

PHILIPS

Data handbook



Electronic
components
and materials

Electron tubes

Book T6

1986

Geiger-Müller tubes

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GEIGER-MÜLLER TUBES

	<i>page</i>
Selection guide	1
General	
Cross-reference guide	6
Radiation units	8
General information	9
Device data	17

DATA HANDBOOK SYSTEM

Our Data Handbook System comprises more than 60 books with specifications on electronic components, subassemblies and materials. It is made up of four series of handbooks:

ELECTRON TUBES	BLUE
SEMICONDUCTORS	RED
INTEGRATED CIRCUITS	PURPLE
COMPONENTS AND MATERIALS	GREEN

The contents of each series are listed on pages iv to viii.

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

When ratings or specifications differ from those published in the preceding edition they are indicated with arrows in the page margin. Where application information is given it is advisory and does not form part of the product specification.

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ELECTRON TUBES (BLUE SERIES)

The blue series of data handbooks comprises:

- T1** Tubes for r.f. heating
- T2a** Transmitting tubes for communications, glass types
- T2b** Transmitting tubes for communications, ceramic types
- T3** Klystrons
- T4** Magnetrons for microwave heating
- T5** Cathode-ray tubes
Instrument tubes, monitor and display tubes, C.R. tubes for special applications
- T6** Geiger-Müller tubes
- T8** Colour display systems
Colour TV picture tubes, colour data graphic display tube assemblies, deflection units
- T9** Photo and electron multipliers
- T10** Plumbicon camera tubes and accessories
- T11** Microwave semiconductors and components
- T12** Vidicon and Newvicon camera tubes
- T13** Image intensifiers and infrared detectors
- T15** Dry reed switches
- T16** Monochrome tubes and deflection units
Black and white TV picture tubes, monochrome data graphic display tubes, deflection units

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The red series of data handbooks comprises:

- S1 Diodes**
Small-signal silicon diodes, voltage regulator diodes ($< 1,5 \text{ W}$), voltage reference diodes, tuner diodes, rectifier diodes
- S2a Power diodes**
- S2b Thyristors and triacs**
- S3 Small-signal transistors**
- S4a Low-frequency power transistors and hybrid modules**
- S4b High-voltage and switching power transistors**
- S5 Field-effect transistors**
- S6 R.F. power transistors and modules**
- S7 Surface mounted semiconductors**
- S8a Light-emitting diodes**
- S8b Devices for optoelectronics**
Optocouplers, photosensitive diodes and transistors, infrared light-emitting diodes and infrared sensitive devices, laser and fibre-optic components
- S9 Power MOS transistors**
- S10 Wideband transistors and wideband hybrid IC modules**
- S11 Microwave transistors**
- S12 Surface acoustic wave devices**
- S13 Semiconductor sensors**

INTEGRATED CIRCUITS (PURPLE SERIES)

The purple series of data handbooks comprises:

EXISTING SERIES

Superseded by:

IC1	Bipolar ICs for radio and audio equipment	IC01N
IC2	Bipolar ICs for video equipment	IC02Na and IC02Nb
IC3	ICs for digital systems in radio, audio and video equipment	IC01N, IC02Na and IC02Nb
IC4	Digital integrated circuits CMOS HE4000B family	
IC5	Digital integrated circuits — ECL ECL10 000 (GX family), ECL100 000 (HX family), dedicated designs	IC08N
IC6	Professional analogue integrated circuits	IC03N and Supplement to IC11N
IC7	Signetics bipolar memories	
IC8	Signetics analogue circuits	IC11N
IC9	Signetics TTL logic	IC09N and IC15N
IC10	Signetics Integrated Fuse Logic (IFL)	IC13N
IC11	Microprocessors, microcomputers and peripheral circuitry	IC14N

NEW SERIES

IC01N	Radio, audio and associated systems Bipolar, MOS	(published 1985)
IC02Na	Video and associated systems Bipolar, MOS Types MAB8031AH to TDA1524A	(published 1985)
IC02Nb	Video and associated systems Bipolar, MOS Types TDA2501 to TEA1002	(published 1985)
IC03N	Integrated circuits for telephony	(published 1985)
IC04N	HE4000B logic family CMOS	
IC05N	HE4000B logic family — incased ICs CMOS	(published 1984)
IC06N*	High-speed CMOS; PC74HC/HCT/HCU Logic family	(published 1986)
IC07N	High-speed CMOS; PC54/74HC/HCT/HCU — uncased ICs Logic family	
IC08N	ECL 10K and 100K logic families	(published 1984)
IC09N	TTL logic series	(published 1986)
IC10N	Memories MOS, TTL, ECL	
IC11N	Linear LSI	(published 1985)
Supplement to IC11N	Linear LSI	(published 1986)
IC12N	Semi-custom gate arrays & cell libraries ISL, ECL, CMOS	
IC13N	Semi-custom Integrated Fuse Logic	(published 1985)
IC14N	Microprocessors, microcontrollers & peripherals Bipolar, MOS	(published 1985)
IC15N	FAST TTL logic series	(published 1984)

Note

Books available in the new series are shown with their date of publication.

* Supersedes the IC06N 1985 edition and the Supplement to IC06N issued Autumn 1985.

COMPONENTS AND MATERIALS (GREEN SERIES)

The green series of data handbooks comprises:

- C1 **Programmable controller modules**
PLC modules, PC20 modules
- C2 **Television tuners, coaxial aerial input assemblies, surface acoustic wave filters**
- C3 **Loudspeakers**
- C4 **Ferroxcube potcores, square cores and cross cores**
- C5 **Ferroxcube for power, audio/video and accelerators**
- C6 **Synchronous motors and gearboxes**
- C7 **Variable capacitors**
- C8 **Variable mains transformers**
- C9 **Piezoelectric quartz devices**
- C10 **Connectors**
- C11 **Varistors, thermistors and sensors**
- C12 **Potentiometers, encoders and switches**
- C13 **Fixed resistors**
- C14 **Electrolytic and solid capacitors**
- C15 **Ceramic capacitors**
- C16 **Permanent magnet materials**
- C17 **Stepping motors and associated electronics**
- C18 **Direct current motors**
- C19 **Piezoelectric ceramics**
- C20 **Wire-wound components for TVs and monitors**
- C21* **Assemblies for industrial use**
HNIL FZ/30 series, NORbits 60-, 61-, 90-series, input devices
- C22 **Film capacitors**

* To be issued shortly.

SELECTION GUIDE

SELECTION GUIDE

Cylindrical tubes

type number	sensitive			counting rate	sensitive length mm	plateau threshold V	max. plateau length V	max. plateau slope %/V	max. dead time μs	background shielded count/min	dose rate range mGy/h
	for			at 10 ⁻² mGy/h ¹							
	α	β	γ	(¹³⁷ Cs) count/s							
ZP1200		●		28	40	400	200	0.04	90	10	10 ⁻³ – 10 ²
ZP1201 ³		●		20	40	400	200	0.04	110	10	10 ⁻³ – 40
ZP1210		●		110	140	400	100	0.15	200	70	3 × 10 ⁻⁴ – 10
ZP1220		●		180	240	400	100	0.15	210	90	2 × 10 ⁻⁴ – 3
ZP1250	●	●		10 ²	0.5	420	80	0.40	10	1	1 – 3 × 10 ⁵
ZP1300		●		300 ²	8	500	100	0.30	11	1	10 ⁻¹ – 2 × 10 ⁴
ZP1301 ³		●		350 ²	8	500	100	0.30	13	1	10 ⁻¹ – 2 × 10 ⁴
ZP1302 ³		●		350 ²	8	500	100	0.30	13	9	10 ⁻¹ – 2 × 10 ⁴
ZP1310		●		1600 ²	16	500	150	0.15	15	2	2 × 10 ⁻² – 4 × 10 ³
ZP1313 ³		●		1600 ²	16	500	150	0.15	15	2	10 ⁻² – 3 × 10 ³
ZP1320	○	●		9	28	500	150	0.08	45	12	3 × 10 ⁻³ – 2 × 10 ²
ZP1321 ²	○	●		9	28	500	150	0.08	45	12	3 × 10 ⁻³ – 10 ²
ZP1330	○	●		65	75	450	350	0.02	70	30	6 × 10 ⁻⁴ – 10

Window tubes

type number	sensitive for			counting rate at 10 ⁻² mGy/h (¹³⁷ Cs) ¹	window ϕ/type	plateau threshold	max. plateau length	max. plateau slope	max. dead time	background shielded	dose rate range
	α	β	γ	count/s	mm	V	V	%/V	μs	count/min	mGy/h
ZP1400	●	●	●	25	9 c	400	200	0.04	90	10	10 ⁻³ – 10
ZP1401	●	●	○	25	9 a	400	200	0.04	90	10	10 ⁻³ – 10
ZP1410	●	●	○	32	19.8 a	450	250	0.02	175	15	10 ⁻³ – 10
ZP1430	●	●	○	44	27.8 a	450	250	0.04	190	25	6 × 10 ⁻⁴ – 6
ZP1431	●	●	○	44	27.8 c	450	250	0.04	190	25	6 × 10 ⁻⁴ – 6
ZP1441	●	●	○	16	19.8 a	500	200	0.09	65	5	3 × 10 ⁻³ – 10 ²
ZP1442	●	●	○	16	19.8 c	500	200	0.09	65	8	3 × 10 ⁻³ – 10 ²
ZP1451	●	●	○	29	27.8 a	500	250	0.07	60	9	10 ⁻³ – 20
ZP1452	●	●	○	29	27.8 c	500	250	0.07	60	18	10 ⁻³ – 20
ZP1470	●	●	●	38	24.1 b	550	150	0.15	70	25	10 ⁻³ – 20
ZP1480	●	●	○	24	17 d	400	100	0.20	120	30	10 ⁻³ – 20
ZP1481	●	●	○	24	17 d	400	100	0.20	120	30	10 ⁻³ – 20
ZP1490	●	●	●	29	28 a	450	250	0.05	30	15	10 ⁻³ – 20

- Notes
- 1R = 8.69 mGy
 - Counting rate at 10 mGy
 - With compensating filter

Window thickness (mg/cm²)

- a: 1.5 to 2.0 d: 2.5 to 3.0
b: 1.5 to 2.5 e: 2.5 to 3.5
c: 2.0 to 3.0 f: 3.5 to 4.0

X-ray sensitive tubes

type number	sensitive for α β γ	counting rate at 10^{-2} mGy/h ¹ (¹³⁷ Cs) count/s	window ϕ /type mm	plateau threshold V	max. plateau length V	max. plateau slope %/V	max. dead time μ s	background shielded count/min	dose rate range mGy/h
ZP1600	6.0 – 20*	660	19.8 e	1600	400	0.07	110	25	—
ZP1610	2.5 – 40*	—	7 x 18 f	—	operating voltage 1550 V				—

*keV

Cosmic ray guard tube

ZP1700	•	—	—	800	400	0.03	1000	70	3×10^{-4} – 3×10^{-1}
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High temperature tubes

type number	sensitive for α β γ	counting rate at 10^{-2} mGy/h ¹ (¹³⁷ Cs) count/s	sensitive length mm	plateau threshold V	max. plateau length V	max. plateau slope %/V	max. dead time μ s	background shielded count/min	dose rate range mGy/h
ZP1800	•	190	419	700	150	0.08	75	28	2×10^{-4} – 4
ZP1810	•	13	51	650	250	0.08	75	25	3×10^{-3} – 40
ZP1820	•	110	203	450	250	0.06	100	65	3×10^{-4} – 4
ZP1830	•	170	313	450	250	0.06	100	100	2×10^{-4} – 2
ZP1840	•	8	32	850	200	0.08	50	15	4×10^{-3} – 10^2
ZP1850	• •	36	89	875	200	0.10	100	50	10^{-3} – 20
ZP1860	• •	80	22	875	200	0.10	100	75	4×10^{-4} – 4

- Notes
- 1R = 8.69 mGy
 - Counting rate at 10 mGy
 - With compensating filter

Window thickness (mg/cm²)

- a: 1.5 to 2.0 d: 2.5 to 3.0
b: 1.5 to 2.5 e: 2.5 to 3.5
c: 2.0 to 3.0 f: 3.5 to 4.0



GENERAL

GEIGER-MÜLLER TUBES CROSS REFERENCE GUIDE

ZP type no.	185 type no.	MX type no.	US type no.
ZP1200	18503	MX146	—
ZP1210	18520	MX120/01	—
ZP1220	18545	MX145	—
ZP1230*†	—	MX180	—
ZP1240*†	—	MX119	—
ZP1300	18529	MX163	—
ZP1310	18509	MX151	—
ZP1311*††	—	MX189	—
ZP1311*††	—	ZP1100	—
ZP1320	18550	MX164	—
ZP1330	18555	MX177	—
ZP1400	18504	MX147	—
ZP1410	18505	MX148	—
ZP1430	18526	MX169	—
ZP1431	18506	MX149	—
ZP1441	18515	MX152	—
ZP1451	18536	MX166	—
ZP1460*†	18546/01	MX167/01	—
ZP1470	—	MX123	—
ZP1480	—	MX168/02	—
ZP1481	—	MX168	—
ZP1500*†	—	ZP1083	—
ZP1501*†	—	ZP1080	—
ZP1520*†	18525	MX124/01	—
ZP1530*†	—	MX142	—
ZP1600	18507	MX159	—
ZP1610	18511	MX161	—
ZP1700	18518	MX155	—
ZP1800	—	—	171G
ZP1810	—	—	181G2
ZP1820	—	—	78L
ZP1830	—	—	79L
ZP1840	—	—	560N
ZP1850	—	—	90NB3
ZP1860	—	—	912NB3

* data available on request

† obsolete

†† obsolescent

GEIGER-MÜLLER TUBES CROSS REFERENCE GUIDE

185 type no.	ZP type no.
18503	ZP1200
18504	ZP1400
18505	ZP1410
18506	ZP1431
18507	ZP1600
18509	ZP1310
18511	ZP1610
18515	ZP1441
18518	ZP1700
18520	ZP1210
18525	ZP1520*†
18526	ZP1430
18529	ZP1300
18536	ZP1451
18548	ZP1220
18546/01	ZP1460*†
18550	ZP1320
18555	ZP1330

MX type no.	ZP type no.
MX119	ZP1240*†
MX120/01	ZP1210
MX123	ZP1470
MX124/01	ZP1520*†
MX142	ZP1530*†
MX145	ZP1220
MX146	ZP1200
MX147	ZP1400
MX148	ZP1410
MX149	ZP1431
MX151	ZP1320
MX152	ZP1441
MX155	ZP1700
MX159	ZP1600
MX161	ZP1610
MX163	ZP1300
MX164	ZP1320
MX166	ZP1451
MX167/01	ZP1460*†
MX168	ZP1481
MX168/02	ZP1480
MX169	ZP1430
MX177	ZP1330
MX180	ZP1230*†
MX189	ZP1311*††
ZP1080	ZP1501*†
ZP1083	ZP1500*†
ZP1100	ZP1311*††

US type no.	ZP type no.
171G	ZP1800
181G2	ZP1810
78L	ZP1820
79L	ZP1830
560N	ZP1840
90NB3	ZP1850
912NB3	ZP1860

* data available on request

† obsolete

†† obsolescent

RADIATION QUANTITIES AND UNITS

In previous issues of this handbook, the (exposure) dose rate has been given as röntgen/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

$$1 \text{ Gy} = 1 \text{ J/kg in SI units}$$

Since an exposure of 1 R results in an energy deposition of $869 \times 10^{-5} \text{ J/kg}$ in air it follows that 1 R is equivalent to $869 \times 10^{-5} \text{ Gy}$ 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: $2.58 \times 10^{-4} \text{ C/kg}$
absorbed dose	rad	gray	$1 \text{ rad} = 10^{-2} \text{ J/kg}$ $1 \text{ Gy} = 1 \text{ J/kg}$ $= 100 \text{ rad}$ $1 \text{ mGy} = 100 \text{ mrad}$

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.
2. 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 anode resistor. 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.

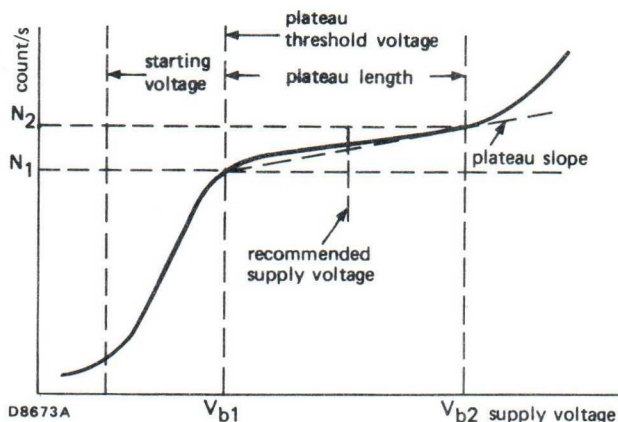


Fig.1

Plateau length: $V_{\text{plateau}} = V_{b2} - V_{b1}$ V

Plateau slope (over the plateau length):

$$\frac{N_2 - N_1}{0.5 (N_1 + N_2)} \times \frac{1}{V_{\text{plateau}}} \times 100 \quad \%/V$$

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

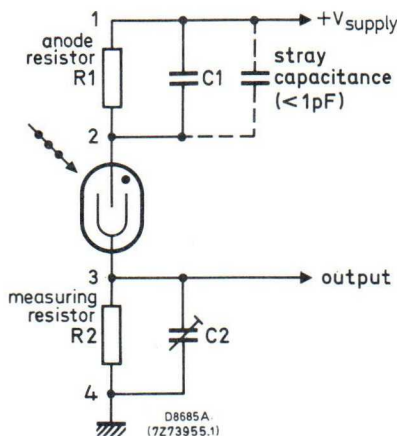


Fig.2

Notes:

1. The input resistance and capacitance of the measuring equipment are represented by R_2 and C_2 respectively.
2. When applying a rectangular pulse at 1 with the tube inserted but short-circuited, C_2 should be adjusted to give an undistorted pulse at 3. Under these conditions $R_1 \times (C_1 + \text{stray capacitance}) = R_2 \times C_2$.

4.3 Measuring circuit B

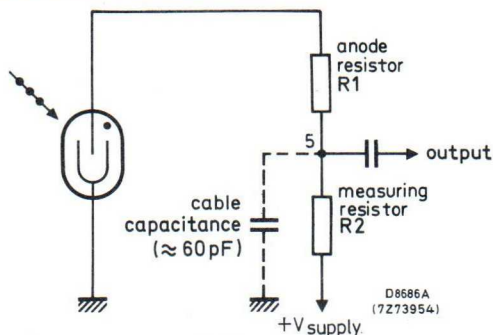


Fig.3

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

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:

$$P = b \times (V_{\text{supply}} - V_{\text{starting}})$$

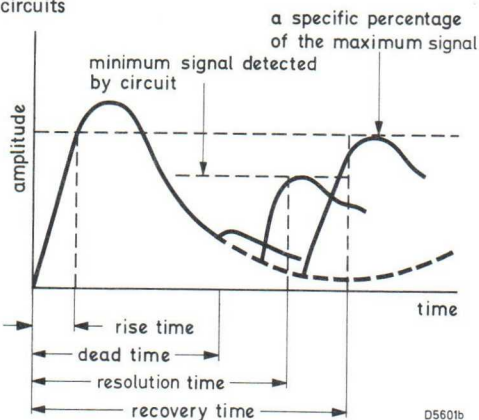
where P = pulse amplitude

$$b = \frac{R_2}{R_1 + R_2} \quad \text{See measuring circuits}$$

V_{supply} = anode supply voltage

V_{starting} = starting voltage

Fig.4



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 as high as 20 pF may **destroy** the tube, but lower values are also dangerous.

5.5 Maximum counting rate

The maximum counting rate is approximately $1/\tau$ (τ = 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 (τ). 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 $\tau = 20 \mu\text{s}$, 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.
3. Beta particles from contamination and impurities of the materials from which the detector itself is made.
4. 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 and are measured at room temperature. Deviation of 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 approximately $\pm 20\%$ may occur.

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.

NOTES (continued)

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.

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.

→ 5.14 Environmental

Tubes are submitted to shock and vibration tests. The values which are given for each tube are not limiting values.

→ 5.15 Temperature

The temperature range over which the tubes work satisfactorily is given for each type. When working at low temperatures it is recommended that the tube is operated in the first third of the plateau.

→ 5.16. Beta response.

This is measured using a point source ($^{90}\text{Sr}/^{90}\text{Y}$) in direct contact with the tube and an extended source ($^{90}\text{Sr}/^{90}\text{Y}$, area 10 cm^2) at a distance of 1 cm from the tube. For the point source the response is expressed in counts per second per Becquerel (c/s/Bq). For the extended source the response is expressed in counts per second per Becquerel/cm² (c/s/Bq cm⁻²). (One Becquerel is equivalent to one disintegration per second)

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 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 in a typical way.

7. 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.

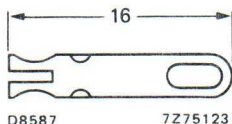


Fig.5

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.

9. OUTSIDE PRESSURE

In tubes provided with a mica window, the gas pressure outside the tube should neither be lower than 35 kPa (≈ 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. Also it should be noted that tubes should not be subjected to substantial changes in air pressure. ←

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.

Warning: generally, life end of a G.M. tube is indicated by an increasing slope and a shorter plateau. For older tubes, operation is recommended at the first third of the plateau. ←

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

NOTES (continued)

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

12. MAXIMUM BETA ABSORPTION (percentages)

source	max. β energy MeV	in mica window (mg/cm ²)			in metal envelope (mg/cm ²)		
		2	3	4	40	60	100
⁴² K	3.55	1	1	2	13	20	30
⁹⁰ Y + ⁹⁰ Sr	2.27	1	3	3	23	32	48
³² P	1.71	3	4	5	33	44	63
⁸⁹ Sr	1.46	3	4	5	40	51	70
²⁴ Na	1.39	3	5	6	41	53	73
¹⁰⁹ Pd	1.00	4	6	8	54	68	85
³⁶ Cl	0.71	7	10	13	72	84	95
¹³¹ I	0.61	8	11	15	77	90	97
²² Na	0.54	8	13	17	81	92	98
⁴⁶ Sc	0.36	15	22	27	94	99	100
⁶⁰ Co	0.31	20	26	34	97	100	100
⁹⁹ Tc	0.29	21	30	37	99	100	100
⁴⁵ Ca	0.25	24	33	42	100	100	100
³⁵ S	0.17	36	49	59	100	100	100
¹⁴ C	0.16	39	51	62	100	100	100
³ H	0.02	100	100	100	100	100	100
→ Geiger-Müller tube type numbers		ZP1401	ZP1400	ZP1461	ZP1320	ZP1330	ZP1300
		ZP1410	ZP1431		ZP1850		ZP1310
		ZP1430	ZP1442		ZP1860		
		ZP1441	ZP1452				
		ZP1451	ZP1470				
			ZP1480				
			ZP1481				

DEVICE DATA

GEIGER-MÜLLER TUBE

Halogen quenched γ radiation counter tube.

QUICK REFERENCE DATA

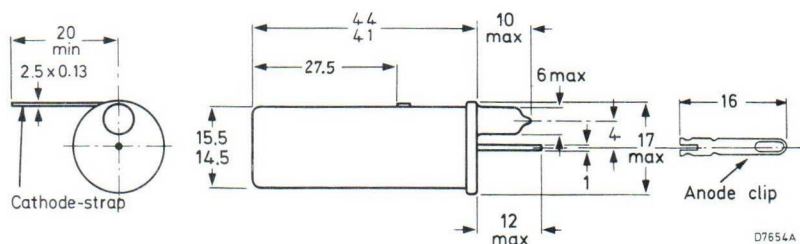
Dose rate range	10^{-3} to 10^2	mGy/h
	10^{-4} to 10	R/h
Plateau threshold voltage	400	V
Plateau length	200	V
Recommended supply voltage	500	V
Chrome-iron cathode	250	mg/cm ²

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

MECHANICAL DATA

Dimensions in mm

Fig.1



CATHODE

Thickness	250	mg/cm ²
Sensitive length	40	mm
Material	chrome-iron	

ENVIRONMENTAL (Manufacturer's test conditions)

Shock (half sine wave 3 ms duration) - peak acceleration	392	m/s ²
Vibration (50 Hz continues sine wave) - acceleration	24.5	m/s ²

FILLING

neon, argon, halogen

CAPACITANCE

Anode to cathode	1.1	pF
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TUBE WEIGHT

7	g
---	---

OPERATING CHARACTERISTICS (Ambient temperature $\approx 25^{\circ}\text{C}$)

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	$\text{M}\Omega$
Anode voltage	max.	600	V
Ambient temperature			
continuous operating	max.	+70	$^{\circ}\text{C}$
	min.	-40	$^{\circ}\text{C}$
storage	max.	+75	$^{\circ}\text{C}$

LIFE EXPECTANCY

Life expectancy at $\approx 25^{\circ}\text{C}$	5×10^{10}	count
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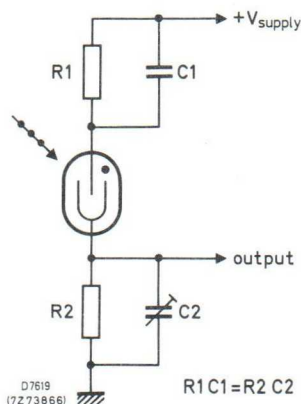
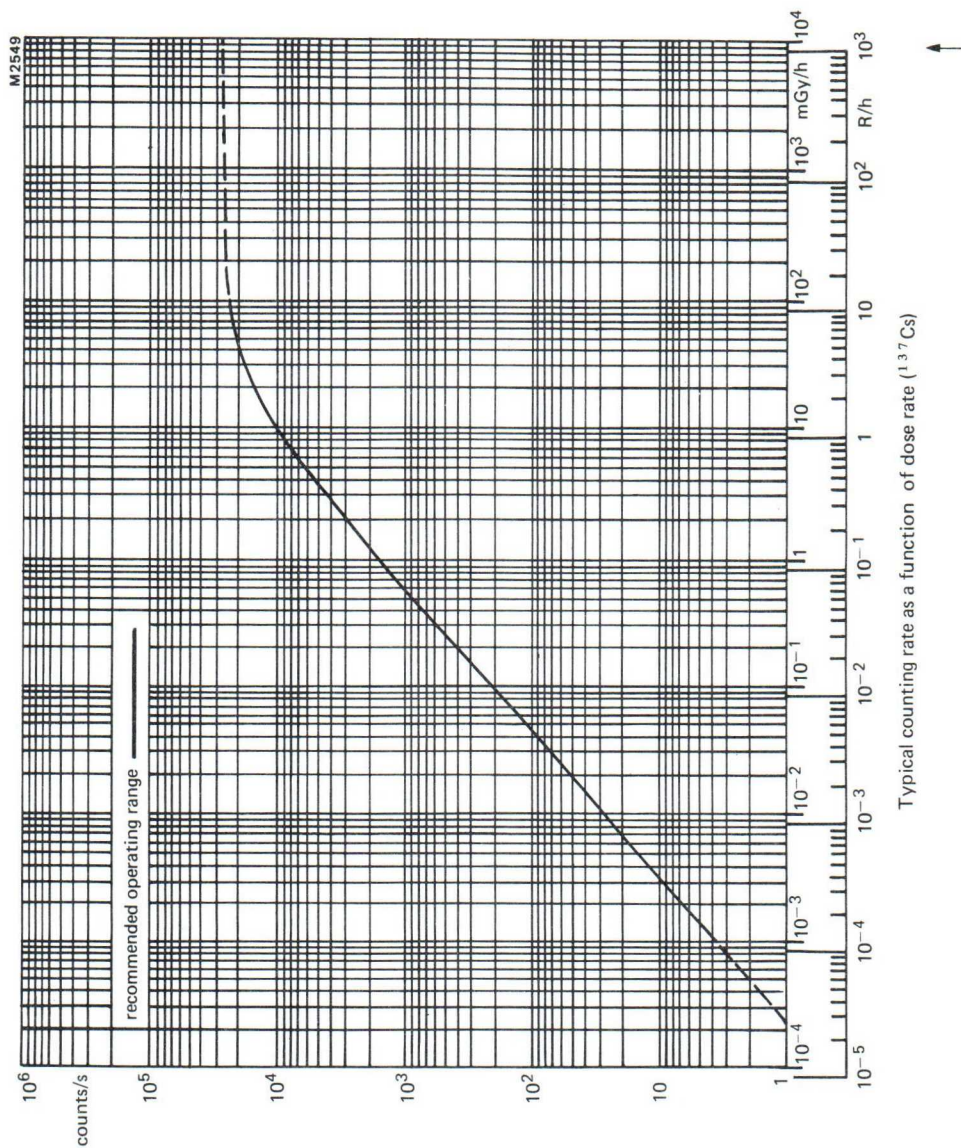
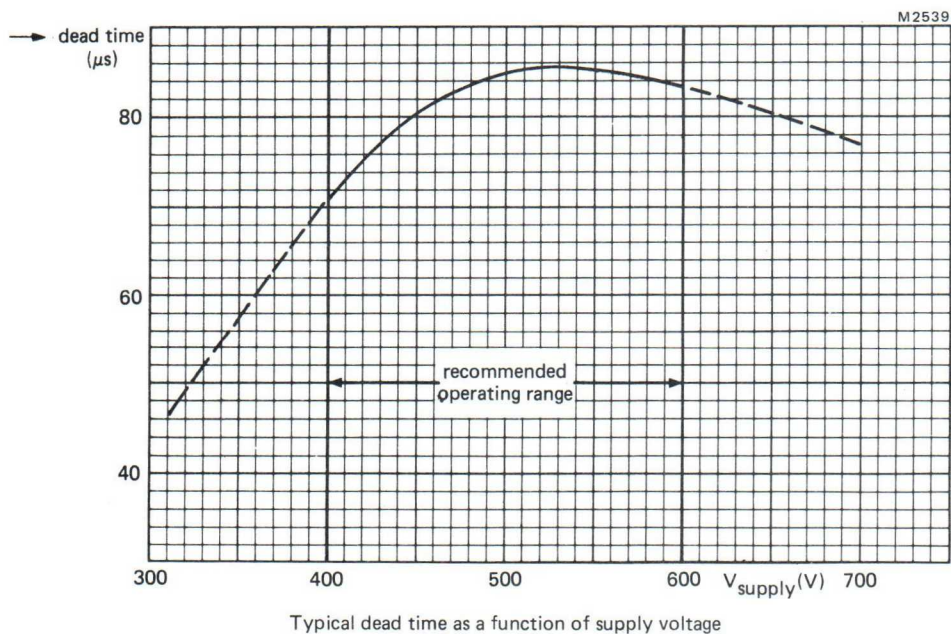
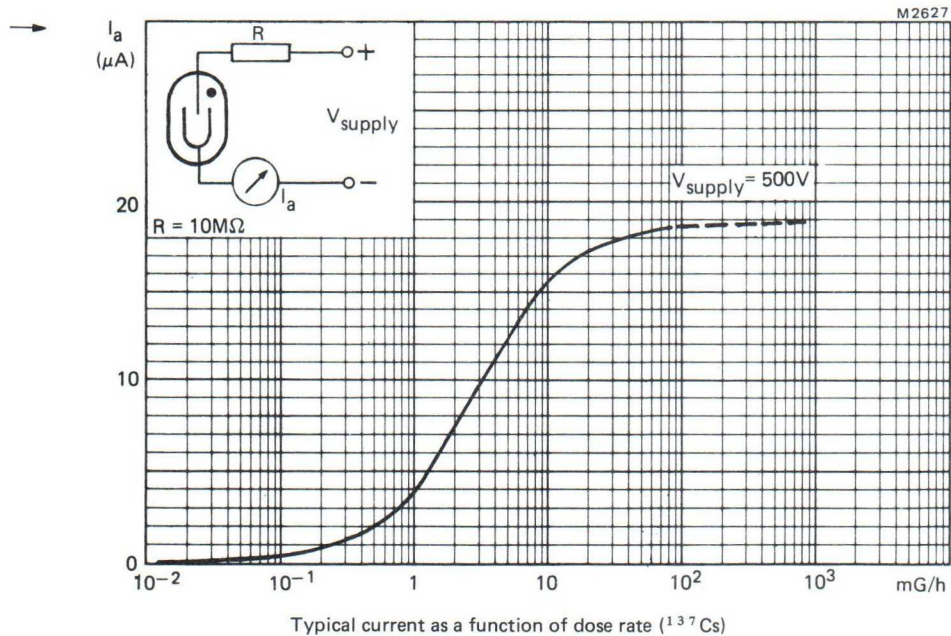
MEASURING CIRCUIT $R_1 = 10 \text{ M}\Omega$ $R_2 = 220 \text{ k}\Omega$ $C_1 = 1 \text{ pF}^*$ 

Fig.2

*See General Information (paragraph 5.5)





GEIGER-MÜLLER TUBE

Halogen quenched γ radiation counter tube fitted in a filter. The energy response is flat to within $\pm 25\%$ over the range 50 keV to 1.25 MeV referred to ^{137}Cs (661 keV). The ZP1201 is an energy compensated version of the ZP1200.

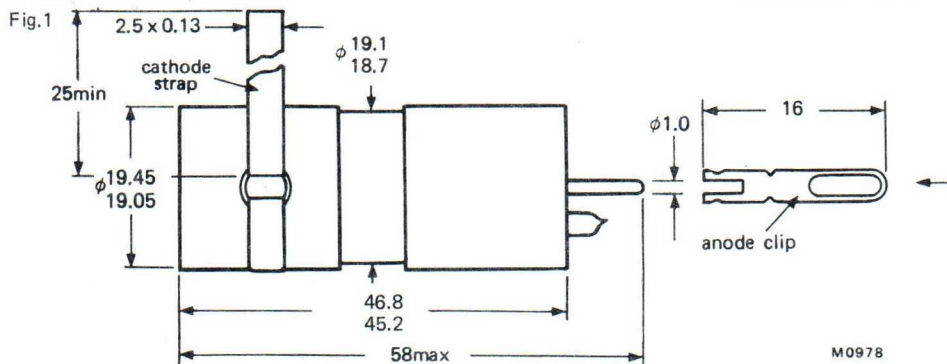
QUICK REFERENCE DATA

Dose rate range	10^{-3} to 40	mGy/h
	10^{-4} to 5	R/h
Plateau threshold voltage	400	V
Plateau length	200	V
Recommended supply voltage	500	V
Chrome-iron cathode	250	mg/cm ²

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

MECHANICAL DATA

Dimensions in mm



CATHODE (ZP1200)

Thickness	250	mg/cm ²
Sensitive length	40	mm
Material	chrome-iron	

ENVIRONMENTAL (Manufacturer's test conditions)

Shock (half sine wave 3 ms duration) — peak acceleration	392	m/s ²
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FILLING

neon, argon, halogen

CAPACITANCE

Anode to cathode	1.2	pF
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TUBE WEIGHT

38 g

OPERATING CHARACTERISTICS (Ambient temperature $\approx 25^{\circ}\text{C}$)

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.	110	μs

LIMITING VALUES (Absolute max. rating system)

Anode resistor	min.	4.7	$\text{M}\Omega$
Anode voltage	max.	600	V
Ambient temperature continuous operating	max.	+70	$^{\circ}\text{C}$
	min.	-40	$^{\circ}\text{C}$
storage	max.	+75	$^{\circ}\text{C}$

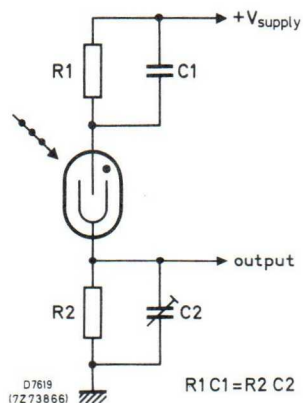
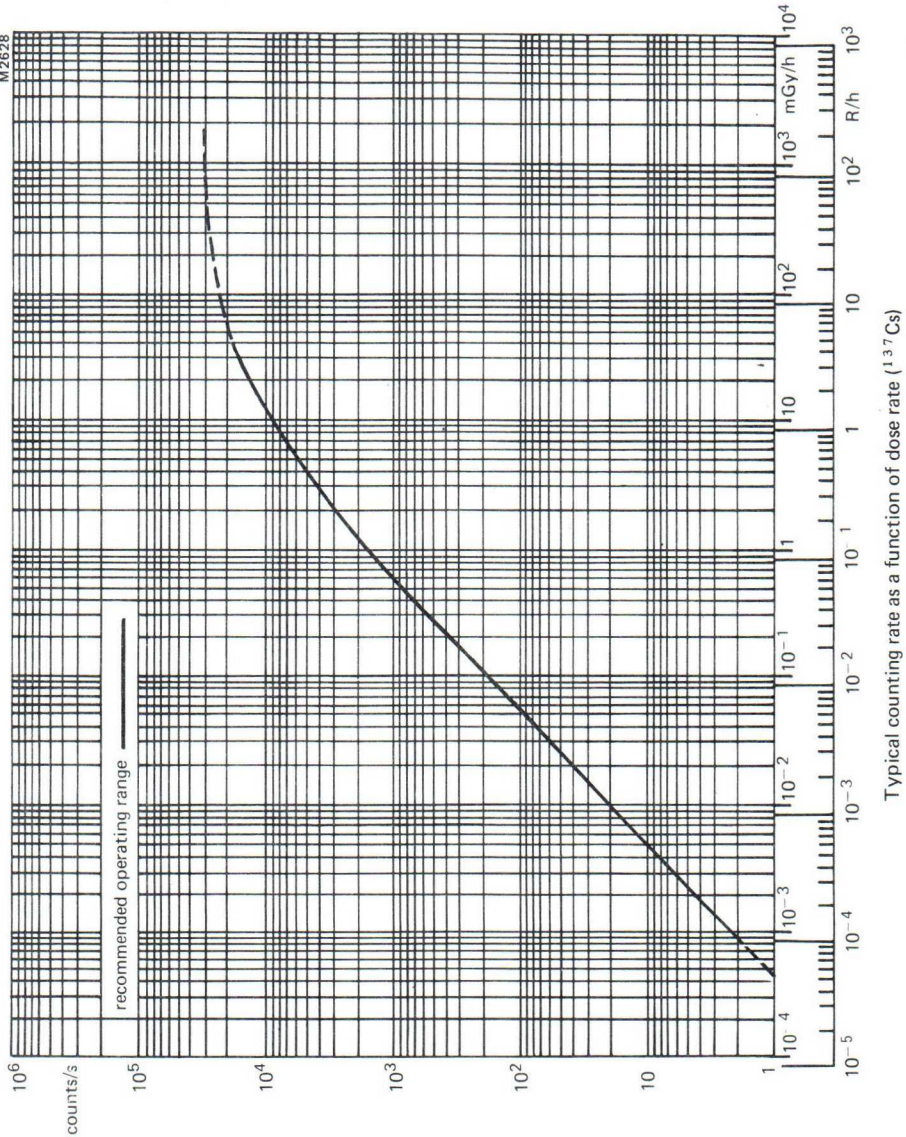
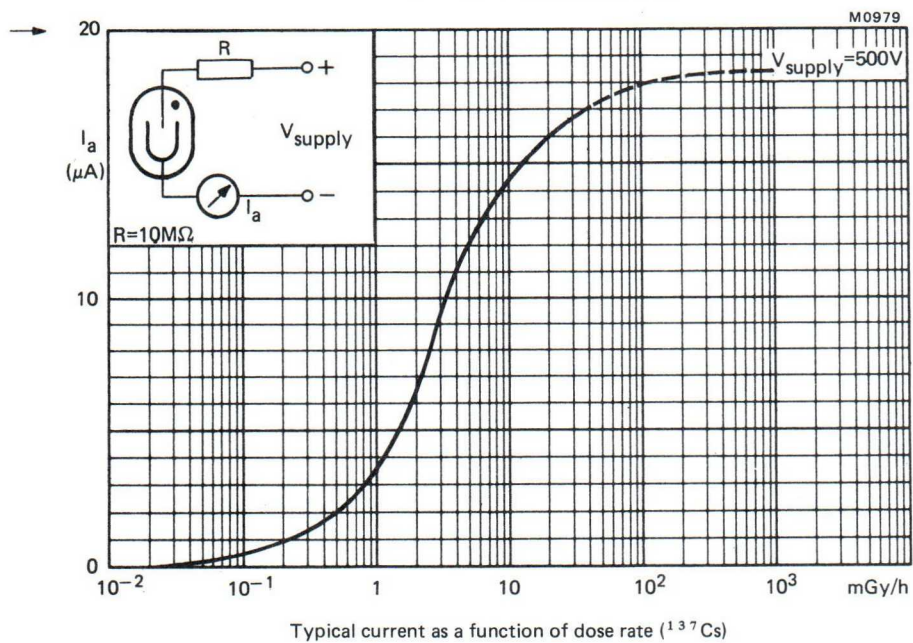
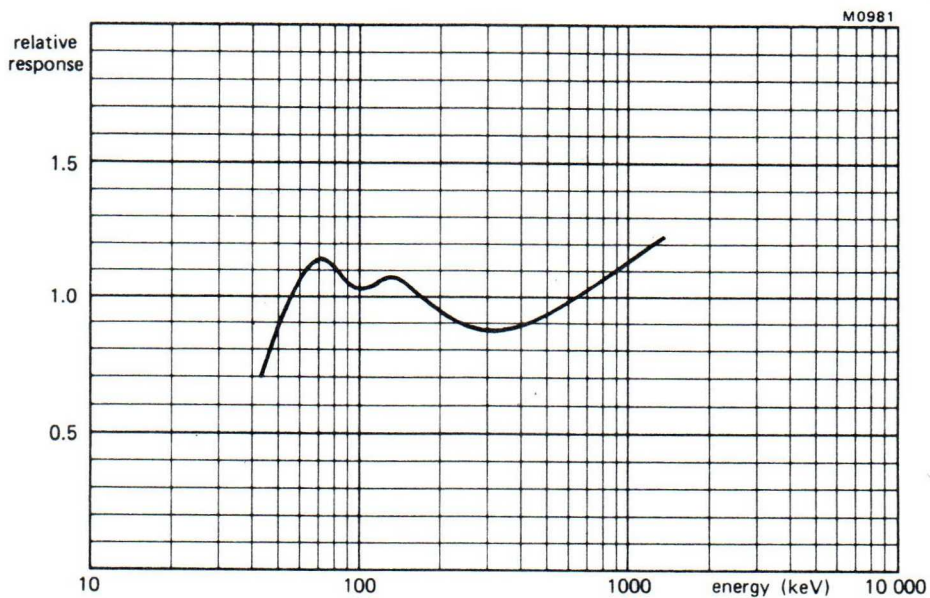
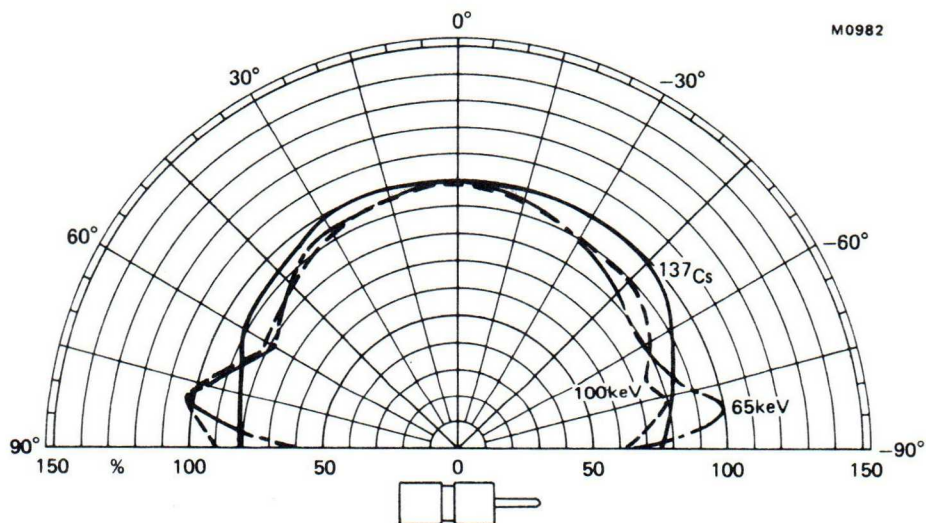
LIFE EXPECTANCYLife expectancy at $\approx 25^{\circ}\text{C}$ 5×10^{10} count**MEASURING CIRCUIT** $R_1 = 10 \text{ M}\Omega$ $R_2 = 220 \text{ k}\Omega$ $C_1 = 1 \text{ pF}^*$ 

Fig.2

*See General Information (paragraph 5.5)





Typical energy response relative to ^{137}Cs 

Typical polar responses (normalised to 100% at 0°)



GEIGER-MÜLLER TUBE

Halogen quenched γ radiation counter tube. Also available in low background version ZP1210/01.

