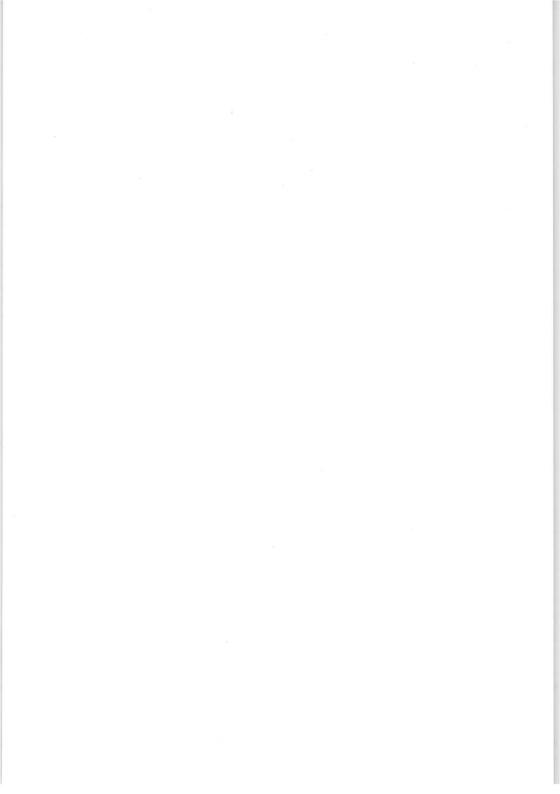
1 Gy = 1 J/kg in SI units

Since an exposure of 1 R results in an energy deposition of 869 x  $10^{-5}$  J/kg in air it follows that 1 R is equivalent to 869 x  $10^{-5}$  Gy or 8.69 mGy.

Consequently this handbook gives data for the counting rate as a function of the absorbed dose rate in air as:

count/s and mGy/h

quantity	old unit	new unit	relationship
exposure dose	röntgen	no special unit	1 R = produces in air ions carrying a charge of: 2.58 x 10 <sup>-4</sup> C/kg
absorbed dose	rad	gray	1 rad = 10 <sup>-2</sup> J/kg 1 Gy = 1 J/kg = 100 rad 1 mGy = 100 mrad



# GENERAL INFORMATION GEIGER-MÜLLER TUBES

Where appropriate, the terminology used conforms to the following publications:— IEC50-531, IEC100, IEC151-25.

#### 1. GENERAL

- 1.1 Geiger-Müller radiation counter tubes (G.M. tubes) are intended to detect alpha particles, beta particles, gamma or X-radiation.
- 1.2 A G.M. tube is a gas-filled device which reacts to individual ionizing events, thus enabling them to be counted.
- 1.3 A G.M. tube consists basically of an electrode at a positive potential (anode) surrounded by a metal cylinder at a negative potential (cathode). The cathode forms part of the envelope or is enclosed in a glass envelope. Ionizing events are initiated by quanta or particles entering the tube either through the window or through the cathode and colliding with the gas molecules.
- 1.4 The gas filling consists of a mixture of one or more rare gases and a quenching agent.
- 1.5 Quenching is the termination of the ionization current pulse in a G.M. tube. Effective quenching in our tubes is determined by the combination of the quenching gas properties and the value of the anode resistor.
- The capacitance of a G.M. tube is that between anode and cathode, ignoring the capacitive effects of external connections.

#### 3. OPERATING CHARACTERISTICS

### 3.1. Starting voltage

This is the lowest voltage applied to a G.M. tube at which pulses of 1 V amplitude appear across the tube. See fig.1.

#### 3.2 Plateau

This is the section of the counting rate versus voltage characteristic (with constant irradiation), over which the counting rate is substantially independent of the applied voltage. Unless otherwise stated, the plateau is measured at a counting rate of approximately 100 count/s.

#### 3.3 Plateau threshold voltage

This is the lowest voltage applied which corresponds to the start of the plateau for the stated sensitivity of the measuring circuit. See fig.1.

#### 3.4 Plateau length

This is the range of applied voltage over which the plateau extends. See fig.1.

#### 3.5 Plateau slope

This is the change in counting rate over the plateau length, expressed in % per volt. See fig.1.

#### 3.6 Recommended supply voltage

This is the supply voltage at which the G.M. tube should preferably be used. This voltage is normally chosen to be in the middle of the plateau. See fig.1.

### **OPERATING CHARACTERISTICS** (continued)

### 3.7 Background

This is the counting rate in the absence of the radiation which the G.M. tube is intended to measure.

#### 3.8 Dead time

This is the time interval, after the initiation of a discharge resulting in a normal pulse, during which the G.M. tube is insensitive to further ionizing events. See fig.4.

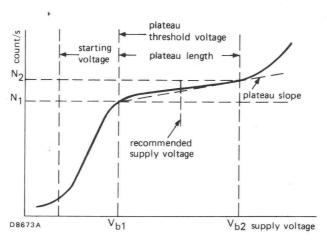


Fig.1

Plateau length:

$$V_{plateau} = V_{b2} - V_{b1}$$

Plateau slope (over the plateau length):

$$\frac{N_2 - N_1}{0.5 (N_1 + N_2)} \times \frac{1}{V_{plateau}} \times 100$$

%/V

where N  $_1$  is the counting rate at V  $_{b1}$ , and N  $_2$  is the counting rate at V  $_{b2}$ 

#### 4. MEASURING CIRCUITS

4.1 The measuring equipment used to establish the G.M. tube data consists of the circuit given in the data, an emitter follower with a pulse shaper, a limiting amplifier and a scaler.

#### 4.2 Measuring circuit A

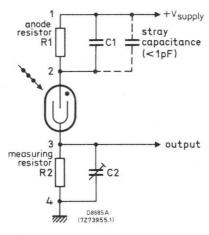


Fig.2

#### Notes:

- 1. The input resistance and capacitance of the measuring equipment are represented by R2 and C2 respectively.
- 2. When applying a rectangular pulse at 1 with the tube inserted but short-circuited, C2 should be adjusted to give an undistorted pulse at 3. Under these conditions  $R1 \times (C1 + stray capacitance) = R2 \times C2$ .

#### 4.3 Measuring circuit B

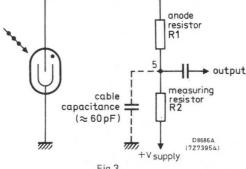


Fig.3

Tapping the load resistor at 5 in fig.3 reduces the influence of a capacitive load.

## **GENERAL** GM TUBES

#### 5. NOTES

#### 5.1 Resolution (resolving) time (of a counting system or a counter).

This is the minimum time interval between two distinct ionizing events which enables both to be counted

#### 5.2 Recovery time

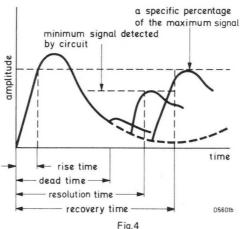
This is the minimum time interval between the initiation of a normal size pulse and the initiation of the next pulse of normal size. See fig.4.

#### 5.3 Pulse amplitude

The pulse amplitude of a G.M. tube may be approximated by the equation:

$$P = b \times (V_{supply} - V_{starting})$$
 where 
$$P = pulse \ amplitude$$
 
$$b = \frac{R_2}{R_1 + R_2} \ (See \ measuring \ circuits \ on \ page \ 3)$$
 
$$V_{supply} = anode \ supply \ voltage$$





#### 5.4 Anode resistor

Normally the tube should be operated with an anode resistor of the value indicated in the measuring circuit, or higher. Decreasing the value of the anode resistor not only decreases the dead time but also the plateau length. A decrease in resistance below the limiting value may affect tube life and lead to its early destruction.

The anode resistor should be connected direct to the anode connector of the tube to ensure that parasitic capacitances of leads will not excessively increase the capacitive load on the tube. An increase in capacitive load may increase the pulse amplitude, the pulse duration, the dead time, and the plateau slope. In addition the plateau will be shortened appreciably. Shunt capacitances of more than 20 pF may destroy the tube.

#### 5.5 Maximum counting rate

The maximum counting rate is approximately  $1/\tau$  ( $\tau$  = dead time). For continuous stable operation it is recommended that the counting rate is adjusted to a value in the linear part of the counting rate/dose rate curve. In extreme cases the time constant RC (see fig.2) may exceed the dead time of the tube. If this is so, CI may be omitted, thus reducing the RC product. However, this could cause calibration problems in series equipment production if the stray capacitances in individual instruments show wide variations.

#### 5.6 Tube sensitivity at extremely high dose rates.

At dose rates exceeding the recommended maximum, a G.M. tube will produce the maximum number of counting pulses per second, limited by its dead time and the circuit in which it is incorporated.

However, due to the characteristics of a specific circuit, the **indicated** counting rate may fall appreciably, even to zero.

If dose rates exceeding 10 times the recommended maximum for window tubes, or 100 times for cylinder tubes, are likely to be encountered, it is advisable to use a circuit that continuously indicates saturation.

#### 5.7 Dead time losses

After every pulse, the tube is temporarily insensitive during a period known as the dead time ( $\tau$ ). Consequently, the pulses that occur during this period are not counted. At a counting rate of N count/s the tube will be dead during  $100 \times N \times \tau$ % of the time, so that approximately  $100 \times N \times \tau$ % of the counts will be lost.

If, in an experiment, the inaccuracy must be < 1%, N should be less than 1/100  $\tau$  count/s. Example: If  $\tau$  = 20  $\mu$ s, an inaccuracy of 1% is reached at a counting rate of approximately 500 count/s.

#### 5.8 Background

See definition under 3.7. The most important sources of background are:

- 1. Gamma radiation from the environment and from cosmic radiation.
- 2. Mesons from cosmic radiation.
- Beta particles from contamination and impurities of the materials from which the detector itself is made.
- Spontaneous discharge or pulses in the detector and the counting circuit that do not originate from radiation.

From published experimental data the gamma contribution accounts for approximately 70% of the background and a further 25% (approximately) is due to cosmic mesons. For the majority of G.M. tube applications, the background may be reduced to an acceptable level by shielding the tube with lead or steel. Thus most of the gamma contribution is eliminated. The values given in the data in count per minute are derived from averages over a longer duration.

#### 5.9 Counting rate/dose rate curves

These are measured with the source perpendicular to the tube axis, at the recommended supply voltage. The curves shown are typical. Deviation of up to approximately  $\pm$  10% may occur.

#### 5.10 Current/dose rate curves

These are measured with the source perpendicular to the tube axis. The curves shown are typical. Deviation of up to approximately  $\pm$  20% may occur.

## GENERAL G.M. TUBES

#### NOTES (continued)

#### 5.11 Dead time curves

These represent the dead time (see 3.8 and fig.4) as a function of the supply voltage, measured with pulsed X-radiation in the recommended circuit, unless otherwise stated. The curves shown are typical. The maximum value is stated under OPERATING CHARACTERISTICS. Note that a higher anode resistor results in a longer dead time.

#### 5.12 Energy response curves

These represent the energy sensitivity as a function of the radiation energy, measured in the recommended circuit and in the linear part of the counting rate/dose rate curve. The curves shown are typical. Deviation depends on energy and construction.

#### 5.13 Polar response curves

These represent the relative sensitivity as a function of the angle of irradiation (as defined in the drawing), measured in the recommended circuit. The curves shown are typical. Deviation depends on energy and construction.

#### 6. LIMITING VALUES

The limiting values of G.M. tubes are given in the Absolute Maximum Rating System in accordance with IEC Publication 134.

Absolute maximum ratings are limiting values of operating and environmental conditions, applicable to any electronic device of a specified type as defined by its published data, which should not be exceeded under the worst probable conditions.

These values are chosen by the device manufacturer to provide acceptable serviceability of the device. taking no responsibility for equipment variations, environmental variations and the effects of changes in operating conditions due to variations in the characteristics of the device under consideration and of all other electronic devices in the equipment.

The equipment manufacturer should design so that, initially and throughout life, no absolute maximum value for the intended service is exceeded with any device under the worst probable operating conditions with respect to supply voltage variation, equipment control adjustment load variation, signal variation, environmental conditions, and variations in characteristics of the device under consideration and of all other electronic devices in the equipment.

Note: When operated at a limiting value the tubes may not be expected to function in

**Note:** When operated at a limiting value the tubes may not be expected to function in accordance with the published operating characteristics. Under operating conditions where limiting values coincide or are combined with extreme counting rates, the tubes may not function properly.

#### MOUNTING

G.M. tubes must not be clamped tightly in the vicinity of glass-metal seals. Great care must be taken in handling and fixing thin walled tubes. Mica windows are extremely fragile and must never be touched.

Low capacitance between anode and cathode is essential, i.e. the **shortest possible** connections between anode terminal and load resistor must be made.

Soldering to the anode pin or to the cathode wall may destroy the tube. Most types are provided with a cathode lead or strap. This lead should be used for connection to the cathode. Tubes with an anode pin are supplied with the appropriate connector (see fig.5). This must be used.

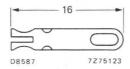


Fig.5

#### 8. STORAGE AND HANDLING

The tube should not be stored at ambient temperatures outside the limits given under the heading LIMITING VALUES on the data sheets.

To prevent leakage between the anode and the cathode, the tube should be dry and clean. Condensation of water vapour may cause a short-circuit between anode and cathode.

#### OUTSIDE PRESSURE

In tubes provided with a mica window, the gas pressure outside the tube should neither be lower than 35 kPa ( $\approx 25$  cm Hg) nor higher than the atmospheric pressure (unless otherwise stated) and changes in pressure should be gradual.

Care should be taken not to expose tubes with very thin envelopes to pressures substantially higher than atmospheric.

#### 10. ENERGY DEPENDENCE

The sensitivity of G.M. tubes to gamma radiation is influenced considerably by the energy of the radiation.

At energies above about 300 to 400 keV, the action of the tube is due to emission of electrons from the cathode and the higher the atomic number of the cathode material the greater will be the electron emission. Radiation with an energy of less than 300 to 400 keV is absorbed by the gas filling, the absorption increasing as the energy decreases. This gives rise to the characteristic peak in sensitivity which occurs at about 60 keV, below which the sensitivity decreases rapidly due to cut-off by the thickness or density of the cathode wall. By using an external filter a near linear sensitivity can be obtained.

#### 11. LIFE

#### 11.1 Storage life

If stored in a cool dry place, free from continuous or severe vibration, there is hardly any deterioration in the tube's characteristics. A storage life of years is not unusual.

#### 11.2 Operational life

The operational life of a G.M. tube is expressed in counts (discharges). Theoretically the quenching gas, ionized during a discharge, should be re-combined between discharges. However, minute quantities will be chemically bound, no longer taking part in the quenching process. This will lead to a gradual reduction of the plateau length, and, for a given working voltage, to an increased counting rate. This will culminate in a continuous state of discharge of the tube, rendering it useless.

Apart from the accumulated number of counts registered, the ambient temperature during operation is of prime importance to the life of the tube. At temperatures above 50 °C, changes in the gas mixture may occur, possibly reducing the total number of counts attainable. Short periods of operation (not exceeding 1 h) up to approximately 70 °C should not prove harmful, but life will progressively decrease with increasing temperature.

Thus, depending on application and circumstances, the quenching gas could be exhausted in as little as a few hours or theoretically last for many years.

For these reasons G.M. tubes cannot be guaranteed unconditionally for a specified period of time.

Exceeding the LIMITING VALUES Soldering to the tube body or pin Bending the anode pin Touching the mica window

may destroy the tube

## GENERAL G.M. TUBES

## 12. MAXIMUM BETA ABSORPTION (percentages)

source max. β energy		in mica	a window (r	mg/cm <sup>2</sup> )	in meta	in metal envelope (mg/cm²)		
	MeV	2	3	4	40	60	100	
4 2 K	3.55	1	1	2	13	20	30	
<sup>90</sup> Y + <sup>90</sup> Sr	2.27	1	3	3	23	32	48	
3 2 P	1.71	3	4	5	33	44	63	
<sup>89</sup> Sr	1.46	3	4	5	40	51	70	
<sup>24</sup> Na	1.39	3	5	6	41	53	73	
<sup>1 0 9</sup> Pd	1.00	4	6	8	54	68	85	
3 6 CI	0.71	7	10	13	72	84	95	
1 3 1	0.61	8	11	15	77	90	97	
<sup>2</sup> <sup>2</sup> Na	0.54	8	13	17	81	92	98	
<sup>46</sup> Sc	0.36	15	22	27	94	99	100	
<sup>6 0</sup> Co	0.31	20	26	34	97	100	100	
99Tc	0.29	21	30	37	99	100	100	
<sup>4 5</sup> Ca	0.25	24	33	42	100	100	100	
<sup>3 5</sup> S	0.17	36	49	59	100	100	100	
<sup>1 4</sup> C	0.16	39	51	62	100	100	100	
<sup>3</sup> H	0.02	100	100	100	100	100	100	
Geiger-Müll type num		ZP1401 ZP1410 ZP1430 ZP1441 ZP1451	ZP1400 ZP1431 ZP1442 ZP1452 ZP1470 ZP1480 ZP1481	ZP1461	ZP1320 ZP1322	ZP1330	ZP130 ZP131	

## GEIGER-MÜLLER TUBE

Halogen quenched  $\gamma$  radiation counter tube.

#### QUICK REFERENCE DATA

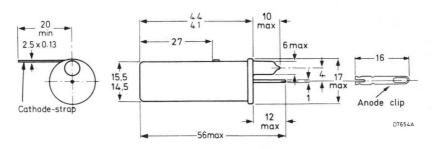
Dose rate range	$10^{-3}$ to 10	mGy/h	
Plateau threshold voltage	400	V	
Plateau length	200	V	
Recommended supply voltage	500	V	
Chrome-iron cathode	250	mg/cm <sup>2</sup>	

This data must be read in conjunction with General Information Geiger-Müller tubes.

### **MECHANICAL DATA**

Dimensions in mm

Fig. 1



#### CATHODE

Thickness 250 mg/cm²
Sensitive length 40 mm
Material chrome-iron

FILLING neon, argon, halogen

#### CAPACITANCE

Anode to cathode 1.1 pF

## OPERATING CHARACTERISTICS (Ambient temperature ≈ 25 °C)

Measured in circuit of Fig.2

Starting voltage max. 325 V
Plateau threshold voltage max. 400 V
Plateau length 200 V
Recommended supply voltage 500 V

Plateau slope max. 0.04 %/V Background (shielded with 50 mm Pb with

an inner liner of 3 mm Al), at recommended supply voltage max. 10 count/min Dead time, at recommended supply voltage max. 90 µs

LIMITING VALUES (Absolute max. rating system)

Anode resistor min. 4.7 M $\Omega$  Anode voltage max. 600 V

Ambient temperature continuous operating max. +70 °C min. -40 °C

storage max. +75 °C

5 x 10<sup>10</sup>

count

#### LIFE EXPECTANCY

Life expectancy at  $\approx$  25 °C

#### MEASURING CIRCUIT

 $R_1 = 10 M\Omega$ 

 $R_2 = 220 \text{ k}\Omega$ 

 $C_1 = 1 pF$ 

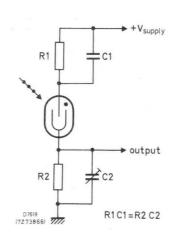
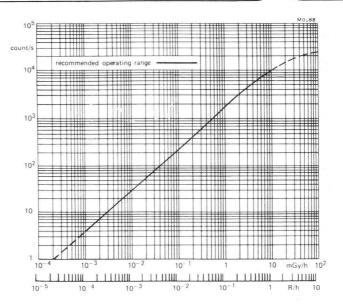
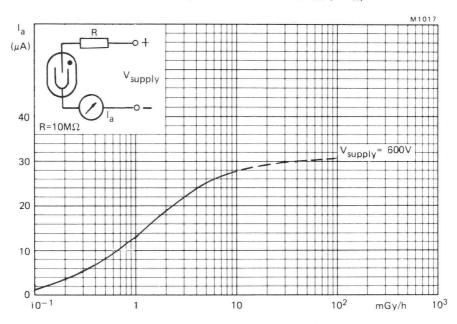


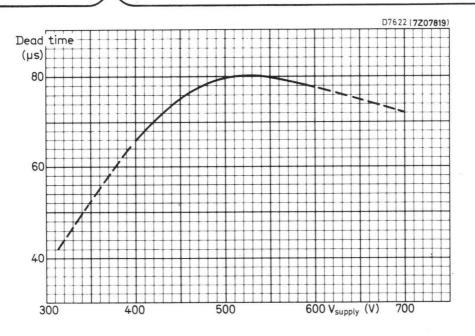
Fig.2



Typical counting rate as a function of dose rate (137Cs)



Typical current as a function of dose rate  $(^{60}\text{Co})$ 



Typical dead time as a function of supply voltage

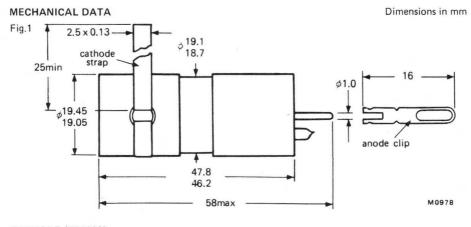
# GEIGER-MÜLLER TUBE

Halogen quenched  $\gamma$  radiation counter tube fitted in a filter. The energy response is flat to within +25 % over the range 50 keV to 1.25 MeV referred to <sup>137</sup>Cs (661 keV). The ZP1201 is an energy compensated version of the ZP1200.

#### QUICK REFERENCE DATA

Dose rate range	10 <sup>-3</sup> to 10	mGy/h	
Plateau threshold voltage	400	V	
Plateau length	200	V	
Recommended supply voltage	500	V	
Chrome-iron cathode	250	mg/cm <sup>2</sup>	

This data must be read in conjunction with General Information Geiger-Müller tubes.



#### CATHODE (ZP1200)

Thickness	250	mg/cm²
Sensitive length	40	mm
Material	chrome-iron	
FILLING	neon, argon, halogen	

#### CAPACITANCE

A d- 4 th- d-	1	2 .	οF
Anode to cathode		.2	זר

### OPERATING CHARACTERISTICS (Ambient temperature ≈ 25 °C)

Measured in circuit	OT	FIQ. Z	
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Starting voltage

Plateau threshold voltage	max.	400	V	
Plateau length		200	V	
Recommended supply voltage		500	V	

325

10

count/min

max.

max.

Plateau slope 0.04 %/V max. Background (shielded with 50 mm Pb with

an inner liner of 3 mm Al), at recommended supply voltage

Dead time, at recommended supply voltage max. 110 μs

LIMITING VALUES (Absolute max. rating system)			
Anode resistor	min.	4.7	$\Omega M$
Anode voltage	max.	600	V
Ambient temperature continuous operating	max. min.	+70 -40	°C
storage	max.	+75	oC

#### LIFE EXPECTANCY

5 x 10<sup>10</sup> Life expectancy at  $\approx 25$  °C count

#### MEASURING CIRCUIT

 $R_1 = 10 M\Omega$ 

 $R_2 = 220 \text{ k}\Omega$ 

 $C_1 = 1 pF$ 

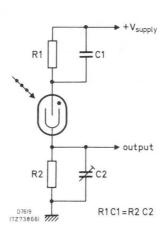
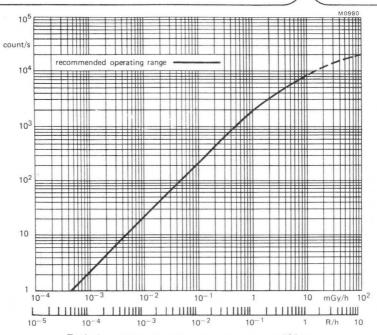
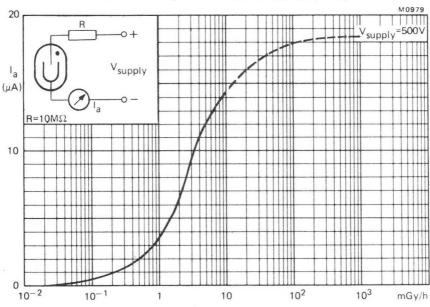


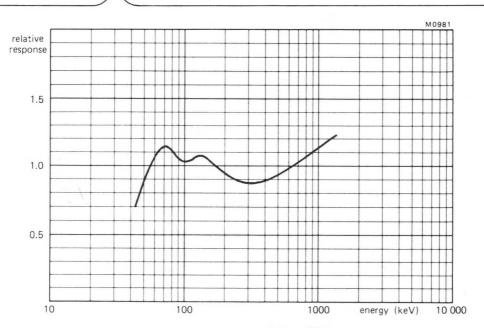
Fig.2



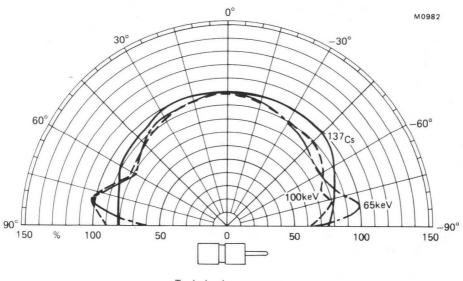
Typical counting rate as a function of dose rate (137Cs)



Typical current as a function of dose rate (137Cs)



Typical energy response relative to 137Cs



Typical polar responses

## GEIGER-MÜLLER TUBE

Halogen quenched  $\gamma$  radiation counter tube.

#### QUICK REFERENCE DATA

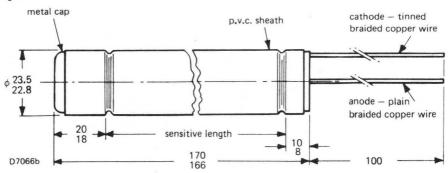
Dose rate range	10 <sup>-3</sup> to 2	mGy/h	-
Plateau threshold voltage	400	V	
Plateau length	100	V	
Recommended supply voltage	450	V	
Chrome-iron cathode	525	mg/cm <sup>2</sup>	

This data must be read in conjunction with General Information Geiger-Müller tubes.

#### **MECHANICAL DATA**

Dimensions in mm

Fig.1



Tube must not be clamped within 30 mm of either end.

#### CATHODE

Thickness 525 mg/cm²
Sensitive length 140 mm
Material chrome-iron

FILLING neon, argon, halogen

#### CAPACITANCE

Anode to cathode 4.5 pF

Plateau slope

## OPERATING CHARACTERISTICS (Ambient temperature ≈ 25 °C)

Measured in circuit of Fig.2

Starting voltage max. 350 V
Plateau threshold voltage max. 400 V

Plateau length 100 V

Recommended supply voltage 450 V

Background (shielded with 50 mm Pb with an inner liner of 3 mm Al), at recommended supply voltage max. 70 count/min.

0.15

+75

max.

max.

%/V

oc

Dead time, at recommended supply voltage  $\mu s$  max. 200  $\mu s$ 

## LIMITING VALUES (Absolute max. rating system)

## LIFE EXPECTANCY

storage

Life expectancy at  $\approx 25$  °C 5 x 10<sup>10</sup> count

#### MEASURING CIRCUIT

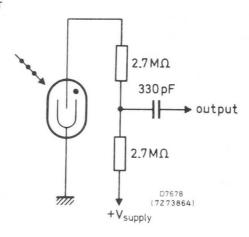
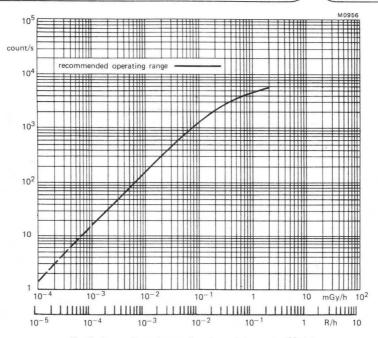
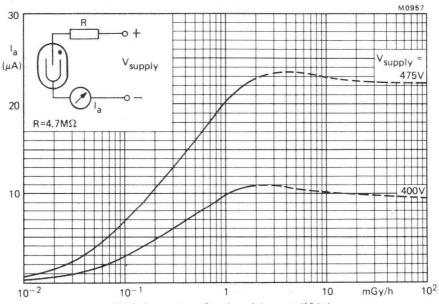


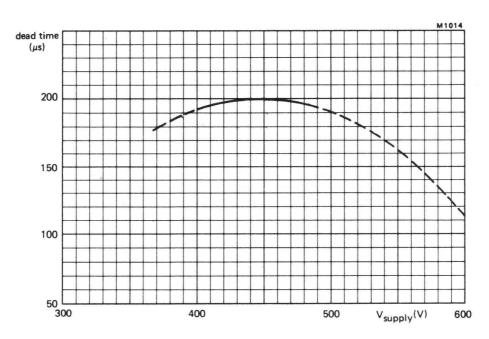
Fig.2



Typical counting rate as a function of dose rate (60 Co)



Typical current as a function of dose rate (60 Co)



Typical dead time as a function of supply voltage

Halogen quenched  $\gamma$  radiation counter tube.

#### QUICK REFERENCE DATA

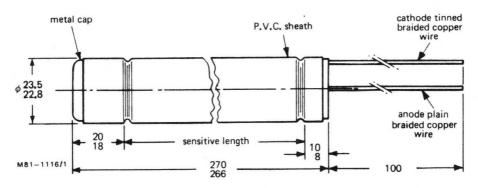
Dose rate range	10 <sup>-3</sup> to 1	mGy/h
Plateau threshold voltage	400	V
Plateau length	100	V
Recommended supply voltage	450	V
Chrome-iron cathode	525	mg/cm <sup>2</sup>

This data must be read in conjunction with General Information Geiger-Müller tubes.

#### **MECHANICAL DATA**

Dimensions in mm





Tube must not be clamped within 30 mm of either end.

#### CATHODE

Thickness	525	mg/cm <sup>2</sup>
Sensitive length	240	mm
Material	chrome-iron	
FILLING	neon, argon, halogen	

#### CAPACITANCE

Anode to cathode 10 pF

Measured in circuit of Fig.2

Starting voltage max. 350 V
Plateau threshold voltage max. 400 V
Plateau length 100 V
Recommended supply voltage 450 V

Plateau slope max. 0.15 %/V

Background (shielded with 50 mm Pb with an inner liner of 3 mm Al), at recommended supply voltage

supply voltage max. 90 count/min. Dead time, at recommended supply voltage max. 210  $\mu s$ 

#### LIMITING VALUES (Absolute max. rating system)

Anode resistor min. 2.7 M $\Omega$ Anode voltage max. 500 V

 Ambient temperature continuous operating
 max. +70 °C

 min. -40 °C

 storage
 max. +75 °C

#### LIFE EXPECTANCY

Life expectancy at  $\approx 25$  °C  $5 \times 10^{10}$  count

#### MEASURING CIRCUIT

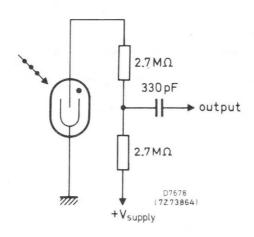
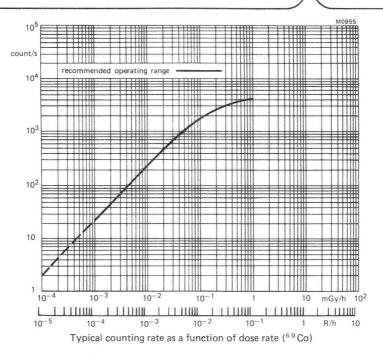
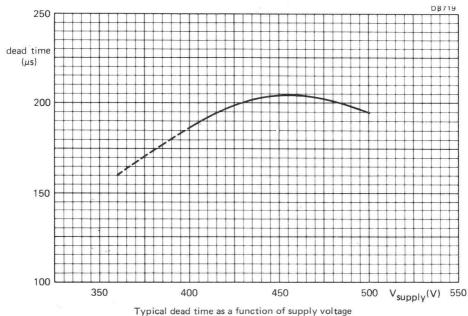


Fig.2





Halogen quenched  $\gamma$  and high energy  $\beta$  (> 0.5 MeV) radiation counter tube.