QUICK REFERENCE DATA

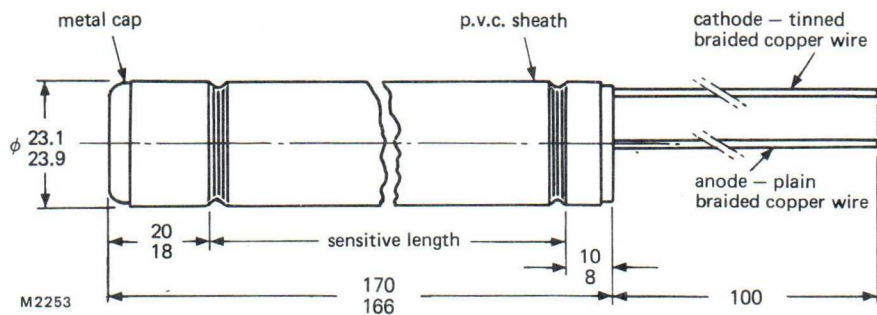
Dose rate range	3×10^{-4} to 10	mGy/h
	4×10^{-5} to 1	R/h
Plateau threshold voltage	400	V
Plateau length	100	V
Recommended supply voltage	450	V
Chrome-iron cathode	525	mg/cm ²

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/cm ²
Sensitive length	140	mm
Material	chrome-iron	

ENVIRONMENTAL (Manufacturer's test conditions)

Shock (half sine wave 3 ms duration) — peak acceleration	392	m/s ²
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FILLING

neon, argon, halogen

CAPACITANCE

Anode to cathode	4.5	pF
------------------	-----	----

TUBE WEIGHT

85	g
----	---

OPERATING CHARACTERISTICS (Ambient temperature $\approx 25^{\circ}\text{C}$)

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.	0.15	%/V
Background (shielded with 50 mm Pb with an inner liner of 3 mm Al), at recommended supply voltage	max.	70	count/min.
Dead time, at recommended supply voltage	max.	200	μs

LIMITING VALUES (Absolute max. rating system)

Anode resistor	min.	2.7	$\text{M}\Omega$
Anode voltage	max.	500	V
Ambient temperature			
continuous operating	max.	+70	$^{\circ}\text{C}$
	min.	-40	$^{\circ}\text{C}$
storage	max.	+75	$^{\circ}\text{C}$

LIFE EXPECTANCY

Life expectancy at $\approx 25^{\circ}\text{C}$	5×10^{10}	count
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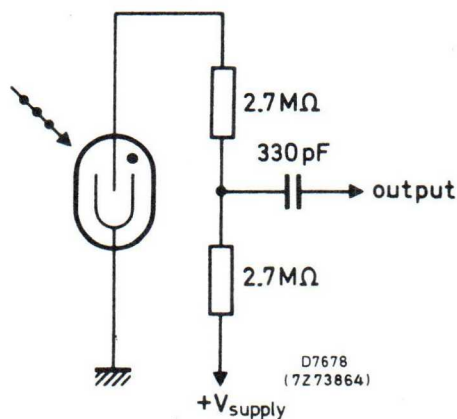
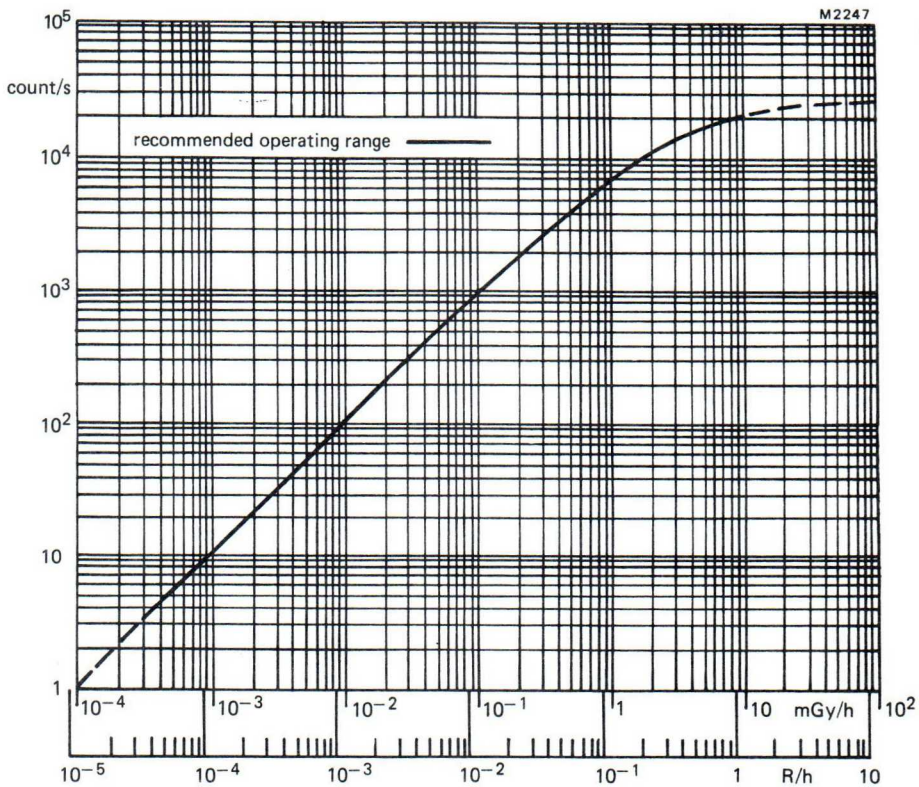
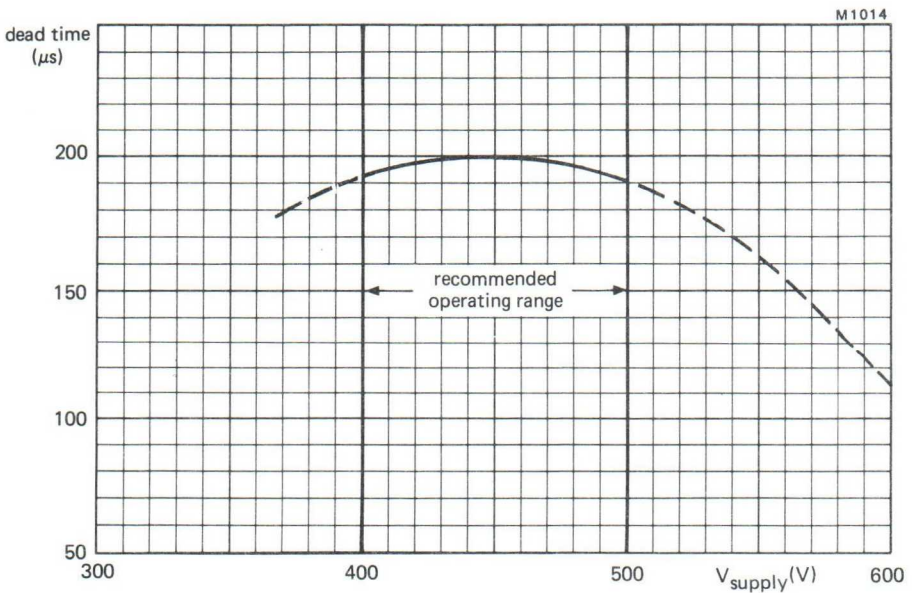
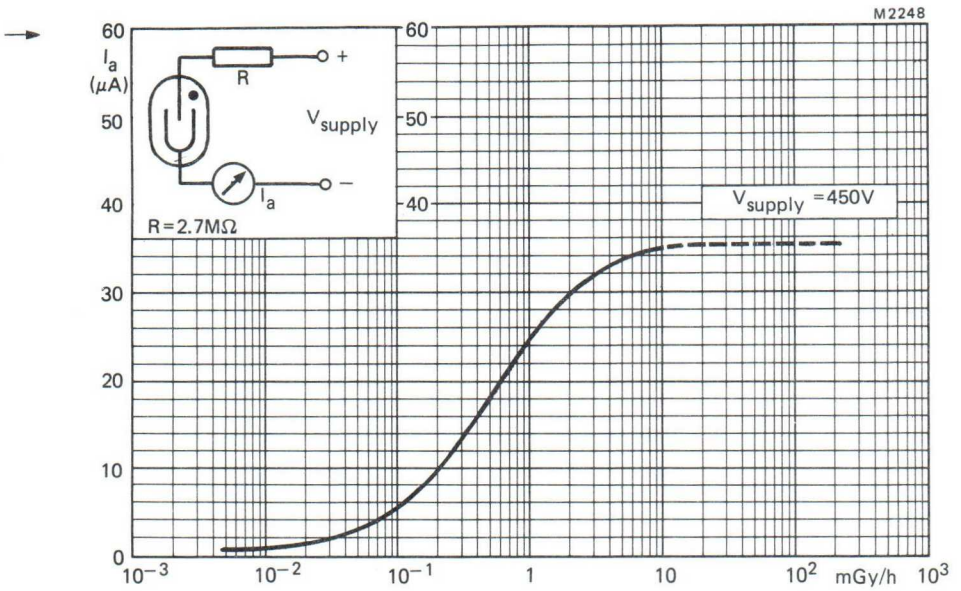
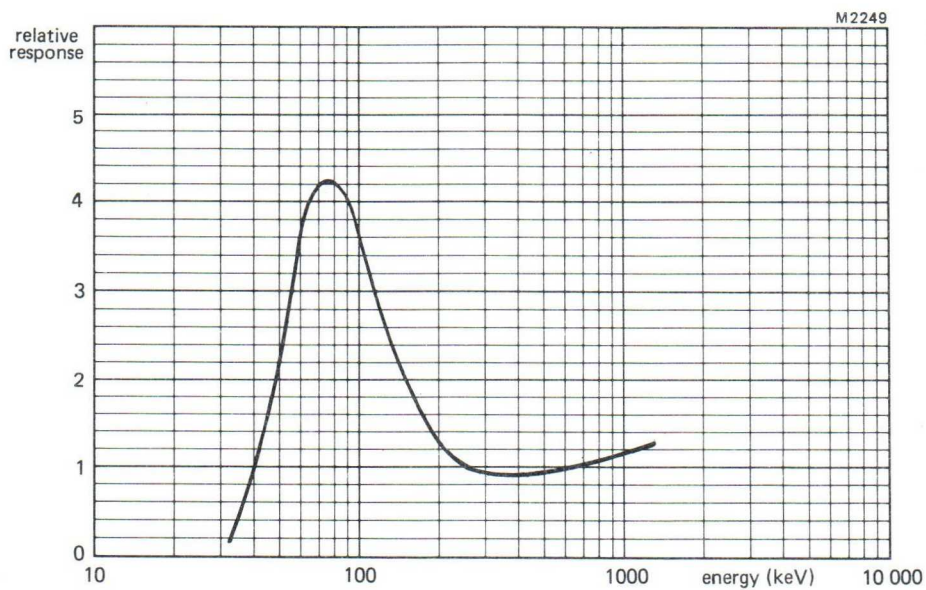
MEASURING CIRCUIT

Fig.2

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





Typical energy response relative to ^{137}Cs



GEIGER-MÜLLER TUBE

Halogen quenched γ radiation counter tube. Also available in low background version ZP1220/01. ←

QUICK REFERENCE DATA

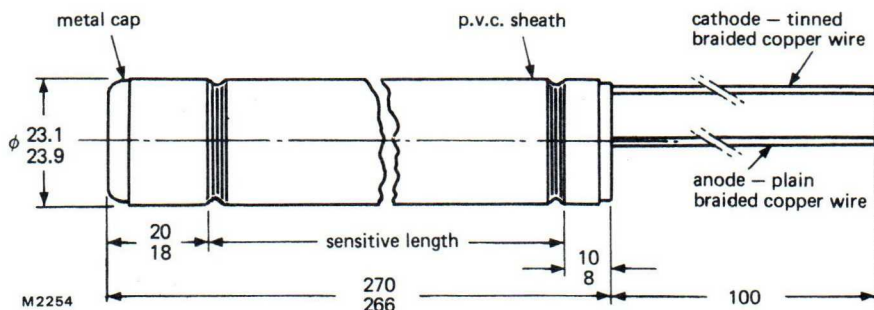
Dose rate range	2×10^{-4} to 3	mGy/h	←
	2×10^{-5} to 3×10^{-1}	R/h	
Plateau threshold voltage	400	V	
Plateau length	100	V	
Recommended supply voltage	450	V	
Chrome-iron cathode	525	mg/cm ²	

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/cm ²	←
Sensitive length	240	mm	
Material	chrome-iron		

ENVIRONMENTAL (Manufacturer's test conditions)

Shock (half sine wave 3 ms duration) — peak acceleration	392	m/s ²	
--	-----	------------------	--

FILLING

neon, argon, halogen

CAPACITANCE

Anode to cathode	10	pF	
------------------	----	----	--

TUBE WEIGHT

140	g	
-----	---	--

OPERATING CHARACTERISTICS (Ambient temperature $\approx 25^{\circ}\text{C}$)

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.	0.15	%/V
Background (shielded with 50 mm Pb with an inner liner of 3 mm Al), at recommended supply voltage	max.	90	count/min.
Dead time, at recommended supply voltage	max.	210	μs

LIMITING VALUES (Absolute max. rating system)

Anode resistor	min.	2.7	$\text{M}\Omega$
Anode voltage	max.	500	V
Ambient temperature			
continuous operating	max.	+70	$^{\circ}\text{C}$
	min.	-40	$^{\circ}\text{C}$
storage	max.	+75	$^{\circ}\text{C}$

LIFE EXPECTANCY

Life expectancy at $\approx 25^{\circ}\text{C}$	5×10^{10}	count
---	--------------------	-------

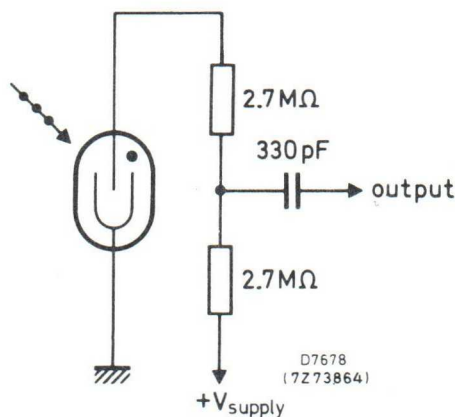
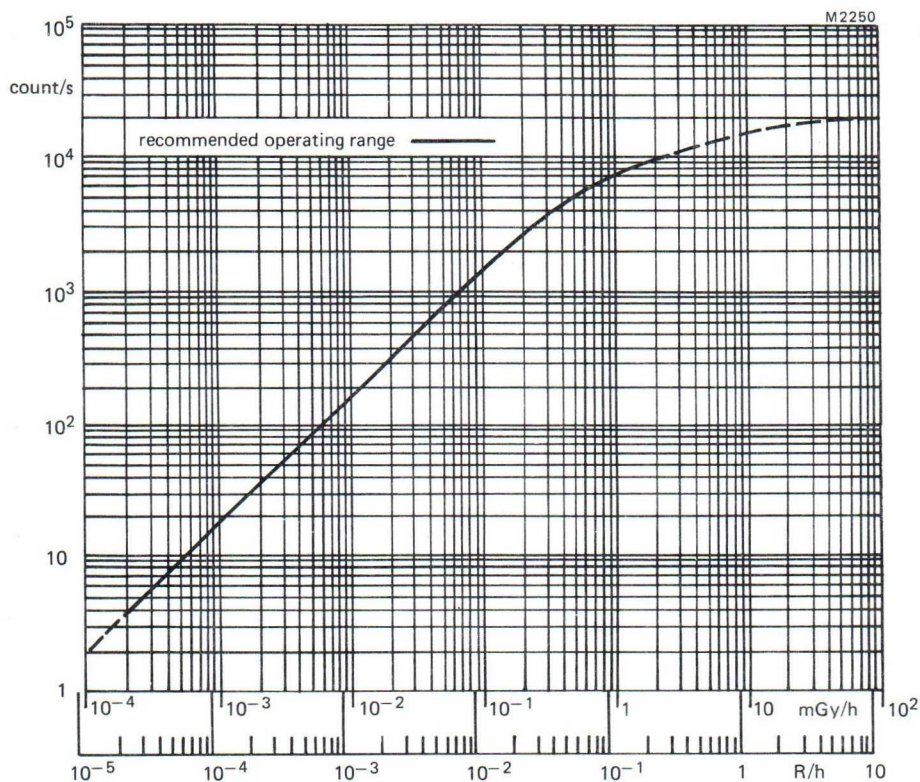
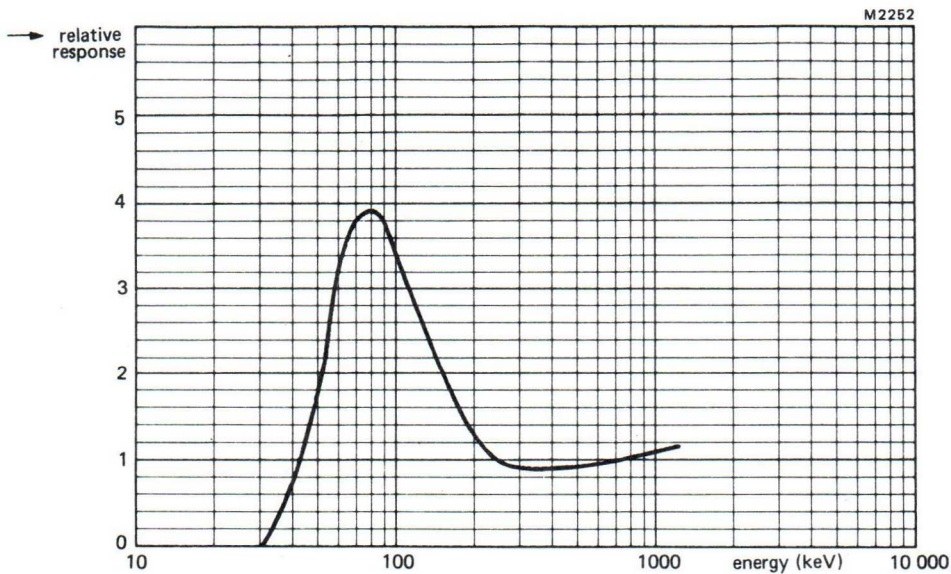
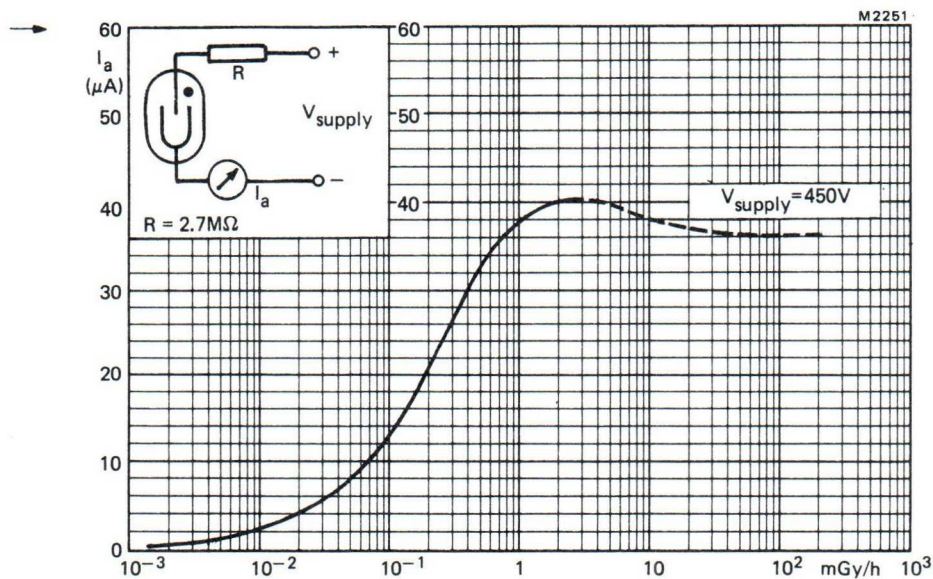
MEASURING CIRCUIT

Fig.2

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



GEIGER-MÜLLER TUBE

Halogen quenched γ and high energy β (> 0.5 MeV) radiation counter tube.

QUICK REFERENCE DATA

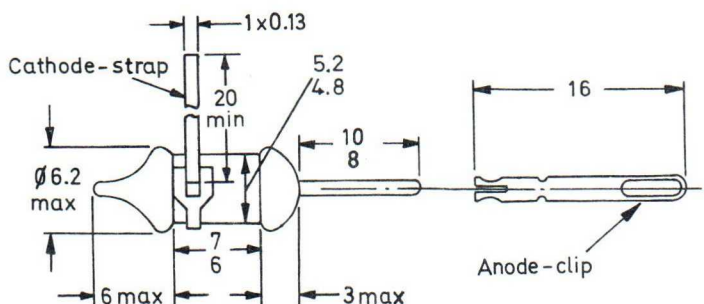
Dose rate range	10^{-1} to 2×10^4	mGy/h
	10^{-2} to 2×10^3	R/h
Plateau threshold voltage	500	V
Plateau length	100	V
Recommended supply voltage	550	V
Chrome-iron cathode	80 to 100	mg/cm ²

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 ²
Sensitive length	7	mm
Material	chrome-iron	

ENVIRONMENTAL (Manufacturer's test conditions)

Shock (half sine wave 3 ms duration) — peak acceleration	392	m/s ²
Vibration (50 Hz continuous sine wave) - acceleration	49	m/s ²

FILLING

helium, neon, halogen

CAPACITANCE

Anode to cathode	0.7	pF
------------------	-----	----

TUBE WEIGHT

0.5	g
-----	---

OPERATING CHARACTERISTICS (Ambient temperature $\approx 25^{\circ}\text{C}$)

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 Al), at recommended supply voltage	max.	1	count/min
Dead time, at recommended supply voltage	max.	11	μs

LIMITING VALUES (Absolute max. rating system)

Anode resistor	min.	2.2	$\text{M}\Omega$
Anode voltage	max.	600	V
Ambient temperature continuous operating	max.	+70	$^{\circ}\text{C}$
	min.	-40	$^{\circ}\text{C}$
storage	max.	+75	$^{\circ}\text{C}$

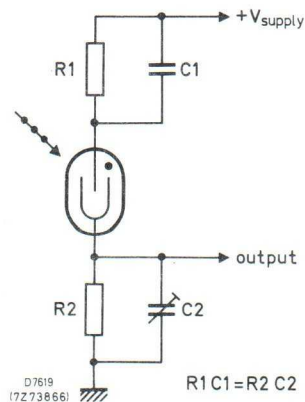
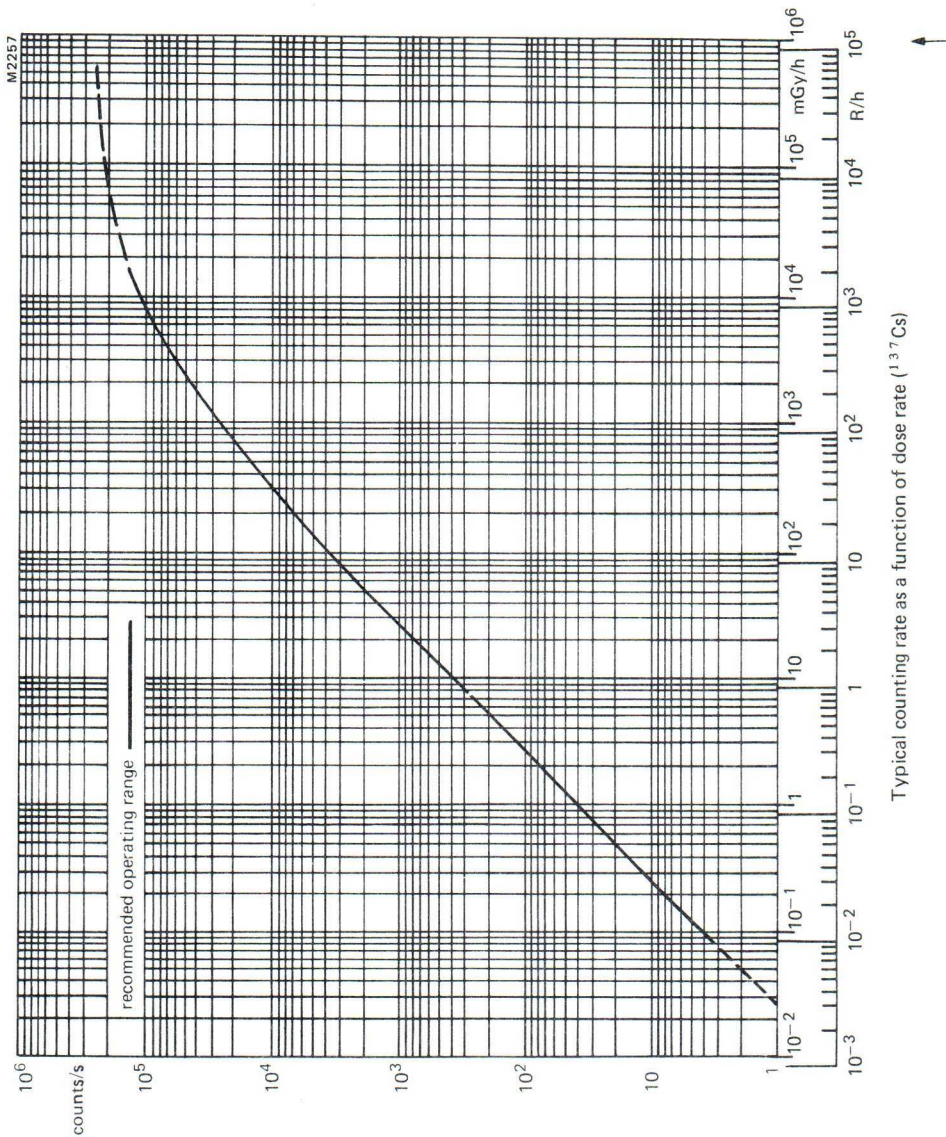
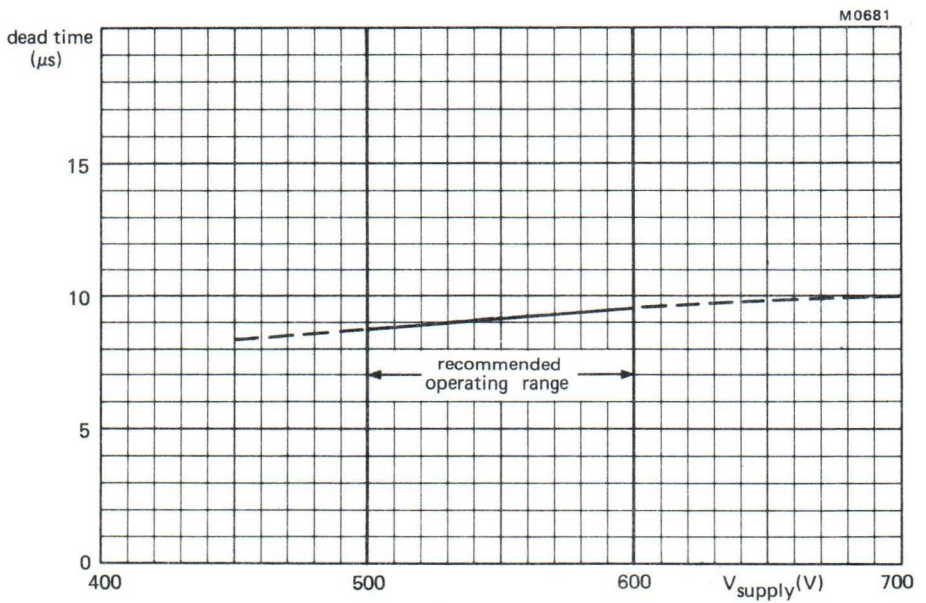
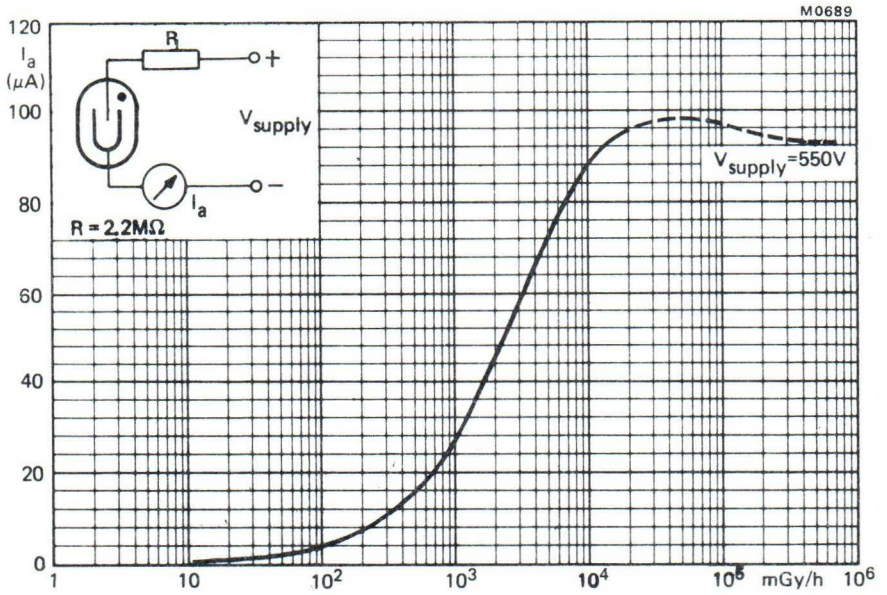
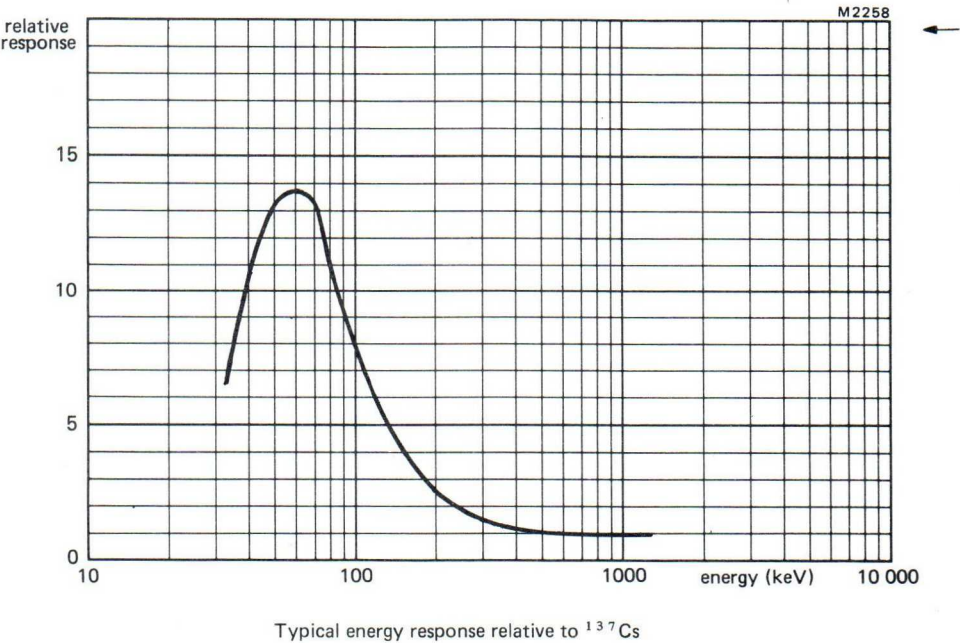
LIFE EXPECTANCY→ Life expectancy at $\approx 25^{\circ}\text{C}$ 5×10^{10} count**MEASURING CIRCUIT** $R_1 = 2.2 \text{ M}\Omega$ $R_2 = 47 \text{ k}\Omega$ $C_1 = 1 \text{ pF}^*$ 

Fig.2

*See General Information (paragraph 5.5)









GEIGER-MÜLLER TUBE

Halogen quenched γ radiation counter tube fitted in a filter. The energy response is flat to within $\pm 15\%$ over the range 80 keV to 1.25 MeV referred to ^{137}Cs (661 keV). The ZP1301 is an energy compensated version of the ZP1300. Also available with long life artificial background as ZP1302.