#### QUICK REFERENCE DATA

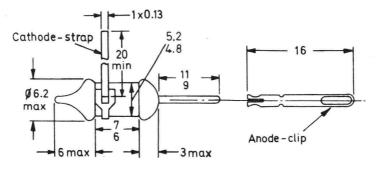
Dose rate range	$10^{-1}$ to $2 \times 10^4$	mGy/h
Plateau threshold voltage	500	V
Plateau length	100	V
Recommended supply voltage	550	V
Chrome-iron cathode	80 to 100	mg/cm <sup>2</sup>

This data must be read in conjunction with General Information Geiger-Müller tubes.

#### **MECHANICAL DATA**

Dimensions in mm

Fig.1



D7076A

#### CATHODE

 Thickness
 80 to 100
 mg/cm²

 Sensitive length
 8
 mm

 Material
 chrome-iron
 FILLING

 helium, neon, halogen
 helium, neon, halogen

#### CAPACITANCE

Anode to cathode 0.7 pF

Measured i	n circi	uit o	f	Fig.2
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Starting voltage	max.	400	V
Plateau threshold voltage	max.	500	V

100 ٧ Plateau length Recommended supply voltage 550

Plateau slope max. 0.3 %/V

Background (shielded with 50 mm Pb with an inner liner of 3 mm Al), at recommended

supply voltage Dead time, at recommended supply voltage max. 11 μs

max.

count/min

LIMITING VALUES (Absolute max. rating system)

Anode resistor 2.2  $M\Omega$ min.

Anode voltage 600 V max.

Ambient temperature continuous operating +70 OC max. -40 oC

min. oC +75 storage max.

#### LIFE EXPECTANCY

1010 Life expectancy at ≈25 °C count

#### MEASURING CIRCUIT

 $R_1 = 2.2 M\Omega$ 

 $R_2 = 47 k\Omega$  $C_1 = 1 pF$ 

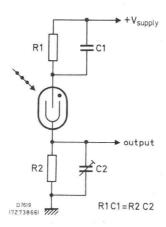
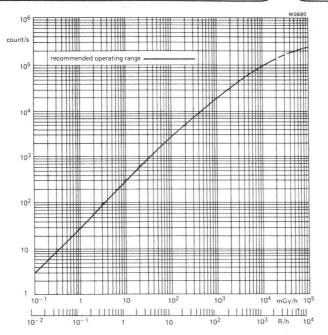
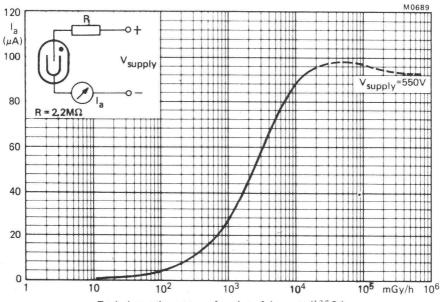


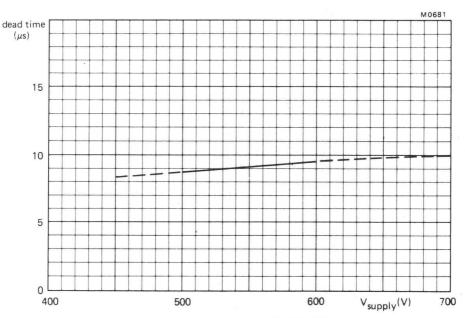
Fig.2



Typical counting rate as a function of dose rate (137Cs)



Typical counting rate as a function of dose rate (137Cs)



Typical dead time as a function of supply voltage

Halogen quenched  $\gamma$  radiation counter tube fitted in a filter. The energy response is flat to within  $\pm$  15% over the range 80 keV to 3.0 MeV referred to  $^{13.7}$ Cs (661 keV). The ZP1301 is an energy compensated version of the ZP1300. Also available with long life artificial background as ZP1302.

#### QUICK REFERENCE DATA

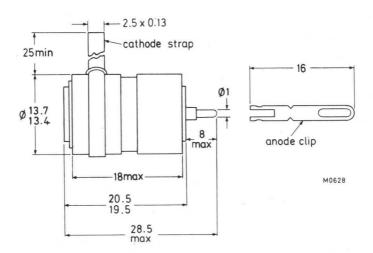
Dose rate range	$10^{-1}$ to $2 \times 10^4$	mGy/h	
Plateau threshold voltage	500	V	
Plateau length	100	V	
Recommended supply voltage	500	V	
Chrome-iron cathode	80 to 100	mg/cm <sup>2</sup>	

This data must be read in conjunction with General Information Geiger-Müller tubes.

#### MECHANICAL DATA

Dimensions in mm

Fig.1



#### CATHODE (ZP1300)

Thickness
Sensitive length

Material chrome iron

FILLING helium, neon, halogen

CAPACITANCE

Anode to cathode 1.25 pF

mg/cm<sup>2</sup>

mm

80 to 100

## OPERATING CHARACTERISTICS (Ambient temperature $\approx$ 25 $^{\rm o}$ C)

Measured in circuit of Fig.2

•			
Starting voltage	max.	400	V
Plateau threshold voltage	max.	500	V
Plateau length		100	V
Recommended supply voltage		550	V
Plateau slope	max.	0.3	%/V
Background (shielded with 50 mm Pb with			
an inner liner of 3 mm AI) at 550 V	max.	1	count/min
Dead time at 550 V	max.	13	μs
LIMITING VALUES (Absolute max. rating system)			
Anode resistor	min.	2.2	$M\Omega$
Anode voltage	max.	600	V
Ambient temperature	max.	+70	оС
continuous operating	min.	-40	oC
storage	max.	+75	oC

#### LIFE EXPECTANCY

Life expectancy at  $\approx 25$  °C 10<sup>10</sup> count

## MEASURING CIRCUIT

 $R_1 = 2.2 M\Omega$  $R_2 = 47 k\Omega$ 

 $C_1 = 1 pF$ 

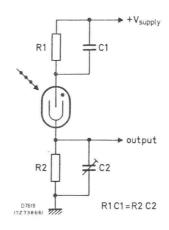
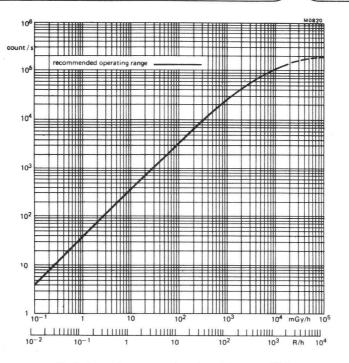
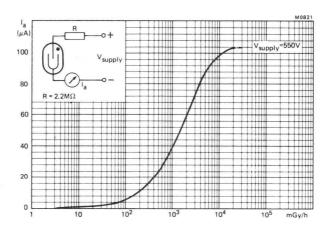


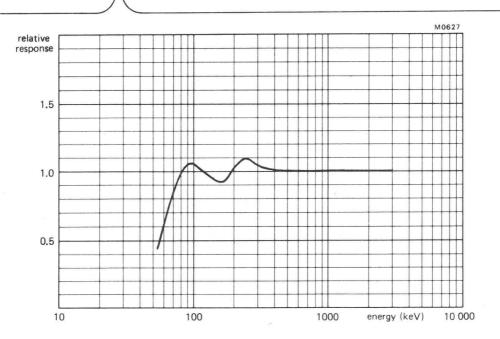
Fig.2



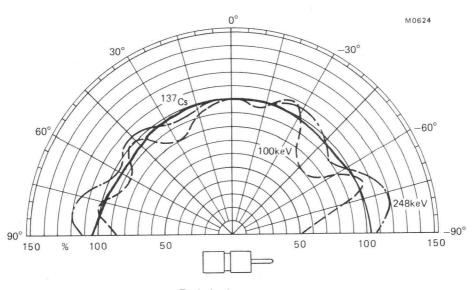
Typical counting rate as a function of dose rate (137Cs)



Typical current as a function of dose rate (137Cs)



Typical energy response relative to  $\,^{1\,3\,7}\,\mathrm{Cs}$ 



Typical polar responses

Halogen quenched  $\gamma$  and high energy  $\beta$  (> 0.5 MeV) radiation counter tube

#### QUICK REFERENCE DATA

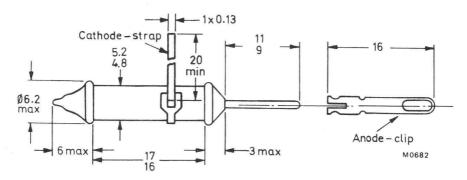
Dose rate range	$4 \times 10^{-3}$ to $3 \times 10^{3}$	mGy/h	•
Plateau threshold voltage	500	V	
Plateau length	150	V	
Recommended supply voltage	575	V	
Chrome-iron cathode	80 to 100	mg/cm <sup>2</sup>	

This data must be read in conjunction with General Information Geiger-Müller tubes.

#### MECHANICAL DATA

Dimensions in mm

Fig.1



#### CATHODE

Thickness	80 to 100	mg/cm <sup>2</sup>
Sensitive length	16	mm
Material	chrome-iron	

FILLING helium, neon, halogen

#### CAPACITANCE

Anode to cathode 1.2 pF

Measured in ci	ircuit o	t Fig.2
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Starting voltage	max.	380	V
Plateau threshold voltage	max.	500	V

Plateau length 150 V

Recommended supply voltage  $$575\ \mbox{V}$$  Plateau slope \$max.\$ 0.15  $\mbox{\%/V}$$ 

Background (shielded with 50 mm Pb with an inner liner of 3 mm Al), at recommended supply voltage max. 2 count/min

Dead time, at recommended supply voltage max. 15  $\mu s$ 

LIMITING VALUES (Absolute max. rating system)

Anode resistor min. 2.2 M $\Omega$ Anode voltage max. 650 V

Ambient temperature continuous operating max. +70 °C

#### LIFE EXPECTANCY

Life expectancy at  $\approx 25$  °C 5 x 10<sup>10</sup> count

#### MEASURING CIRCUIT

 $R_1 = 2.2 M\Omega$ 

 $R_2 = 47 k\Omega$ 

 $C_1 = 1 pF$ 

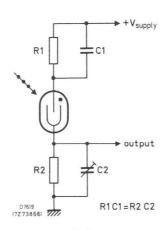
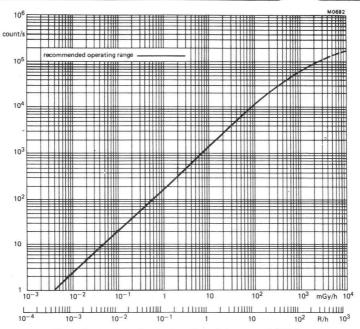
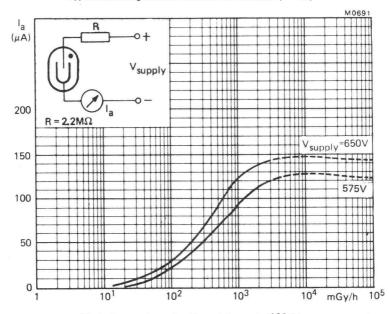


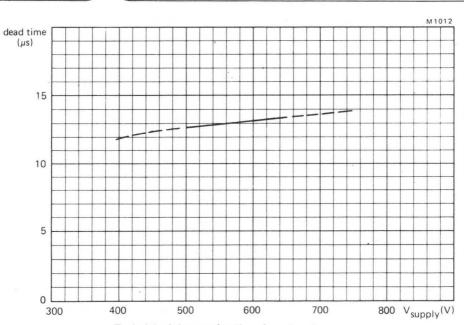
Fig.2



Typical counting rate as a function of dose rate (137Cs)



Typical current as a function of dose rate (137Cs)



Typical dead time as a function of supply voltage

Halogen quenched  $\gamma$  radiation counter tube fitted in a filter. The energy response is flat to within  $\pm 15\%$  over the range 50 keV to 1.25 MeV referred to  $^{137}$  Cs (661 keV).

The ZP1313 is an energy compensated version of the ZP1310.

#### QUICK REFERENCE DATA

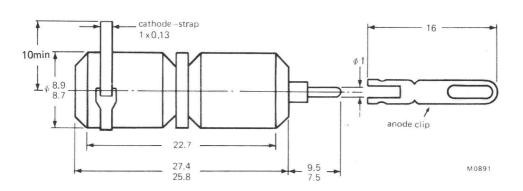
Dose rate range	$4 \times 10^{-3}$ to $3 \times 10^{3}$	mGy/h
Energy range	40 to 3000	keV
Plateau threshold voltage	500	V
Plateau length	150	V
Recommended supply voltage	575	V
Chrome-iron cathode	80 to 100	mg/cm <sup>2</sup>

This data must be read in conjunction with General Information Geiger-Müller tubes.

#### MECHANICAL DATA

Fig.1

Dimensions in mm



## CATHODE (ZP1310)

Thickness Sensitive length

Sensitive lengt

FILLING

FILLING

CAPACITANCE

Anode to cathode

80 to 100 mg/cm<sup>2</sup>

16 mm

chrome-iron

helium, neon, halogen

2.0 pF

Measured in circuit of Fig.2

Starting voltage 380 max. Plateau threshold voltage max. 500 Plateau length 150

Recommended supply voltage 575

Plateau slope max. 0.15 %/V

Background shielded with 50 mm Pb with

an inner liner of 3 mm Al), at recommended 2 count/min supply voltage max. Dead time, at recommended supply voltage max. 15 μs

LIMITING VALUES (Absolute max, rating system)

2.2  $M\Omega$ Anode resistor min.

Anode voltage 650 V max.

Ambient temperature +70 oC continuous operating max. oC min. -40oC

max.

+75

storage

 $5 \times 10^{10}$ Life expectancy at ≈ 25 °C count

#### MEASURING CIRCUIT

LIFE EXPECTANCY

 $R_1 = 2.2 M\Omega$ 

 $R_2 = 47 k\Omega$ 

 $C_1 = 1 pF$ 

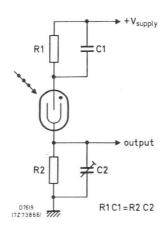
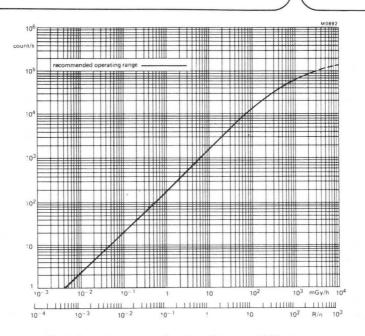
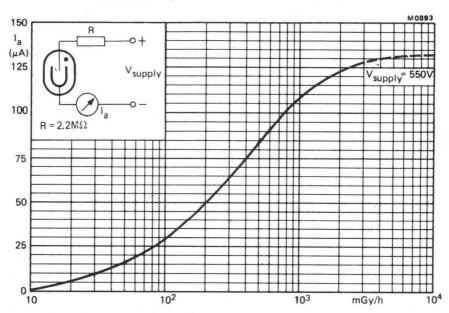


Fig.2

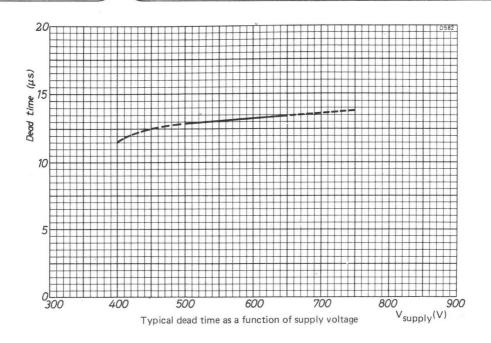
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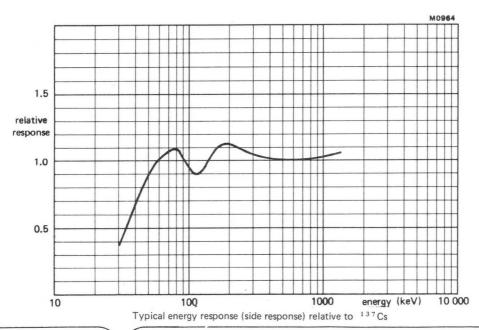


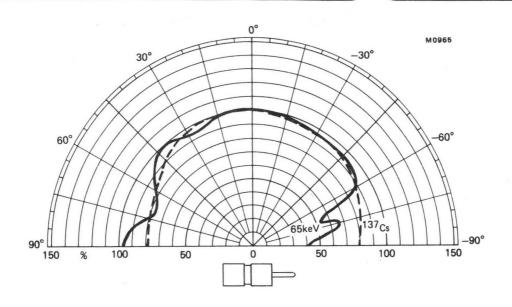
Typical counting rate as a function of dose rate (137Cs)

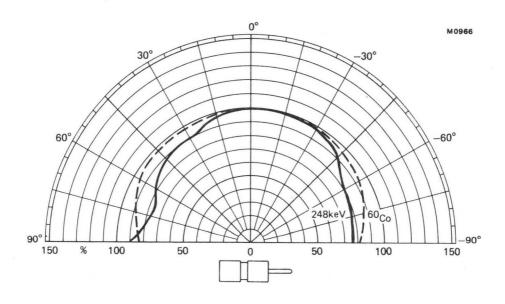


Typical current as a function of dose rate (137Cs)









Typical polar responses

Halogen quenched  $\gamma$  and  $\beta$  (> 0.25 MeV) radiation counter tube.

#### QUICK REFERENCE DATA

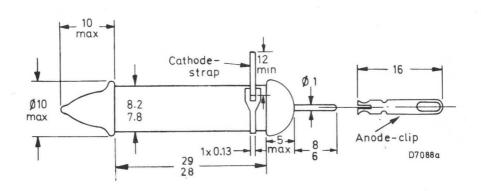
Dose rate range	10 <sup>-3</sup> to 10 <sup>2</sup>	mGy/h	
Plateau threshold voltage	500	V	
Plateau length	150	V	
Recommended supply voltage	575	V	
Chrome-iron cathode	32 to 40	mg/cm <sup>2</sup>	

This data must be read in conjunction with General Information Geiger-Müller tubes.

#### MECHANICAL DATA

Dimensions in mm

Fig.1



#### CATHODE

Thickness	32 to 40	mg/cm <sup>2</sup>
Sensitive length	28	mm
Material	chrome-iron	
FILLING	neon, argon, halogen	

#### CAPACITANCE

Anode to cathode 1.1 pF

## ZP1320

Plateau slope

#### OPERATING CHARACTERISTICS (Ambient temperature ≈ 25 °C)

Measured in circuit of Fig.2

V Starting voltage 380 max. 500 V Plateau threshold voltage max. Plateau length 150 V

Recommended supply voltage 575 V

0.08

12

45

max.

max.

max.

%/V

μs

count/min

Background (shielded with 50 mm Pb with an inner liner of 3 mm Al), at recommended supply voltage

Dead time, at recommended supply voltage

## LIMITING VALUES (Absolute max. rating system)

Anode resistor 2.2  $M\Omega$ min. V Anode voltage max. 650 Ambient temperature

+70 oC continuous operating max. oC min. -40oC storage max. +75

## LIFE EXPECTANCY

5 X 1010 Life expectancy at ≈ 25 °C count

## MEASURING CIRCUIT

 $R_1 = 4.7 M\Omega$ 

 $R_2 = 100 \text{ k}\Omega$  $C_1 = 1 pF$ 

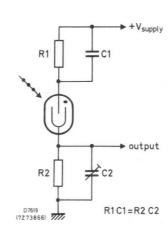
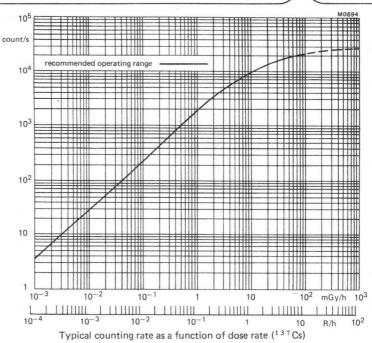
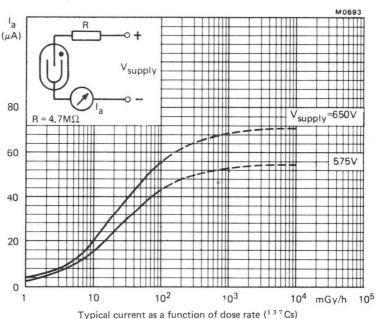
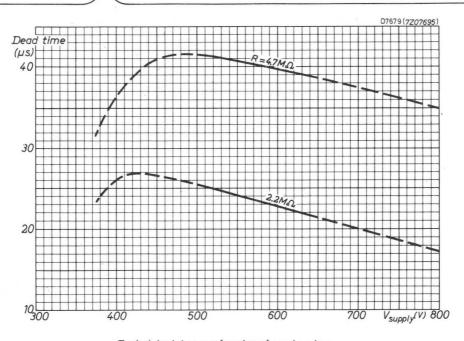


Fig.2







Typical dead time as a function of supply voltage

Halogen quenched  $\gamma$  and  $\beta$  (> 0.25 MeV) radiation counter tube.

#### QUICK REFERENCE DATA

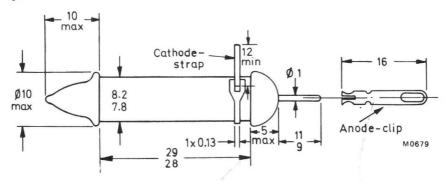
Dose rate range	$10^{-3}$ to $10^{2}$	mGy/h
Plateau threshold voltage	500	V
Plateau length	150	V
Recommended supply voltage	575	V
Chrome-iron cathode	32 to 40	mg/cm <sup>2</sup>

This data must be read in conjunction with General Information Geiger-Müller tubes.

#### **MECHANICAL DATA**

Dimensions in mm

Fig.1



#### CATHODE

Thickness	32 to 40	mg/cm <sup>2</sup>
Sensitive length	28	mm
Material	chrome-iron	

## **FILLING**

neon, argon, halogen

## CAPACITANCE

Anode to cathode 1.1 pF

OPERATING CHARACTERISTICS (Ambier	nt temperature ≈ 25 °C)		
Measured in circuit of Fig.2			
Starting voltage	max.	380	V
Plateau threshold voltage	max.	500	V
Plateau length		150	V
Recommended supply voltage		575	V
Plateau slope	max.	0.08	%/V
Background (shielded with 50 mm Pb with an inner liner of 3 mm Al), at recommended			, ,
supply voltage	max.	12	count/min
Dead time, at recommended supply voltage	max.	45	μs
LIMITING VALUES (Absolute max. rating s	system)		
Anode resistor	min.	2.2	$\Omega$ M
Anode voltage	max.	650	V
Ambient temperature continuous operating	max.	+70	°C
			0 -

#### LIFE EXPECTANCY

Life expectancy at  $\approx 25$  °C 5  $\times$  10<sup>10</sup> count

oC

oC

-40

+75

min.

max.

#### MEASURING CIRCUIT

 $R_1 = 4.7 M\Omega$  $R_2 = 100 k\Omega$ 

storage

 $C_1 = 1 pF$ 

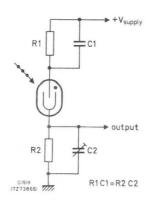
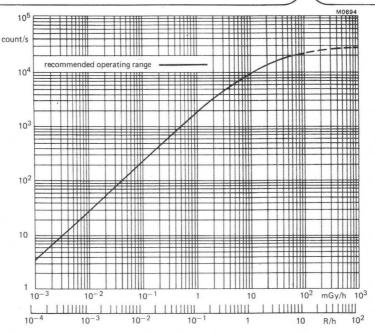
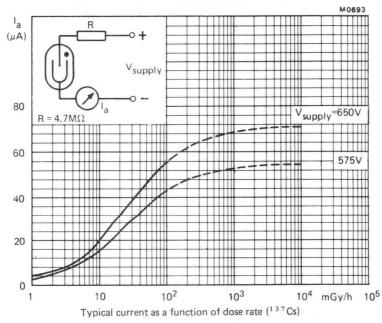
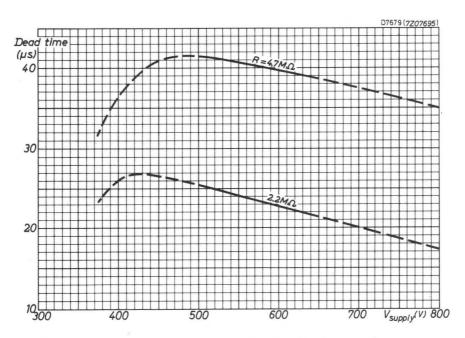


Fig.2



Typical counting rate as a function of dose rate (137Cs)





Typical dead time as a function of supply voltage

Halogen quenched  $\gamma$  and  $\beta$  (>0.3 MeV) radiation counter tube for use in damp and/or saline atmosphere.

#### QUICK REFERENCE DATA

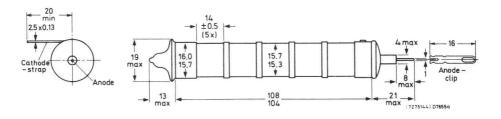
3 x 10 <sup>-4</sup> to 10	mGv/h
450	V
350	V
625	V
40 to 60	mg/cm <sup>2</sup>
	350 625

This data must be read in conjunction with General Information Geiger-Müller tubes.

#### **MECHANICAL DATA**

Dimensions in mm

Fig.1



The cathode is covered with a corrosion resistant coating.

#### CATHODE

0, 1111002			
Construction	cylindrical wall with strengthening ribs		
Thickness between strengthening ribs	40 to 60	mg/cm <sup>2</sup>	
Sensitive length	75	mm	
Material	chrome-iron		
FILLING	neon, argon, halogen	•	
CAPACITANCE			
Anode to cathode	4.0	pF	

					0
Measured	In	CITC	uit	01	F1q.2

Starting voltage	max.	400	V
Plateau threshold voltage	max.	450	V
Plateau length		350	V
Recommended supply voltage		625	V
Plateau slope	max.	0.02	%/V
Background (shielded with 50 mm Pb with an inner liner of 3 mm Al), at recommended			
supply voltage	max.	30	count/min
Dead time, at recommended supply voltage	max.	70	μs
LIMITING VALUES (Absolute max. rating system)			
Anode resistor	min.	2.2	$M\Omega$
Anode voltage	max.	800	V
Ambient temperature continuous operating	max. min.	+70 -40	oC C

## LIFE EXPECTANCY

Life expectancy at  $\approx 25$  °C 5 x 10<sup>10</sup> count

+75

max.

oC

#### MEASURING CIRCUIT

 $R = 2.2 M\Omega$ 

storage

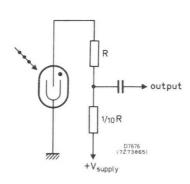
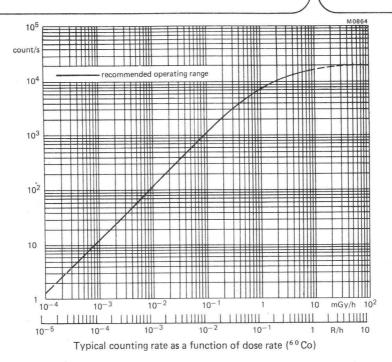
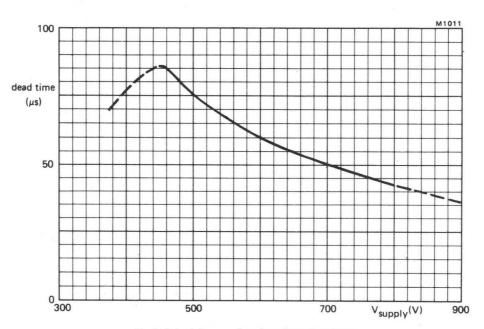


Fig.2

2



M0863 la (µA) 250 Vsupply V<sub>supply</sub> 200  $R = 2.2M\Omega$ 150 100 50 450V  $10^{-1}$ 10  $10^{3}$ mGy/h Typical current as a function of dose rate (60 Co)



Typical dead time as a function of supply voltage

End window halogen quenched  $\beta$  and  $\gamma$  radiation counter tube.

#### QUICK REFERENCE DATA

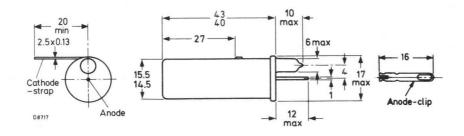
10 <sup>-3</sup> to 10	mGy/h
400	V
200	V
500	V
250	mg/cm <sup>2</sup>
2.0 to 3.0	mg/cm <sup>2</sup>
	400 200 500 250

This data must be read in conjunction with General Information Geiger-Müller tubes.

## MECHANICAL DATA

Fig.1

Dimensions in mm



#### WINDOW

Thickness	2.0 to 3.0	mg/cm <sup>2</sup>
Useful diameter	9	mm
Material	mica	

#### CATHODE

Thickness	250	mg/cm <sup>2</sup>
Sensitive length	39	mm
Material	chrome-iron	

## FILLING neon, argon, halogen

#### CAPACITANCE

Anode to cathode	1.1	pF	
------------------	-----	----	--

## OPERATING CHARACTERISTICS (Ambient temperature $\approx$ 25 $^{\rm O}$ C)

Measured in circuit of Fig.2

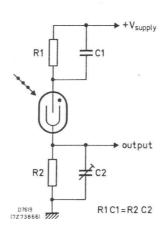
Starting voltage	max.	325	V
Plateau threshold voltage	max.	400	V
Plateau length		200	V
Recommended supply voltage		500	V
Plateau slope	max.	0.04	%/V
Background (shielded with 50 mm Pb with an inner liner of 3 mm Al), at recommended			
supply voltage	max.	10	count/min.
Dead time, at recommended supply voltage	max.	90	μs
LIMITING VALUES (Absolute max. rating system).			
Anode resistor	min.	4.7	$\Omega$ M
Anode voltage	max.	600	V
Ambient temperature			
continuous operating	max.	+70	оС
	min.	-40	oC
storage	max.	+75	oC
LIFE EXPECTANCY			

# Life expectancy at $\approx 25$ °C MEASURING CIRCUIT

 $R_1 = 10 M\Omega$ 

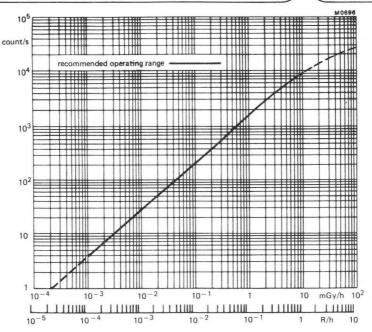
 $R_2 = 220 \text{ k}\Omega$ 

 $C_1 = 1 pF$ 

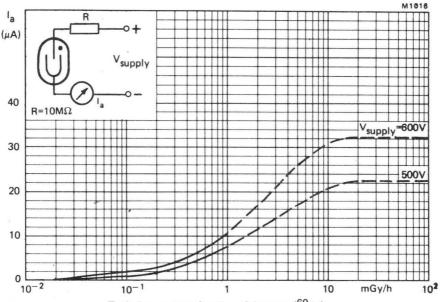


5 × 10<sup>10</sup>

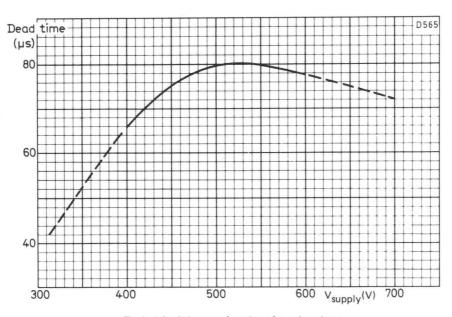
count



Typical counting rate as a function of dose rate (137Cs)



Typical current as a function of dose rate (60Co)



Typical dead time as a function of supply voltage

End window halogen quenched  $\alpha$ ,  $\beta$  and  $\gamma$  radiation counter tube.

#### QUICK REFERENCE DATA

Dose rate range	10 <sup>-3</sup> to 10	mGy/h
Plateau threshold voltage	400	V
Plateau length	200	V
Recommended supply voltage	500	V
Chrome-iron cathode	250	mg/cm <sup>2</sup>
Mica window (9 mm diameter)	1.5 to 2.0	mg/cm <sup>2</sup>

This data must be read in conjunction with General Information Geiger-Müller tubes.