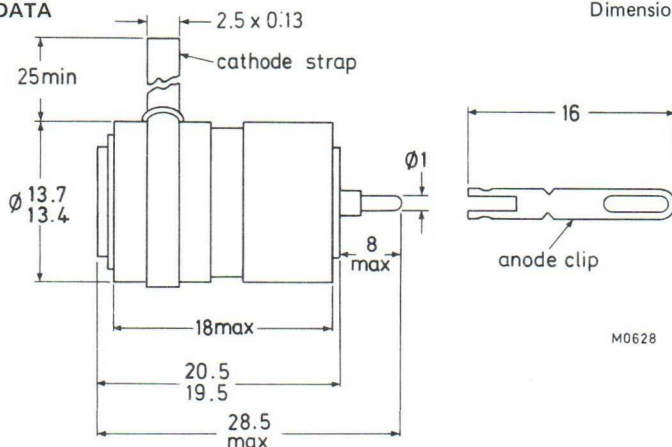
QUICK REFERENCE DATA

Dose rate range	10^{-1} to 2×10^4	mGy/h
	10^{-2} to 2×10^3	R/h
Plateau threshold voltage	500	V
Plateau length	100	V
Recommended supply voltage	550	V
Chrome-iron cathode	80 to 100	mg/cm ²

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

MECHANICAL DATA

Dimensions in mm



note: cathode strap should be connected to the tube as shown

CATHODE (ZP1300)

Thickness	80 to 100	mg/cm ²
Sensitive length	8	mm
Material	chrome iron	

ENVIRONMENTAL (Manufacturer's test conditions)

Shock (half sine wave 3 ms duration) — peak acceleration	392	m/s ²
--	-----	------------------

FILLING

helium, neon, halogen

CAPACITANCE

Anode to cathode	0.95	pF
------------------	------	----

TUBE WEIGHT

20	g
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OPERATING CHARACTERISTICS (Ambient temperature $\approx 25^{\circ}\text{C}$)

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 Al) 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	$\text{M}\Omega$
Anode voltage	max.	600	V
Ambient temperature	max.	+70	$^{\circ}\text{C}$
continuous operating	min.	-40	$^{\circ}\text{C}$
storage	max.	+75	$^{\circ}\text{C}$

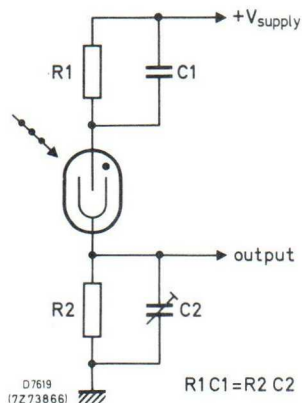
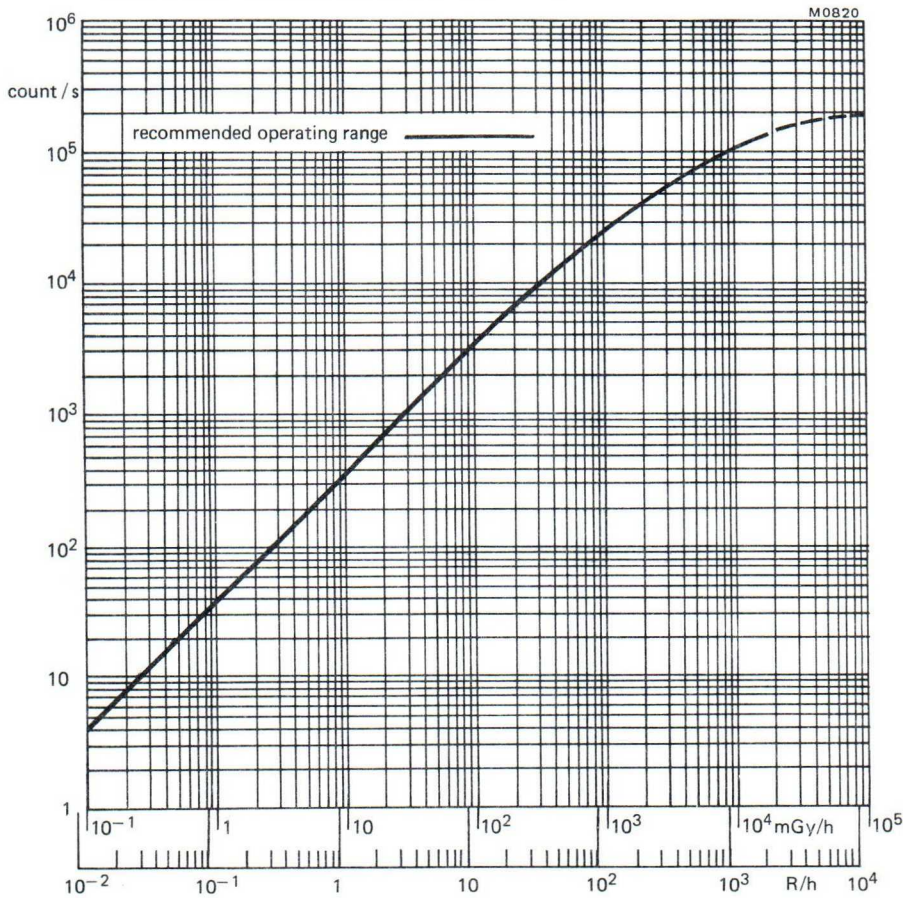
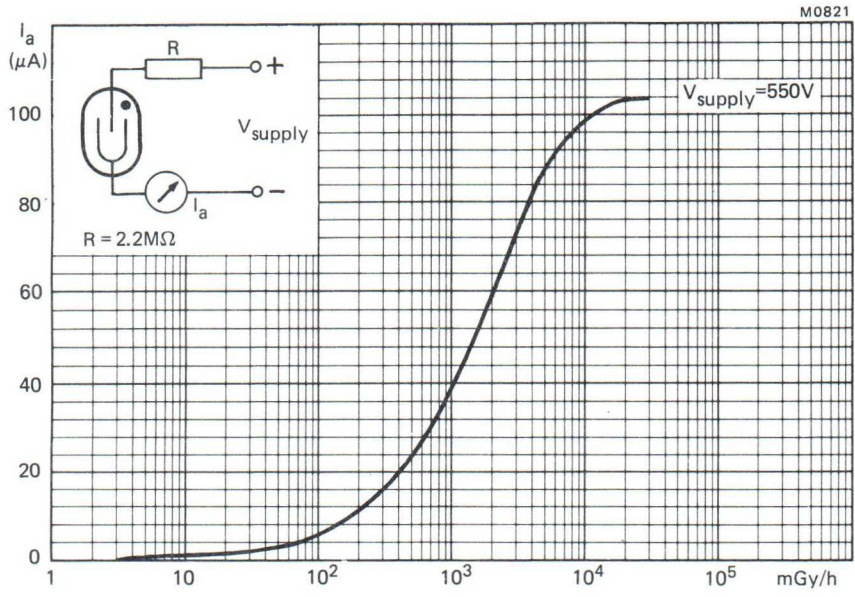
LIFE EXPECTANCY→ Life expectancy at $\approx 25^{\circ}\text{C}$ 5×10^{10} count**MEASURING CIRCUIT** $R_1 = 2.2 \text{ M}\Omega$ $R_2 = 47 \text{ k}\Omega$ $C_1 = 1 \text{ pF}^*$ 

Fig.2

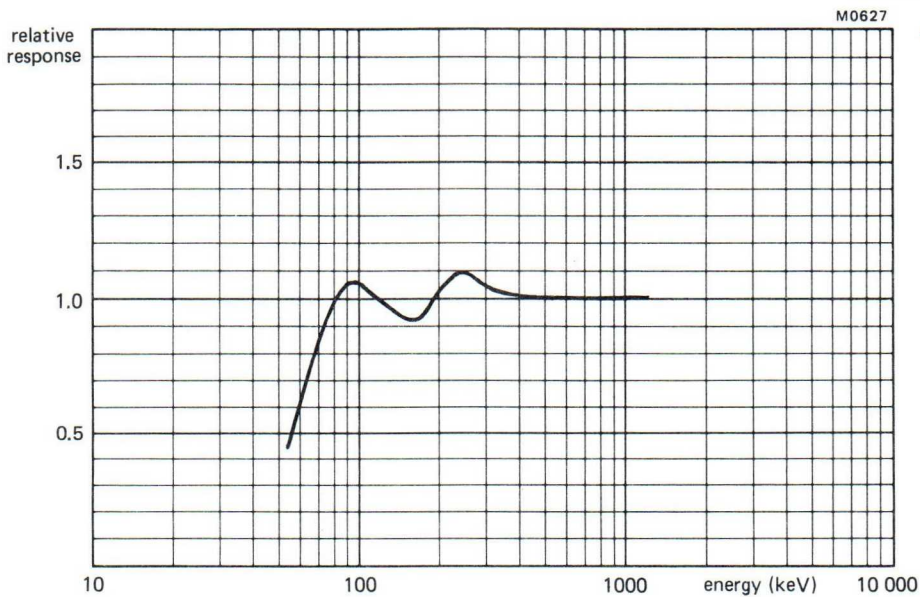
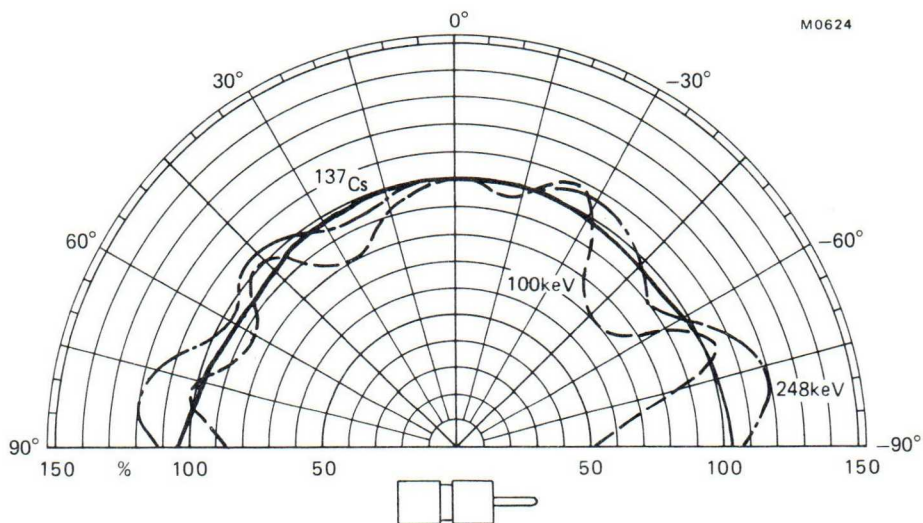
*See General Information
(paragraph 5.5)



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



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

Typical energy response relative to ^{137}Cs 

Typical polar responses (normalised to 100% at 0°)

GEIGER-MÜLLER TUBE

Halogen quenched γ and high energy β (> 0.5 MeV) radiation counter tube

QUICK REFERENCE DATA

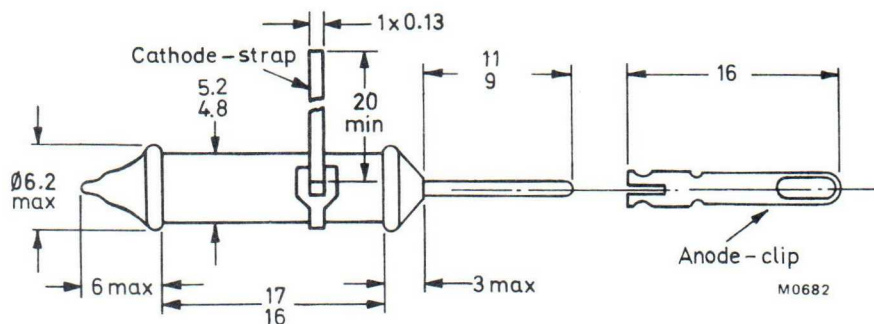
Dose rate range	2×10^{-2} to 4×10^3	mGy/h
	2×10^{-3} to 5×10^2	R/h
Plateau threshold voltage	500	V
Plateau length	150	V
Recommended supply voltage	575	V
Chrome-iron cathode	80 to 100	mg/cm ²

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 ²
Sensitive length	16	mm
Material	chrome-iron	

ENVIRONMENTAL (Manufacturer's test conditions)

Shock (half sine wave 3 ms duration) — peak acceleration	392	m/s ²
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FILLING

helium, neon, halogen

CAPACITANCE

Anode to cathode	1.2	pF
------------------	-----	----

TUBE WEIGHT

0.7	g
-----	---

OPERATING CHARACTERISTICS (Ambient temperature $\approx 25^\circ\text{C}$)

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.	0.15	%/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	μs

LIMITING VALUES (Absolute max. rating system)

Anode resistor	min.	2.2	$\text{M}\Omega$
Anode voltage	max.	650	V
Ambient temperature			
continuous operating	max.	+70	$^\circ\text{C}$
	min.	-40	$^\circ\text{C}$
storage	max.	+75	$^\circ\text{C}$

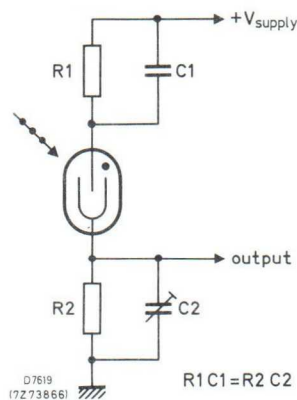
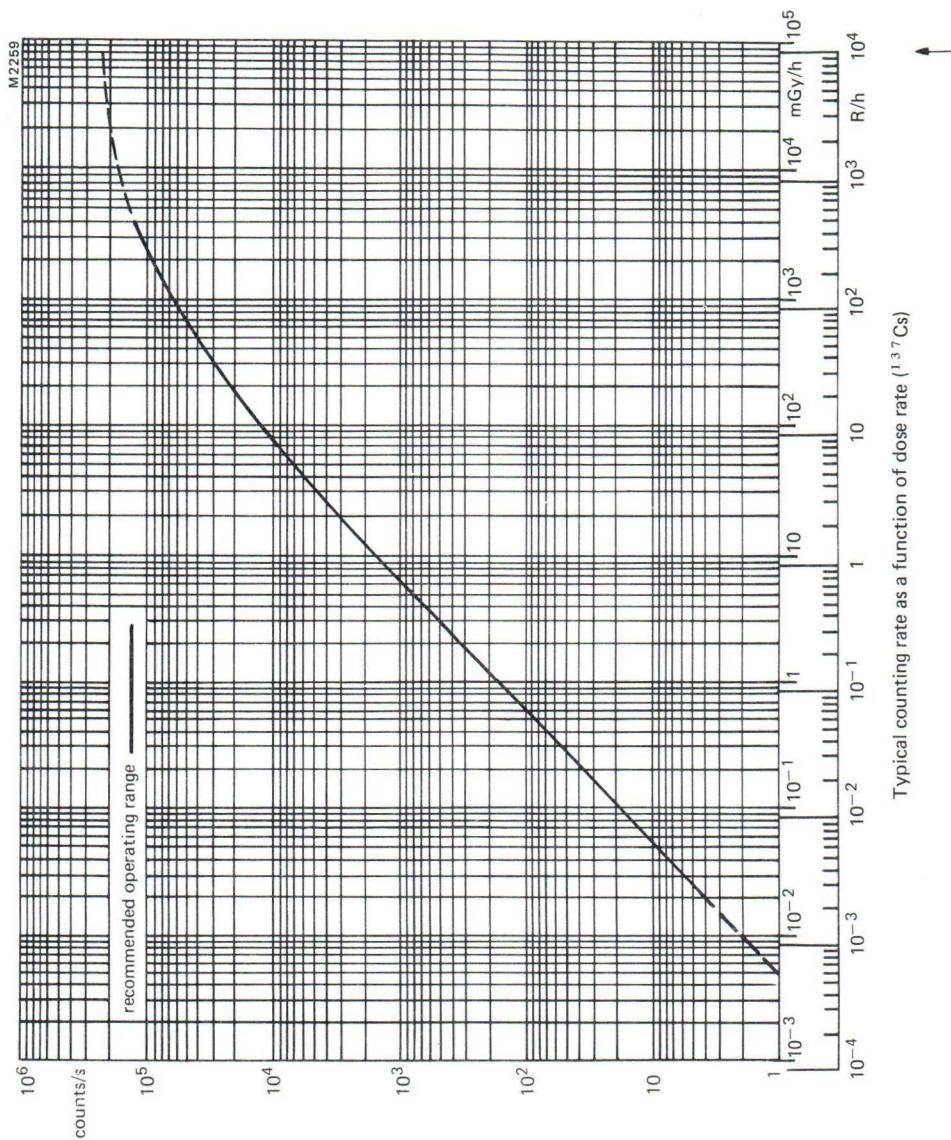
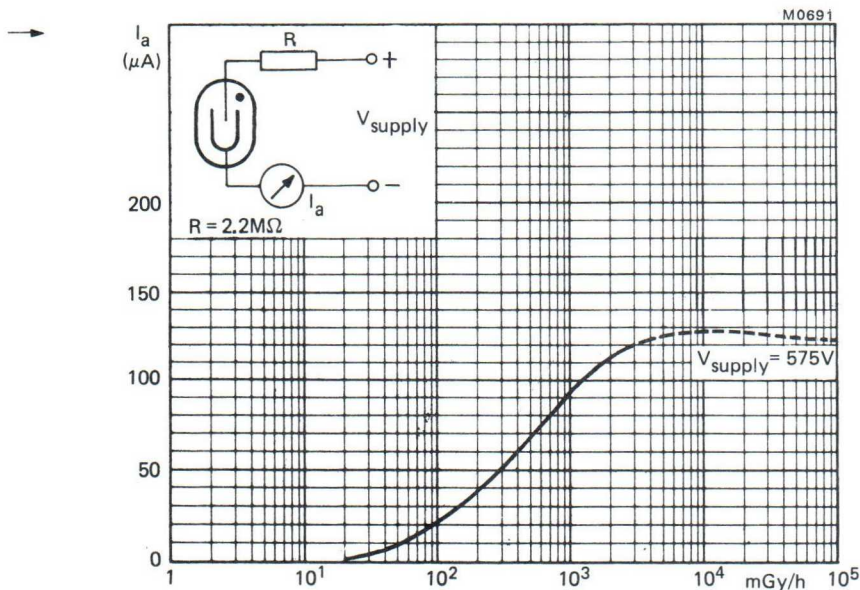
LIFE EXPECTANCYLife expectancy at $\approx 25^\circ\text{C}$ -
 5×10^{10} count**MEASURING CIRCUIT** $R_1 = 2.2 \text{ M}\Omega$ $R_2 = 47 \text{ k}\Omega$ $C_1 = 1 \text{ pF}^*$ 

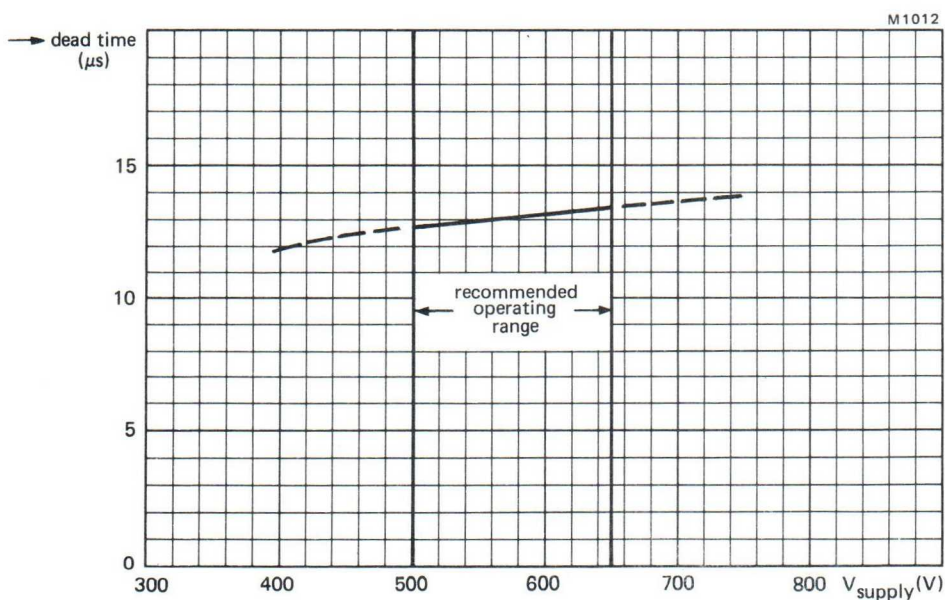
Fig.2

*See General Information (paragraph 5.5)

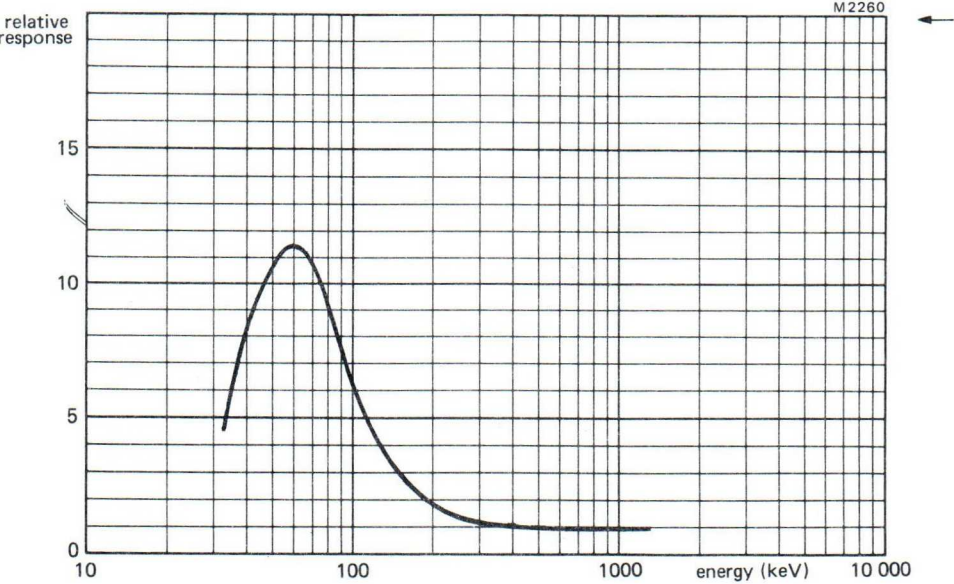




Typical current as a function of dose rate (^{137}Cs)



Typical dead time as a function of supply voltage



Typical energy response relative to ^{137}Cs



GEIGER-MÜLLER TUBE

Halogen quenched γ 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

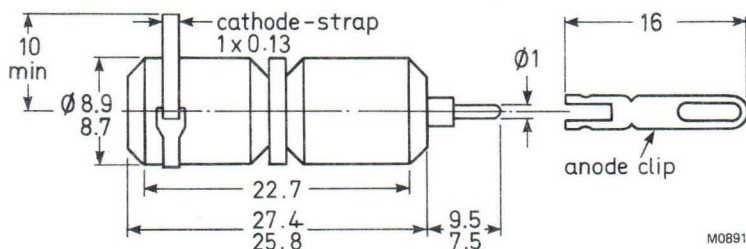
Dose rate range	10^{-2} to 3×10^3	mGy/h
	10^{-3} to 4×10^2	R/h
Plateau threshold voltage	500	V
Plateau length	150	V
Recommended supply voltage	575	V
Chrome-iron cathode	80 to 100	mg/cm ²

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

MECHANICAL DATA

Dimensions in mm

Fig.1



note: cathode strap should be connected to the tube as shown

CATHODE (ZP1310)

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

ENVIRONMENTAL (Manufacturer's test conditions)

Shock (half sine wave 3 ms duration) — peak acceleration	392	m/s ²
--	-----	------------------

FILLING

helium, neon, halogen

CAPACITANCE

Anode to cathode	2.0	pF
------------------	-----	----

TUBE WEIGHT

	7.0	g
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OPERATING CHARACTERISTICS (Ambient temperature $\approx 25^{\circ}\text{C}$)

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.	0.15	%/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	μs

LIMITING VALUES (Absolute max, rating system)

Anode resistor	min.	2.2	$\text{M}\Omega$
Anode voltage	max.	650	V
Ambient temperature continuous operating	max.	+70	$^{\circ}\text{C}$
	min.	-40	$^{\circ}\text{C}$
storage	max.	+75	$^{\circ}\text{C}$

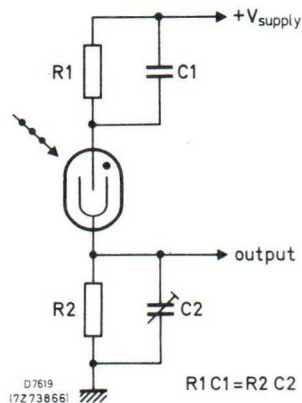
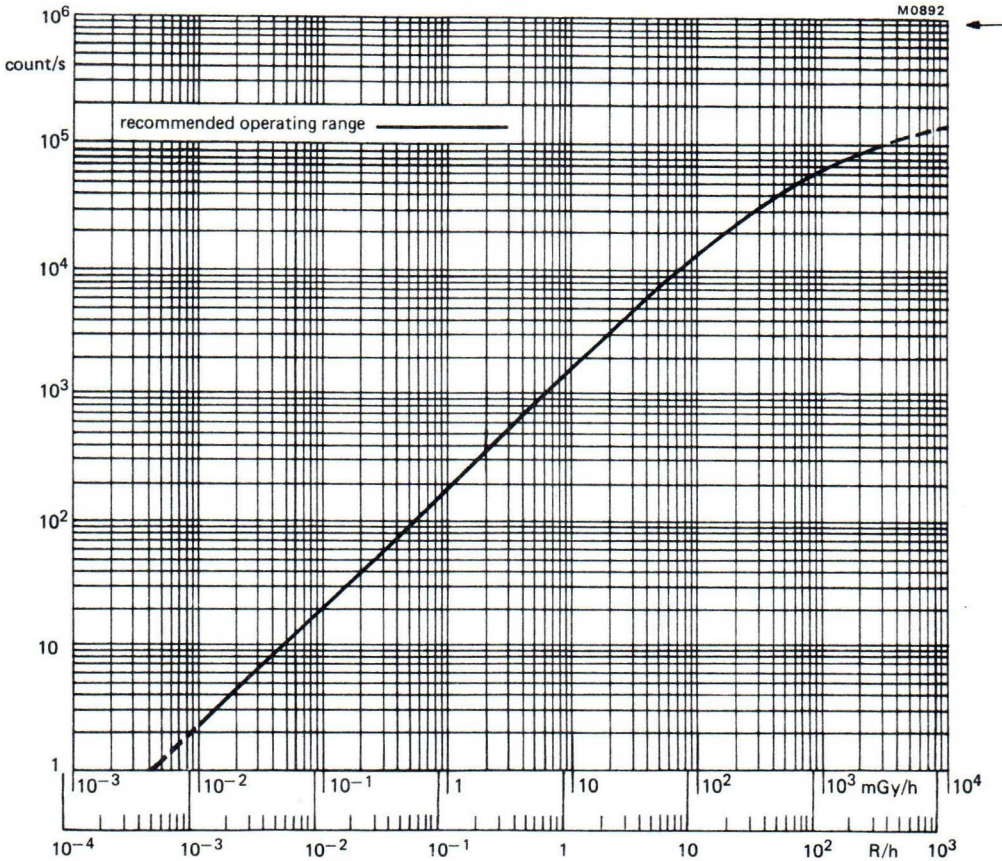
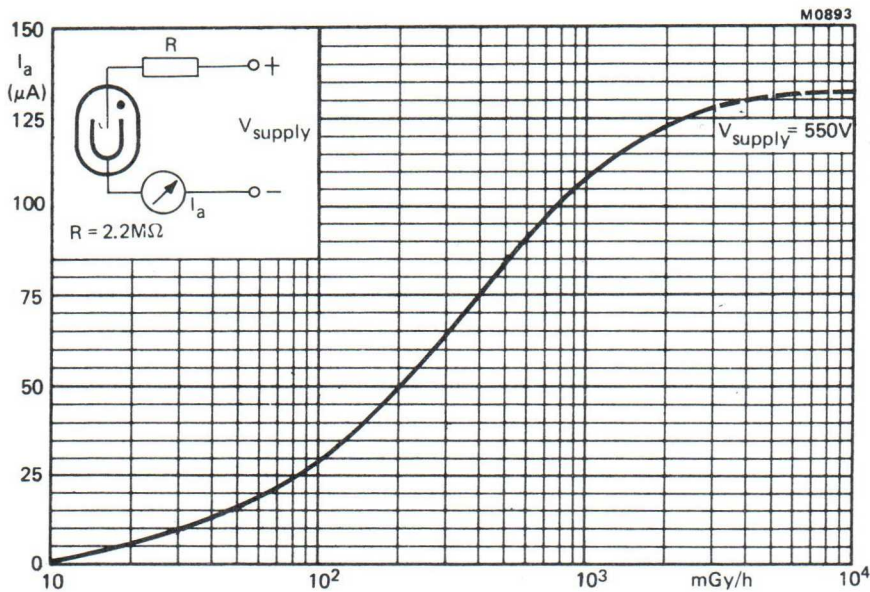
LIFE EXPECTANCYLife expectancy at $\approx 25^{\circ}\text{C}$ 5×10^{10} count**MEASURING CIRCUIT** $R_1 = 2.2 \text{ M}\Omega$ $R_2 = 47 \text{ k}\Omega$ $C_1 = 1 \text{ pF}^*$ 

Fig.2

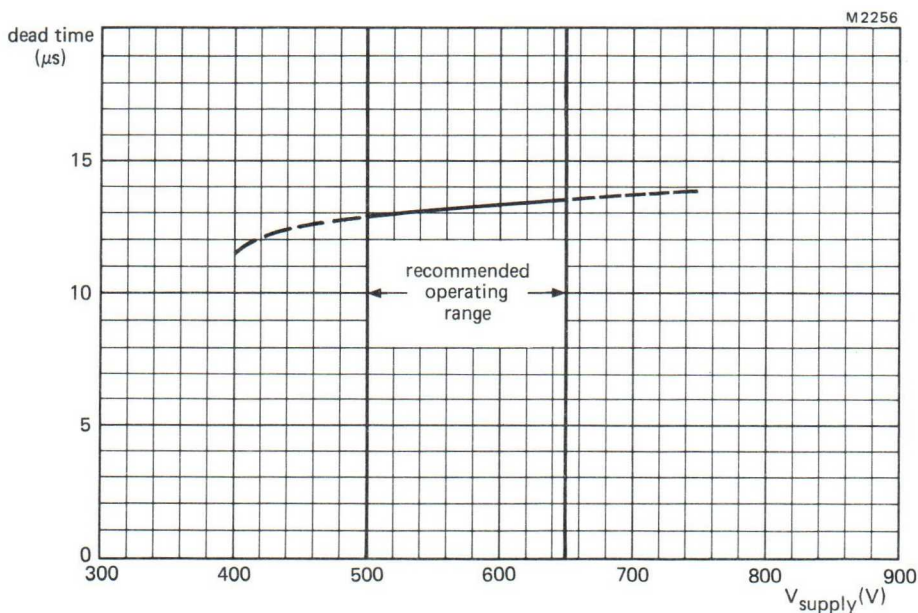
*See General Information (paragraph 5.5)



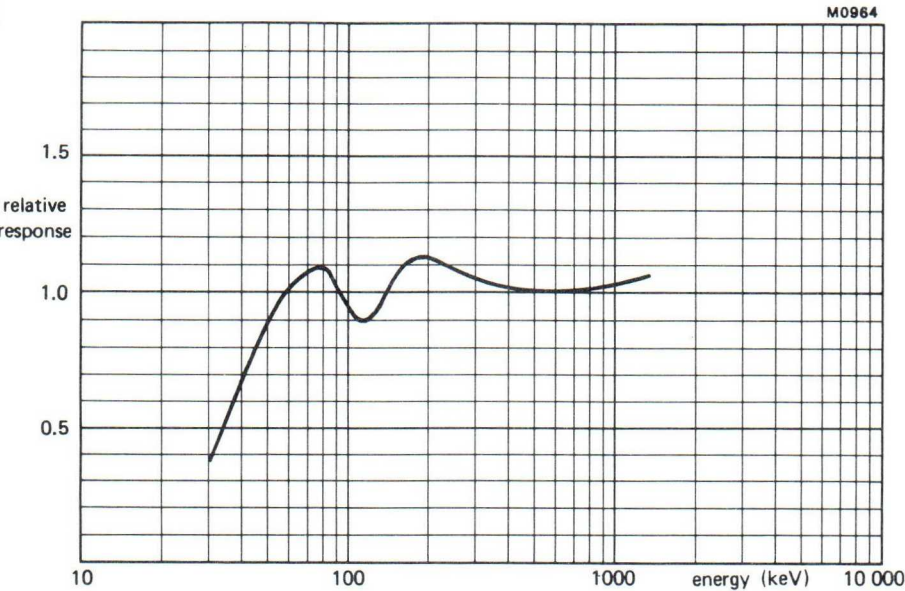
Typical counting rate as a function of dose rate (¹³⁷Cs)



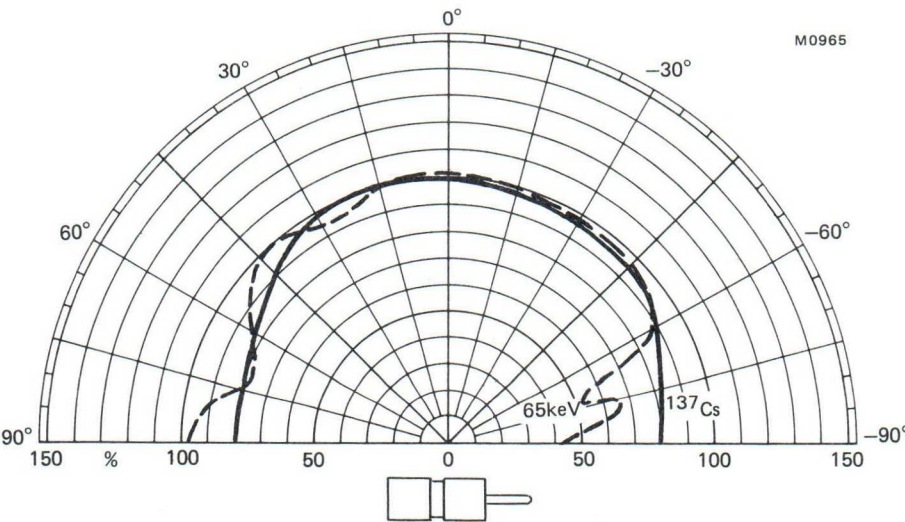
Typical current as a function of dose rate (^{137}Cs)



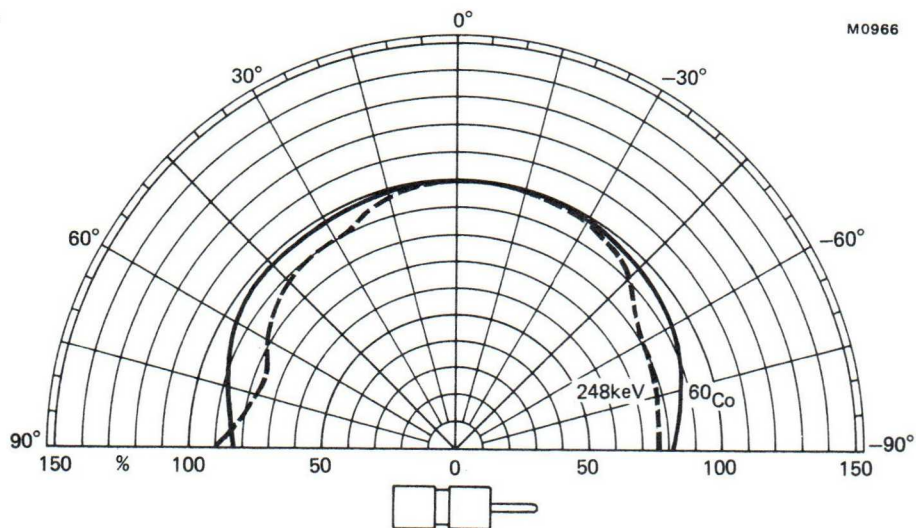
Typical dead time as a function of supply voltage



Typical energy response (side response) relative to ^{137}Cs



Typical polar responses (normalised to 100% at 0°)



GEIGER-MÜLLER TUBE

Halogen quenched γ and β (> 0.25 MeV) radiation counter tube.

QUICK REFERENCE DATA

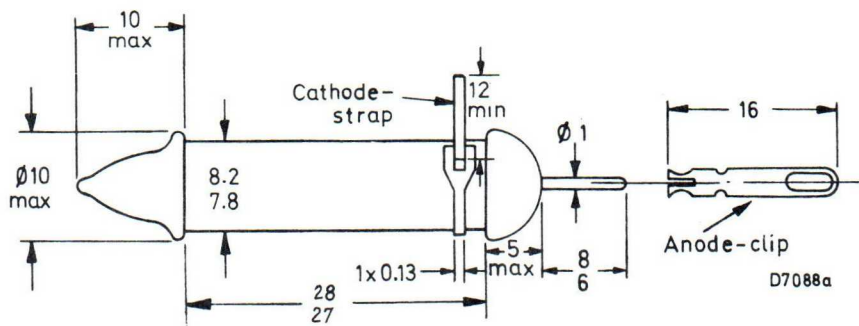
Dose rate range	3×10^{-3} to 2×10^2	mGy/h
	4×10^{-4} to 20	R/h
Plateau threshold voltage	500	V
Plateau length	150	V
Recommended supply voltage	575	V
Chrome-iron cathode	32 to 40	mg/cm ²

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 ²
Sensitive length	28	mm
Material	chrome-iron	

ENVIRONMENTAL (Manufacturer's test conditions)

Shock (half sine wave 3 ms duration) — peak acceleration	392	m/s ²
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FILLING

neon, argon, halogen

CAPACITANCE

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

TUBE WEIGHT

	1.0	g
--	-----	---

OPERATING CHARACTERISTICS (Ambient temperature $\approx 25^{\circ}\text{C}$)

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 system)

Anode resistor	min.	2.2	$\text{M}\Omega$
Anode voltage	max.	650	V
Ambient temperature continuous operating	max.	+70	$^{\circ}\text{C}$
	min.	-40	$^{\circ}\text{C}$
storage	max.	+75	$^{\circ}\text{C}$

LIFE EXPECTANCY

Life expectancy at $\approx 25^{\circ}\text{C}$	5×10^{10}	count
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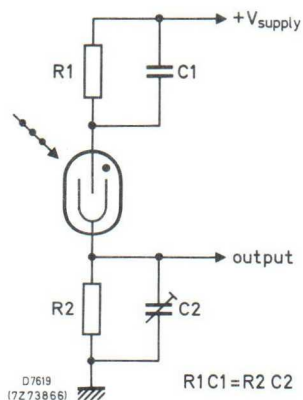
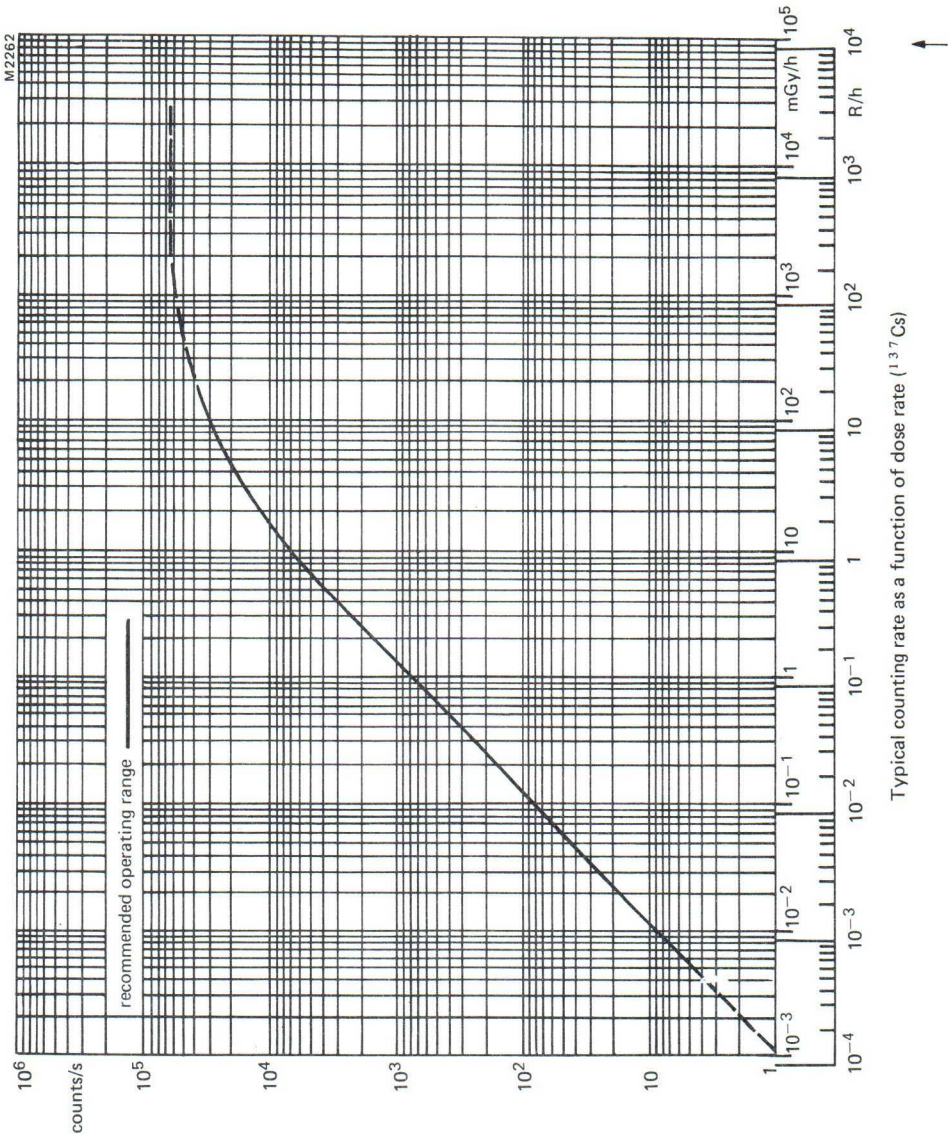
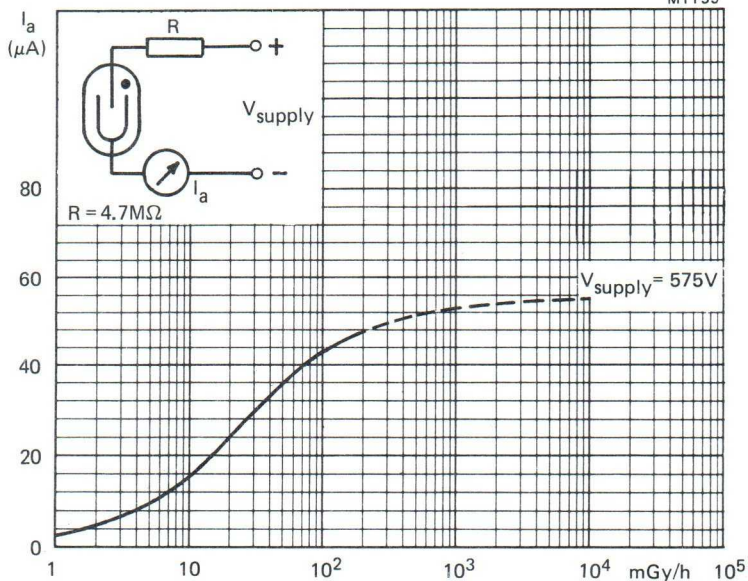
MEASURING CIRCUIT $R_1 = 4.7 \text{ M}\Omega$ $R_2 = 100 \text{ k}\Omega$ $C_1 = 1 \text{ pF}^*$ 

Fig.2

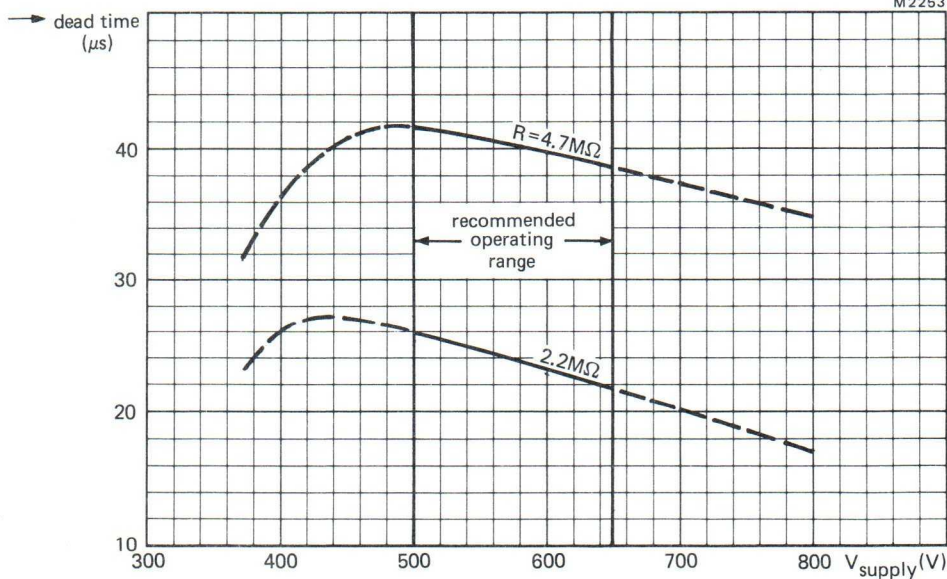
*See General Information (paragraph 5.5)



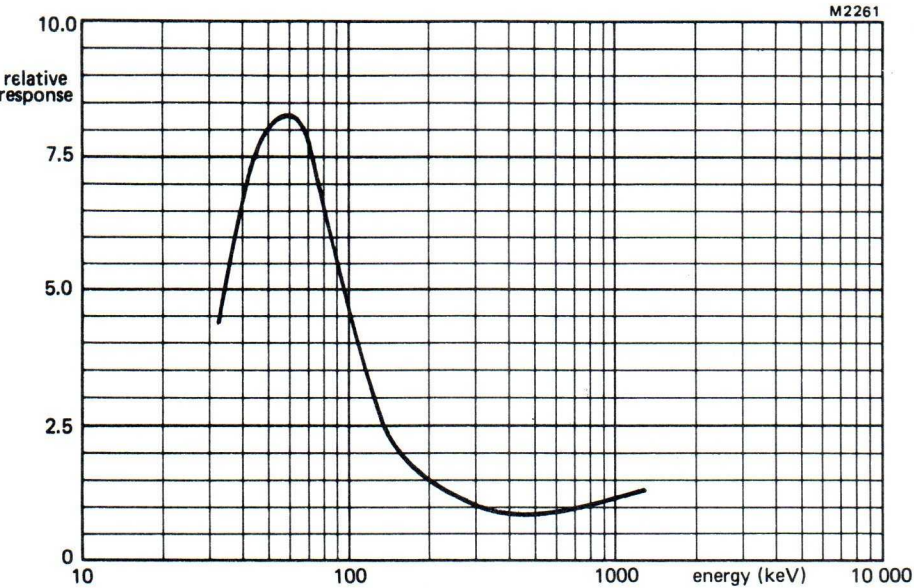
M1155



M2263



Typical dead time as a function of supply voltage



Typical energy response relative to ^{137}Cs



DEVELOPMENT DATA

This data sheet contains advance information and specifications are subject to change without notice.

ZP1321

GEIGER-MÜLLER TUBE

Halogen quenched γ radiation counter tube fitted in a filter. The energy response is flat to within +20 % over the range 40 keV to 1.25 MeV referred to ^{137}Cs (661 keV). The ZP1321 is an energy compensated version of the ZP1320.

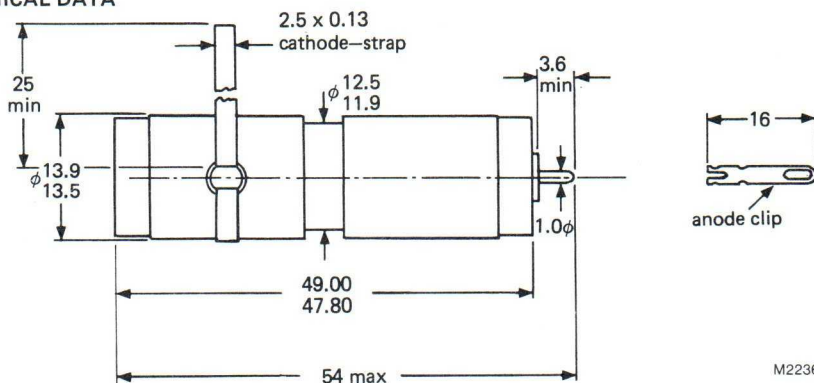
QUICK REFERENCE DATA

Dose rate range	3×10^{-3} to 10^2	mGy/h
	4×10^{-4} to 10	R/h
Plateau threshold voltage	500	V
Plateau length	150	V
Recommended supply voltage	575	V
Chrome-iron cathode	32 to 40	mg/cm ²

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

MECHANICAL DATA

Fig.1



CATHODE (ZP1320)

Thickness	32 to 40	mg/cm ²
Sensitive length	27	mm
Material	chrome-iron	

ENVIRONMENTAL (Manufacturer's test conditions)

Shock (half sine wave 3 ms duration) — peak acceleration	392	m/s ²
--	-----	------------------

FILLING

neon, argon, halogen

CAPACITANCE

Anode to cathode	1.3	pF
------------------	-----	----

TUBE WEIGHT

23	g
----	---

OPERATING CHARACTERISTICS (Ambient temperature $\approx 25^{\circ}\text{C}$)

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.	15	count/min
Dead time, at recommended supply voltage	max.	55	μs

LIMITING VALUES (Absolute max. rating system)

Anode resistor	min.	2.2	$\text{M}\Omega$
Anode voltage	max.	650	V
Ambient temperature continuous operating	max.	+70	$^{\circ}\text{C}$
	min.	-40	$^{\circ}\text{C}$
storage	max.	+75	$^{\circ}\text{C}$

LIFE EXPECTANCY

Life expectancy at $\approx 25^{\circ}\text{C}$	5×10^{10}	count
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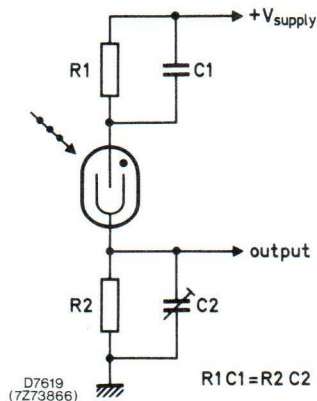
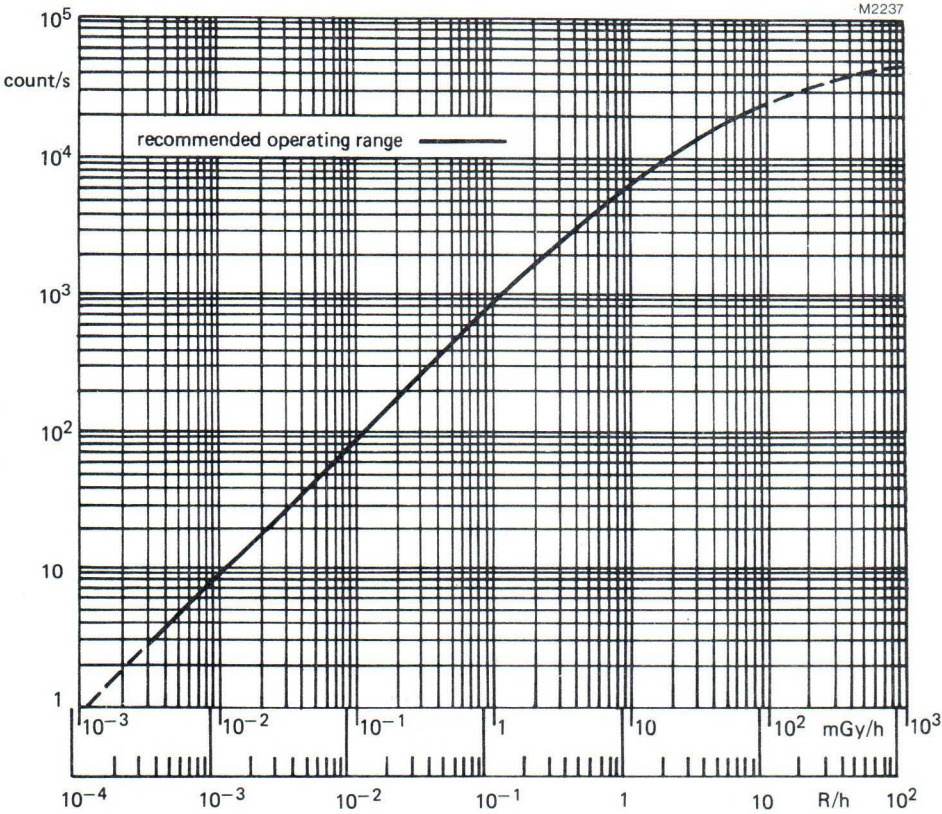
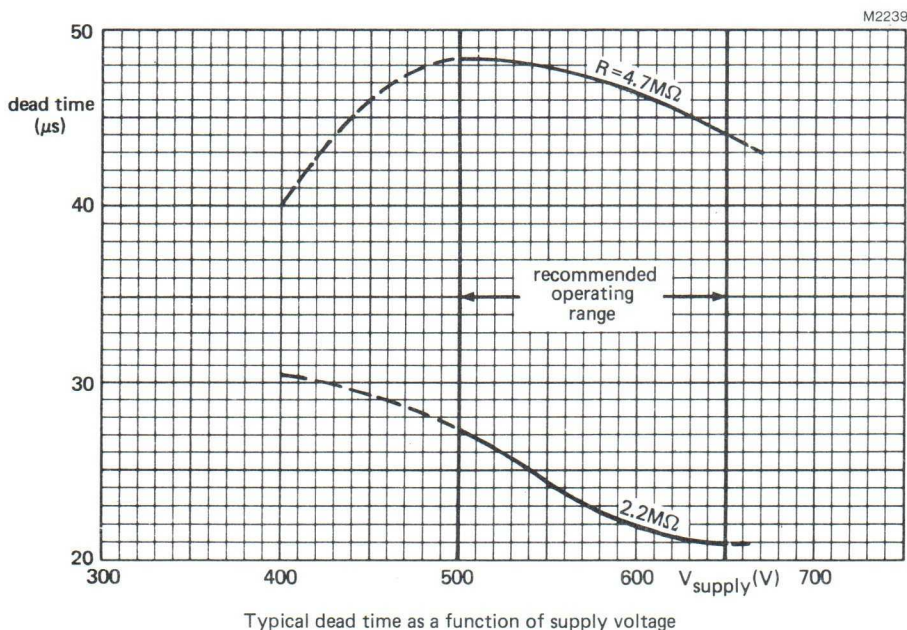
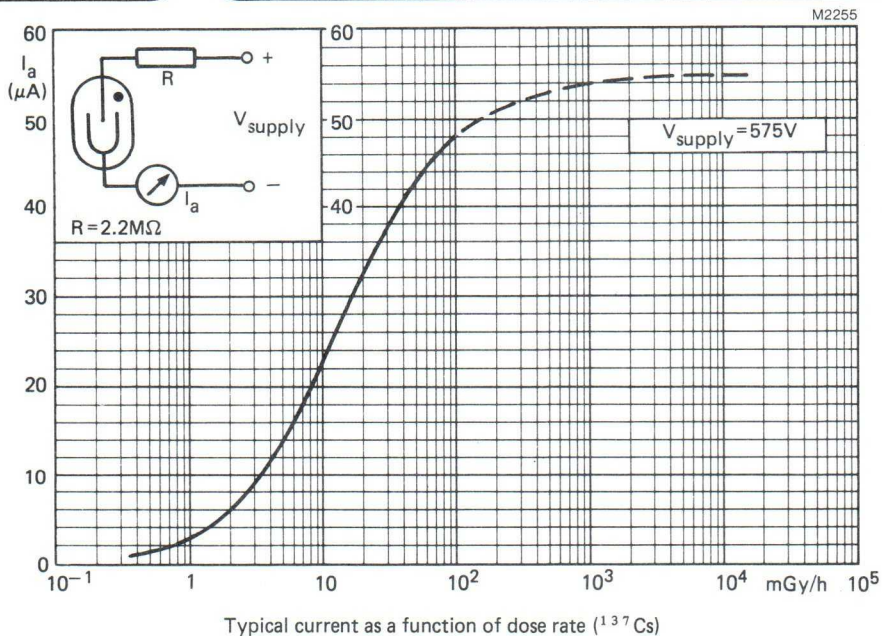
MEASURING CIRCUIT $R_1 = 4.7 \text{ M}\Omega$ $R_2 = 100 \text{ k}\Omega$ $C_1 = 1 \text{ pF}^*$ 

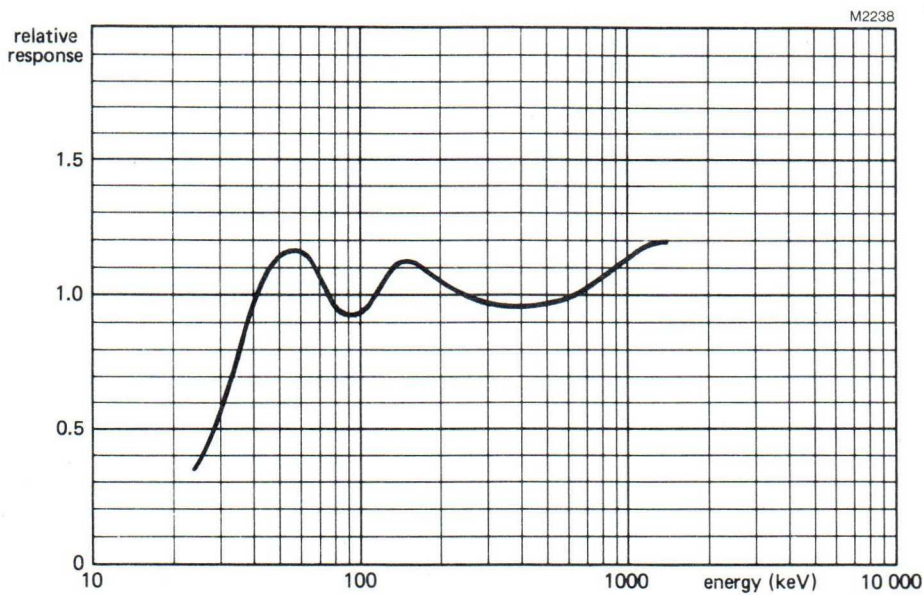
Fig.2

*See General Information (paragraph 5.5)

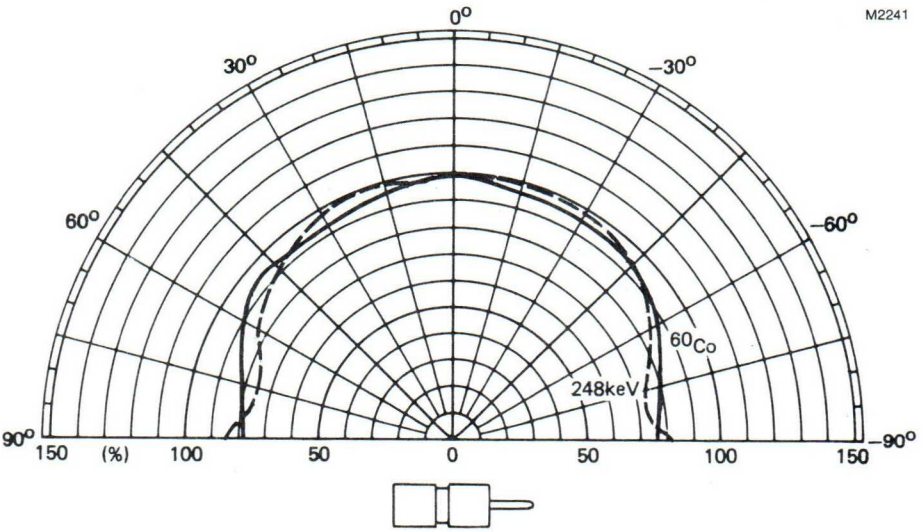
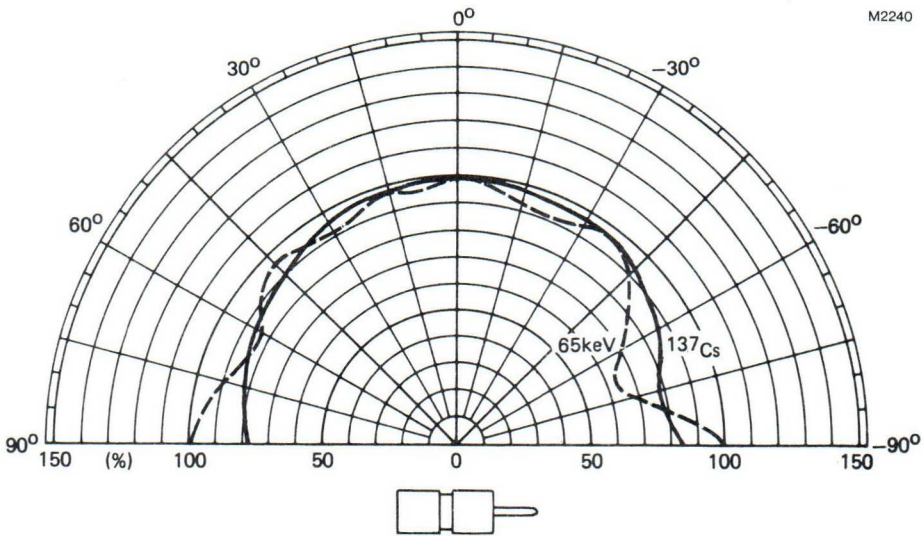


Typical counting rate as a function of dose rate (¹³⁷Cs)





Typical energy response relative to ^{137}Cs



Typical polar responses
(normalised to 100% at 0°)

GEIGER-MÜLLER TUBE

Halogen quenched γ and β (> 0.3 MeV) radiation counter tube for use in damp and/or saline atmosphere.

QUICK REFERENCE DATA

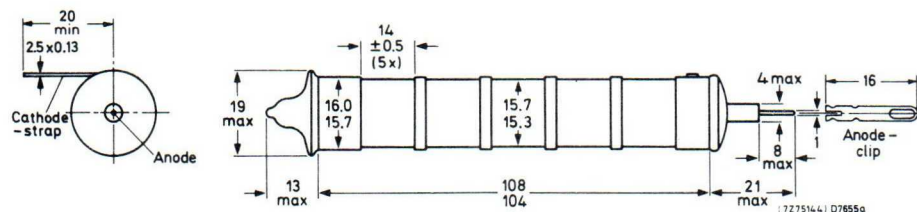
Dose rate range	6×10^{-4} to 10 7×10^{-5} to 1	mGy/h R/h
Plateau threshold voltage	450	V
Plateau length	350	V
Recommended supply voltage	625	V
Chrome-iron cathode	40 to 60	mg/cm ²

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

Construction	cylindrical wall with strengthening ribs	
Thickness between strengthening ribs	40 to 60	mg/cm ²
Sensitive length	75	mm
Material	chrome-iron	

ENVIRONMENTAL (Manufacturer's test conditions)

Shock (half sine wave 3 ms duration) — peak acceleration	392	m/s ²
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FILLING

neon, argon, halogen

CAPACITANCE

Anode to cathode	4.0	pF
------------------	-----	----

TUBE WEIGHT

TUBE WEIGHT	9.0	g
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OPERATING CHARACTERISTICS (Ambient temperature $\approx 25^\circ\text{C}$)

Measured in circuit of Fig.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	$\text{M}\Omega$
Anode voltage	max.	800	V
Ambient temperature continuous operating	max.	+70	$^\circ\text{C}$
	min.	-40	$^\circ\text{C}$
storage	max.	+75	$^\circ\text{C}$

LIFE EXPECTANCY

Life expectancy at $\approx 25^\circ\text{C}$	5×10^{10}	count
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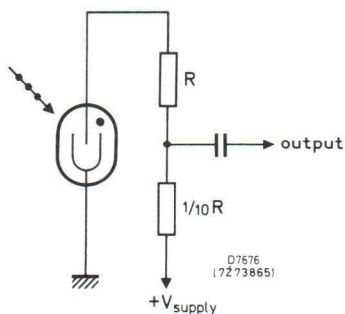
→ **BETA RESPONSE**Point source ($^{90}\text{Sr}/^{90}\text{Y}$) between ribs: 0.24 c/s/BqExtended source ($^{90}\text{Sr}/^{90}\text{Y}$) in direct contact: 2.1 c/s/Bq cm^{-2} → **MEASURING CIRCUITS** $R = 2.2 \text{ M}\Omega$ 

Fig.2 Manufacturer's measuring circuit

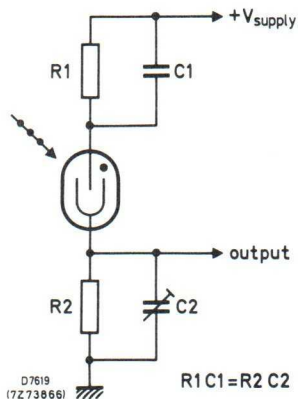
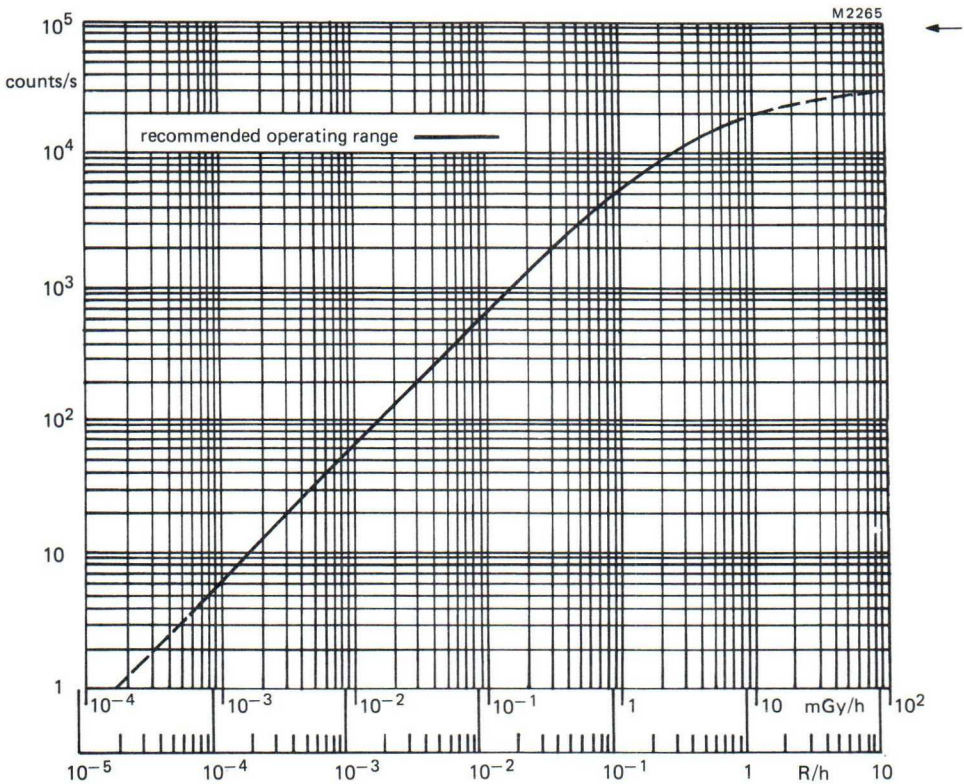
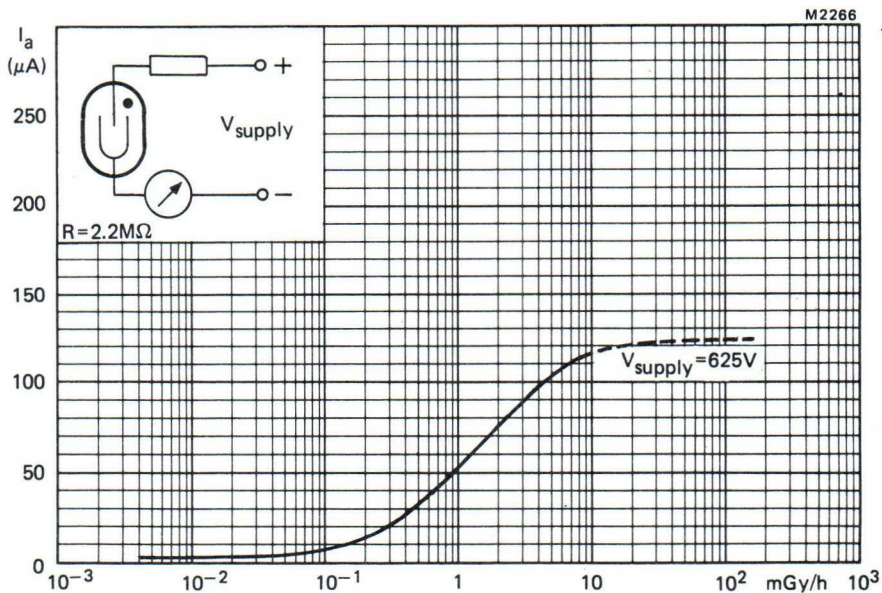
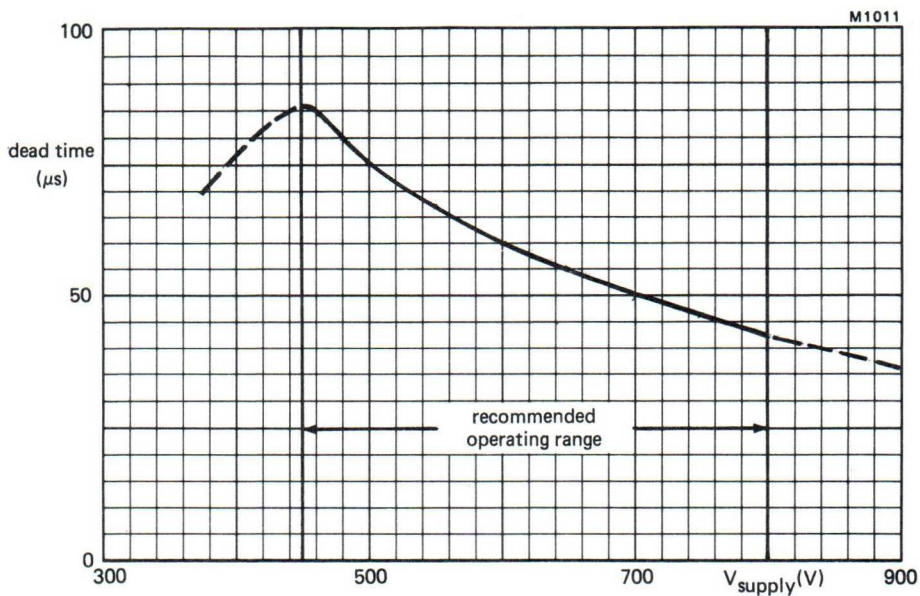


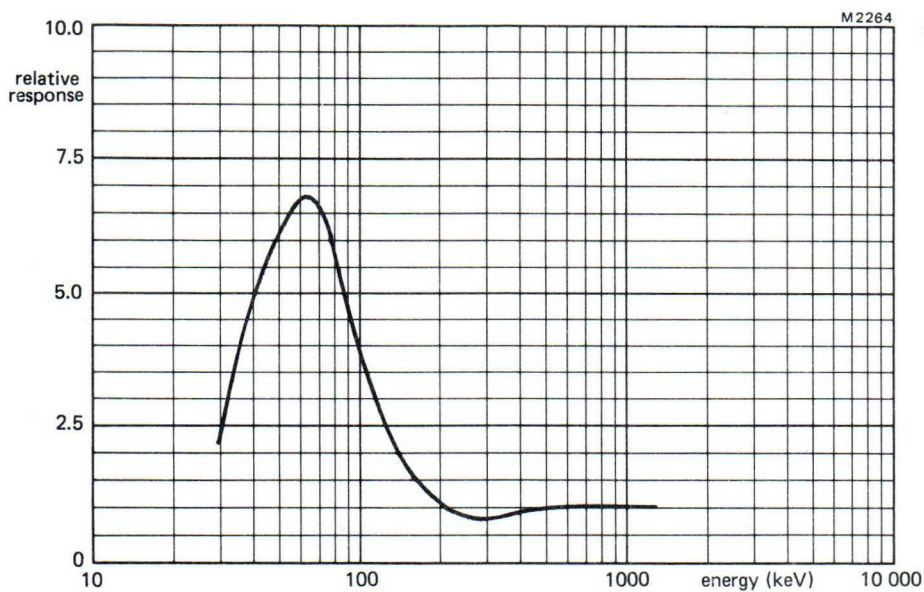
Fig.3 For optimum performance at very high dose rates this circuit may be used



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

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

Typical dead time as a function of supply voltage



Typical energy response relative to ^{137}Cs



GEIGER-MÜLLER TUBE

End window halogen quenched β and γ radiation counter tube.

QUICK REFERENCE DATA

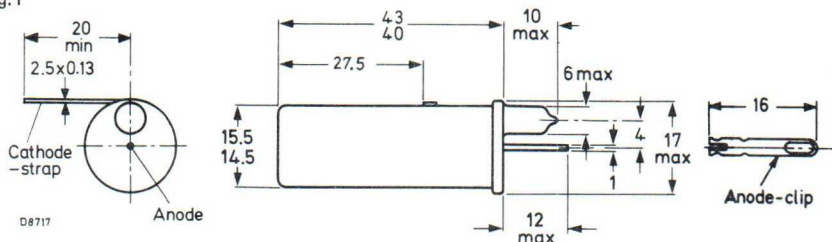
Dose rate range	10^{-3} to 10^2	mGy/h
	10^{-4} to 10	R/h
Plateau threshold voltage	400	V
Plateau length	200	V
Recommended supply voltage	500	V
Chrome-iron cathode	250	mg/cm ²
Mica window (9 mm diameter)	2.0 to 3.0	mg/cm ²

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/cm ²
Useful diameter	9	mm
Material	mica	

CATHODE

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

ENVIRONMENTAL

Shock (half sine wave 3 ms duration) - peak acceleration	392	m/s ²
Vibration (50 Hz continuous sine wave) - acceleration	24.5	m/s ²

FILLING

neon, argon, halogen ←

CAPACITANCE

Anode to cathode	1.1	pF
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TUBE WEIGHT

	7.0	g
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OPERATING CHARACTERISTICS (Ambient temperature $\approx 25^{\circ}\text{C}$)

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	$\text{M}\Omega$
Anode voltage	max.	600	V
Ambient temperature			
continuous operating	max.	+70	$^{\circ}\text{C}$
	min.	-40	$^{\circ}\text{C}$
storage	max.	+75	$^{\circ}\text{C}$

LIFE EXPECTANCY

Life expectancy at $\approx 25^{\circ}\text{C}$	5×10^{10}	count
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BETA RESPONSE

Point source ($^{90}\text{Sr}/^{90}\text{Y}$)	0.25	c/s/Bq
Extended source ($^{90}\text{Sr}/^{90}\text{Y}$)	0.42	c/s/Bq cm^{-2}

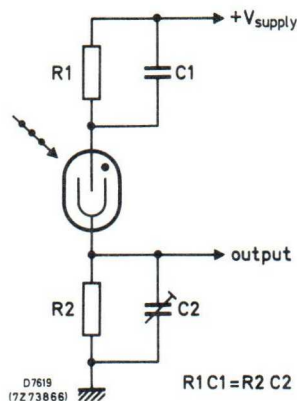
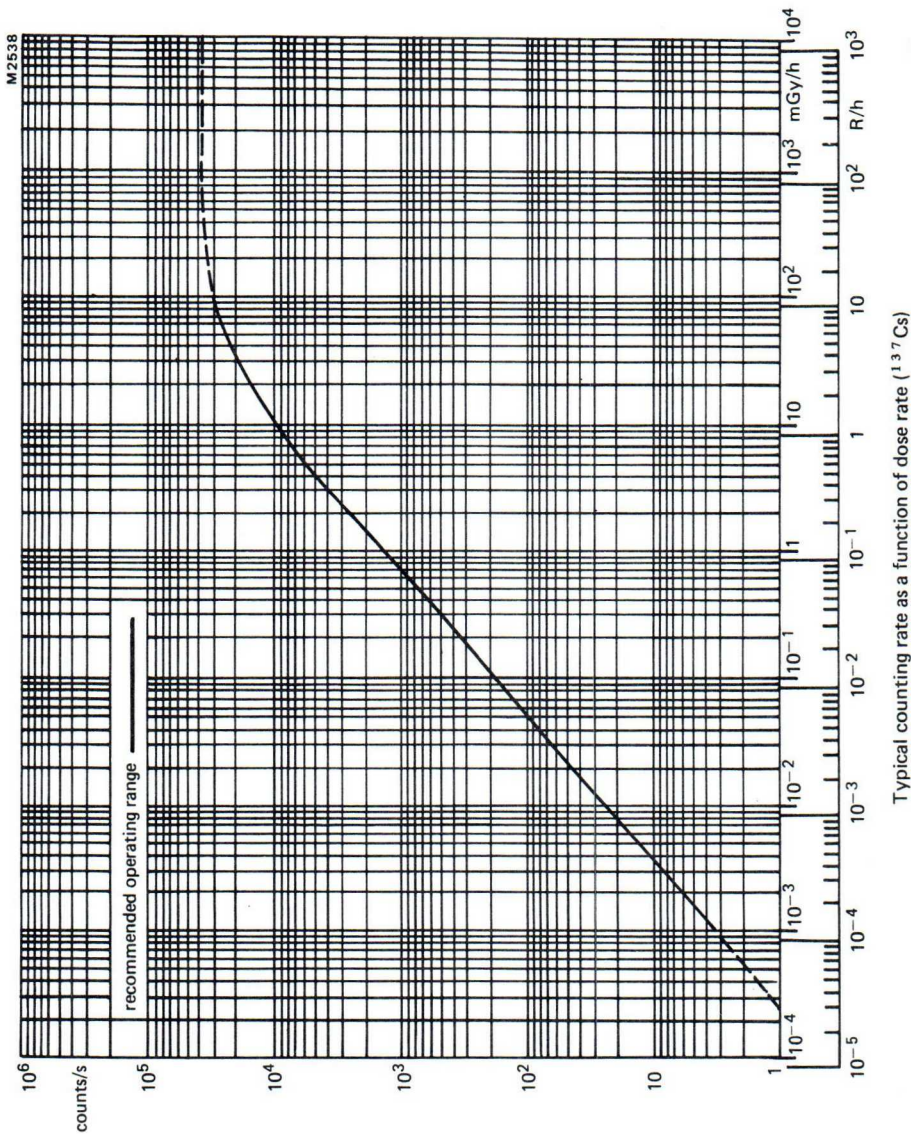
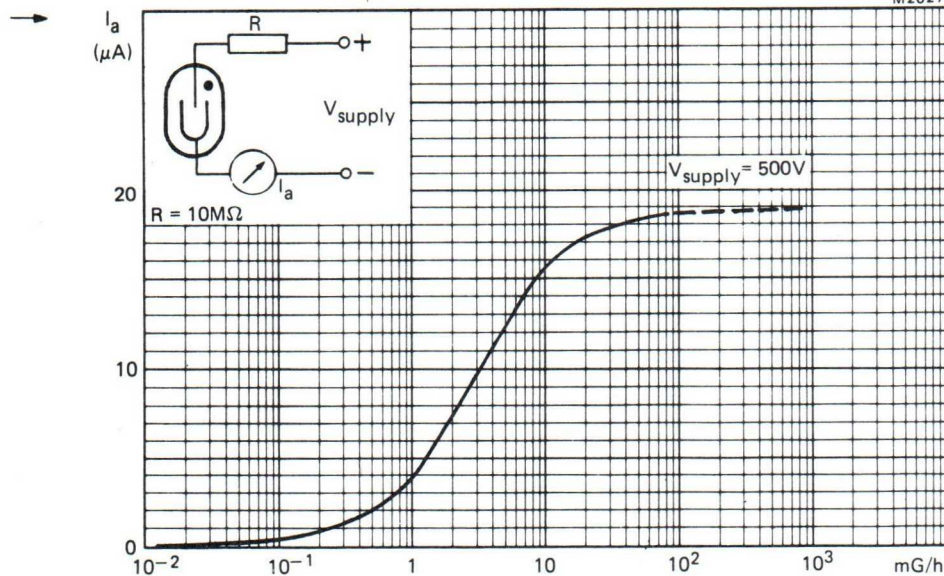
MEASURING CIRCUIT $R_1 = 10 \text{ M}\Omega$ $R_2 = 220 \text{ k}\Omega$ $C_1 = 1 \text{ pF}^*$ 

Fig.2

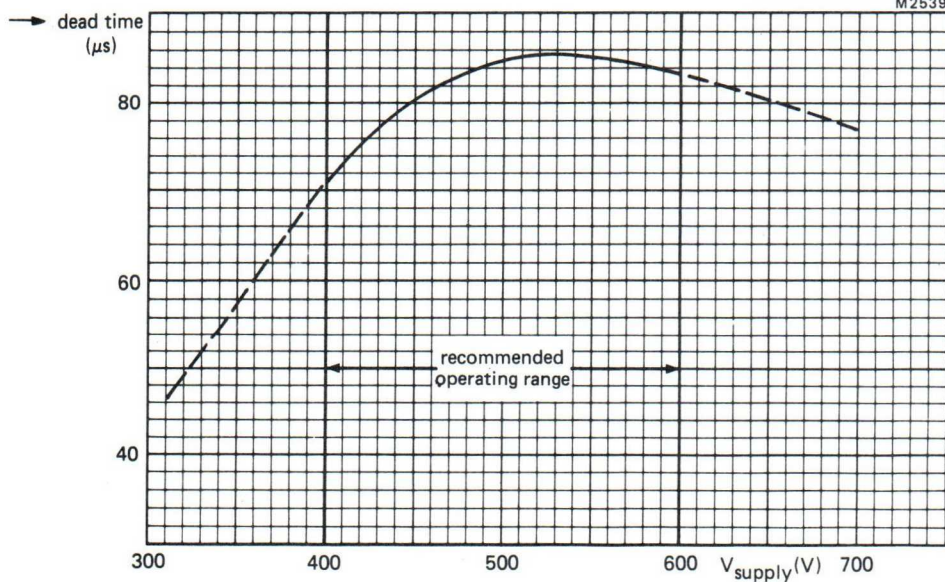
*See General Information (paragraph 5.5)



M2627



M2539



GEIGER-MÜLLER TUBE

End window halogen quenched α , β and γ radiation counter tube.