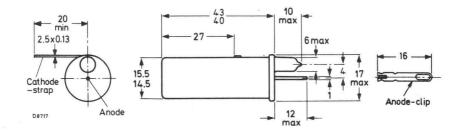
### MECHANICAL DATA

Dimensions in mm

mg/cm<sup>2</sup>

1.5 to 2.0

Fig. 1



### WINDOW Thickness

Useful diameter	9	mm
Material	mica	
CATHODE		
Thickness	250	mg/cm <sup>2</sup>
Sensitive length	39	mm
Material	chrome-iron	
FILLING	neon, argon, halogen	

#### CAPACITANCE

Anode to cathode 1.1 pF

## OPERATING CHARACTERISTICS (Ambient temperature $\approx$ 25 $^{\rm O}$ C)

Measured in circuit of Fig.2			
Starting voltage	max.	325	V
Plateau threshold voltage	max.	400	V
Plateau length		200	V
Recommended supply voltage		500	V
Plateau slope	max.	0.04	%/V
Background (shielded with 50 mm Pb with an inner liner of 3 mm AI), at recommended		10	
supply voltage	max.	10	count/min
Dead time, at recommended supply voltage	max.	90	$\mu$ s
LIMITING VALUES (Absolute max. rating system).			
Anode resistor	min.	4.7	$M\Omega$
Anode voltage	max.	600	V
Ambient temperature			
continuous operating	max.	+70	oC
	min.	-40	oC
storage	max.	+75	oC

#### LIFE EXPECTANCY

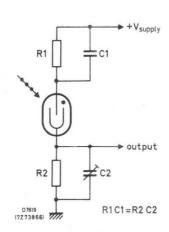
Life expectancy at  $\approx$  25 °C

#### MEASURING CIRCUIT

 $R_1 = 10 M\Omega$ 

 $R_2 = 220 \text{ k}\Omega$ 

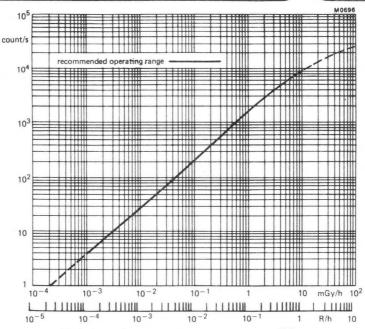
 $C_1 = 1 pF$ 



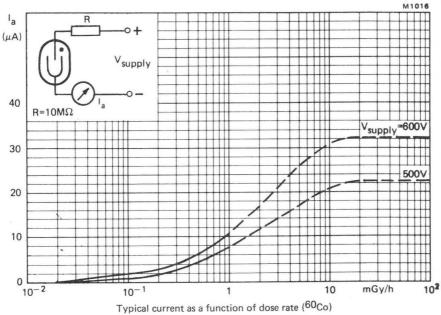
5 x 10<sup>10</sup>

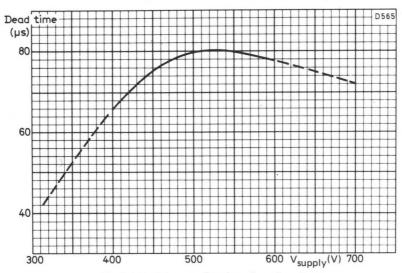
count

Fig.2



Typical counting rate as a function of dose rate (137Cs)





Typical dead time as a function of supply voltage

End window halogen quenched  $\alpha$ ,  $\beta$  and  $\gamma$  radiation counter tube.

#### QUICK REFERENCE DATA

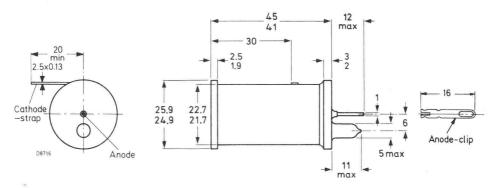
Dose rate range	10 <sup>-3</sup> to 3 x 10	mGy/h	
Plateau threshold voltage	450	V	
Plateau length	250	V	
Recommended supply voltage	575	V	
Chrome-iron cathode	910	mg/cm <sup>2</sup>	
Mica window (19.8 mm diameter)	1.5 to 2.0	mg/cm <sup>2</sup>	

This data must be read in conjunction with General Information Geiger-Müller tubes.

#### MECHANICAL DATA

Dimensions in mm

Fig.1



#### WINDOW

Thickness Useful diameter

mica Material

#### CATHODE

mg/cm<sup>2</sup> 910 Thickness 37 mm Sensitive length chrome-iron Material

FILLING

CAPACITANCE

2.5 pF Anode to cathode

mg/cm<sup>2</sup>

mm

1.5 to 2.0

neon, argon, halogen

19.8

### OPERATING CHARACTERISTICS (Ambient temperature $\approx$ 25 $^{\rm o}$ C)

Measured	in	circuit	of	Fig.2	
----------	----	---------	----	-------	--

max.	350	V
max.	450	V
	250	V
	575	V
max.	0.02	%/V
max.	15	count/min.
max.	175	μs
min.	2.2	$\Omega M$
max.	700	V
	max. max. max.	max. 450 250 575 max. 0.02 max. 15 max. 175

Ambient temperature			
continuous operating	max.	+70	oC
	min.	-40	oC
storage	max.	+75	oC

LIFE EXPECTANCY

Life expectancy at  $\approx 25$  °C 5  $\times$  10<sup>10</sup> count

### MEASURING CIRCUIT

 $R = 10 M\Omega$ 

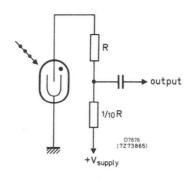
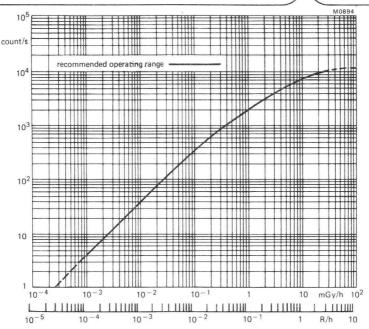
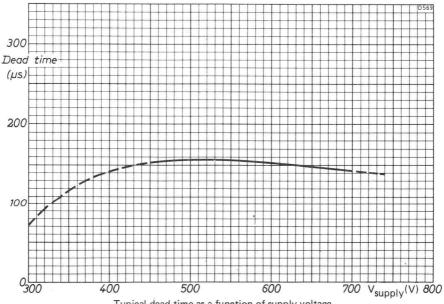


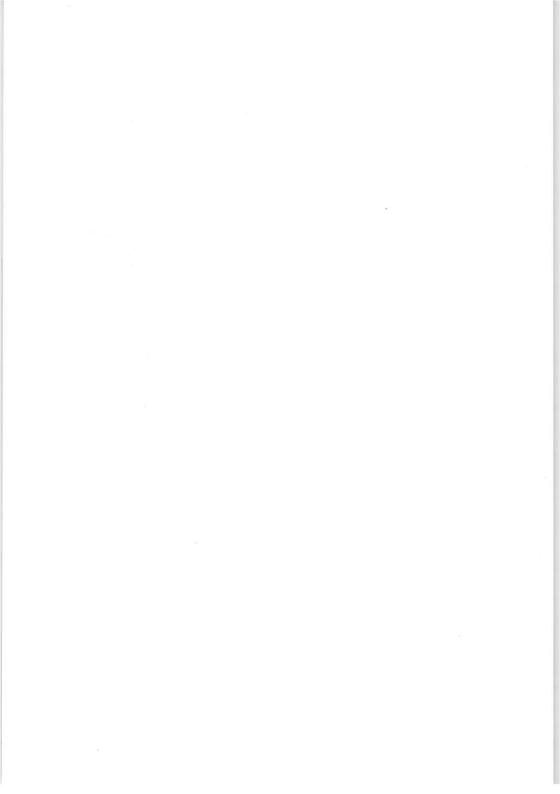
Fig.2



Typical counting rate as a function of dose rate (60 Co)



Typical dead time as a function of supply voltage



End window halogen quenched  $\alpha$ ,  $\beta$  and  $\gamma$  radiation counter tube.

#### QUICK REFERENCE DATA

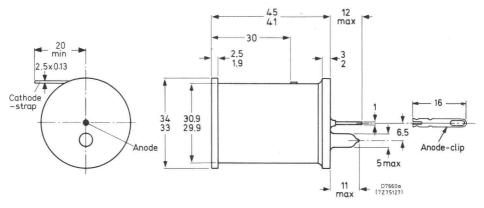
D	10-3 - 0 10	0 //
Dose rate range	$10^{-3}$ to 2 x 10	mGy/h
Plateau threshold voltage	450	V
Plateau length	250	V
Recommended supply voltage	575	V
Chrome-iron cathode	980	mg/cm <sup>2</sup>
Mica window (27.8 mm diameter)	1.5 to 2.0	mg/cm <sup>2</sup>

This data must be read in conjunction with General Information Geiger-Müller tubes.

#### MECHANICAL DATA

Fig.1

Dimensions in mm



#### WINDOW

Thickness	1.5 to 2.0	mg/cm <sup>2</sup>
Useful diameter	27.8	mm
Material	mica	

#### CATHODE

Thickness	980	mg/cm <sup>2</sup>
Sensitive length	37	mm
Material	chrome-iron	

# FILLING

#### CAPACITANCE

Anode to cathode

3.5 pF

neon, argon, halogen

Measured in circuit of Fig.2

### **OPERATING CHARACTERISTICS** (Ambient temperature $\approx$ 25 $^{\rm O}$ C)

Starting voltage	max.	375	V
Plateau threshold voltage	max.	450	V
Plateau length		250	V
Recommended supply voltage		575	V
Plateau slope	max.	0.04	%/V
Background (shielded with 50 mm Pb with			

max.

max.

max.

25

190

+75

count/min

MS

oc

an inner liner of 3 mm AI), at recommended supply voltage

Dead time, at recommended supply voltage

LIMITING VALUES (Absolute max. rating system)

min. 4.7  $M\Omega$ Anode resistor 700 V Anode voltage max. Ambient temperature +70 oC continuous operating max.. oC min. --40

LIFE EXPECTANCY

Life expectancy at  $\approx 25$  °C 5  $\times$  10<sup>10</sup> count

#### MEASURING CIRCUIT

 $R_1 = 10 M\Omega$ 

storage

 $R_2 = 220 \text{ k}\Omega$ 

 $C_1 = 1 pF$ 

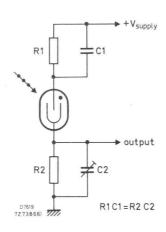
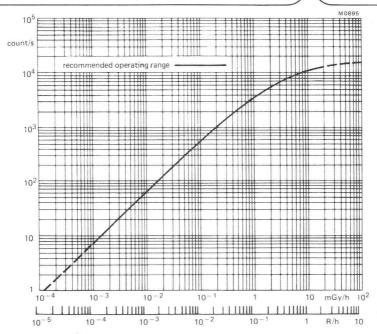
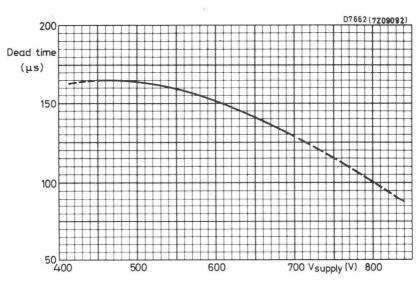


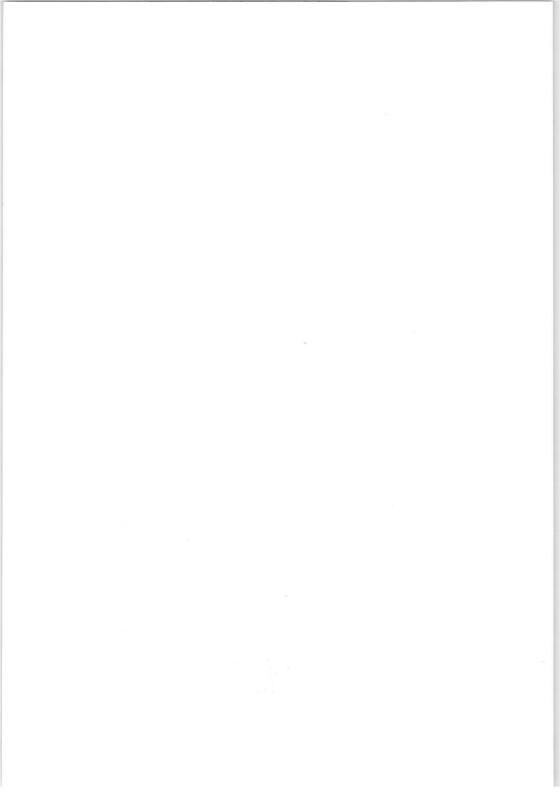
Fig.2



Typical counting rate as a function of dose rate (60 Co)



Typical dead time as a function of supply voltage



End window halogen quenched  $\beta$  and  $\gamma$  radiation counter tube.

#### QUICK REFERENCE DATA

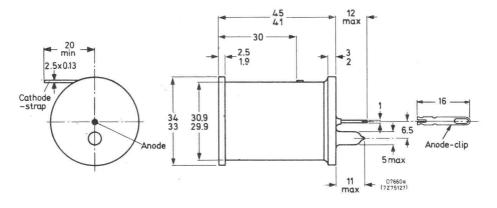
ACCORD STREET AND STREET STORY AND STREET AN		
Dose rate range	10 <sup>-3</sup> to 2 x 10	mGy/h
Plateau threshold voltage	450	V
Plateau length	250	V
Recommended supply voltage	575	V
Chrome-iron cathode	980	mg/cm <sup>2</sup>
Mica window (27.8 mm diameter)	2.0 to 3.0	mg/cm <sup>2</sup>

This data must be read in conjunction with General Information Geiger-Müller tubes.

#### MECHANICAL DATA

Fig.1

Dimensions in mm



#### WINDOW

Thickness	2.0 to 3.0	mg/cm <sup>2</sup>
Useful diameter	27.8	mm
Material	mica	
CATHODE		
Thickness	980	mg/cm <sup>2</sup>
Sensitive length	37	mm
Material	chrome-iron	

**FILLING** neon, argon, halogen

### CAPACITANCE

Anode to cathode

3.5 pF

Measured in	circuit	of	Fig.2
-------------	---------	----	-------

Starting voltage	max.	375	V
Plateau threshold voltage	max.	450	V
Plateau length		250	V
Recommended supply voltage		575	V

Plateau slope max. 0.04 %/V

Background (shielded with 50 mm Pb with an inner liner of 3 mm Al), at recommended supply voltage m

supply voltage max. 25 count/min Dead time, at recommended supply voltage max. 190  $\mu$ s

### LIMITING VALUES (Absolute max. rating system)

Anode resistor min. 4.7 M $\Omega$ Anode voltage max. 700 V

Ambient temperature continuous operating max. +70 °C min. -40 °C

min. -40 °C storage max. +75 °C

#### LIFE EXPECTANCY

Life expectancy at  $\approx 25$  °C  $5 \times 10^{10}$  count

#### MEASURING CIRCUIT

 $R_1 = 10 M\Omega$ 

 $R_2 = 220 \text{ k}\Omega$ 

 $C_1 = 1 pF$ 

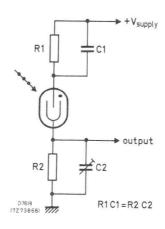
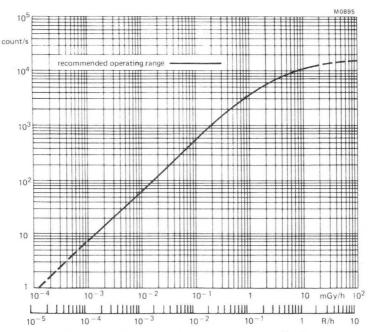
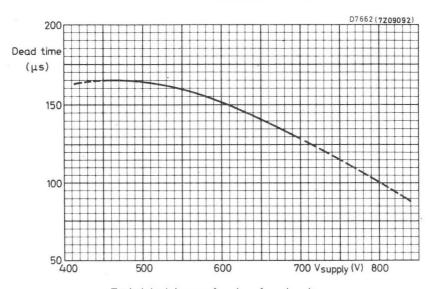


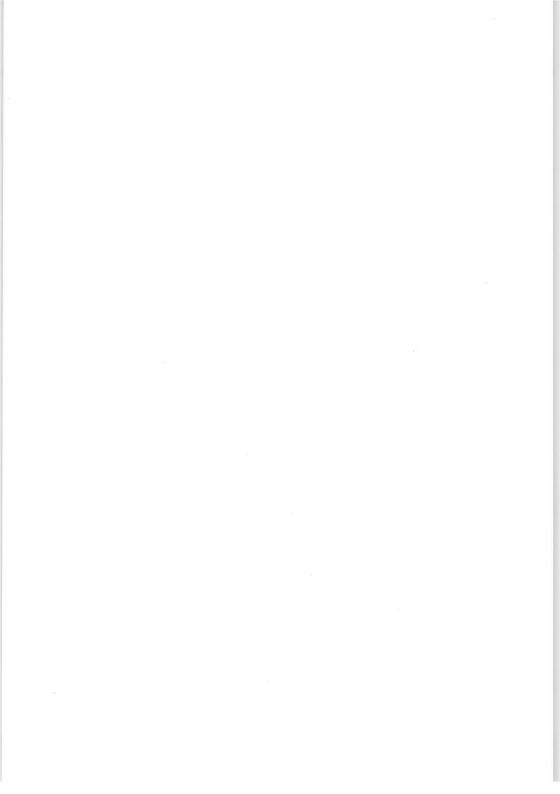
Fig.2



Typical counting rate as a function of dose rate (60 Co)



Typical dead time as a function of supply voltage



End window halogen quenched  $\alpha$ ,  $\beta$  and  $\gamma$  radiation counter tube for measurement of low levels of radiation in combination with a guard counter tube, e.g. ZP1700.