QUICK REFERENCE DATA

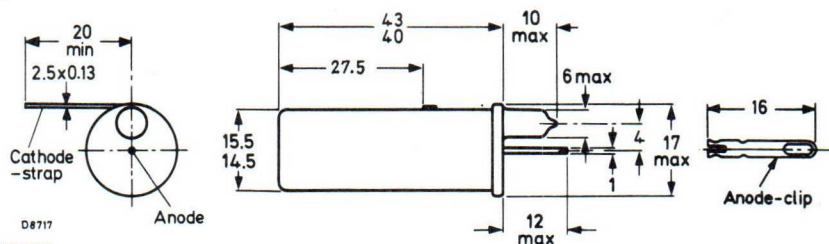
Dose rate range	10^{-3} to 10^2	mGy/h
	10^{-4} to 10	R/h
Plateau threshold voltage	400	V
Plateau length	200	V
Recommended supply voltage	500	V
Chrome-iron cathode	250	mg/cm ²
Mica window (9 mm diameter)	1.5 to 2.0	mg/cm ²

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 ²
Useful diameter	9	mm
Material	mica	

CATHODE

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

ENVIRONMENTAL

Shock (half sine wave 3 ms duration) - peak acceleration	392	m/s ²
Vibration (50 Hz continuous sine wave) - acceleration	24.5	m/s ²

FILLING

neon, argon, halogen

CAPACITANCE

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

TUBE WEIGHT

	7.0	g
--	-----	---

OPERATING CHARACTERISTICS (Ambient temperature $\approx 25^{\circ}\text{C}$)

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	$\text{M}\Omega$
Anode voltage	max.	600	V
Ambient temperature continuous operating	max.	+70	$^{\circ}\text{C}$
	min.	-40	$^{\circ}\text{C}$
storage	max.	+75	$^{\circ}\text{C}$

LIFE EXPECTANCY

Life expectancy at $\approx 25^{\circ}\text{C}$	5×10^{10}	count
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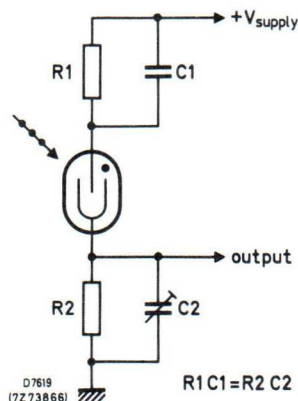
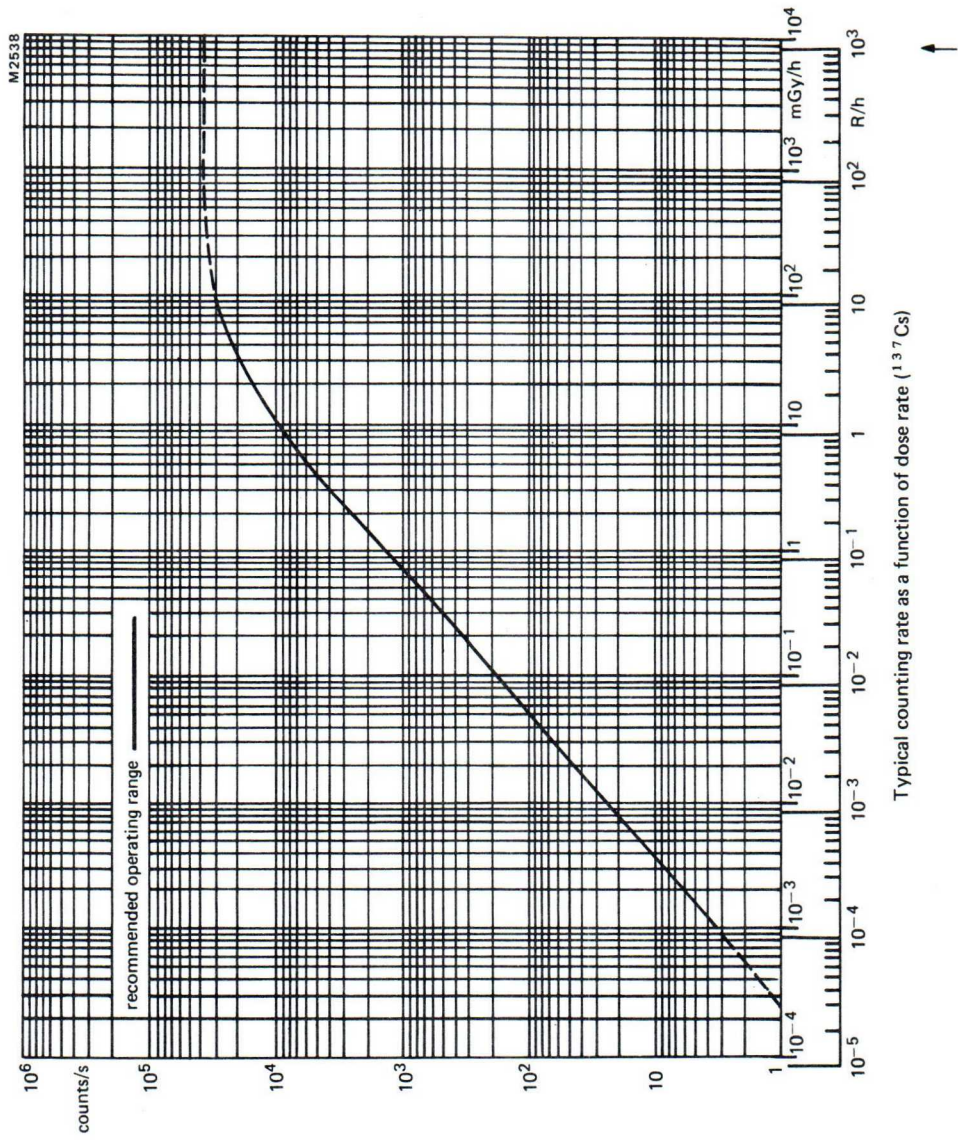
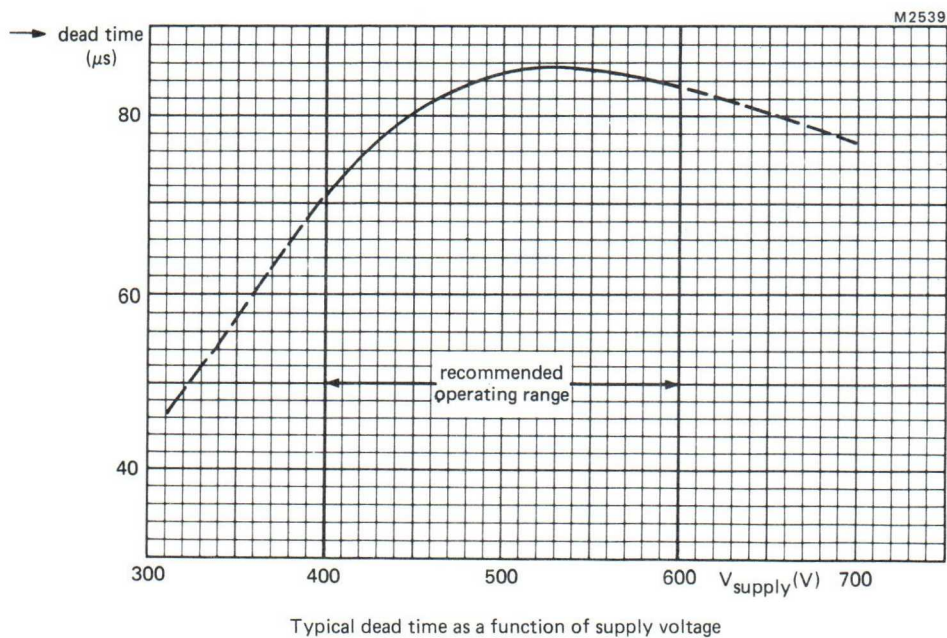
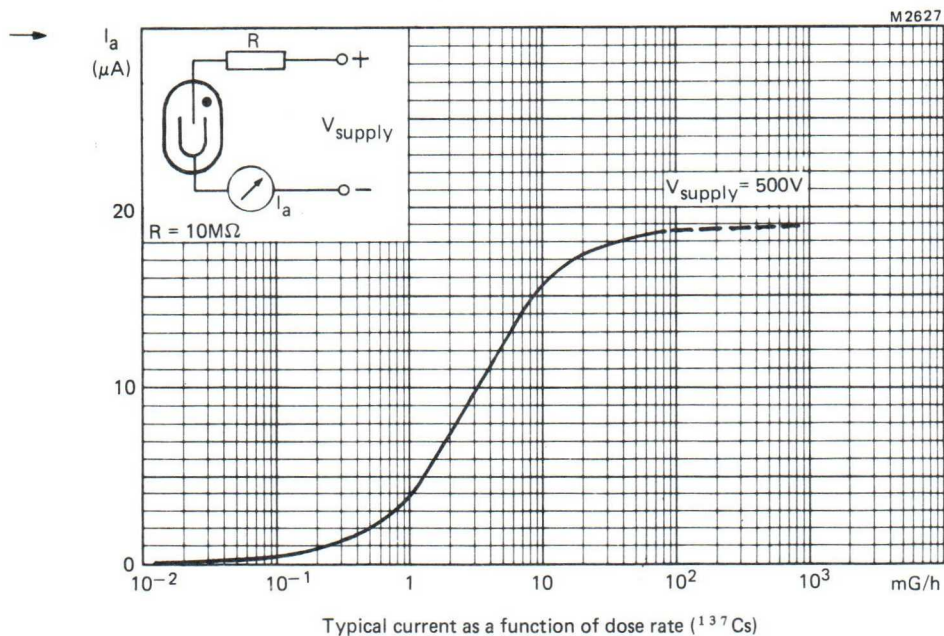
MEASURING CIRCUIT $R_1 = 10 \text{ M}\Omega$ $R_2 = 220 \text{ k}\Omega$ $C_1 = 1 \text{ pF}^*$ 

Fig.2

*See General Information (paragraph 5.5)





GEIGER-MÜLLER TUBE

End window halogen quenched α , β and γ radiation counter tube.

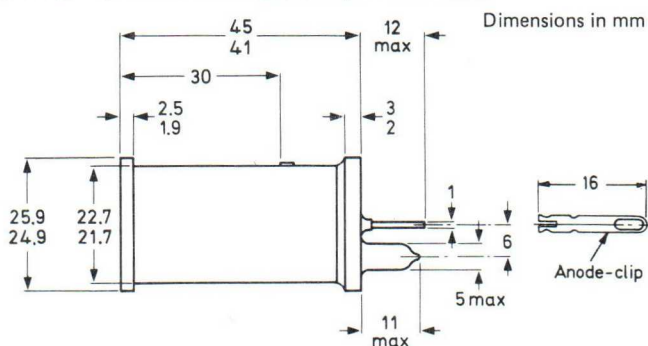
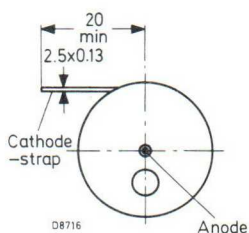
QUICK REFERENCE DATA

Dose rate range	10 ⁻³ to 10	mGy/h
	10 ⁻⁴ to 1	R/h
Plateau threshold voltage	450	V
Plateau length	250	V
Recommended supply voltage	575	V
Chrome-iron cathode	910	mg/cm ²
Mica window (19.8 mm diameter)	1.5 to 2.0	mg/cm ²

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

MECHANICAL DATA

Fig.1



WINDOW

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

CATHODE

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

ENVIRONMENTAL (Manufacturer's test conditions)

Shock (half sine wave 3 ms duration) - peak acceleration	392	m/s ²
--	-----	------------------

FILLING

neon, argon, halogen

CAPACITANCE

Anode to cathode 2.5 pF

TUBE WEIGHT

OPERATING CHARACTERISTICS (Ambient temperature $\approx 25^\circ\text{C}$)

Measured in circuit of Fig.2

Starting voltage	max.	350	V
Plateau threshold voltage	max.	450	V
Plateau length		250	V
Recommended supply voltage		575	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.	15	count/min.
Dead time, at recommended supply voltage	max.	175	μs

LIMITING VALUES (Absolute max. rating system)

Anode resistor	min.	2.2	M Ω
Anode voltage	max.	700	V
Ambient temperature			
continuous operating	max.	+70	$^\circ\text{C}$
	min.	-40	$^\circ\text{C}$
storage	max.	+75	$^\circ\text{C}$

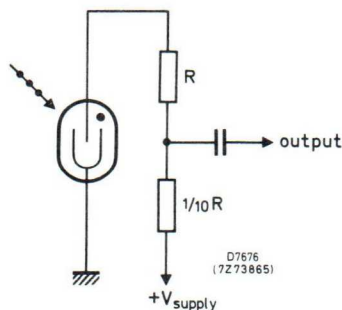
LIFE EXPECTANCYLife expectancy at $\approx 25^\circ\text{C}$ 5×10^{10} count**MEASURING CIRCUITS** $R = 10\text{ M}\Omega$ 

Fig.2 Manufacturer's measuring circuit

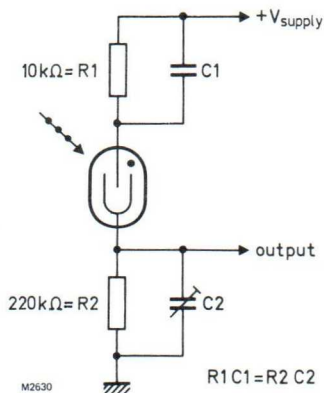
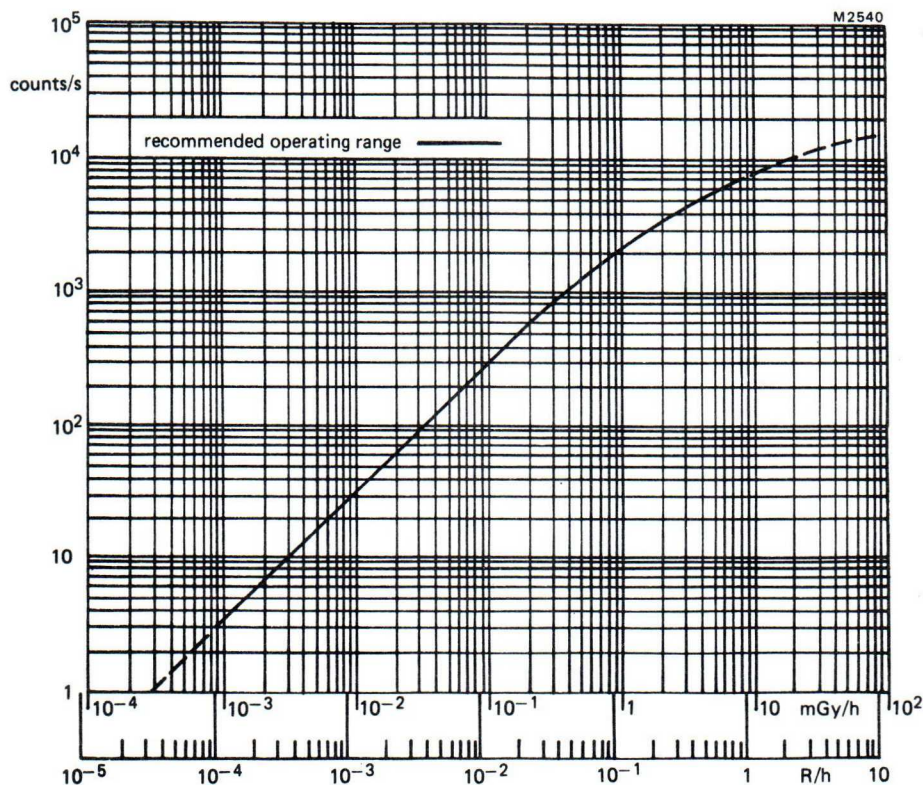
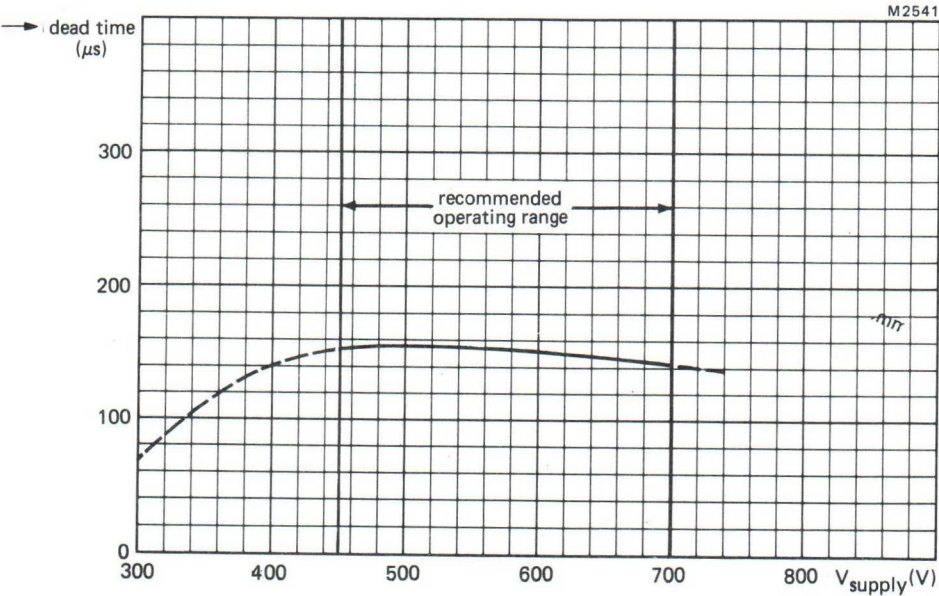


Fig.3 For optimum performance at very high dose rates this circuit may be used

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



GEIGER-MÜLLER TUBE

End window halogen quenched α , β and γ radiation counter tube.

QUICK REFERENCE DATA

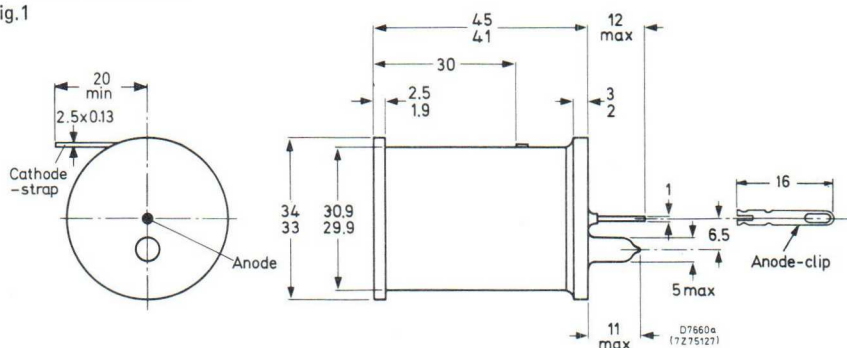
Dose rate range	6×10^{-4} to 6	mGy/h
	7×10^{-5} to 7×10^{-1}	R/h
Plateau threshold voltage	450	V
Plateau length	250	V
Recommended supply voltage	575	V
Chrome-iron cathode	980	mg/cm ²
Mica window (27.8 mm diameter)	1.5 to 2.0	mg/cm ²

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 ²
Useful diameter	27.8	mm
Material	mica	

CATHODE

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

ENVIRONMENTAL (Manufacturer's test conditions)

Shock (half sine wave 3 ms duration) - peak acceleration	392	m/s ²
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FILLING

neon, argon, halogen

CAPACITANCE

Anode to cathode	3.5	pF
------------------	-----	----

TUBE WEIGHT

51	g
----	---

OPERATING CHARACTERISTICS (Ambient temperature $\approx 25^{\circ}\text{C}$)

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	max.	25	count/min
→ Dead time, at recommended supply voltage	max.	230	μs

LIMITING VALUES (Absolute max. rating system)

Anode resistor	min.	4.7	$\text{M}\Omega$
Anode voltage	max.	700	V
Ambient temperature			
continuous operating	max.,	+70	$^{\circ}\text{C}$
	min.,	-40	$^{\circ}\text{C}$
storage	max.	+75	$^{\circ}\text{C}$

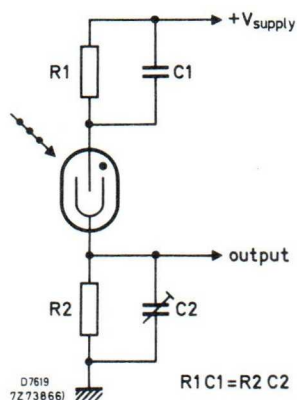
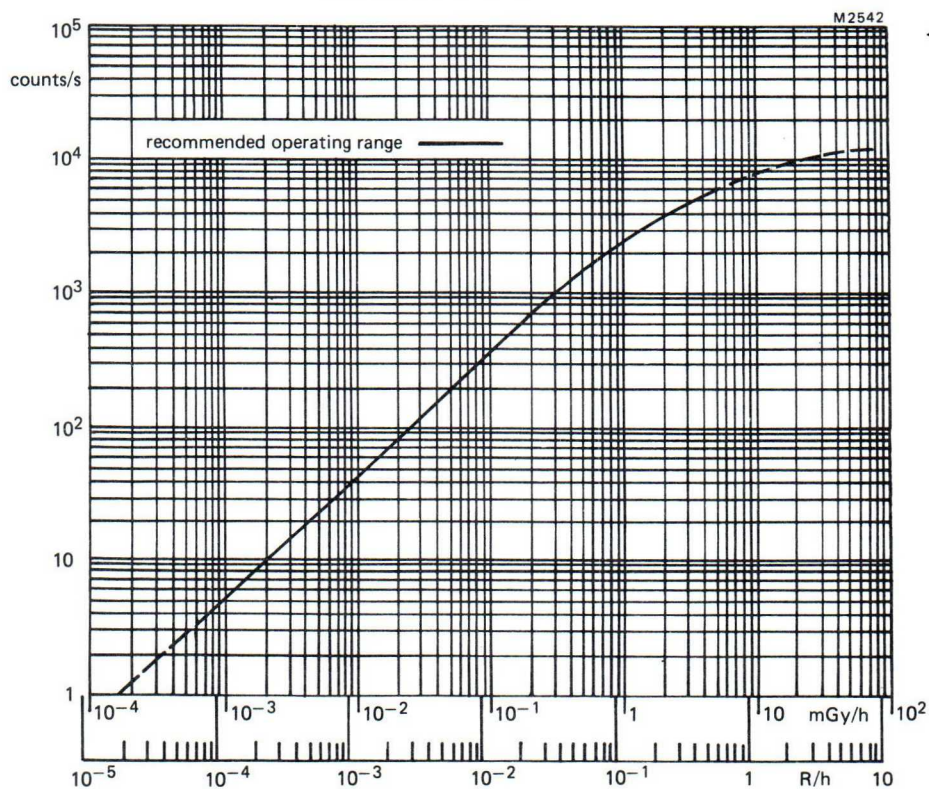
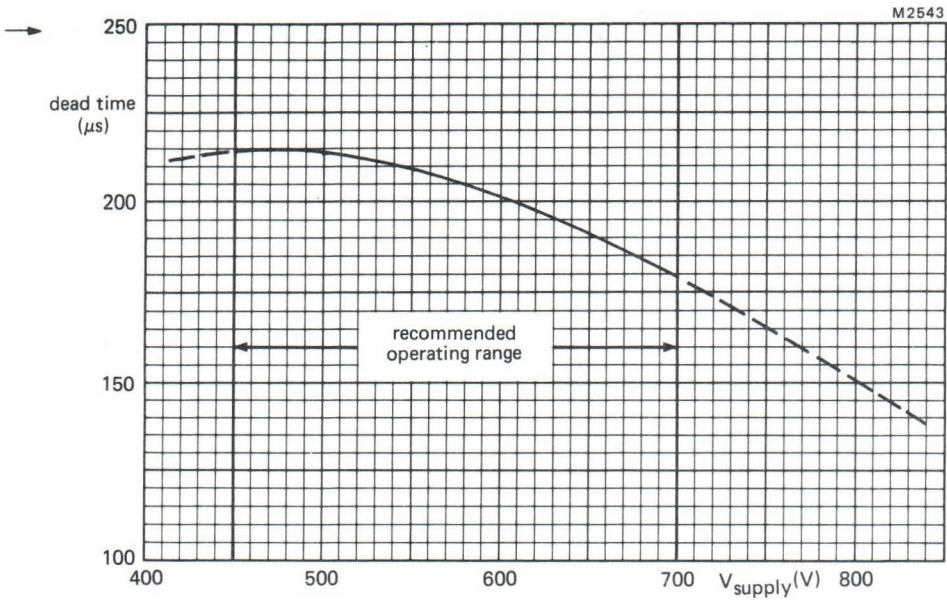
LIFE EXPECTANCYLife expectancy at $\approx 25^{\circ}\text{C}$ 5×10^{10} count**MEASURING CIRCUIT** $R_1 = 10 \text{ M}\Omega$ $R_2 = 220 \text{ k}\Omega$ $C_1 = 1 \text{ pF}^*$ 

Fig.2

*See General Information (paragraph 5.5)

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



Typical dead time as a function of supply voltage

GEIGER-MÜLLER TUBE

End window halogen quenched β and γ radiation counter tube.

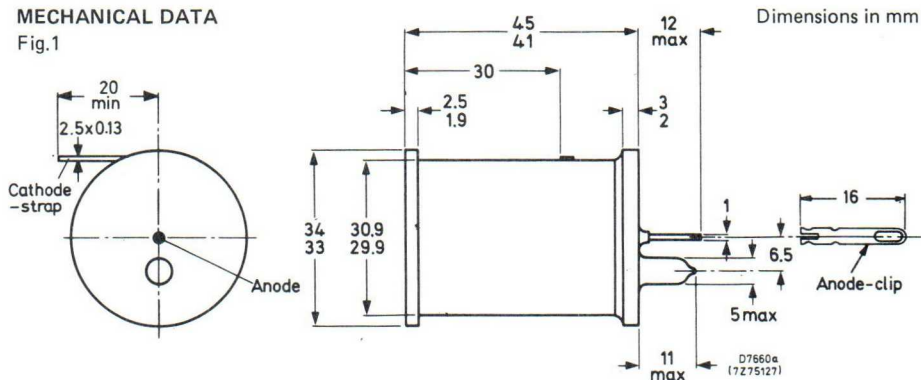
QUICK REFERENCE DATA

Dose rate range	6×10^{-4} to 6	mGy/h
	7×10^{-5} to 7×10^{-1}	R/h
Plateau threshold voltage	450	V
Plateau length	250	V
Recommended supply voltage	575	V
Chrome-iron cathode	980	mg/cm ²
Mica window (27.8 mm diameter)	2.0 to 3.0	mg/cm ²

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

MECHANICAL DATA

Fig.1



WINDOW

Thickness	2.0 to 3.0	mg/cm ²
Useful diameter	27.8	mm
Material	mica	

CATHODE

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

ENVIRONMENTAL (Manufacturer's test conditions)

Shock (half sine wave 3 ms duration) - peak acceleration	392	m/s ²
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FILLING

neon, argon, halogen

CAPACITANCE

Anode to cathode	3.5	pF
------------------	-----	----

TUBE WEIGHT

51	g
----	---

OPERATING CHARACTERISTICS (Ambient temperature $\approx 25^\circ\text{C}$)

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	max.	25	count/min
Dead time, at recommended supply voltage	max.	190	μs

LIMITING VALUES (Absolute max. rating system)

Anode resistor	min.	4.7	$\text{M}\Omega$
Anode voltage	max.	700	V
Ambient temperature			
continuous operating	max.	+70	$^\circ\text{C}$
storage	min.	-40	$^\circ\text{C}$
	max.	+75	$^\circ\text{C}$

LIFE EXPECTANCY

Life expectancy at $\approx 25^\circ\text{C}$	5×10^{10}	count
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BETA RESPONSE

Point source ($^{90}\text{Sr}/^{90}\text{Y}$)	0.32	c/s/Bq
Extended source ($^{90}\text{Sr}/^{90}\text{Y}$)	2.05	c/s/Bq cm^{-2}

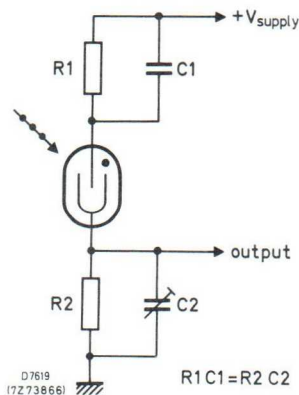
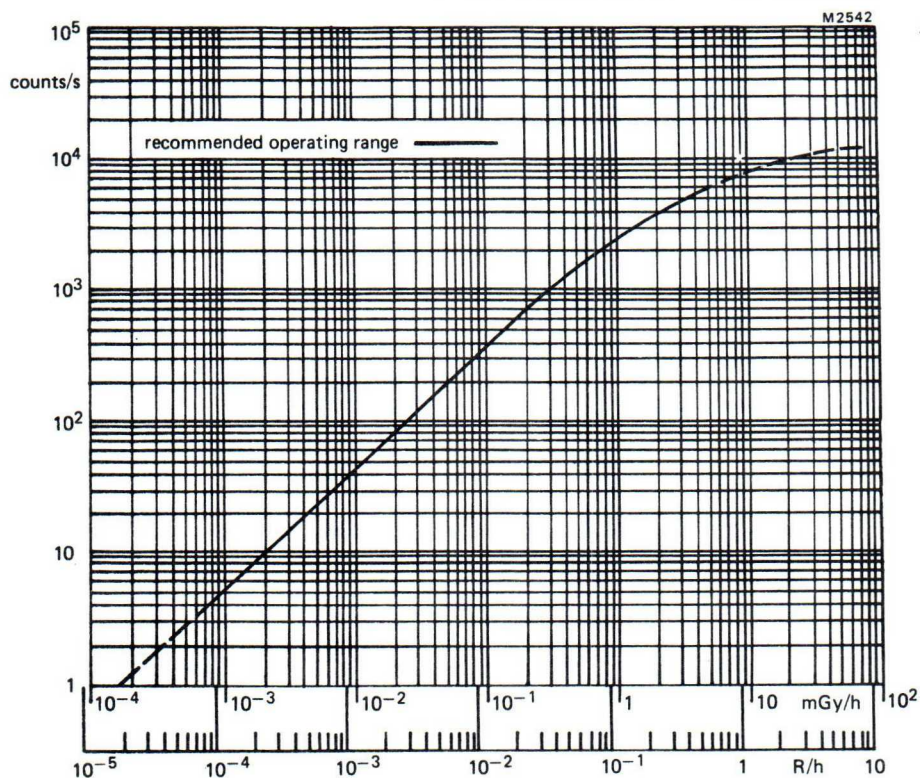
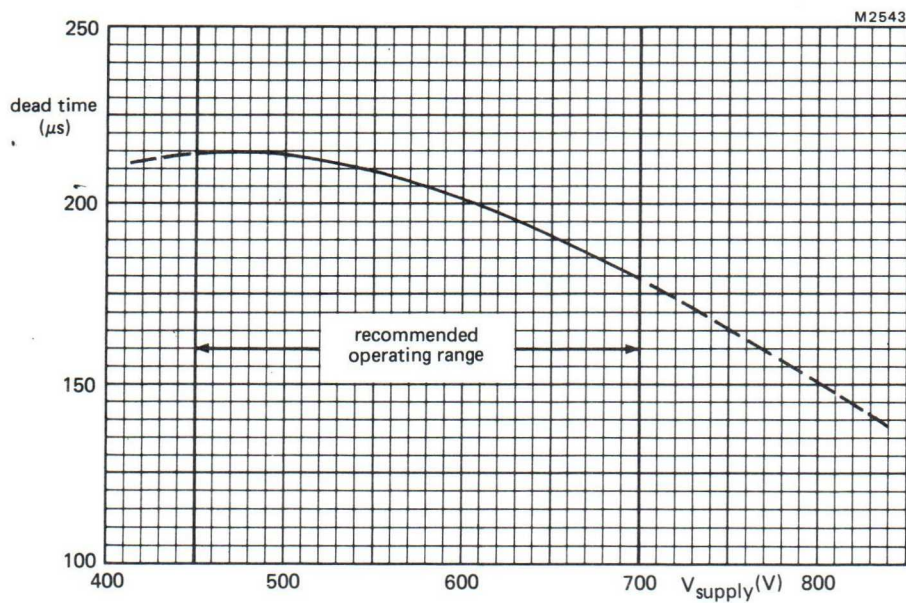
MEASURING CIRCUIT $R_1 = 10 \text{ M}\Omega$ $R_2 = 220 \text{ k}\Omega$ $C_1 = 1 \text{ pF}^*$ 

Fig.2

*See General Information (paragraph 5.5)

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



Typical dead time as a function of supply voltage

GEIGER-MÜLLER TUBE

End window halogen quenched α , β and γ radiation counter tube for measurement of low levels of radiation in combination with a guard counter tube, e.g. ZP1700.

QUICK REFERENCE DATA

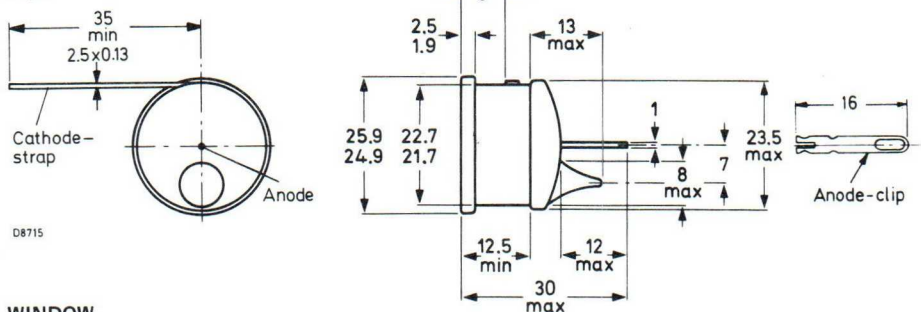
Dose rate range	3×10^{-3} to 10^2	mGy/h
	3×10^{-4} to 10	R/h
Plateau threshold voltage	500	V
Plateau length	200	V
Recommended supply voltage	600	V
Chrome-iron cathode	910	mg/cm ²
Mica window (19.8 mm diameter)	1.5 to 2.0	mg/cm ²

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 ²
Useful diameter	19.8	mm
Material	mica	

CATHODE

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

ENVIRONMENTAL (Manufacturer's test conditions)

Shock (half sine wave 3 ms duration) - peak acceleration	392	m/s ²
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FILLING

neon, argon, halogen

CAPACITANCE

Anode to cathode	1.0	pF
------------------	-----	----

TUBE WEIGHT

	14	g
--	----	---

OPERATING CHARACTERISTICS (Ambient temperature $\approx 25^{\circ}\text{C}$)

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.	5	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.	1.2	count/min
Dead time, at recommended supply voltage	max.	65	μs

LIMITING VALUES (Absolute max. rating system)

Anode resistor	min.	2.2	$\text{M}\Omega$
Anode voltage	max.	700	V
Ambient temperature continuous operating	max.	+70	$^{\circ}\text{C}$
	min.	-40	$^{\circ}\text{C}$
storage	max.	+75	$^{\circ}\text{C}$

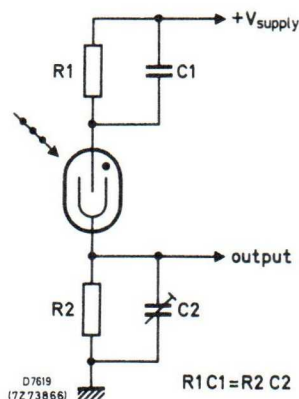
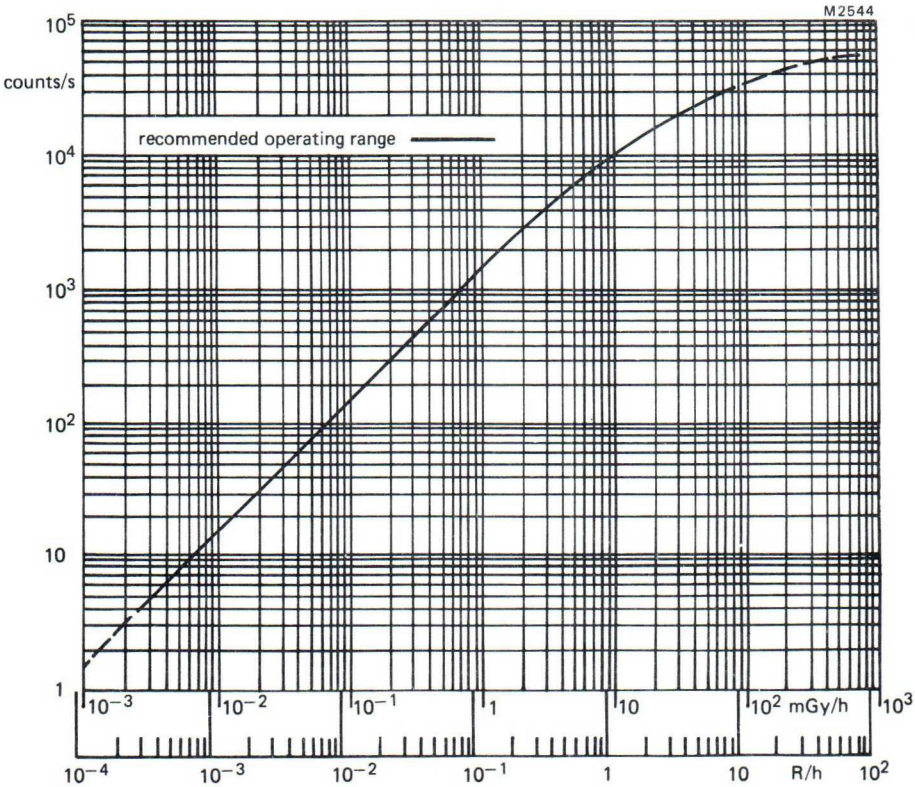
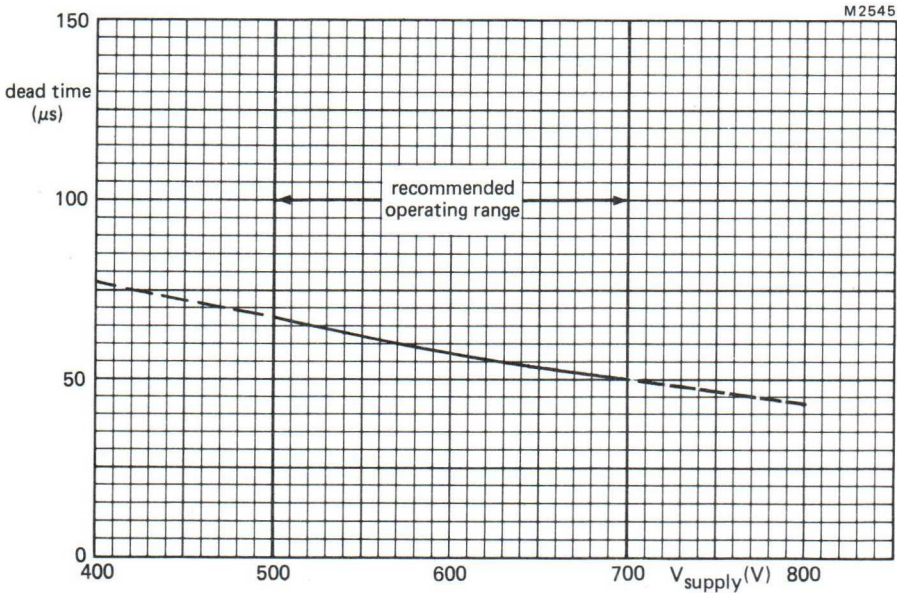
LIFE EXPECTANCYLife expectancy at $\approx 25^{\circ}\text{C}$ 5×10^{10} count**MEASURING CIRCUIT** $R_1 = 4.7 \text{ M}\Omega$ $R_2 = 100 \text{ k}\Omega$ $C_1 = 1 \text{ pF}^*$ 

Fig.2

*See General Information (paragraph 5.5)



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



Typical dead time as a function of supply voltage

GEIGER-MÜLLER TUBE

End window halogen quenched β and γ radiation counter tube.

QUICK REFERENCE DATA

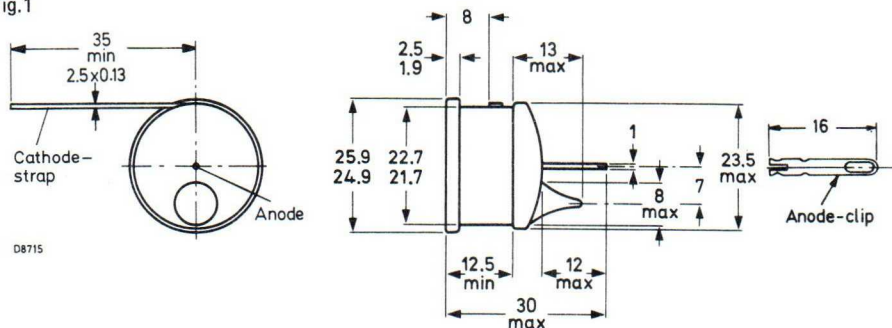
Dose rate range	3×10^{-3} to 10^2	mGy/h
	3×10^{-4} to 10	R/h
Plateau threshold voltage	500	V
Plateau length	200	V
Recommended supply voltage	600	V
Chrome-iron cathode	910	mg/cm ²
Mica window (19.8 mm diameter)	2.0 to 3.0	mg/cm ²

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/cm ²
Useful diameter	19.8	mm
Material	mica	

CATHODE

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

ENVIRONMENTAL (Manufacturer's test conditions)

Shock (half sine wave 3 ms duration) - peak acceleration	392	m/s ²
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FILLING

neon, argon, halogen

CAPACITANCE

Anode to cathode	1.0	pF
------------------	-----	----

TUBE WEIGHT

	14	g
--	----	---

OPERATING CHARACTERISTICS (Ambient temperature $\approx 25^\circ\text{C}$)

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.	8	count/min
Dead time, at recommended supply voltage	max.	65	μs

LIMITING VALUES (Absolute max. rating system)

Anode resistor	min.	2.2	$\text{M}\Omega$
Anode voltage	max.	700	V
Ambient temperature			
continuous operating	max.	+70	$^\circ\text{C}$
	min.	-40	$^\circ\text{C}$
storage	max.	+75	$^\circ\text{C}$

LIFE EXPECTANCY

Life expectancy at $\approx 25^\circ\text{C}$	5×10^{10}	count
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BETA RESPONSE

Point source ($^{90}\text{Sr}/^{90}\text{Y}$)	0.41	c/s/Bq
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Extended source ($^{90}\text{Sr}/^{90}\text{Y}$)	1.13	c/s/Bq cm^{-2}
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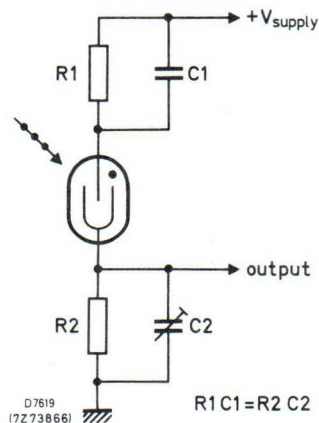
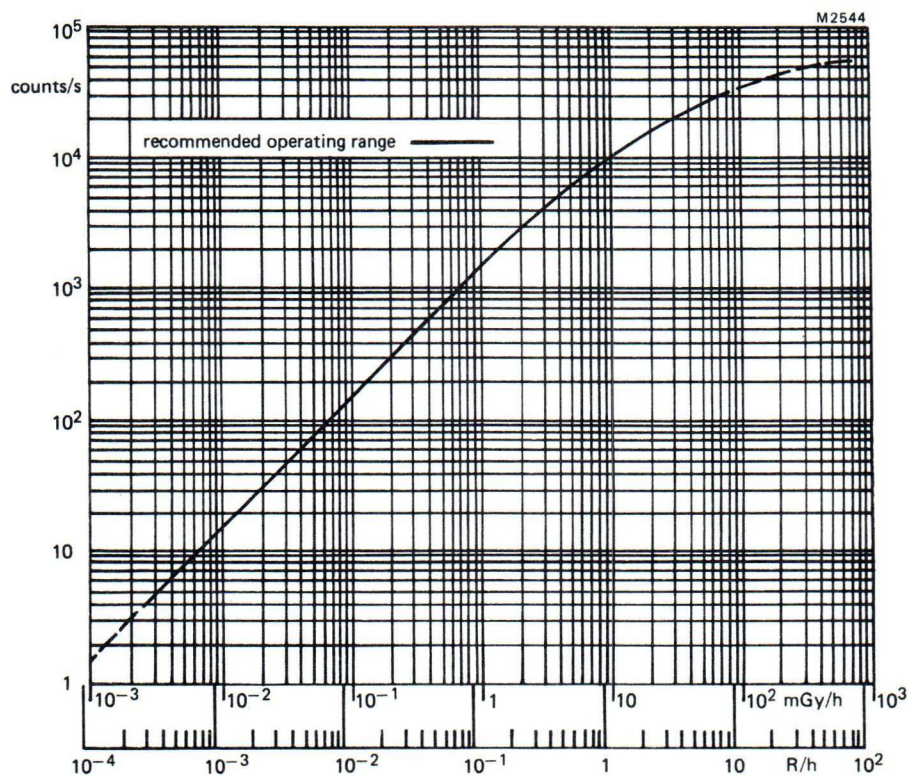
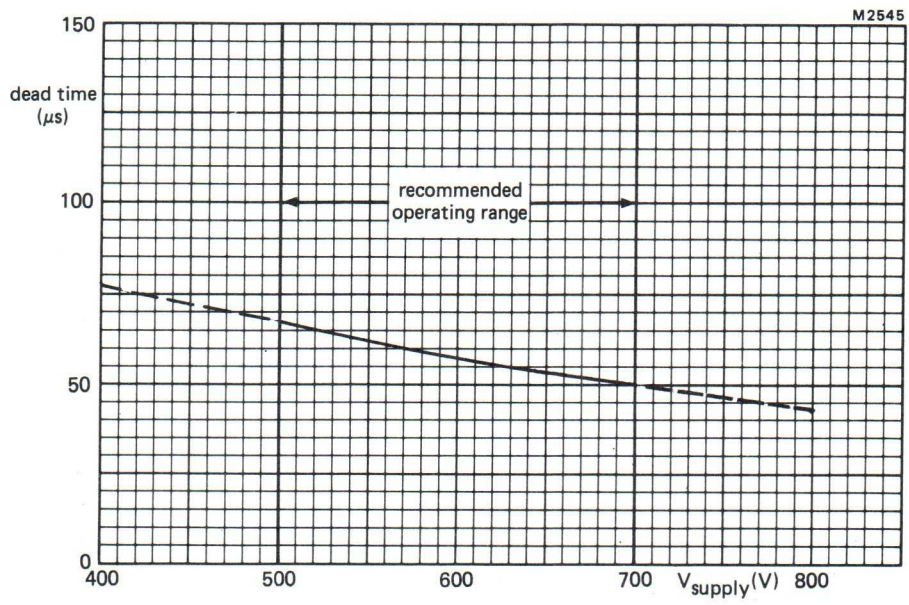
MEASURING CIRCUIT $R_1 = 4.7 \text{ M}\Omega$ $R_2 = 100 \text{ k}\Omega$ $C_1 = 1 \text{ pF}^*$ 

Fig.2

*See General Information (paragraph 5.5)

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



Typical dead time as a function of supply voltage

GEIGER-MÜLLER TUBE

End window halogen quenched α , β and γ radiation counter tube for measurement of low levels of radiation in combination with a guard counter tube, e.g. ZP1700.

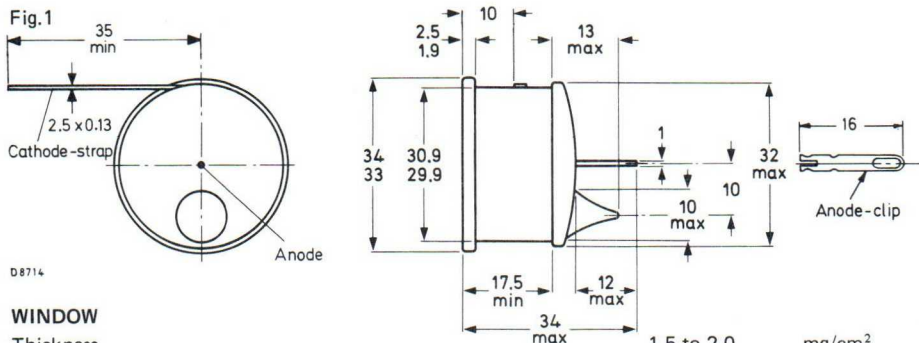
QUICK REFERENCE DATA

Dose rate range	10^{-3} to 20	mGy/h
	10^{-4} to 2	R/h
Plateau threshold voltage	500	V
Plateau length	250	V
Recommended supply voltage	625	V
Chrome-iron cathode	980	mg/cm ²
Mica window (27.8 mm diameter)	1.5 to 2.0	mg/cm ²

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/cm ²
Useful diameter	27.8	mm
Material	mica	

CATHODE

Thickness	980	mg/cm ²
Sensitive length	16	mm
Material	chrome-iron	

ENVIRONMENTAL (Manufacturer's test conditions)

Shock (half sine wave 3 ms duration) - peak acceleration	392	m/s ²
--	-----	------------------

FILLING

neon, argon, halogen

CAPACITANCE

Anode to cathode	1.4	pF
------------------	-----	----

TUBE WEIGHT

	22	g
--	----	---

OPERATING CHARACTERISTICS (Ambient temperature $\approx 25^{\circ}\text{C}$)

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	$\text{M}\Omega$
Anode voltage	max.	750	V
Ambient temperature continuous operating	max.	+70	$^{\circ}\text{C}$
	min.	-40	$^{\circ}\text{C}$
storage	max.	+75	$^{\circ}\text{C}$

LIFE EXPECTANCY

Life expectancy at $\approx 25^{\circ}\text{C}$	5×10^{10}	count
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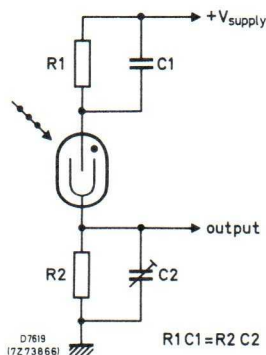
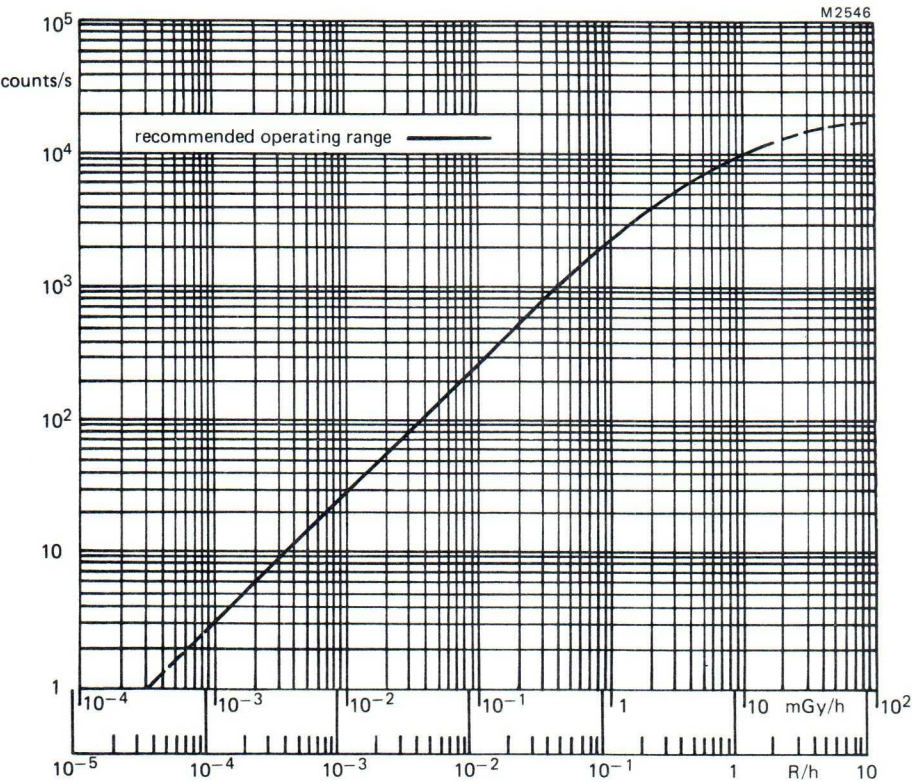
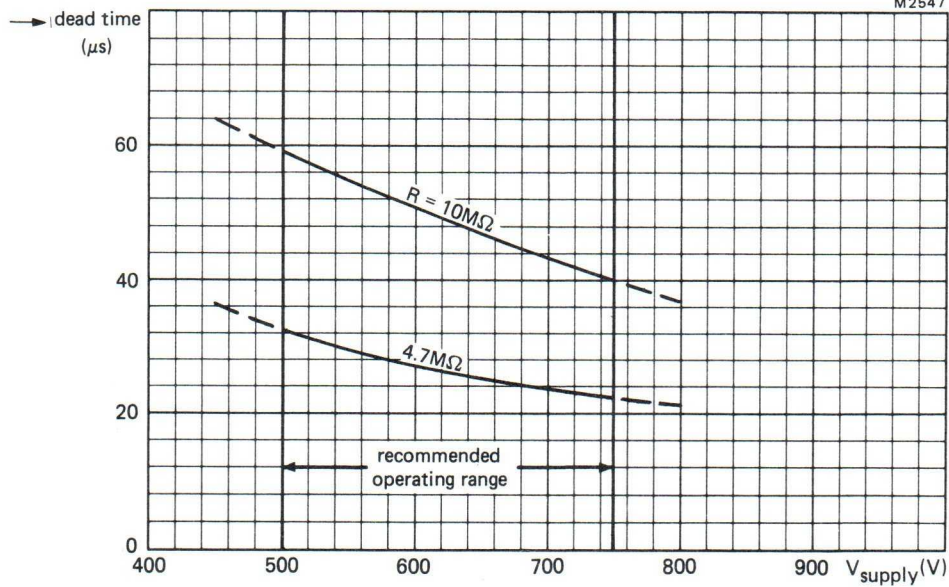
MEASURING CIRCUIT $R_1 = 10 \text{ M}\Omega$ $R_2 = 220 \text{ k}\Omega$ $C_1 = 1 \text{ pF}^*$ 

Fig.2

*See General Information (paragraph 5.5)



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



Typical dead time as a function of supply voltage

GEIGER-MÜLLER TUBE

End window halogen quenched β and γ radiation counter tube.

QUICK REFERENCE DATA

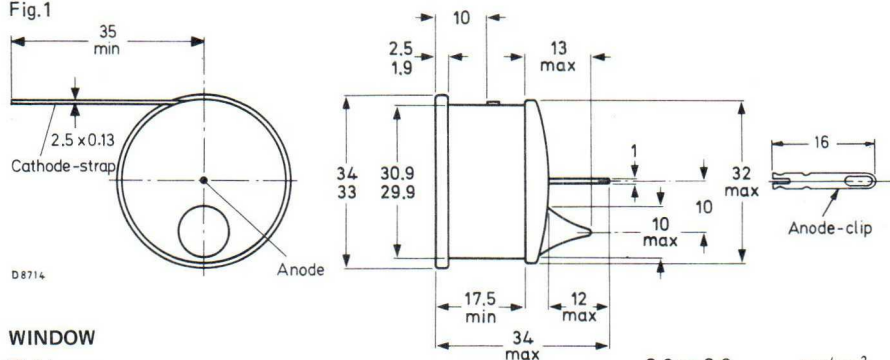
Dose rate range	10^{-3} to 20	mGy/h
	10^{-4} to 2	R/h
Plateau threshold voltage	500	V
Plateau length	250	V
Recommended supply voltage	625	V
Chrome-iron cathode	980	mg/cm ²
Mica window (27.8 mm diameter)	2.0 to 3.0	mg/cm ²

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/cm ²
Useful diameter	27.8	mm
Material	mica	

CATHODE

Thickness	980	mg/cm ²
Sensitive length	16	mm
Material	chrome-iron	

ENVIRONMENTAL (Manufacturer's test conditions)

Shock (half sine wave 3 ms duration) - peak acceleration	392	m/s ²
--	-----	------------------

FILLING

neon, argon, halogen

CAPACITANCE

Anode to cathode	1.4	pF
------------------	-----	----

TUBE WEIGHT

	22	g
--	----	---

OPERATING CHARACTERISTICS (Ambient temperature $\approx 25^\circ\text{C}$)

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

LIMITING VALUES (Absolute max. rating system)

Anode resistor	min.	4.7	$\text{M}\Omega$
Anode voltage	max.	750	V
Ambient temperature			
continuous operating	max.	+70	$^\circ\text{C}$
	min.	-40	$^\circ\text{C}$
storage	max.	+75	$^\circ\text{C}$

LIFE EXPECTANCYLife expectancy at $\approx 25^\circ\text{C}$ 5×10^{10} count**BETA RESPONSE**

Point source ($^{90}\text{Sr}/^{90}\text{Y}$)	0.38	c/s/Bq
Extended source ($^{90}\text{Sr}/^{90}\text{Y}$)	2.27	c/s/Bq cm^{-2}

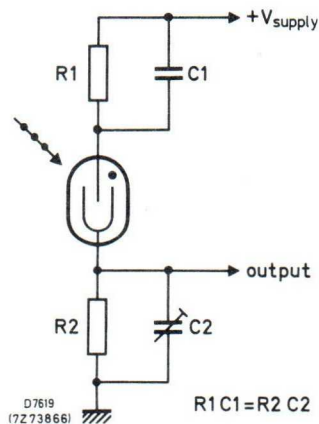
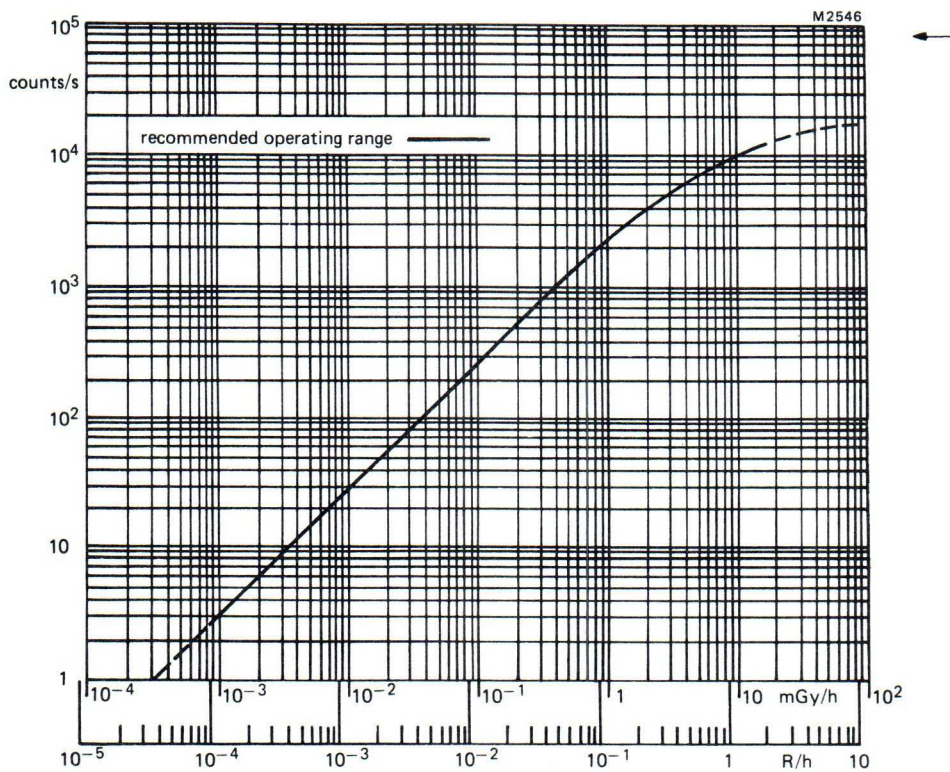
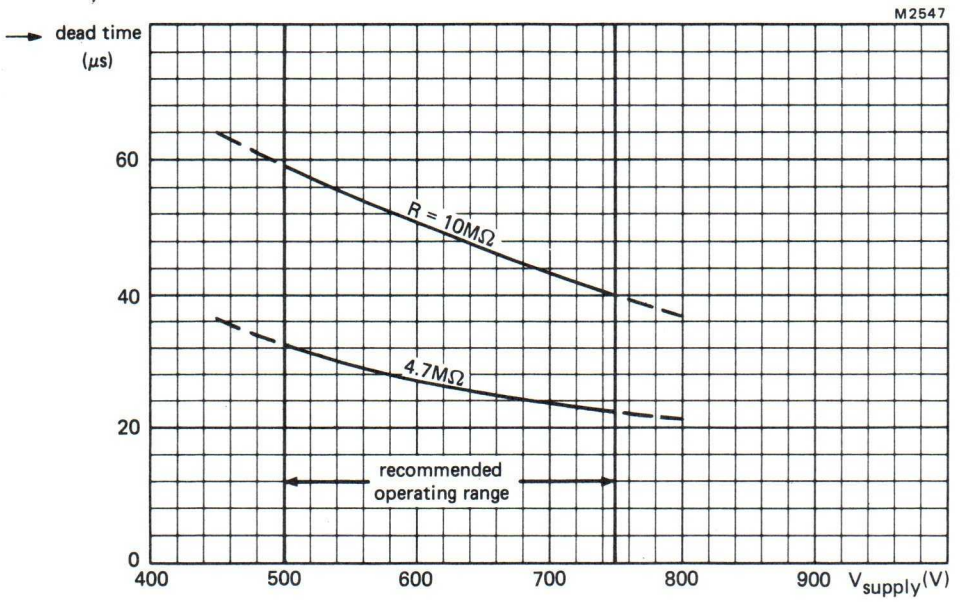
MEASURING CIRCUIT $R_1 = 10 \text{ M}\Omega$ $R_2 = 220 \text{ k}\Omega$ $C_1 = 1 \text{ pF}^*$ 

Fig.2

*See General Information (paragraph 5.5).



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



Typical dead time as a function of supply voltage

GEIGER-MÜLLER TUBE

End window halogen quenched β and γ radiation counter tube.

QUICK REFERENCE DATA

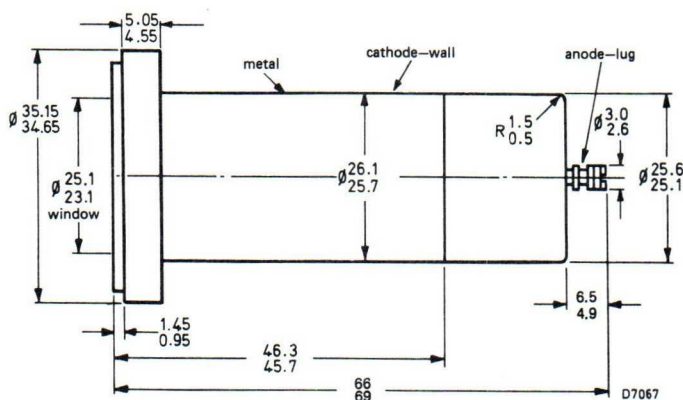
Dose rate range	10^{-3} to 2×10	mGy/h
	10^{-4} to 2	R/h
Threshold voltage	550	V
Plateau length	150	V
Recommended supply voltage	600	V
Chrome-iron cathode	690	mg/cm ²
Mica window thickness (24.1 mm diameter)	1.5 to 2.5	mg/cm ²

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 2.5	mg/cm ²
Effective diameter	24.1	mm
Material	mica	

CATHODE

Thickness	690	mg/cm ²
Sensitive length	26	mm
Material	chrome-iron	

ENVIRONMENTAL (Manufacturer's test conditions)

Shock (half sine wave 3 ms duration) - peak acceleration	392	m/s ²
--	-----	------------------

FILLING

neon, argon, halogen

CAPACITANCE

Anode to cathode	5.0	pF
------------------	-----	----

→ **TUBE WEIGHT**

63	g
----	---

OPERATING CHARACTERISTICS (Ambient temperature $\approx 25^\circ\text{C}$)

Measured in circuit of Fig.2

Starting voltage	max.	500	V
Threshold voltage	max.	550	V
Plateau length	min.	150	V
→ Recommended supply voltage (mid-plateau)		625	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	max.	25	count/min
Dead time, at recommended supply voltage	max.	70	μs

LIMITING VALUES (Absolute max. rating system)

Anode resistor	min.	2.7	M Ω
Anode voltage	max.	700	V
Ambient temperature	max.	+70	$^\circ\text{C}$
continuous operating	min.	-40	$^\circ\text{C}$
storage	max.	+75	$^\circ\text{C}$

LIFE EXPECTANCY

Life expectancy at $\approx 25^\circ\text{C}$	5×10^{10}	count
---	--------------------	-------

→ **BETA RESPONSE**

Point source ($^{90}\text{Sr}/^{90}\text{Y}$)	0.35	c/s/Bq
Extended source ($^{90}\text{Sr}/^{90}\text{Y}$)	2.44	c/s/Bq cm^{-2}

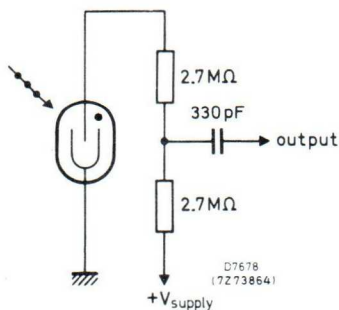
→ **MEASURING CIRCUITS**

Fig.2 Manufacturer's measuring circuit

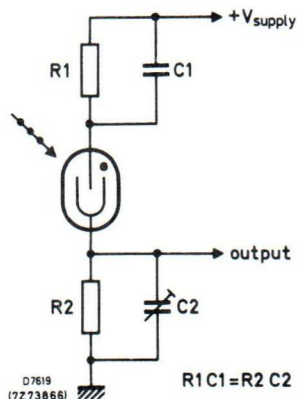
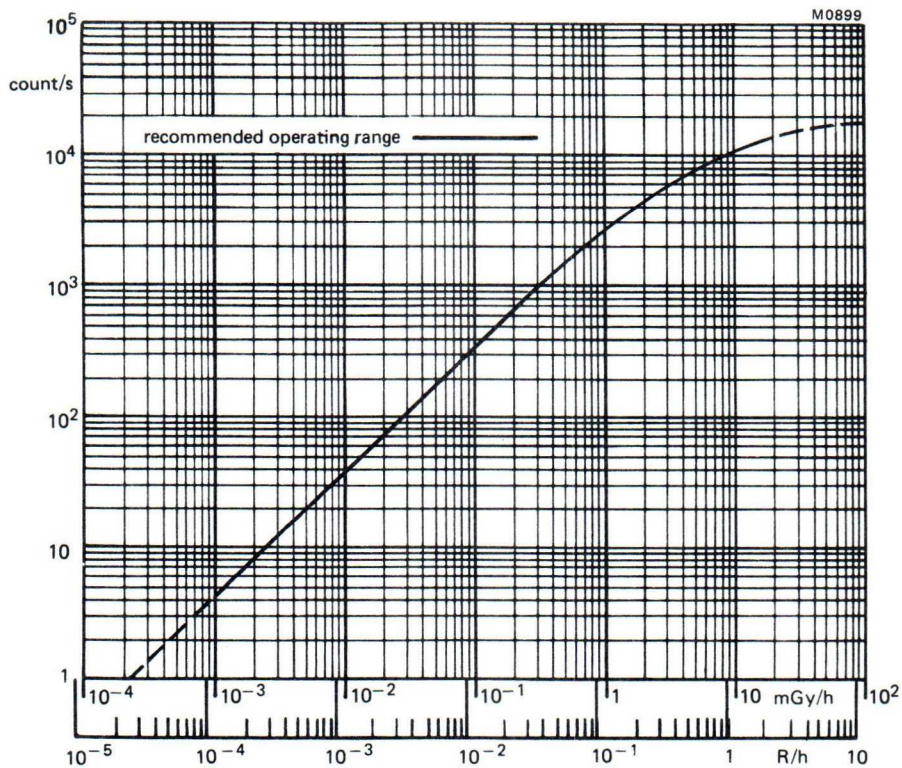
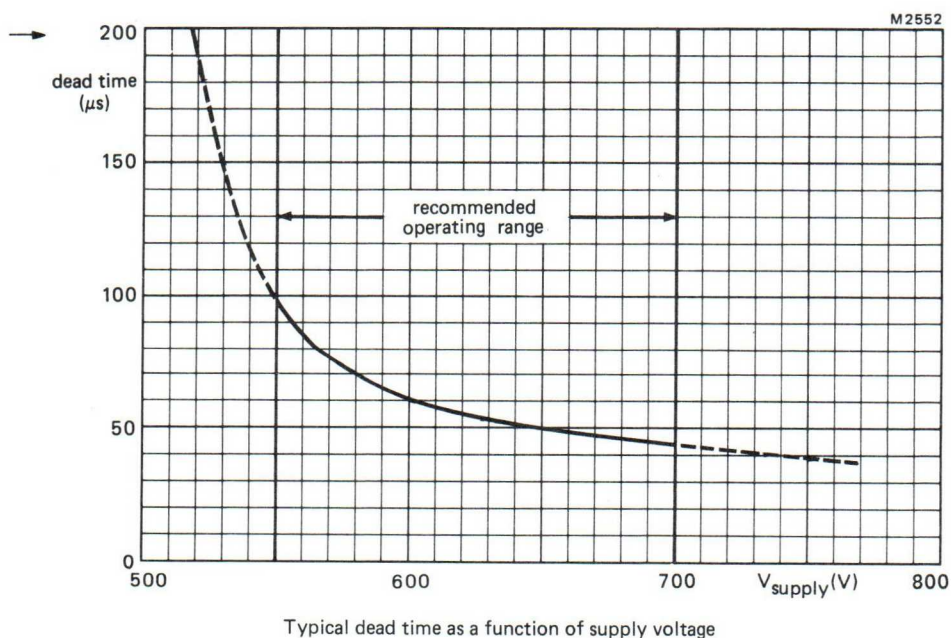
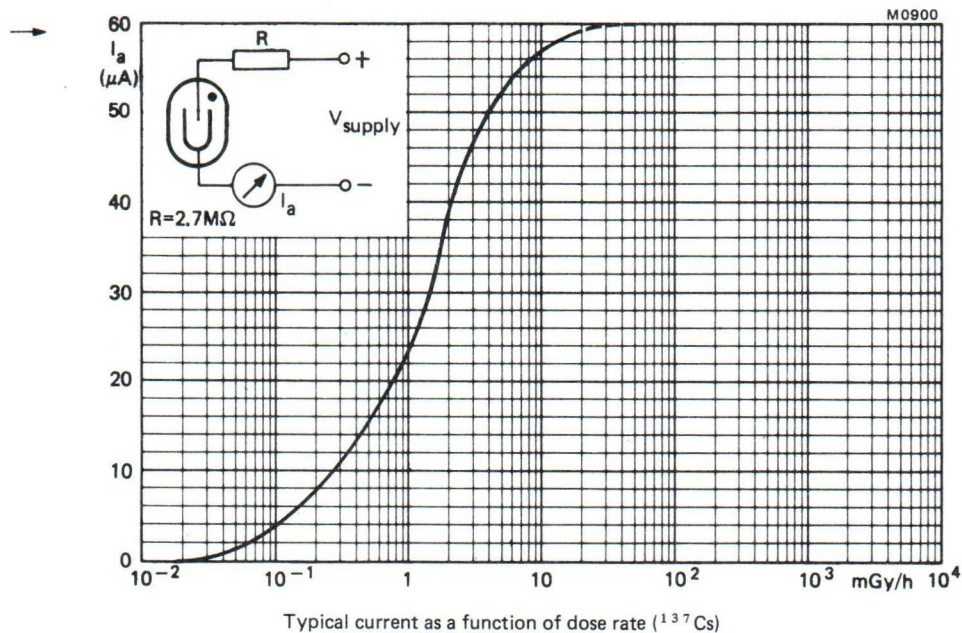


Fig.3 For optimum performance at very high dose rates this circuit may be used



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



GEIGER-MÜLLER TUBE

End window halogen quenched β and γ radiation counter tubes.

QUICK REFERENCE DATA

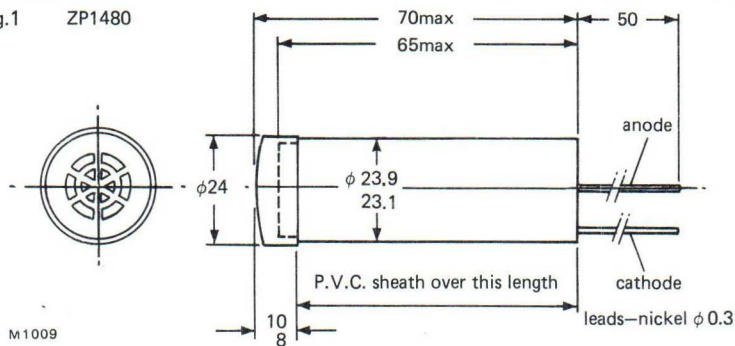
Dose rate range	10^{-3} to 2×10	mGy/h
	10^{-4} to 2	R/h
Plateau threshold voltage	400	V
Plateau length	100	V
Recommended supply voltage	450	V
Chrome-iron cathode	2000	mg/cm ²
Mica window (17 mm diameter)	2.5 to 3.0	mg/cm ²

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

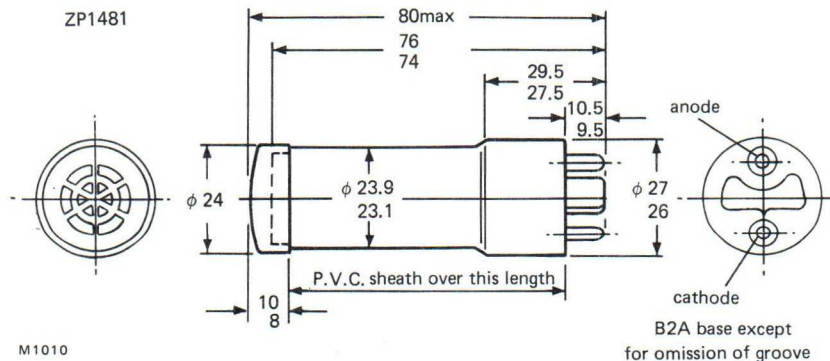
MECHANICAL DATA

Dimensions in mm ←

Fig.1 ZP1480



ZP1481



The ZP1481 may be used with socket type number MX199/SOCKET

WINDOW

Thickness	2.5 to 3.0	mg/cm ²
Useful diameter	17	mm
Material	mica	

CATHODE

Thickness	2000	mg/cm ²
Sensitive length	38	mm
Material	chrome-iron	

→ ENVIRONMENTAL (Manufacturer's test conditions)

Shock (half sine wave 3 ms duration) — peak acceleration	392	m/s ²
--	-----	------------------

FILLING

neon, argon, halogen

CAPACITANCE

Anode to cathode	3.5	pF
------------------	-----	----

→ TUBE WEIGHT

ZP1480:	74	g
ZP1481:	76	g

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
Plateau slope	max.	0.2	%/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.	120	μs

LIMITING VALUES (Absolute max. rating system)

Anode resistor	min.	2.7	MΩ
Anode voltage	max.	500	V
Ambient temperature continuous operating	max.	+70	°C
	min.	-40	°C
storage	max.	+75	°C

LIFE EXPECTANCY

Life expectancy at ≈ 25 °C	5 × 10 ¹⁰	count
----------------------------	----------------------	-------

MEASURING CIRCUIT

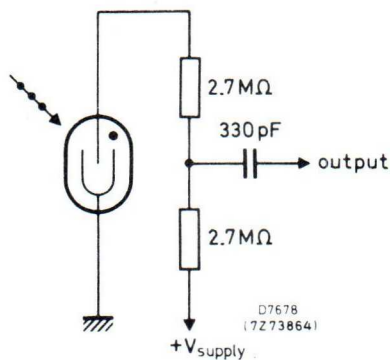
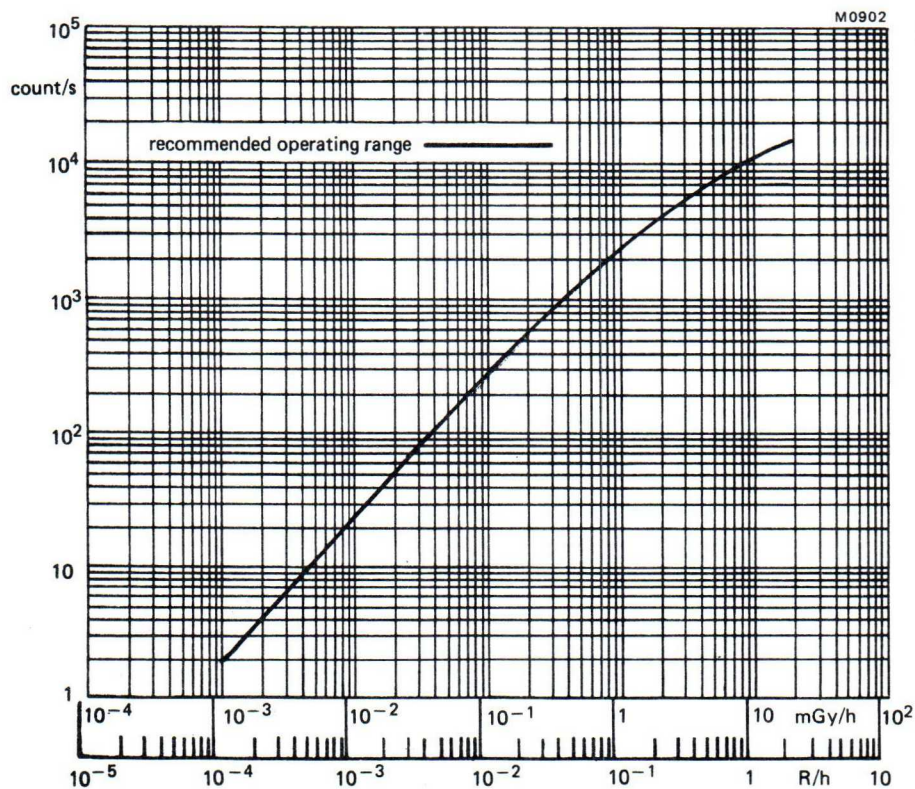
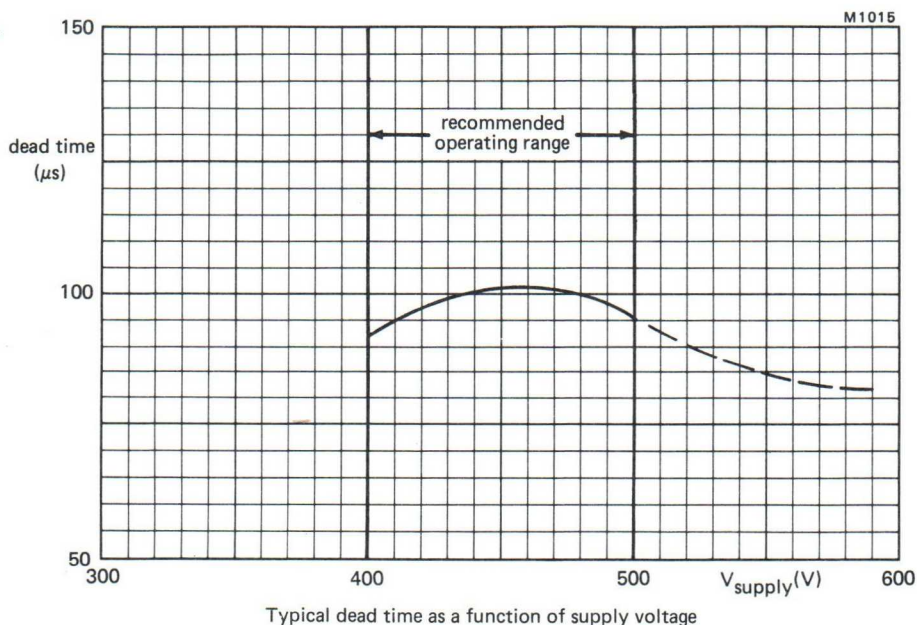
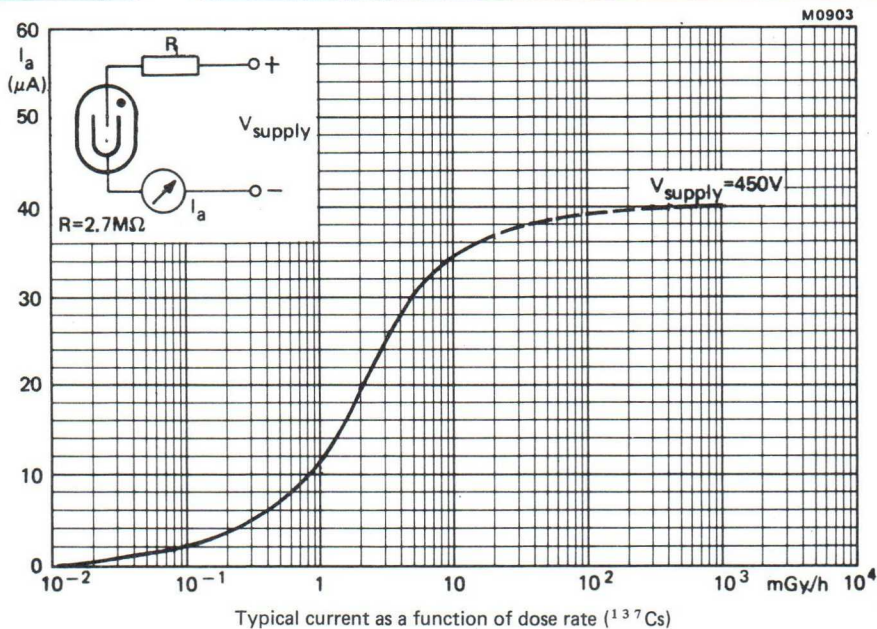


Fig.2

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



DEVELOPMENT SAMPLE DATA

This information is derived from development samples made available for evaluation. It does not necessarily imply that the device will go into regular production.