#### QUICK REFERENCE DATA

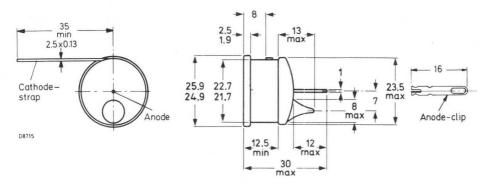
Dose rate range	$10^{-3}$ to $10^{2}$	mGy/h
Plateau threshold voltage	500	V
Plateau length	200	V
Recommended supply voltage	600	V
Chrome-iron cathode	910	mg/cm <sup>2</sup>
Mica window (19.8 mm diameter)	1.5 to 2.0	mg/cm <sup>2</sup>

This data must be read in conjunction with General Information Geiger-Müller tubes.

#### MECHANICAL DATA

Dimensions in mm

Fig.1



#### WINDOW

Thickness	1.5 to 2.0	mg/cm <sup>2</sup>
Useful diameter	19.8	mm
Material	mica	

#### CATHODE

Thickness	910	mg/cm <sup>2</sup>
Sensitive length	12	mm
Material	chrome-iron	

#### **FILLING**

CAPACITANCE	neon, argon, halogen		
Anode to cathode	1.0 pF		

Measured in circuit of Fig.2

Starting voltage	max.	350	V
Plateau threshold voltage	max.	500	V
Plateau length		200	V
Recommended supply voltage		600	V
Plateau slope	max.	0.09	%/V

Background (shielded with 50 mm Pb with an inner liner of 3 mm Al), at recommended supply voltage max. count/min

Background in anti-coincidence circuit with guard counter tube ZP1700 (shielded) with 100 mm Fe and 30 mm Pb), at recommended supply voltage, Fe outisde

count/min max. 1.2 Dead time, at recommended supply voltage 65 max. MS

LIMITING VALUES (Absolute max. rating system)

Anode resistor 2.2  $M\Omega$ min. Anode voltage 700 V max. Ambient temperature continuous operating max. +70 OC oC min. -40OC storage max. +75

#### LIFE EXPECTANCY

Life expectancy at ≈ 25 °C

 $5 \times 10^{10}$ count

#### MEASURING CIRCUIT

 $R_1 = 4.7 M\Omega$  $R_2 = 100 \text{ k}\Omega$  $C_1 = 1 pF$ 

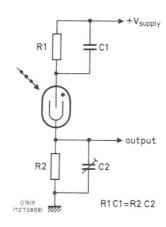
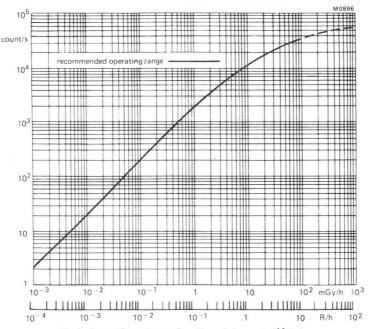
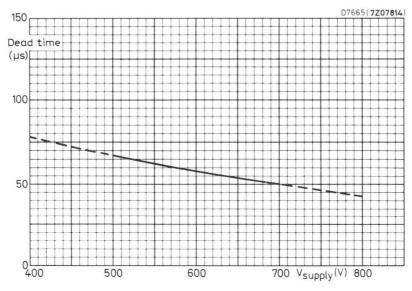


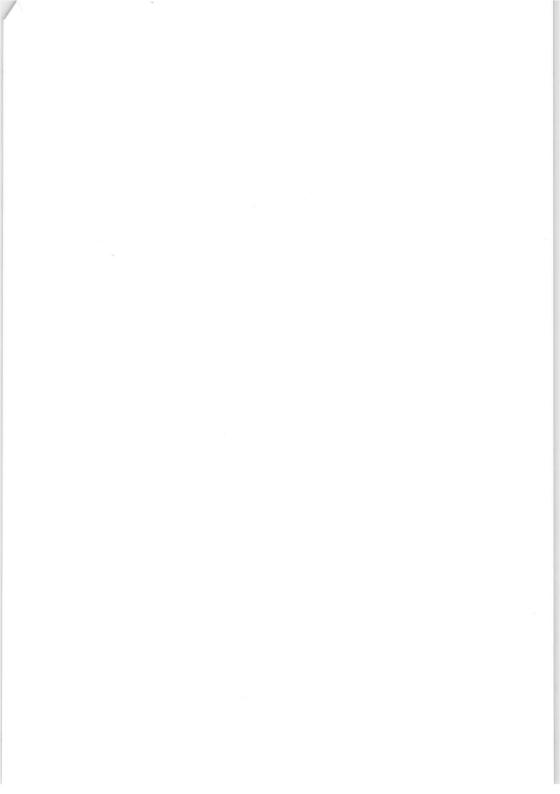
Fig.2



Typical counting rate as a function of dose rate (  $^{6\ 0}$  Co)



Typical dead time as a function of supply voltage



End window halogen quenched  $\beta$  and  $\gamma$  radiation counter tube.

### QUICK REFERENCE DATA

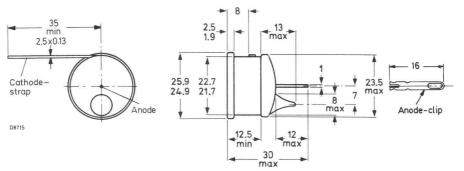
			-
Dose rate range	$10^{-3}$ to $10^{2}$	mGy/h	
Plateau threshold voltage	500	V	
Plateau length	200	V	
Recommended supply voltage	600	V	
Chrome-iron cathode	910	mg/cm <sup>2</sup>	
Mica window (19.8 mm diameter)	2.0 to 3.0	mg/cm <sup>2</sup>	

This data must be read in conjunction with General Information Geiger-Müller tubes.

#### MECHANICAL DATA

Dimensions in mm





#### WINDOW

Thickness	2.0 to 3.0	mg/cm <sup>2</sup>
Useful diameter	19.8	mm
Material	mica	

CATHODE		
Thickness	910 mg/cm <sup>2</sup>	
Sensitive length	12 mm	
Material	chrome-rion	
FILLING	neon, argon, halogen	

CAPACITANCE			
Anode to cathode		1.0	pF

Measured	in	circ	mi+	of	Fig '	2

Starting voltage	max.	350	V
Plateau threshold voltage	max.	500	V
Plateau length		200	V
Recommended supply voltage		600	V

Plateau slope

Background (shielded with 50 mm Pb with an inner liner of 3 mm Al), at recommended supply voltage Dead time, at recommended supply voltage

#### LIMITING VALUES (Absolute max. rating system)

Time the design of the second contracting system,
Anode resistor
Anode voltage
Ambient temperature
continuous operating

storage

LIFE EXPECTANCY

Life expectancy at  $\approx$  25  $^{o}\text{C}$ 

#### MEASURING CIRCUIT

 $R_1 = 4.7 \text{ M}\Omega$   $R_2 = 100 \text{ k}\Omega$   $C_1 = 1 \text{ pF}$ 

min. max. max. min. max.

max.

max.

max.

2.2 MΩ 700 V

MS

%/V

count/min

x. +70 °C n. -40 °C x. +75 °C

0.09

8

65

### $5 \times 10^{10}$ count

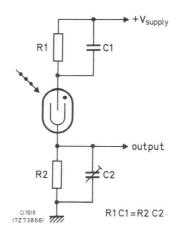
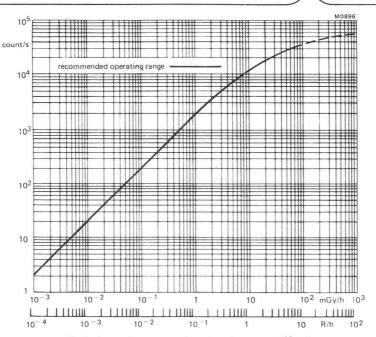
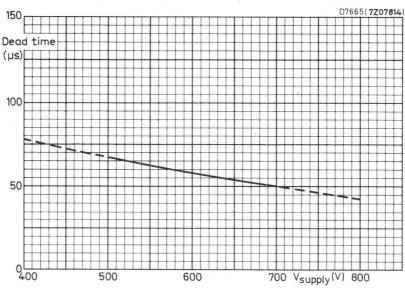


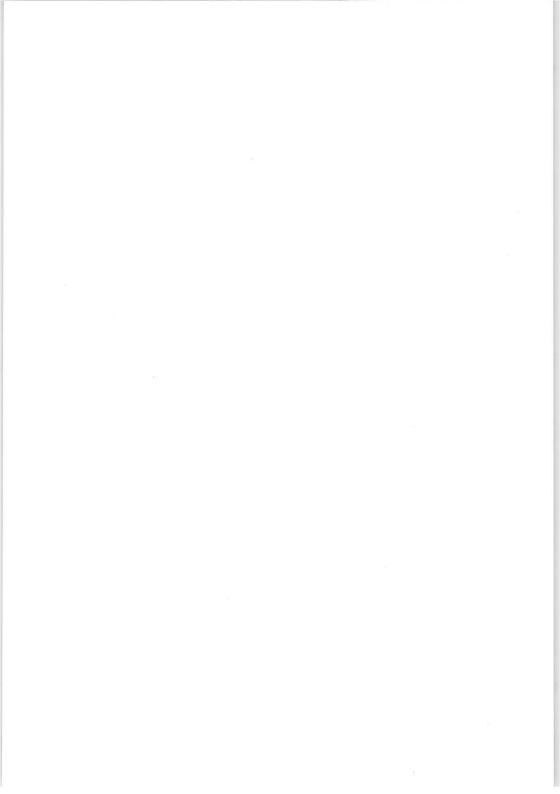
Fig.2



Typical counting rate as a function of dose rate (60 Co)



Typical dead time as a function of supply voltage



End window halogen quenched  $\alpha$ ,  $\beta$  and  $\gamma$  radiation counter tube for measurement of low levels of radiation in combination with a guard counter tube, e.g. ZP1700.

#### QUICK REFERENCE DATA

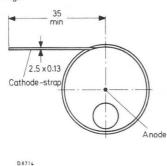
Dose rate range	10 <sup>-3</sup> to 3 x 10	mGy/h
Plateau threshold voltage	500	V
Plateau length	250	V
Recommended supply voltage	625	V
Chrome-iron cathode	980	mg/cm <sup>2</sup>
Mica window (27.8 mm diameter)	1.5 to 2.0	mg/cm <sup>2</sup>

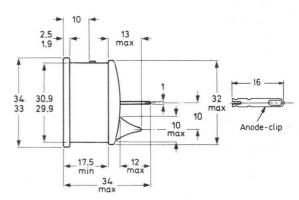
This data must be read in conjunction with General Information Geiger-Müller tubes.

#### MECHANICAL DATA

Dimensions in mm







#### WINDOW

Thickness 1.5 to 2.0 mg/cm²
Useful diameter 27.8 mm
Material mica

#### CATHODE

**FILLING** 

Thickness 980 mg/cm²
Sensitive length 16 mm
Material chrome-iron

#### CAPACITANCE

Anode to cathode 1.4 pF

neon, argon, halogen

### OPERATING CHARACTERISTICS (Ambient temperature $\approx$ 25 $^{\rm o}$ C)

					F. 0
Measured	ın	CITC	TILL	Ot	F10.7

Measured in circuit of Fig.2			
Starting voltage	max.	375	V
Plateau threshold voltage	max.	500	V
Plateau length		250	V
Recommended supply voltage		625	V
Plateau slope	max.	0.07	%/V
Background (shielded with 50 mm Pb with an inner liner of 3 mm Al), at recommended supply voltage	max.	9	count/min
Background in anti-coincidence circuit with guard counter tube ZP1700 (shielded with 100 mm Fe and 30 mm Pb), at recommended supply voltage, Fe outside	max.	2	count/min
Dead time, at recommended supply voltage	max.	60	μs
LIMITING VALUES (Absolute max. rating system)			
Anode resistor	min.	4.7	$\Omega$ M
Anode voltage	max.	750	V
Ambient temperature continuous operating	max. min.	+70 -40	oC oC

#### LIFE EXPECTANCY

Life expectancy at  $\approx$  25  $^{\rm O}C$ 

 $5 \times 10^{10}$  count

+75 °C

max.

### MEASURING CIRCUIT

 $R_1 = 10 M\Omega$ 

storage

 $R_2 = 220 \text{ k}\Omega$ 

 $C_1 = 1 pF$ 

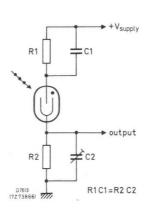
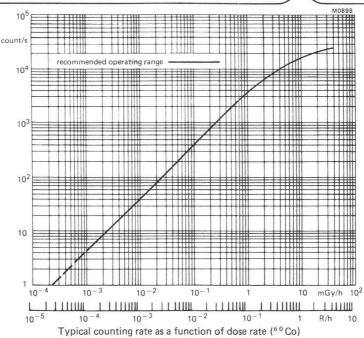
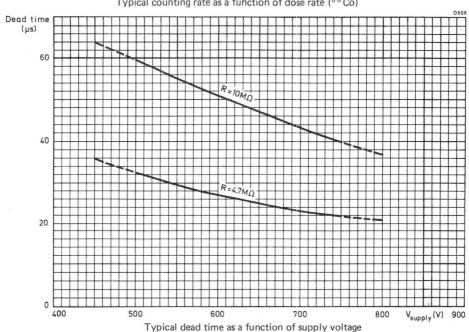
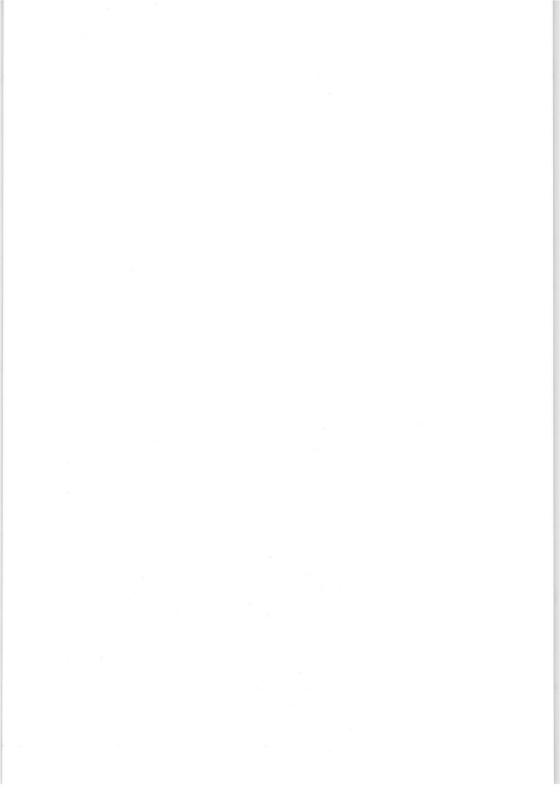


Fig.2







End window halogen quenched  $\beta$  and  $\gamma$  radiation counter tube.

#### QUICK REFERENCE DATA

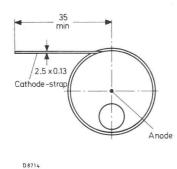
Dose rate range	10 <sup>-3</sup> to 3 x 10	mGv/h
Plateau threshold voltage	500	V
Plateau length	250	V
Recommended supply voltage	625	V
Chrome-iron cathode	980	mg/cm <sup>2</sup>
Mica window (27.8 mm diameter)	2.0 to 3.0	mg/cm <sup>2</sup>

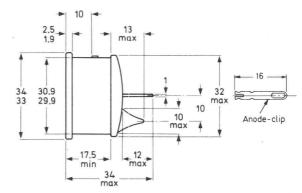
This data must be read in conjunction with General Information Geiger-Müller tubes.

#### MECHANICAL DATA

Dimensions in mm

Fig.1





#### WINDOW

Thickness 2.0 to 3.0 mg/cm²
Useful diameter 27.8 mm
Material mica

#### CATHODE

Thickness 980 rng/cm²
Sensitive length 16 mm
Material chrome-iron

#### **FILLING**

#### CAPACITANCE

Anode to cathode

1.4 pF

neon, argon, halogen

					F . O
Measured	ın	circu	Ιt	OT	FIQ.2

Starting voltage	max.	375	V
Plateau threshold voltage	max.	500	V
Plateau length		250	V
Recommended supply voltage		625	V
Plateau slope	max.	0.07	%/V
Background (shielded with 50 mm Pb with			

an inner liner of 3 mm Al), at recommended supply voltage

18 count/min max. Dead time, at recommended supply voltage max. 60 µs

### LIMITING VALUES /Abox

LIMITING VALUES (Absolute max. rating system)				
Anode resistor	min.	4.7	$\Omega$ M	
Anode voltage	max.	750	V	
Ambient temperature continuous operating	max. min.	+70 40	oC oC	
storage	max.	+75	oC	

### LIFE EXPECTANCY

Life expectancy at  $\approx 25$  °C

 $5 \times 10^{10}$  count

#### MEASURING CIRCUIT

 $R_1 = 10 M\Omega$  $R_2 = 220 \text{ k}\Omega$  $C_1 = 1 pF$ 

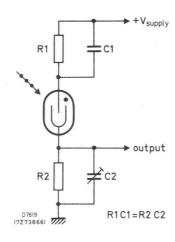
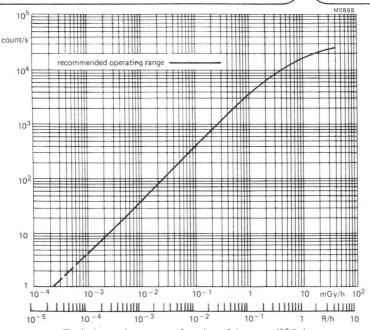
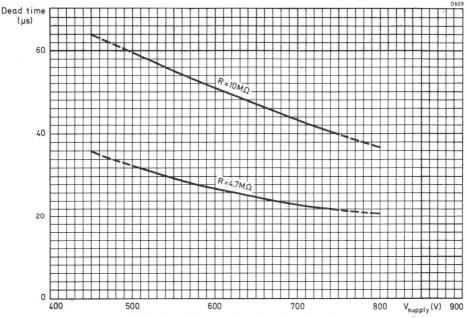


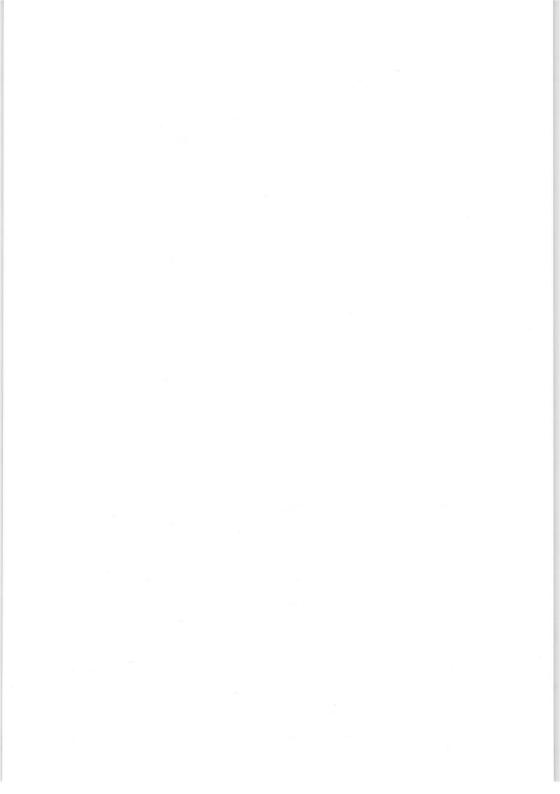
Fig.2



Typical counting rate as a function of dose rate (60 Co)



Typical dead time as a function of supply voltage



End window halogen quenched  $\beta$  and  $\gamma$  radiation counter tube.

#### QUICK REFERENCE DATA

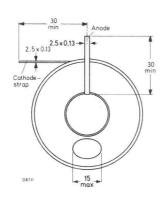
Dose rate range	3 x 10 <sup>-4</sup> to 1	mGy/h
Plateau threshold voltage	700	V
Plateau length	200	V
Recommended supply voltage	800	V
Chrome-iron cathode	950	mg/cm <sup>2</sup>
Mica window (51 mm diameter)	3.5 to 4.0	mg/cm <sup>2</sup>

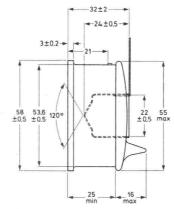
This data must be read in conjunction with General Information Geiger-Müller tubes.

#### MECHANICAL DATA

Dimensions in mm

Fig.1





#### WINDOW

Thickness	3.5 to 4.0	mg/cm <sup>2</sup>
Useful diameter	51	mm
Material	mica	
CATHODE		
Thickness	950	mg/cm <sup>2</sup>

Sensitive length

chrome-iron

Material **FILLING** 

neon, argon, halogen

CAPACITANCE Anode to cathode

5.0 pF

22

mm

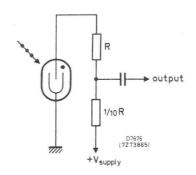
OPERATING CHARACTERISTICS (Ambient temperature ≈ 2	25 °C)		
Measured in circuit of Fig.2			
Starting voltage	max.	400	V
Plateau threshold voltage	max.	700	V
Plateau length		200	V
Recommended supply voltage		800	V
Plateau slope	max.	0.04	%/V
Background (shielded with 50 mm Pb with an inner liner of 3 mm Al), at recommended supply voltage	max.	45	count/min
Dead time, at recommended supply voltage	max.	45	μs
Dead time, at recommended supply vortage	IIIda.	43	μ3
LIMITING VALUES (Absolute max. rating system)			
Anode resistor	min.	3.9	$M\Omega$
Anode voltage	max.	900	V
Ambient temperature			
continuous operating	max.	+70	°C
	min.	-40	°C
storage	max.	+75	oC
LIFE EXPECTANCY			

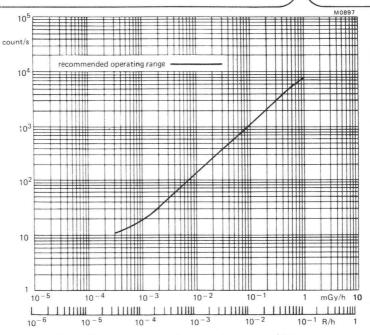
10<sup>10</sup> count

# MEASURING CIRCUIT

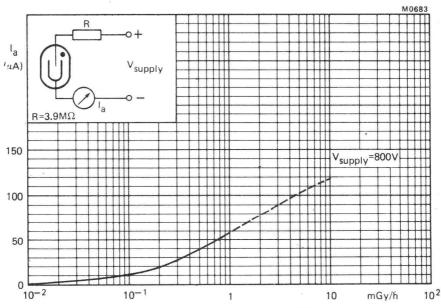
Life expectancy at  $\approx$  25  $^{\rm O}{\rm C}$ 

 $R = 4.7 M\Omega$ 

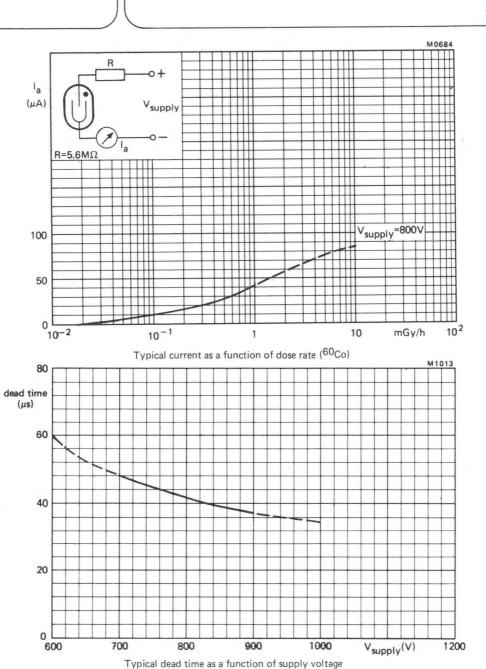




Typical counting rate as a function of dose rate (60 Co)



Typical current as a function of dose rate (60 Co)

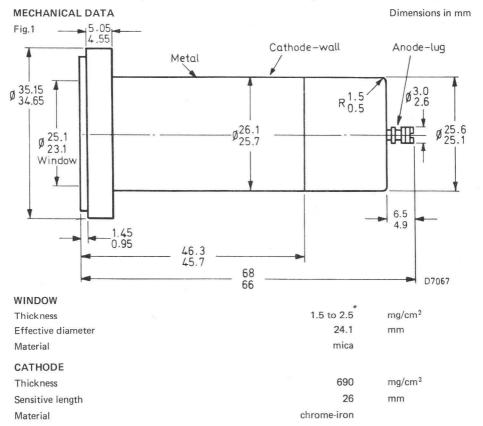


End window halogen quenched  $\beta$  and  $\gamma$  radiation counter tube.

#### QUICK REFERENCE DATA

Dose rate range	$10^{-3}$ to 2 x 10	mGy/h	
Threshold voltage	550	V	
Plateau length	150	V	
Recommended supply voltage	600	V	
Chrome-iron cathode	690	mg/cm <sup>2</sup>	
Mica window thickness (24.1 mm diameter)	1.5 to 2.5	mg/cm <sup>2</sup>	

This data must be read in conjunction with General Information Geiger-Müller tubes.



FII	LLING	neon, arg	on, halogen	
CA	PACITANCE			
	ode to cathode		5.0	pF
0.0	EDATING OLIA DA OTEDISTICO (A making the service of	~ 2E OC\		
	ERATING CHARACTERISTICS (Ambient temperat	ture ≈ 25 °C)		
Me	asured in circuit of Fig.2			
Sta	rting voltage	max.	500	V
Th	reshold voltage	max.	550	V
Pla	teau length	min.	150	V
Re	commended supply voltage (mid-plateau)		600	V
Pla	teau slope	max.	0.15	%/V
	ckground (shielded with 50 mm Pb with n inner liner of 3 mm Al), at recommended			
	upply voltage	max.	25	count/min
De	ad time, at recommended supply voltage	max.	70	μs
LI	MITING VALUES (Absolute max. rating system)			
An	ode resistor	min.	2.7	$\Omega$ M
An	ode voltage	max.	700	V
An	nbient temperature	max.	+70	°C
С	ontinuous operating	min.	-40	oC
S	torage	max.	+75	oC.
LII	FE EXPECTANCY			
Lif	e expectancy at $pprox$ 25 $^{ m O}{ m C}$		$5 \times 10^{10}$	count
ME	ASURING CIRCUIT			



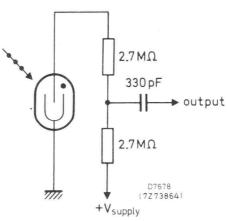
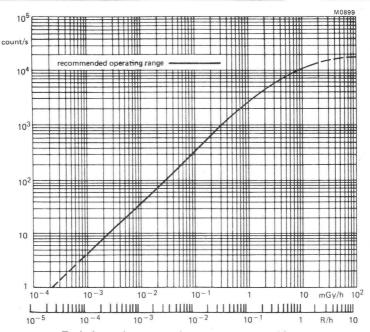
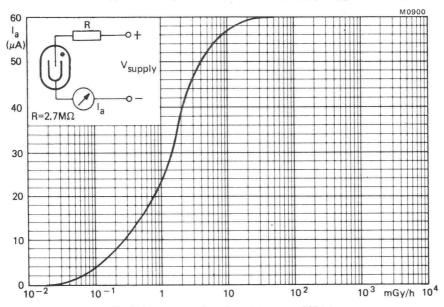


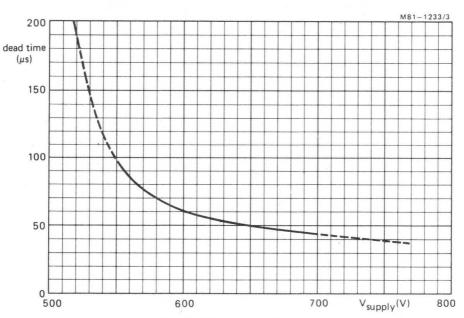
Fig.2



Typical counting rate as a function of dose rate (137Cs)



Typical current as a function of dose rate (137Cs)



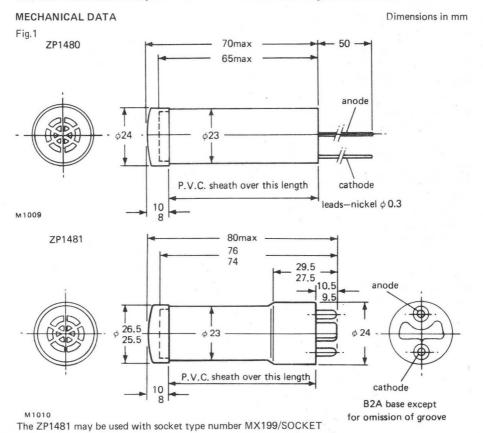
Typical dead time as a function of supply voltage

End window halogen guenched  $\beta$  and  $\gamma$  radiation counter tubes.

#### QUICK REFERENCE DATA

Dose rate range	$10^{-3}$ to 2 x 10	mGy/h	
Plateau threshold voltage	400	V	
Plateau length	100	V	
Recommended supply voltage	450	V	
Chrome-iron cathode	2000	mg/cm <sup>2</sup>	-
Mica window (17 mm diameter)	2.5 to 3.0	mg/cm <sup>2</sup>	

This data must be read in conjunction with General Information Geiger-Müller tubes.