ZP1490

GEIGER-MÜLLER TUBE

End window halogen quenched α , β and γ radiation counter tube for measurement of low levels of radiation.

QUICK REFERENCE GUIDE

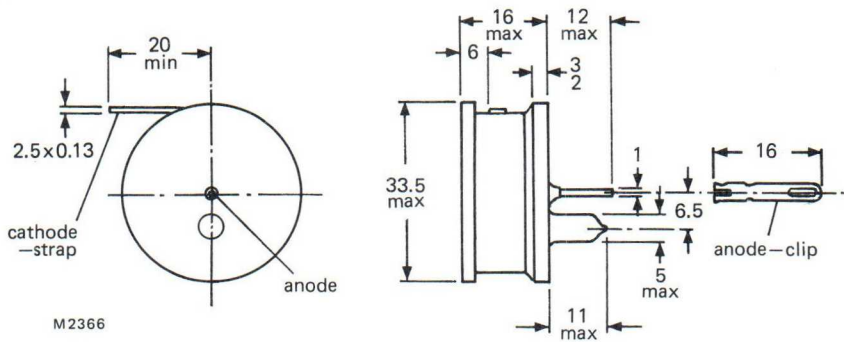
Dose rate range	10^{-3} to 20 10^{-4} to 2	mGy/h R/h
Plateau threshold voltage	450	V
Plateau length	250	V
Recommended supply voltage	575	V
Background (shielded with 50 mm Pb with an inner liner of 3 mm Al)	max. 15	count/min.
Chrome iron cathode	900	mg/cm ²
Mica window (28 mm diameter)	1.5 to 2.0	mg/cm ²

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 ²
Useful diameter	28	mm
Material	mica	

CATHODE

Sensitive length	8	mm
Material	chrome-iron	

FILLING

neon, argon, halogen

TUBE WEIGHT

20 g

OPERATING CHARACTERISTICS (Ambient temperature $\approx 25^{\circ}\text{C}$)

Measured in circuit of Fig.2

Starting voltage	max.	370	V
Plateau threshold voltage	max.	450	V
Plateau length		250	V
Recommended supply voltage		575	V
Plateau slope	max.	0.06	%/V
Background (shielded with 50 mm Pb with an inner liner of 3 mm Al)	max.	15	count/min
Dead time, at recommended supply voltage	max.	55	μs

LIMITING VALUES (Absolute max. rating system)

Anode resistor	min.	4.7	$\text{M}\Omega$
Anode voltage	max.	700	V
Ambient temperature			
continuous operating	max.	+70	$^{\circ}\text{C}$
	min.	-40	$^{\circ}\text{C}$
storage	max.	+75	$^{\circ}\text{C}$

LIFE EXPECTANCY

Life expectancy at $\approx 25^{\circ}\text{C}$	5×10^{10}	count
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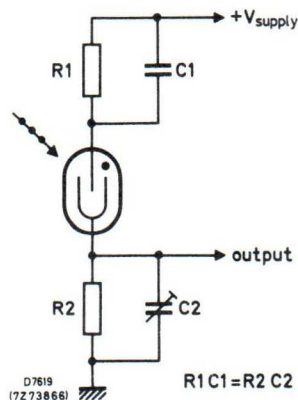
MEASURING CIRCUIT $R_1 = 4.7 \text{ M}\Omega$ $R_2 = 220 \text{ k}\Omega$ $C_1 = 1 \text{ pF}^*$ 

Fig.2

*See General Information (paragraph 5.5)

Graphs will be published in due course

GEIGER-MÜLLER TUBE

End window halogen quenched X-ray counter tube.

QUICK REFERENCE DATA

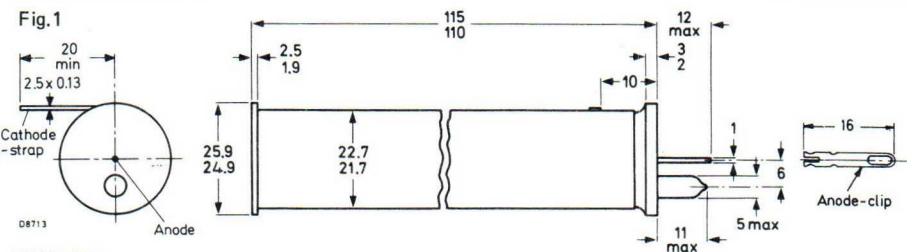
Energy range	6.0 to 20	keV
Wavelength range	0.06 to 0.2	nm
Plateau threshold voltage	1600	V
Plateau length	400	V
Recommended supply voltage	1800	V
Chrome-iron cathode	910	mg/cm ²
Mica window (19.8 mm diameter)	2.5 to 3.5	mg/cm ²

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 ²
Useful diameter	19.8	mm
Material	mica	

CATHODE

Thickness	910	mg/cm ²
Sensitive length	107	mm
Material	chrome-iron	

ENVIRONMENTAL (Manufacturer's test conditions)

Shock (half sine wave 3 ms duration) – peak acceleration	392	m/s ²
--	-----	------------------

FILLING

Gas pressure*	80	kPa
---------------	----	-----

CAPACITANCE

Anode to cathode	2.8	pF
------------------	-----	----

TUBE WEIGHT

*Caution, transport by air to be in a hermetically sealed container.

OPERATING CHARACTERISTICS (Ambient temperature $\approx 25^{\circ}\text{C}$)

Measured in circuit of Fig.2

Starting voltage	max.	1450	V
Plateau threshold voltage	max.	1600	V
Plateau length		400	V
Recommended supply voltage		1800	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.	25	count/min
Dead time, at recommended supply voltage	max.	110	μs

LIMITING VALUES (Absolute max. rating system)

Anode resistor	min.	4.7	$\text{M}\Omega$
Anode voltage	max.	2000	V
Ambient temperature			
continuous operating	max.	+70	$^{\circ}\text{C}$
	min.	0	$^{\circ}\text{C}$
storage	max.	+75	$^{\circ}\text{C}$

LIFE EXPECTANCY

Life expectancy at $\approx 25^{\circ}\text{C}$	10^{10}	count
---	-----------	-------

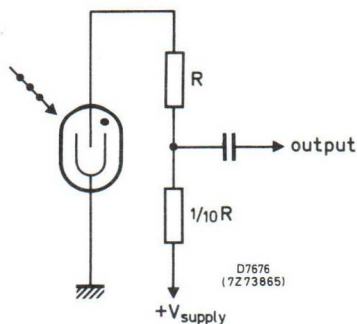
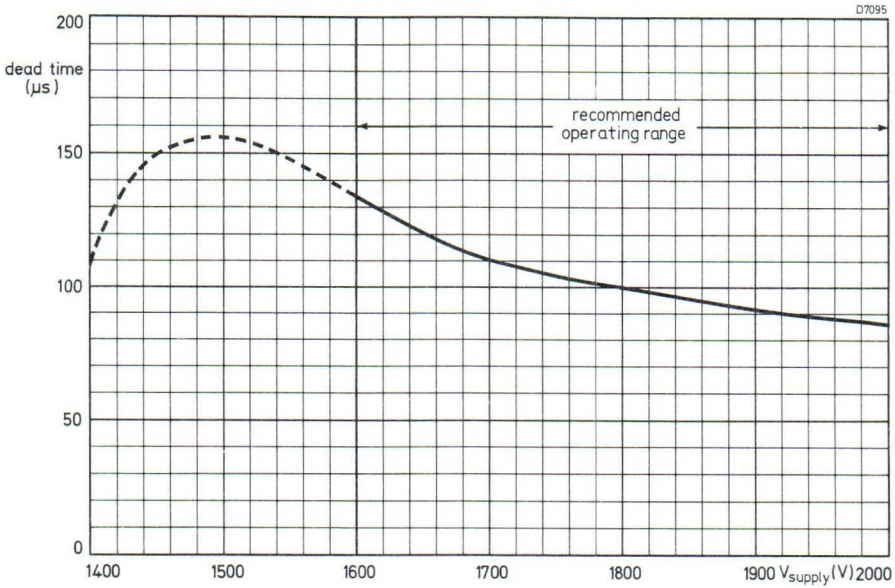
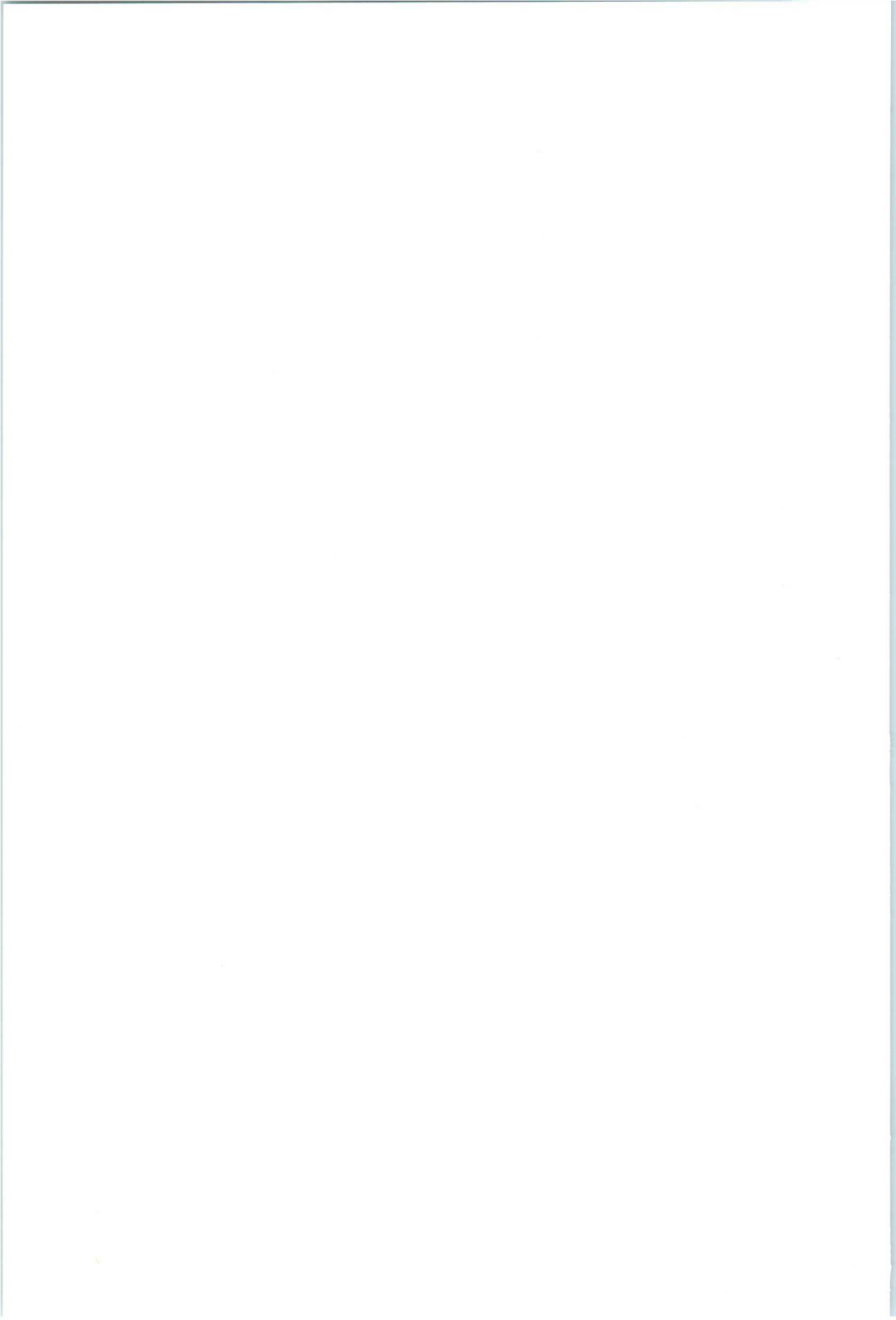
MEASURING CIRCUIT $R = 4.7 \text{ M}\Omega$ 

Fig.2



Typical dead time as a function of supply voltage



GEIGER-MÜLLER TUBE

Side window organically quenched X-ray counter tube.

QUICK REFERENCE DATA

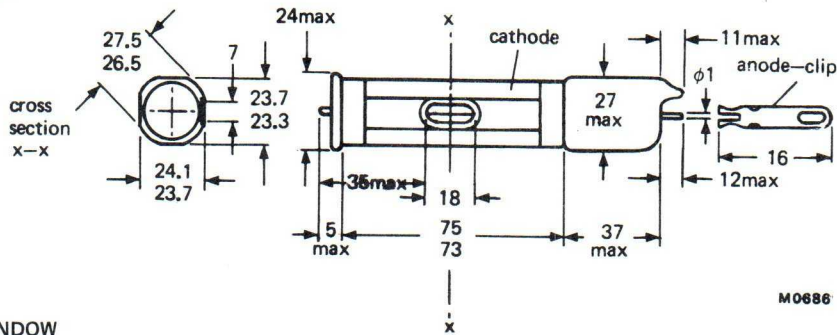
Energy range	2.5 to 40	keV
Wavelength range	0.03 to 0.5	nm
Operating voltage range	1500 to 1800	V
Chrome-iron cathode		
Mica window (7 x 18 mm)	2.0 to 2.5	mg/cm ²

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

MECHANICAL DATA

Dimensions in mm ←

Fig.1



M0686

WINDOW

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

CATHODE

Sensitive length	67	mm
Material	chrome-iron	

ENVIRONMENTAL (Manufacturer's test conditions)

Shock (half sine wave 3 ms duration) -- peak acceleration	392	m/s ²
---	-----	------------------

FILLING

xenon and organic vapour

Gas pressure	40	kPa
--------------	----	-----

CAPACITANCE

Anode to cathode	2.0	pF
------------------	-----	----

TUBE WEIGHT

89	g
----	---

OPERATING CHARACTERISTICS (Ambient temperature $\approx 25^{\circ}\text{C}$)

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 $V_p \approx 10\text{ mV}$ (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	$^{\circ}\text{C}$
	min. -20	$^{\circ}\text{C}$
storage	max. +50	$^{\circ}\text{C}$

MEASURING CIRCUIT

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

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

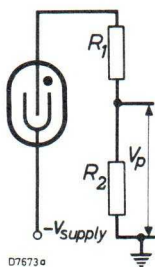
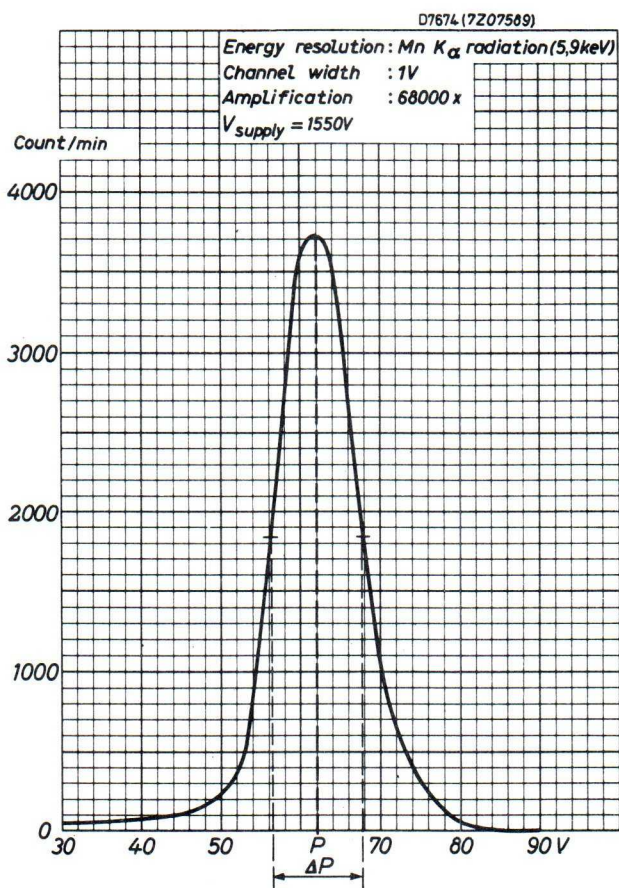


Fig.2

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 = average pulse height, ΔP = width of pulse height at half maximum value.



Typical energy resolution curve



GEIGER-MÜLLER TUBE

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.

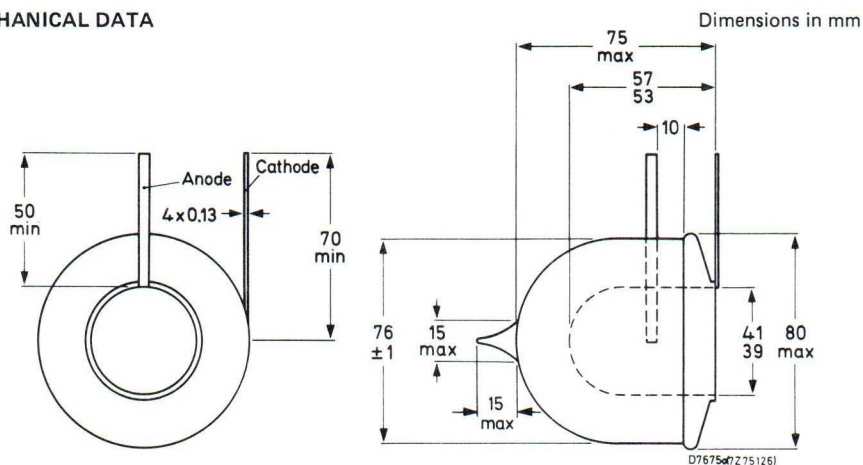
QUICK REFERENCE DATA

Dose rate range	3×10^{-4} to 3×10^{-1}	mGy/h
	4×10^{-5} to 3×10^{-2}	R/h
Plateau threshold voltage	800	V
Plateau length	400	V
Recommended supply voltage	1000	V
Chrome-iron cathode	760	mg/cm ²

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

MECHANICAL DATA

Fig.1



CATHODE AND ANODE

Thickness	760	mg/cm ²
Material	chrome-iron	

ENVIRONMENTAL (Manufacturer's test conditions)

Shock (half sine wave 3 ms duration) — peak acceleration	392	m/s ²
--	-----	------------------

FILLING

neon, argon, halogen

CAPACITANCE

Anode to cathode	8.0	pF
------------------	-----	----

TUBE WEIGHT

186	g
-----	---

OPERATING CHARACTERISTICS (Ambient temperature $\approx 25^\circ\text{C}$)

Measured in 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	$\text{M}\Omega$
Anode voltage	max.	1200	V
Ambient temperature continuous operating	max.	+70	$^\circ\text{C}$
	min.	-40	$^\circ\text{C}$
storage	max.	+75	$^\circ\text{C}$

LIFE EXPECTANCYLife expectancy at $\approx 25^\circ\text{C}$ 5×10^{10} count**MEASURING CIRCUITS**

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

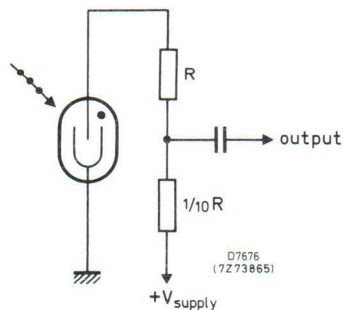
 $R = 10 \text{ M}\Omega$ $R_1 = R_2 = 10 \text{ M}\Omega$ 

Fig.2

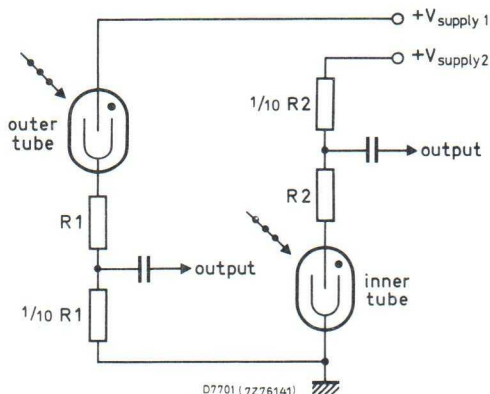
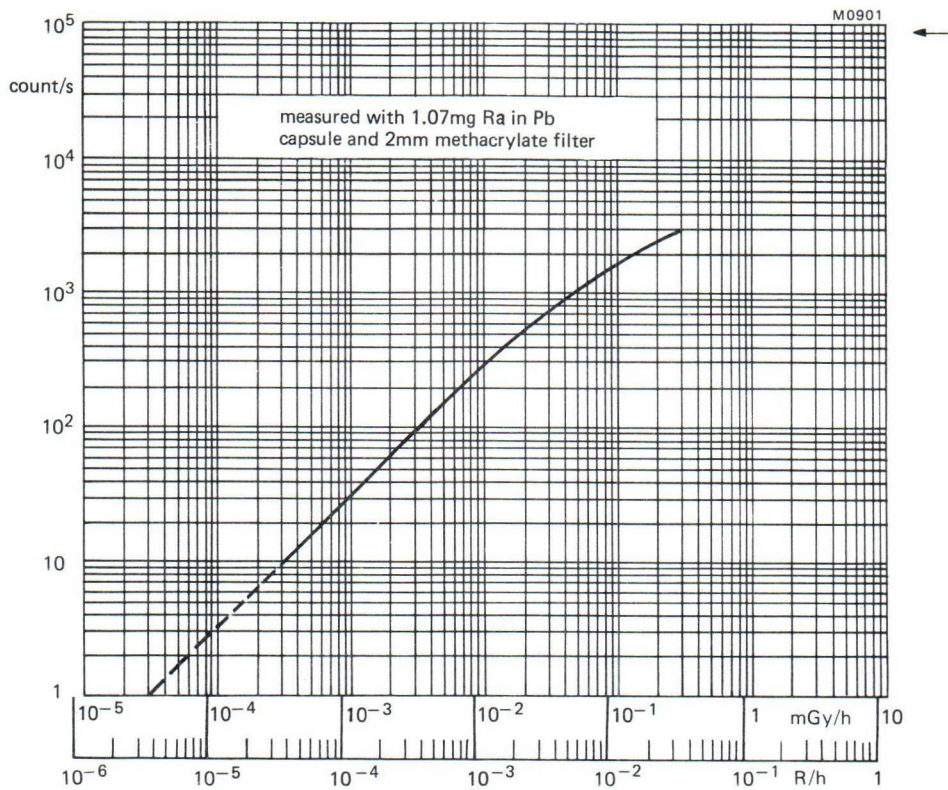
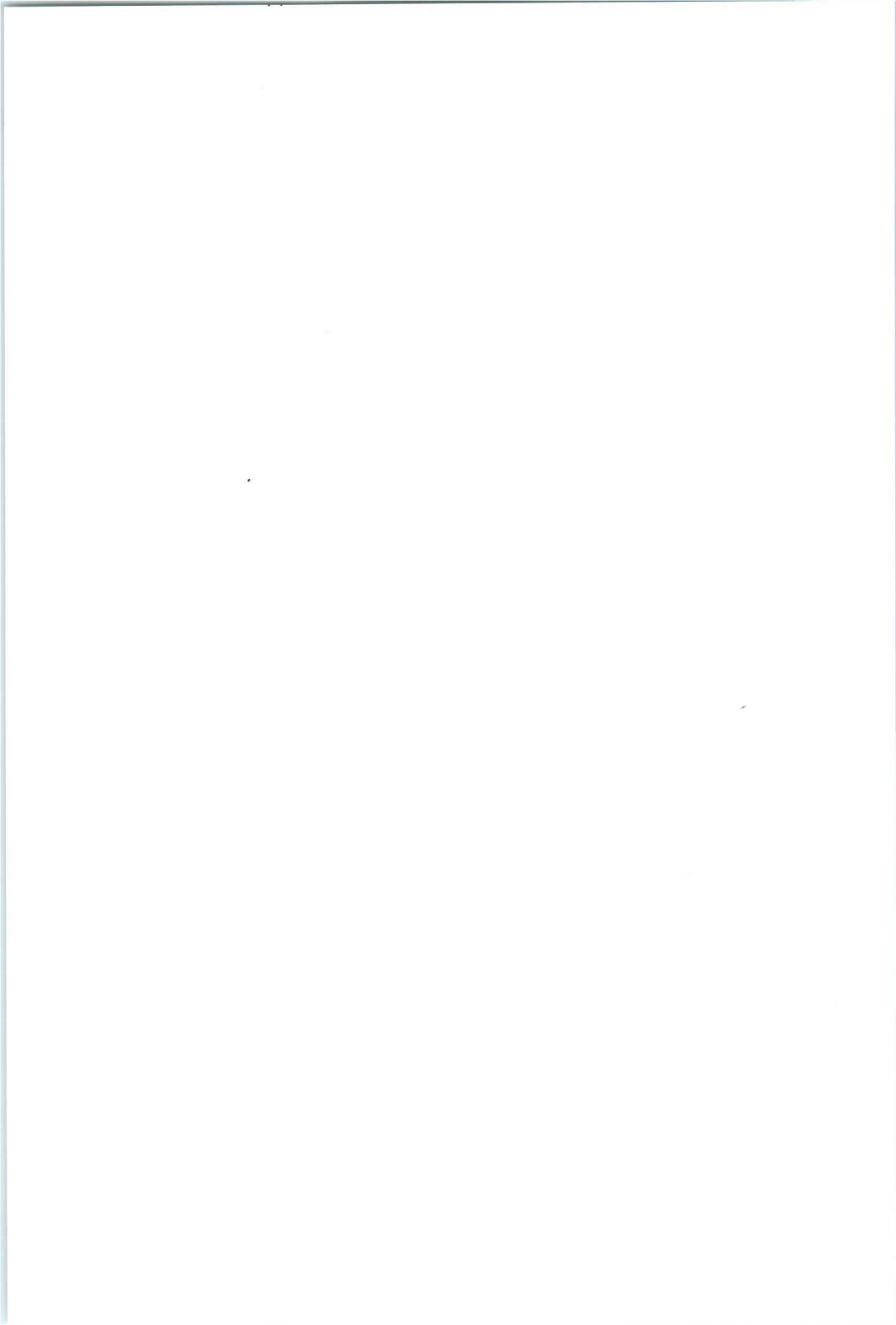


Fig.3



Typical counting rate as a function of dose rate



GEIGER-MÜLLER TUBE

Halogen quenched γ radiation counter tube for use at temperatures up to 200 °C. The temperature response is flat to within 8% over the range -40 °C to +200 °C.

QUICK REFERENCE DATA

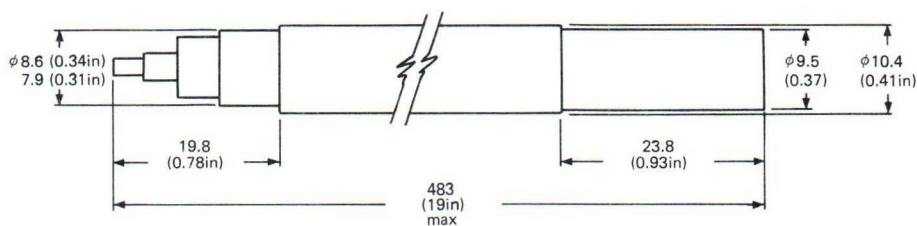
Dose rate range	2×10^{-4} to 4 2×10^{-5} to 5×10^{-1}	mGy/h R/h
Plateau threshold voltage	700	V
Plateau length	150	V
Recommended supply voltage	775	V
Chrome-iron cathode, platinum plated		

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

MECHANICAL DATA

Dimensions in mm (and inches)

Fig.1



tube must not be clamped within 80mm of either end

M.2693

CATHODE

Thickness	0.5	mm
Sensitive length	419	mm
	16.5	inches
Material	chrome iron, platinum plated	

FILLING

neon, argon, halogen

CAPACITANCE

Anode to cathode	11	pF
------------------	----	----

TUBE WEIGHT

57	g
----	---

OPERATING CHARACTERISTICS (Ambient temperature $\approx 25^\circ\text{C}$)

Measured in circuit of Fig.2

Starting voltage	max.	630	V
Plateau threshold voltage	max.	700	V
Plateau length		150	V
Recommended supply voltage		775	V
Plateau slope	max.	0.08	%/V
Background (shielded with 50 mm Pb with an inner liner of 6 mm Al), at recommended supply voltage	max.	25	count/min
Dead time, at recommended supply voltage	max.	75	μs

LIMITING VALUES (Absolute max. rating system)

Anode resistor	min.	0	$\text{M}\Omega$
Anode voltage	max.	850	V
Ambient temperature			
continuous operating	max.	+200	$^\circ\text{C}$
	min.	-40	$^\circ\text{C}$
storage	max.	+150	$^\circ\text{C}$

LIFE EXPECTANCY

Life expectancy at $\approx 25^\circ\text{C}$	10^{10}	count
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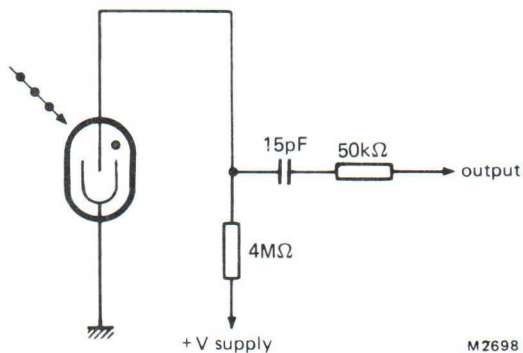
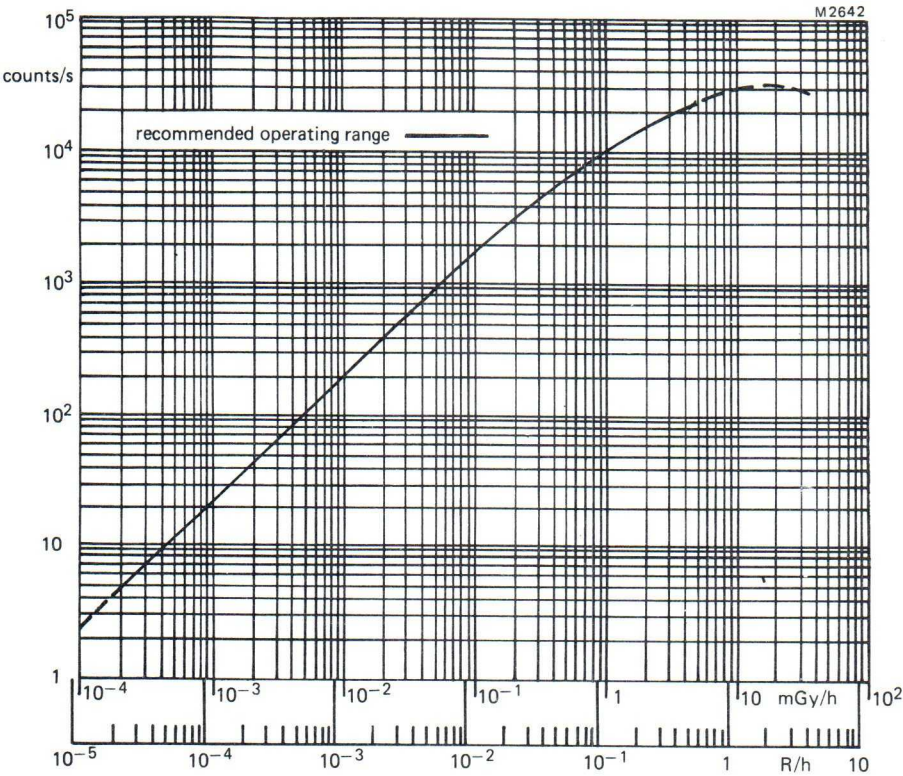
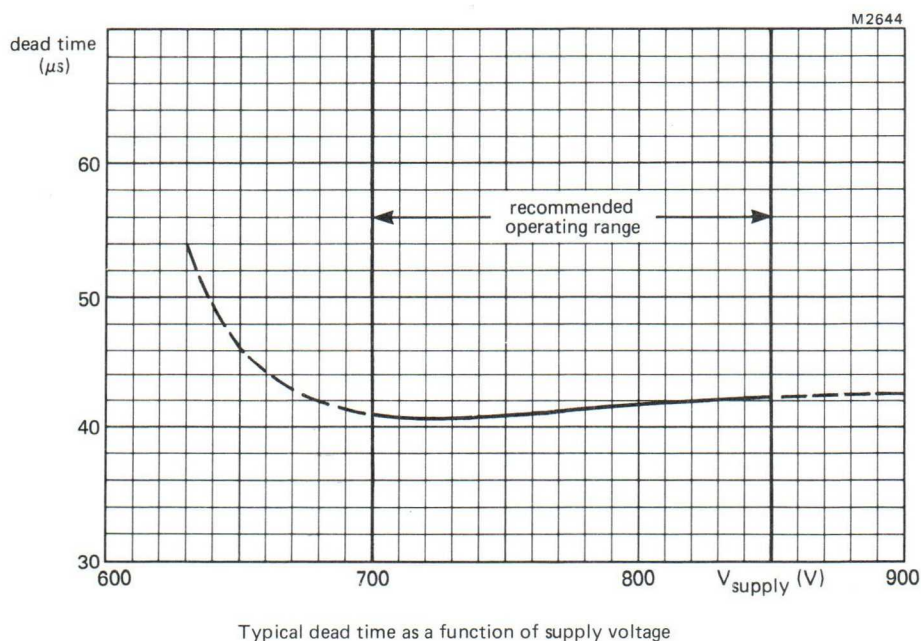
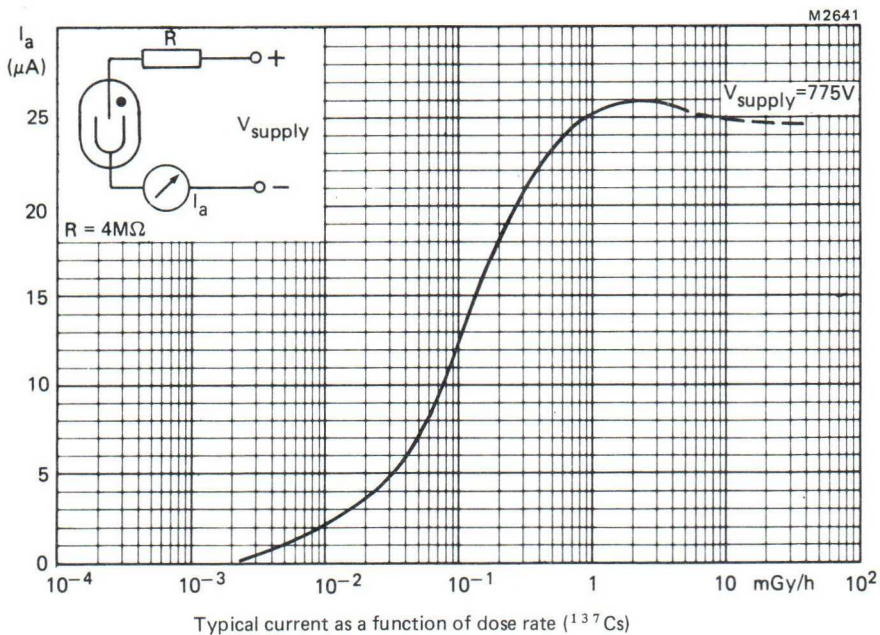
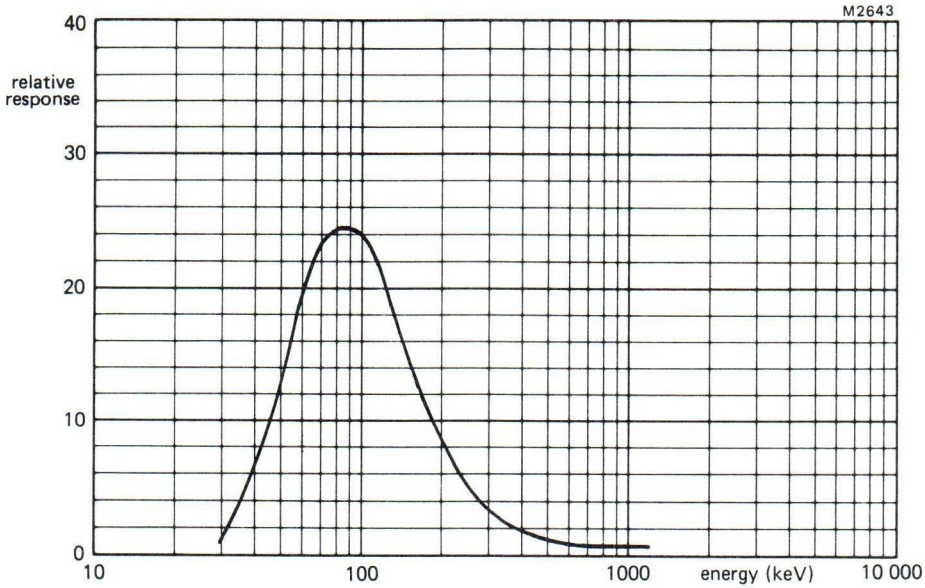
MEASURING CIRCUIT

Fig.2



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





Typical energy response relative to ^{137}Cs

GEIGER-MÜLLER TUBE

Halogen quenched γ radiation counter tube for use at temperatures up to 200 °C. The temperature response is flat to within 8% over the range -40 °C to +200 °C.