## ZP1480 ZP1481

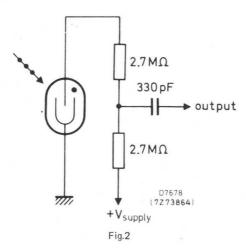
WINDOW			
WINDOW Thickness	2.5 t	3.0	mg/cm <sup>2</sup>
Useful diameter		17	mm
Material		mica	
CATHODE			
→ Thickness		2000	mg/cm <sup>2</sup>
Sensitive length		38	mm
Material	chrome	-iron	
FILLING	neon, argon, hal	ogen	
CAPACITANCE			
Anode to cathode		3.5	pF
OPERATING CHARACTERISTICS (Ambient temper	rature $\approx$ 25 °C)		
Measured in circuit of Fig.2			
Starting voltage	max.	350	V
Plateau threshold voltage	max.	400	V
Plateau length		100	V
Recommended supply voltage		450	V
Plateau slope	max.	0.2	%/V
Background (shielded with 50 mm Pb with an inner liner of 3 mm AI), at recommended			
supply voltage	max.	30	count/min
Dead time, at recommended supply voltage	max.	120	μs
LIMITING VALUES (Absolute max. rating system)	x.		
Anode resistor	min.	2.7	$\Omega$ M
Anode voltage	max.	500	V
Ambient temperature			
continuous operating	max. min.	+70 -40	°C
storage	min. max.	-40 +75	oC
***************************************			-

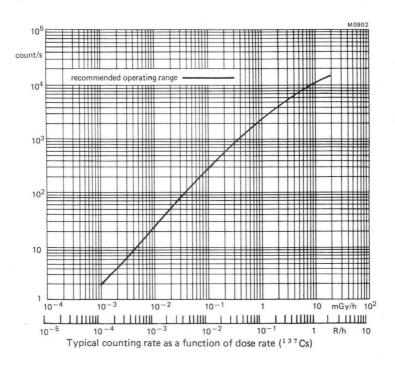
5 x 10<sup>10</sup> count

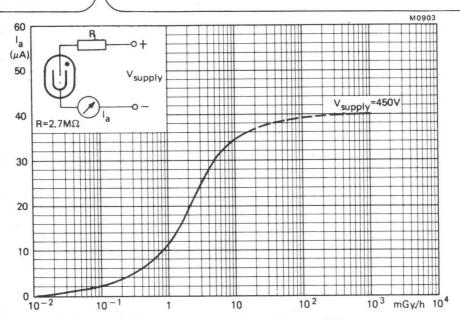
LIFE EXPECTANCY

Life expectancy at  $\approx$  25  $^{o}\text{C}$ 

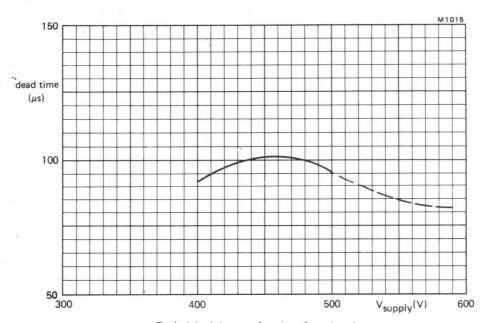
#### MEASURING CIRCUIT







Typical current as a function of dose rate (137Cs)



Typical dead time as a function of supply voltage

End window halogen quenched X-ray counter tube.

#### QUICK REFERENCE DATA

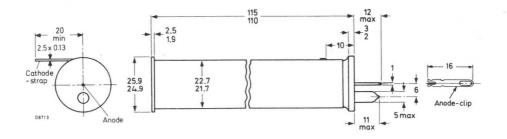
Energy range	6.0 to 20	keV
Wavelength range	0.06 to 0.2	nm
Plateau threshold voltage	1600	V
Plateau length	400	V
Recommended supply voltage	1800	V
Chrome-iron cathode	910	mg/cm <sup>2</sup>
Mica window (19.8 mm diameter)	2.5 to 3.5	mg/cm <sup>2</sup>

This data must be read in conjunction with General Information Geiger-Müller tubes.

#### MECHANICAL DATA

Dimensions in mm

Fig.1



#### WINDOW

Thickness	2.5 to 3.5	mg/cm <sup>2</sup>
Useful diameter	19.8	mm
Material	mica	

CATHODE		
Thickness	910	mg/cm <sup>2</sup>
Sensitive length	107	mm
Material	chrome-iron	
FILLING	neon, halogen	
Gas pressure*	80	kPa

#### CAPACITANCE

Anode to cathode	2.8	pF

<sup>\*</sup>Caution, transport by air to be in a hermetically sealed container.

### OPERATING CHARACTERISTICS (Ambient temperature $\approx$ 25 $^{\rm O}$ C)

Measured	in	circuit	of	Fig.2
----------	----	---------	----	-------

Starting voltage	r	max.	1450	V	
Plateau threshold voltage	r	max.	1600	V	
Plateau length			400	V	
Recommended supply voltage			1800	V	
Plateau slope	r	max.	0.07	%/V	
Background (shielded with 50 mm Pb with an inner liner of 3 mm Al), at recommended					
supply voltage	r	max.	25	count/m	in
Dead time, at recommended supply voltage	r	max.	110	μs	
LIMITING VALUES (Absolute max. rating system)					
Anode resistor	n	min.	4.7	$\Omega$ M	
Anode voltage	r	max.	2000	V	
Ambient temperature					
continuous operating	n	max.	+70	oC	
		nin.	0	oC	
storage	s n	max.	+75	oC	

#### LIFE EXPECTANCY

Life expectancy at  $\approx 25$  °C 10<sup>10</sup> count

### MEASURING CIRCUIT

 $R = 4.7 M\Omega$ 

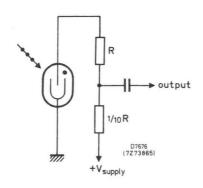
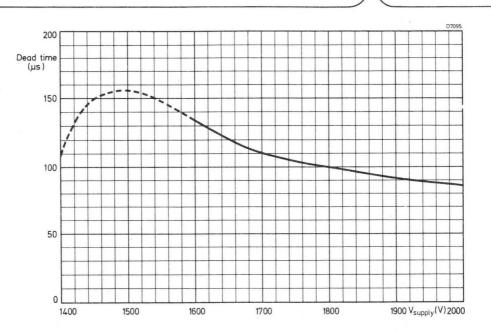
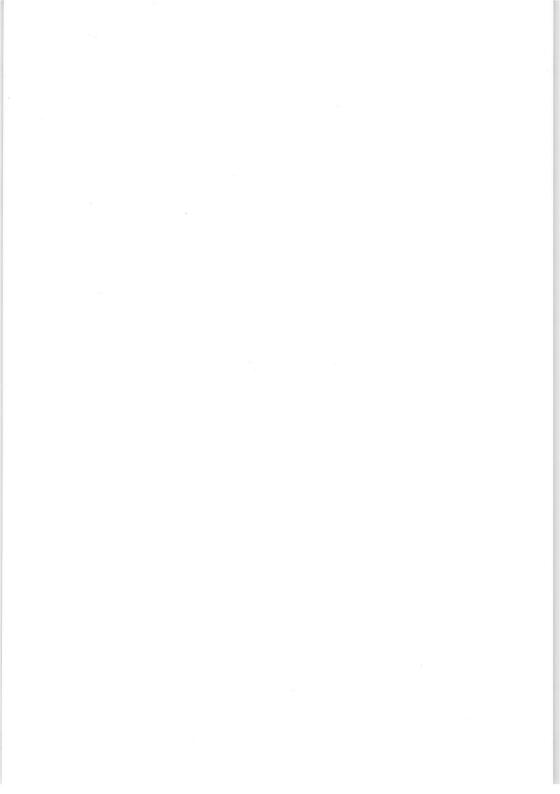


Fig.2



Typical dead time as a function of supply voltage



Side window organically quenched X-ray counter tube.

### QUICK REFERENCE DATA

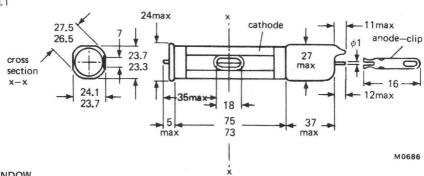
2.5 to 40	keV
0.03 to 0.5	nm
1500 to 1800	V
2.0 to 2.5	mg/cm <sup>2</sup>
	0.03 to 0.5 1500 to 1800

This data must be read in conjunction with General Information Geiger-Müller tubes.

#### MECHANICAL DATA

Dimensions in mm





#### WINDOW

Thickness	2.0 to 2.5	mg/cm <sup>2</sup>
Dimensions	7 x 18	mm
Material	mica	

Material	mica	
CATHODE Sensitive length Material	67 chrome-iron	mm
FILLING Gas pressure	xenon and organic vapour 40	kPa
CAPACITANCE Anode to cathode	2.0	pF

### OPERATING CHARACTERISTICS (Ambient temperature $\approx$ 25 $^{\rm O}$ C)

Measured in circuit of Fig.2				
Recommended supply voltage (note 1)			1550	V
Geiger threshold voltage		min.	1900	V
Operating voltage for pulse amplitude where $V_p \approx 1 \text{ mV}$ (note 2)		1460 to	1540	V
Operating voltage for pulse amplitude where $V_p \approx 10 \ mV$ (note 2)		1690 to	1770	V
Energy resolution (notes 2 and 3) see page 3		max.	22	%
LIMITING VALUES (Absolute max. rating system)				
Anode voltage		max.	1850	V
Ambient temperature				
continuous operating		max.	+50	oC
		min.	-20	oC
storage	,	max.	+50	oC

#### MEASURING CIRCUIT

 $R_1 = 2.2 \text{ k}\Omega$ 

 $R_2 = 100 \text{ k}\Omega$ 

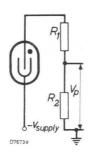
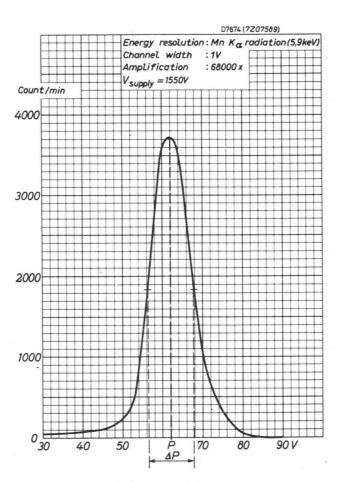


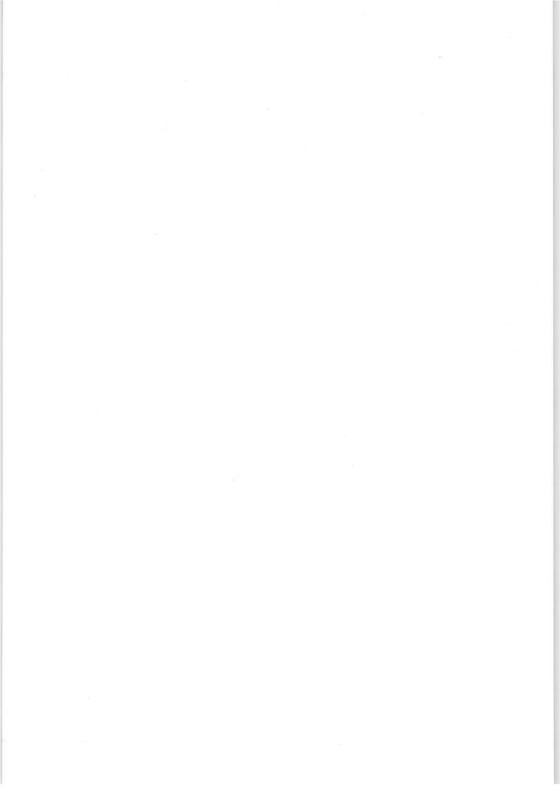
Fig.2

#### NOTES

- 1. For maximum tube life, the supply voltage should be kept as low as possible.
- 2. For Mn K $\alpha$  radiation (5.9 keV)
- 3.  $P = \text{average pulse height, } \Delta P = \text{width of pulse height at half maximum value.}$



Typical energy resolution curve



Halogen quenched cosmic ray guard counter tube for low background measurements in combination with radiation counter tube ZP1441 or ZP1451 in an anti-coincidence circuit.

#### QUICK REFERENCE DATA

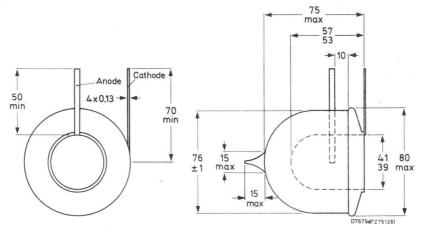
Dose rate range	$3 \times 10^{-4}$ to $3 \times 10^{-1}$	mGy/h	•
Plateau threshold voltage	800	V	
Plateau length	400	V	6
Recommended supply voltage	1000	V	
Chrome-iron cathode	760	mg/cm <sup>2</sup>	

This data must be read in conjunction with General Information Geiger-Müller tubes.

#### MECHANICAL DATA

Dimensions in mm

Fig.1



#### CATHODE AND ANODE

Thickness

Material

**FILLING** 

CAPACITANCE

Anode to cathode

760

chrome-iron

mg/cm<sup>2</sup>

neon, argon, halogen

8.0 pF

#### OPERATING CHARACTERISTICS (Ambient temperature ≈ 25 °C)

Measured	in	circui	t of	Fig.2	
----------	----	--------	------	-------	--

Weasured III Circuit of Fig.2			
Starting voltage	max.	650	V
Plateau threshold voltage	max.	800	V
Plateau length		400	V
Recommended supply voltage		1000	V
Plateau slope	max.	0.03	%/V
Background (shielded with 100 mm Fe with an inner liner of 30 mm Pb), at recommended supply voltage, Fe outside	max.	70	count/min
Dead time, at recommended supply voltage	max.	1000	μs
LIMITING VALUES (Absolute max. rating system)			
Anode resistor	min.	10	$\Omega$ M
Anode voltage	max.	1200	V
Ambient temperature continuous operating	max. min.	+70 -40	°C

#### LIFE EXPECTANCY

Life expectancy at  $\approx$  25  $^{o}\text{C}$ 

5 x 10<sup>10</sup> count

+75

max.

oc

-O +V<sub>supply 1</sub>
-O +V<sub>supply 2</sub>

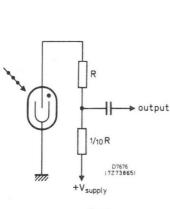
#### MEASURING CIRCUITS

For use as a guard counter tube in an anti-coincidence  $\,$  in combination with ZP1441 or ZP1451, see Fig.3.

$$R = 10 M\Omega$$

storage

$$R_1 = R_2 = 10 M\Omega$$



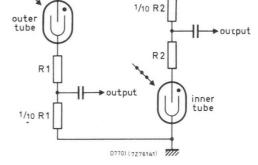
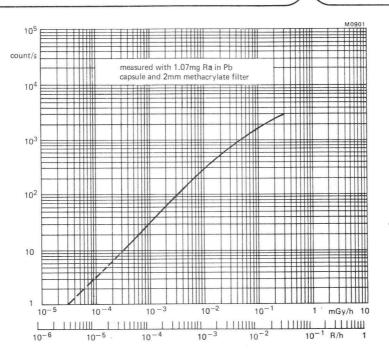
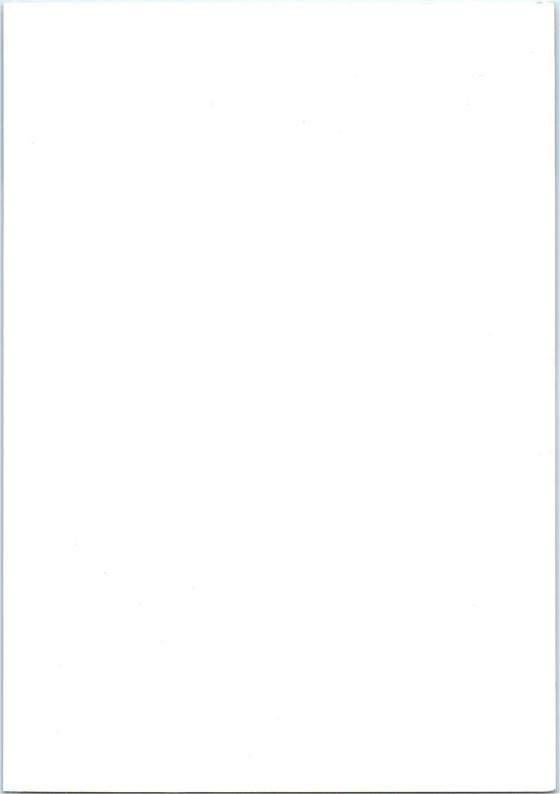


Fig.2

Fig.3



Typical counting rate as a function of dose rate



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