QUICK REFERENCE DATA

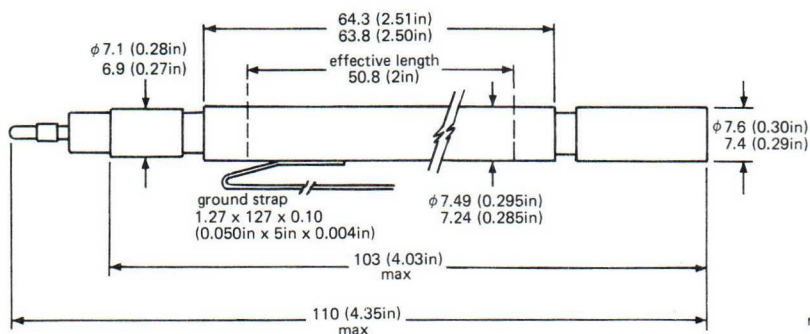
Dose rate range	3×10^{-3} to 40	mGy/h
	3×10^{-4} to 5	R/h
Plateau threshold voltage	650	V
Plateau length	250	V
Recommended supply voltage	775	V
Chrome-iron cathode		

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

MECHANICAL DATA

Dimensions in mm (and inches)

Fig. 1



M2694

tube must not be clamped within 20mm of either end

CATHODE

Thickness	0.5	mm
Sensitive length	51	mm
	2	inches
Material	chrome iron, platinum plated	

FILLING

neon, argon, halogen

CAPACITANCE

Anode to cathode	3	pF
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TUBE WEIGHT

	10	g
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OPERATING CHARACTERISTICS (Ambient temperature $\approx 25^\circ\text{C}$)

Measured in circuit of Fig.2

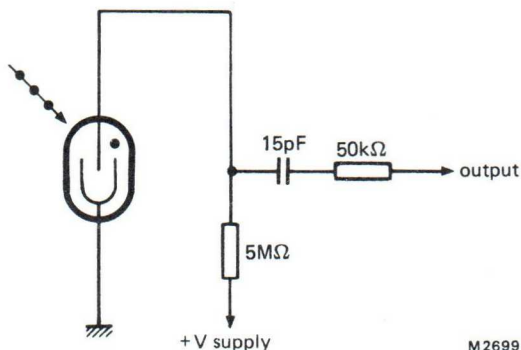
Starting voltage	max.	630	V
Plateau threshold voltage	max.	650	V
Plateau length		250	V
Recommended supply voltage		775	V
Plateau slope	max.	0.08	%/V
Background (shielded with 50 mm Pb with an inner liner of 6 mm Al), at recommended supply voltage	max.	25	count/min
Dead time, at recommended supply voltage	max.	75	μs

LIMITING VALUES (Absolute max. rating system)

Anode resistor	min.	0	$\text{M}\Omega$
Anode voltage	max.	900	V
Ambient temperature continuous operating	max.	+200	$^\circ\text{C}$
	min.	-40	$^\circ\text{C}$
storage	max.	+150	$^\circ\text{C}$

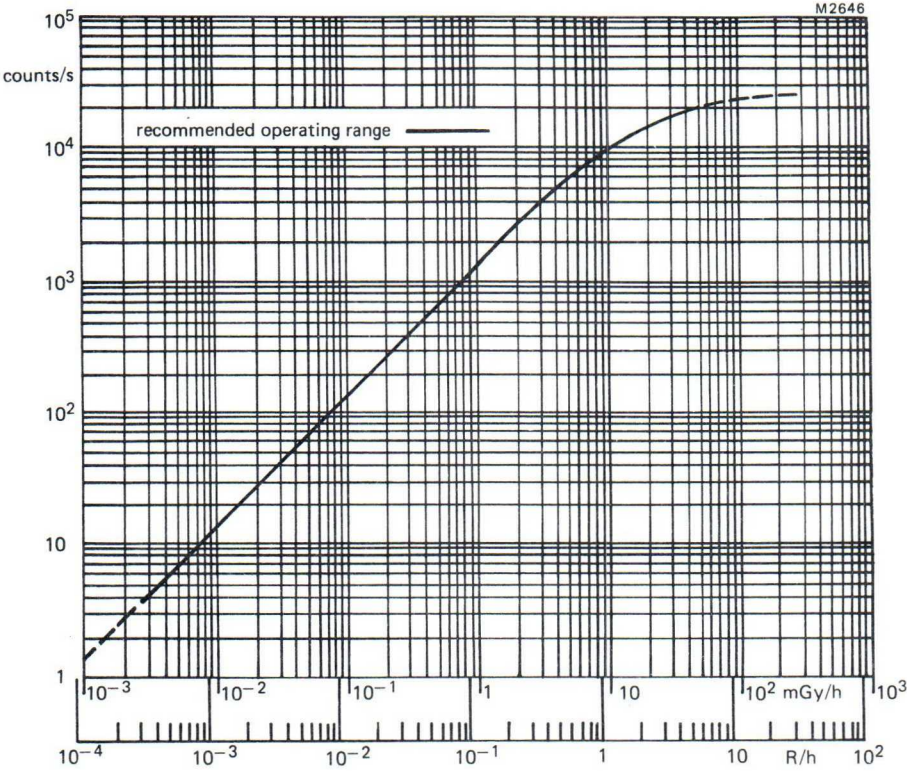
LIFE EXPECTANCY

Life expectancy at $\approx 25^\circ\text{C}$	10^{10}	count
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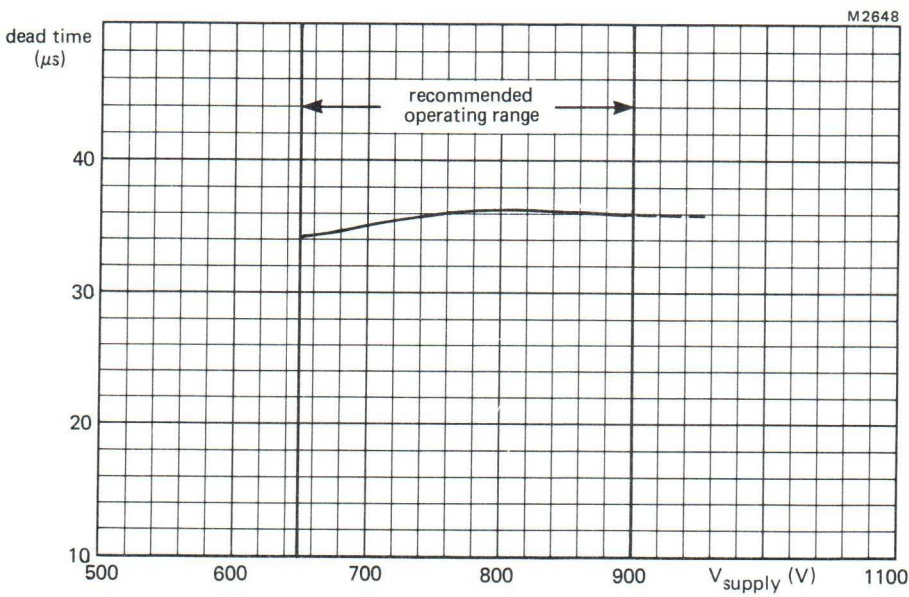
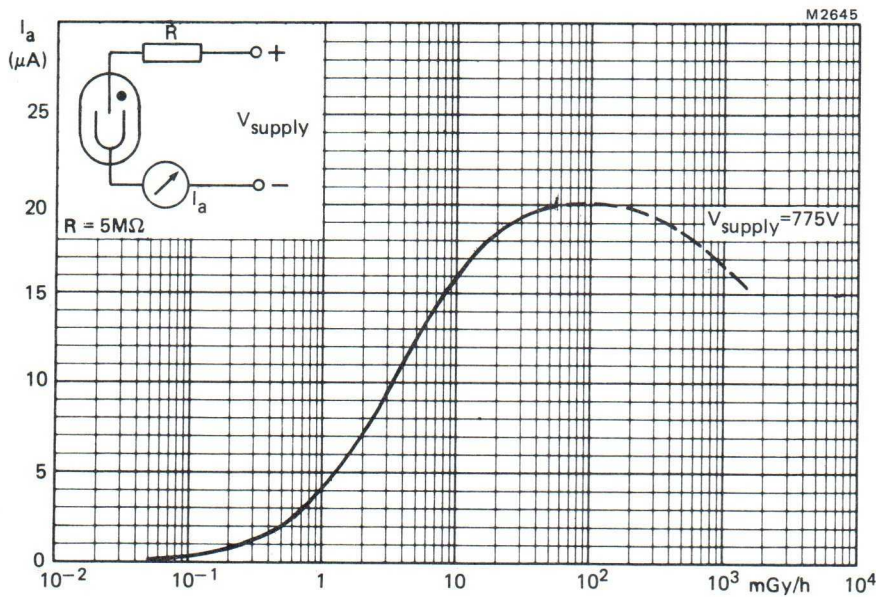
MEASURING CIRCUIT

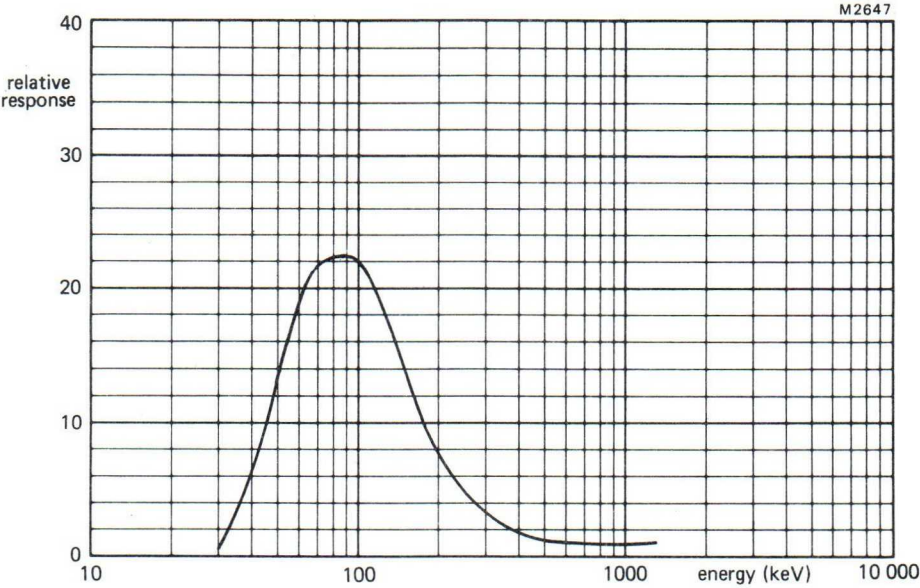
M2699

Fig.2

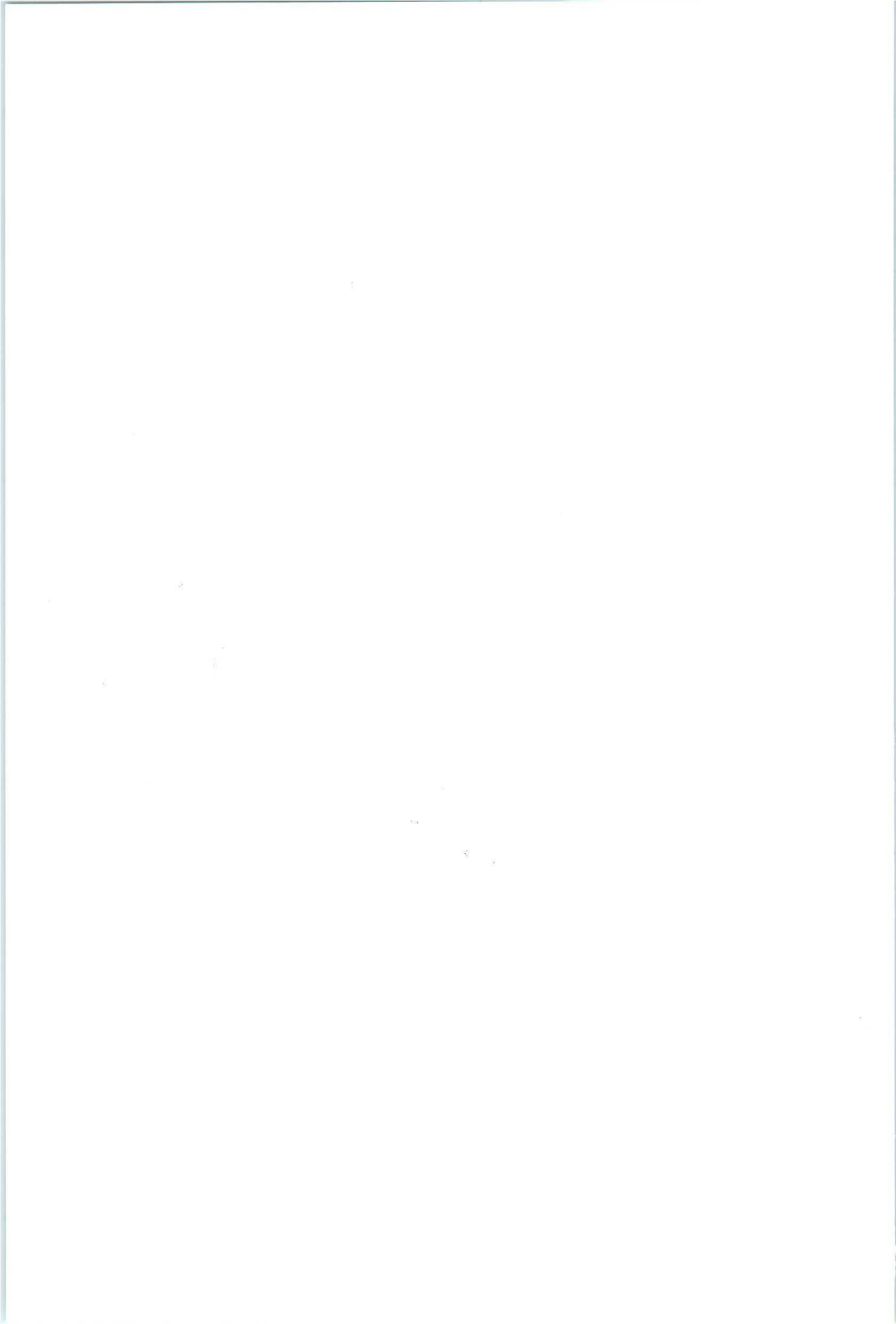


Typical counting rate as a function of dose rate (¹³⁷Cs)





Typical energy response relative to ^{137}Cs



GEIGER-MÜLLER TUBE

Halogen quenched γ radiation counter tube for use at temperatures up to 100 °C. The temperature response is flat to within 10% over the range -40 °C to +100 °C.

QUICK REFERENCE DATA

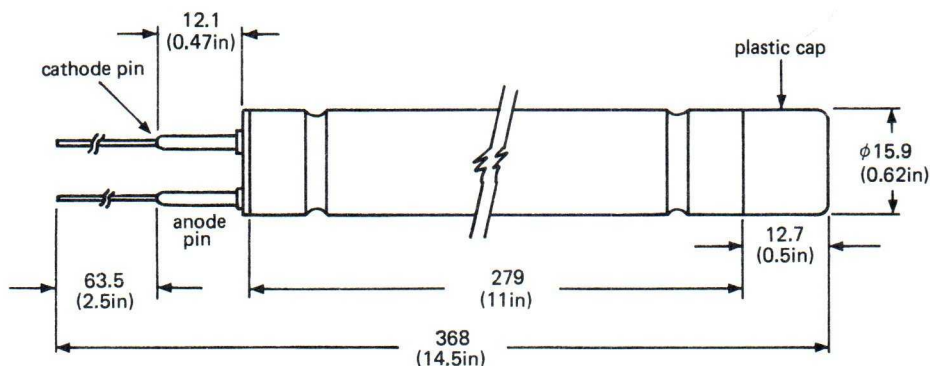
Dose rate range	3×10^{-4} to 4 3×10^{-5} to 4×10^{-1}	mGy/h R/h
Plateau threshold voltage	450	V
Plateau length	250	V
Recommended supply voltage	575	V
Chrome-iron cathode		

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

MECHANICAL DATA

Dimensions in mm (and inches)

Fig.1



tube must not be clamped within 60mm of either end

M2690

CATHODE

Thickness	0.25	mm
Sensitive length	203	mm
	8	inches
Material	chrome iron	

FILLING

neon, argon, halogen

CAPACITANCE

Anode to cathode	6	pF
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TUBE WEIGHT

34	g
----	---

OPERATING CHARACTERISTICS (Ambient temperature $\approx 25^\circ\text{C}$)

Measured in circuit of Fig.2

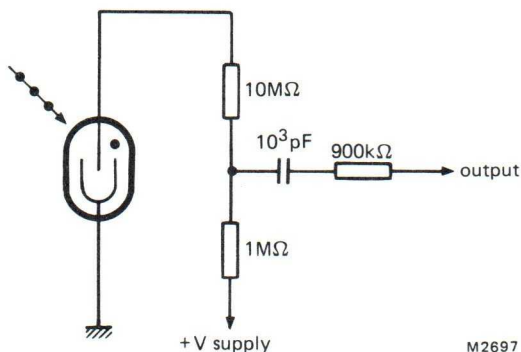
Starting voltage	max.	400	V
Plateau threshold voltage	max.	450	V
Plateau length		250	V
Recommended supply voltage		575	V
Plateau slope	max.	0.06	%/V
Background (shielded with 50 mm Pb with an inner liner of 6 mm Al), at recommended supply voltage	max.	65	count/min
Dead time, at recommended supply voltage	max.	100	μs

LIMITING VALUES (Absolute max. rating system)

Anode resistor	min.	10	$\text{M}\Omega$
Anode voltage	max.	700	V
Ambient temperature			
continuous operating	max.	+100	$^\circ\text{C}$
	min.	-40	$^\circ\text{C}$
storage	max.	+75	$^\circ\text{C}$

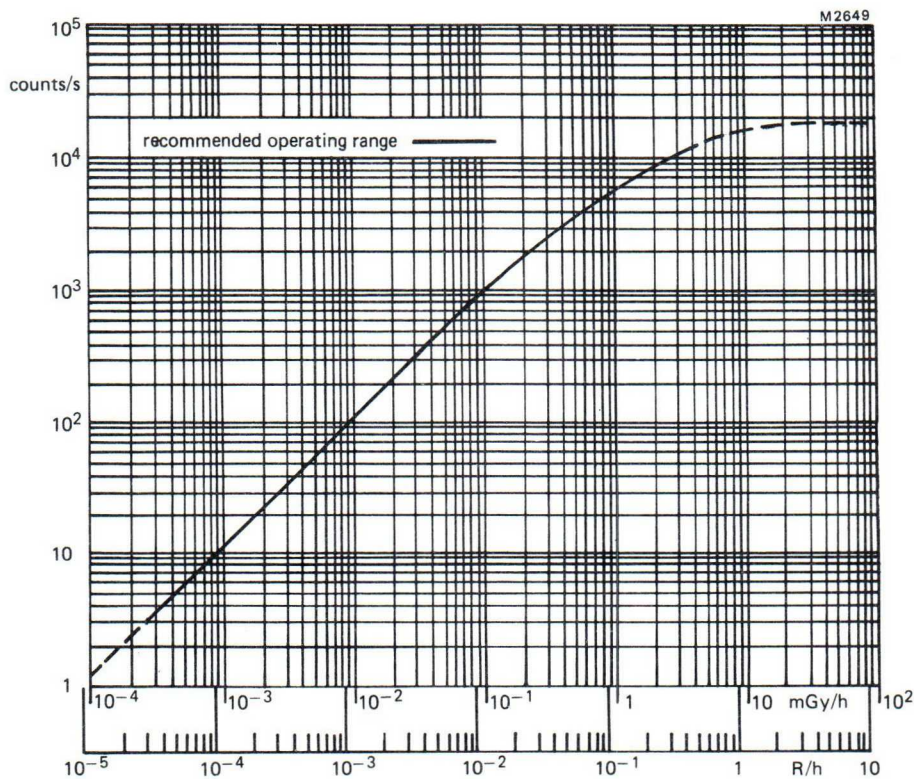
LIFE EXPECTANCY

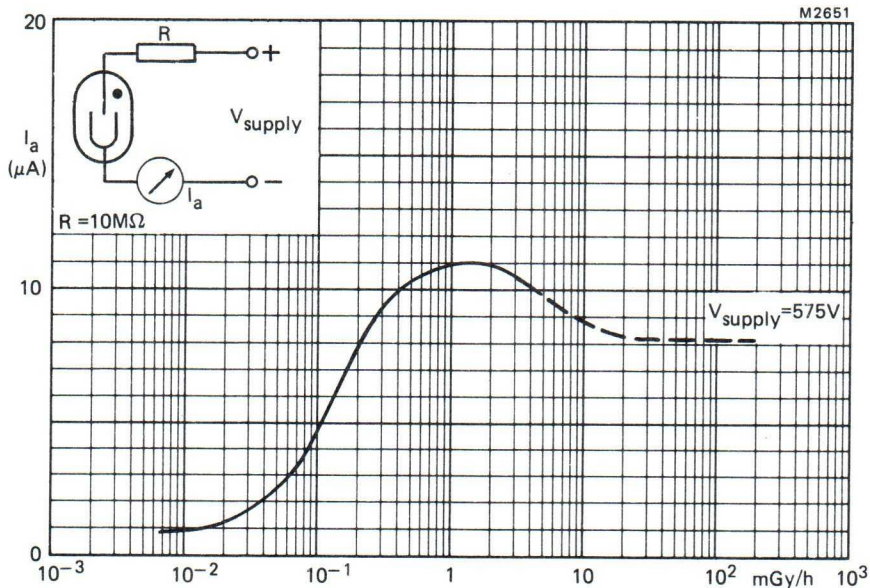
Life expectancy at $\approx 25^\circ\text{C}$	10^{10}	count
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MEASURING CIRCUIT

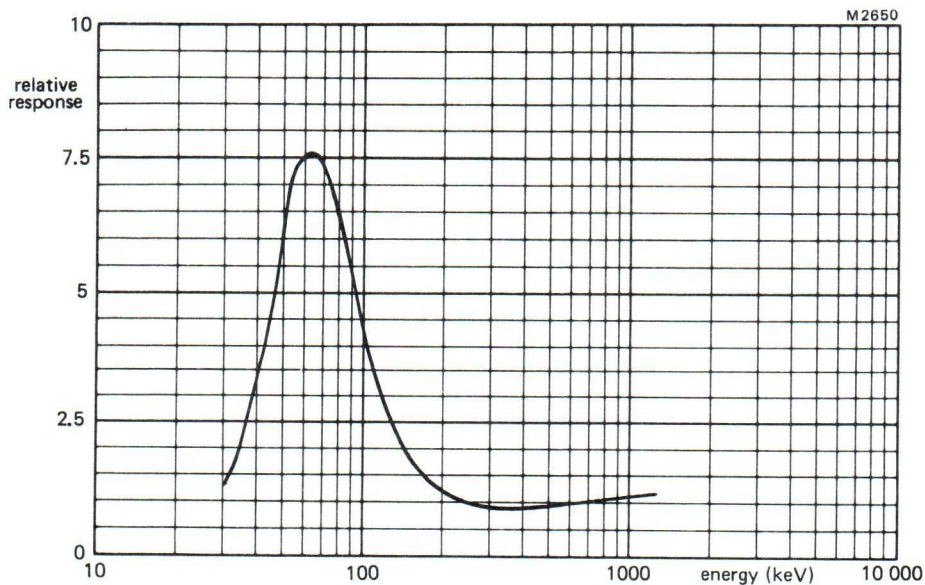
M2697

Fig.2

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



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



Typical energy response relative to ^{137}Cs

GEIGER-MÜLLER TUBE

Halogen quenched γ radiation counter tube for use at temperatures up to 100 °C. The temperature response is flat to within 10% over the range -40 °C to +100 °C.

QUICK REFERENCE DATA

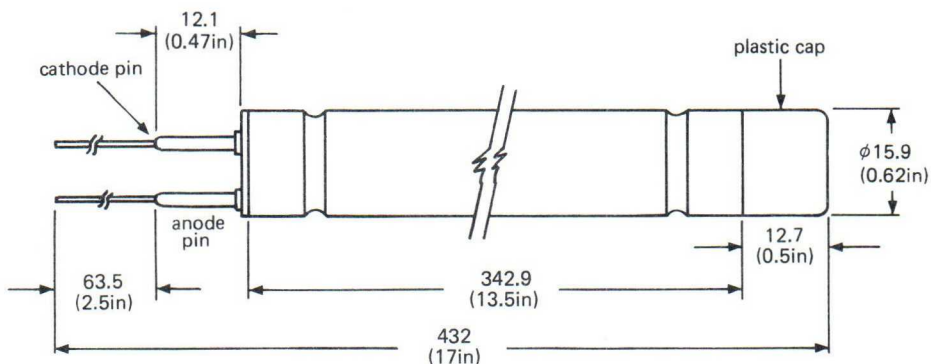
Dose rate range	2×10^{-4} to 2	mGy/h
	2×10^{-5} to 2×10^{-1}	R/h
Plateau threshold voltage	450	V
Plateau length	250	V
Recommended supply voltage	575	V
Chrome-iron cathode		

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

MECHANICAL DATA

Dimensions in mm (and inches)

Fig.1



tube must not be clamped within 75mm of either end

M2691

CATHODE

Thickness	0.25	mm
Sensitive length	313	mm
	12.3	inches
Material	chrome iron	

FILLING

neon, argon, halogen

CAPACITANCE

Anode to cathode	8	pF
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TUBE WEIGHT

45	g
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OPERATING CHARACTERISTICS (Ambient temperature $\approx 25^\circ\text{C}$)

Measured in circuit of Fig.2

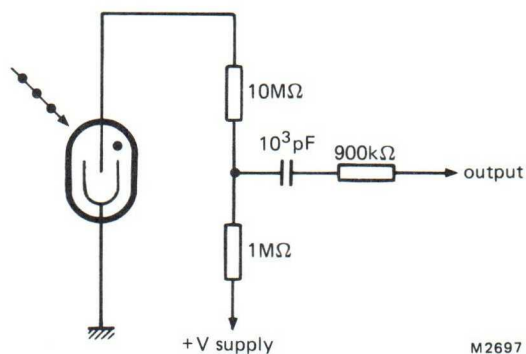
Starting voltage	max.	400	V
Plateau threshold voltage	max.	450	V
Plateau length		250	V
Recommended supply voltage		575	V
Plateau slope	max.	0.06	%/V
Background (shielded with 50 mm Pb with an inner liner of 6 mm Al), at recommended supply voltage	max.	100	count/min
Dead time, at recommended supply voltage	max.	100	μs

LIMITING VALUES (Absolute max. rating system)

Anode resistor	min.	10	$\text{M}\Omega$
Anode voltage	max.	700	V
Ambient temperature			
continuous operating	max.	+100	$^\circ\text{C}$
	min.	-40	$^\circ\text{C}$
storage	max.	+75	$^\circ\text{C}$

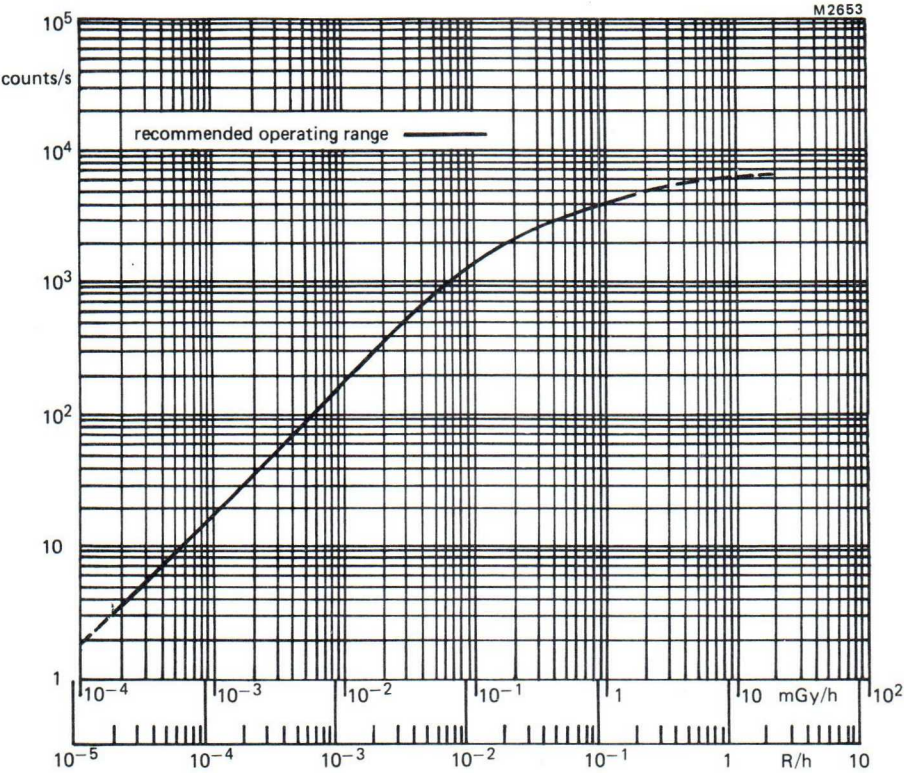
LIFE EXPECTANCY

Life expectancy at $\approx 25^\circ\text{C}$	10^{10}	count
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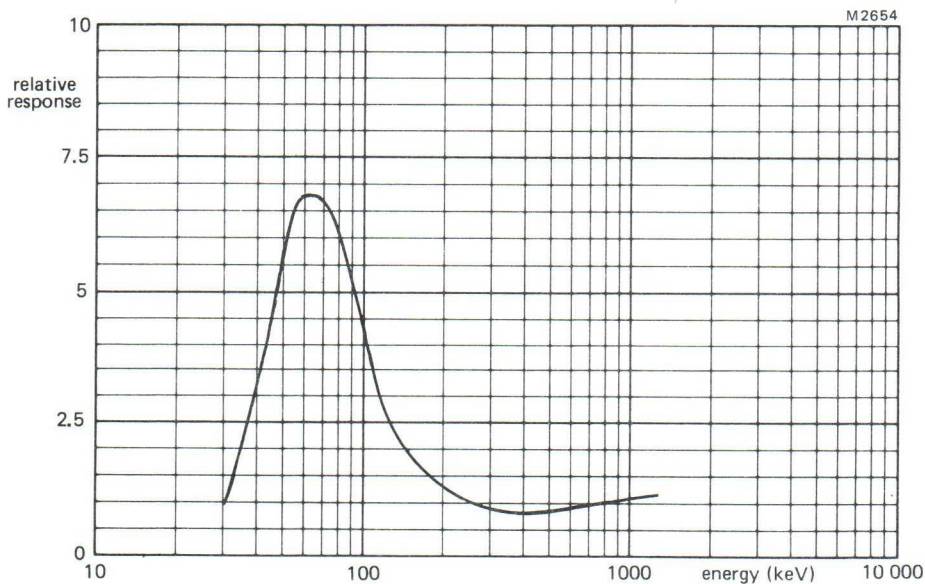
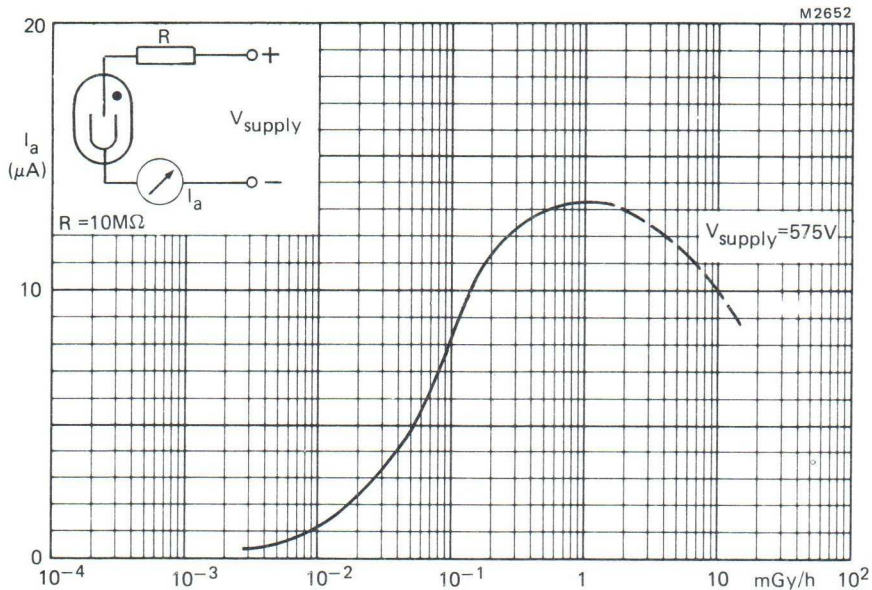
MEASURING CIRCUIT

M2697

Fig.2



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



GEIGER-MÜLLER TUBE

Halogen quenched γ radiation counter tube for use at temperatures up to 175 °C. The temperature response is flat to within 5% over the range -20 °C to +175 °C.

QUICK REFERENCE DATA

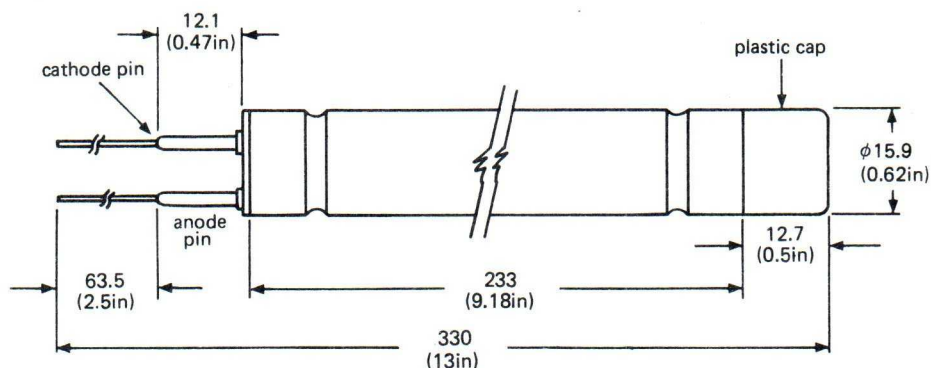
Dose rate range	4×10^{-3} to 10^2 5×10^{-4} to 10	mGy/h R/h
Plateau threshold voltage	850	V
Plateau length	200	V
Recommended supply voltage	950	V
Chrome-iron cathode, platinum plated		

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

MECHANICAL DATA

Dimensions in mm (and inches)

Fig.1



tube must not be clamped within 15mm of either end

M2692

CATHODE

Thickness	1.2	mm
Sensitive length	32	mm
	1.25	inches
Material	chrome iron, platinum plated	

FILLING

neon, argon, halogen

CAPACITANCE

Anode to cathode	2.5	pF
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TUBE WEIGHT

14	g
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OPERATING CHARACTERISTICS (Ambient temperature $\approx 25^{\circ}\text{C}$)

Measured in circuit of Fig.2

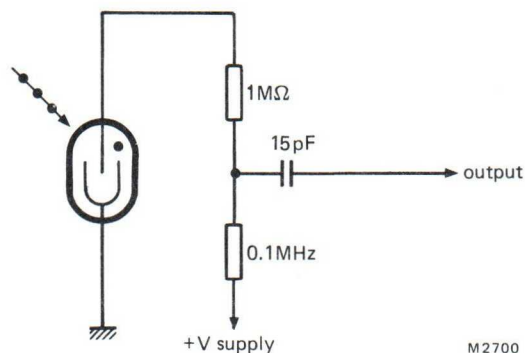
Starting voltage	max.	825	V
Plateau threshold voltage	max.	850	V
Plateau length		200	V
Recommended supply voltage		950	V
Plateau slope	max.	0.08	%/V
Background (shielded with 50 mm Pb with an inner liner of 6 mm Al), at recommended supply voltage	max.	15	count/min
Dead time, at recommended supply voltage	max.	50	μs

LIMITING VALUES (Absolute max. rating system)

Anode resistor	min.	1	$\text{M}\Omega$
Anode voltage	max.	1050	V
Ambient temperature			
continuous operating	max.	+175	$^{\circ}\text{C}$
	min.	-40	$^{\circ}\text{C}$
storage	max.	+125	$^{\circ}\text{C}$

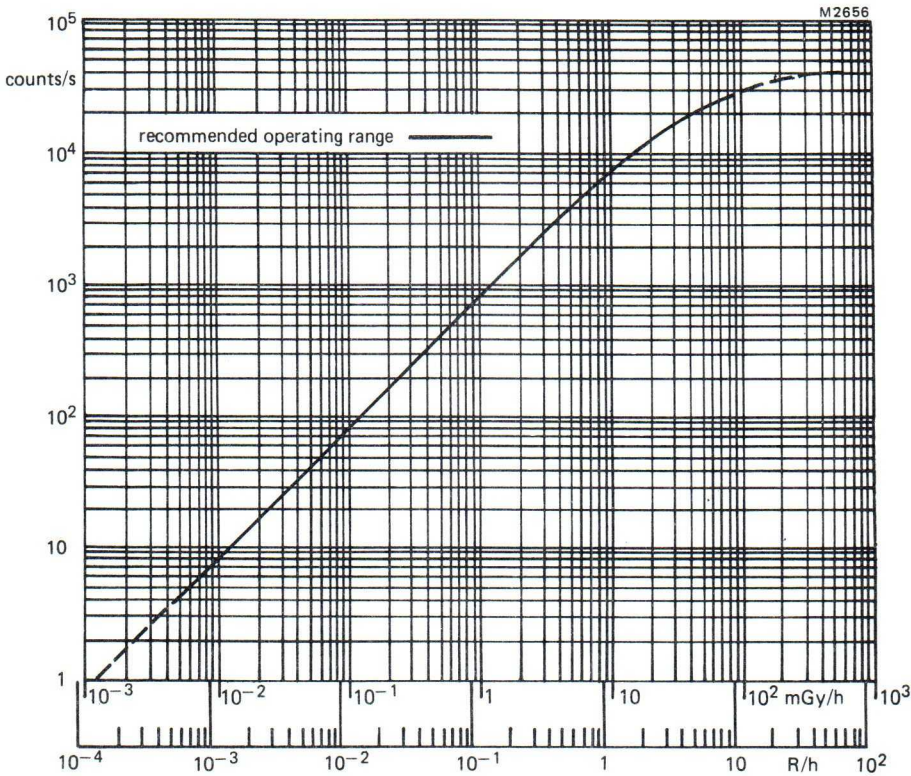
LIFE EXPECTANCY

Life expectancy at $\approx 25^{\circ}\text{C}$	10^{10}	count
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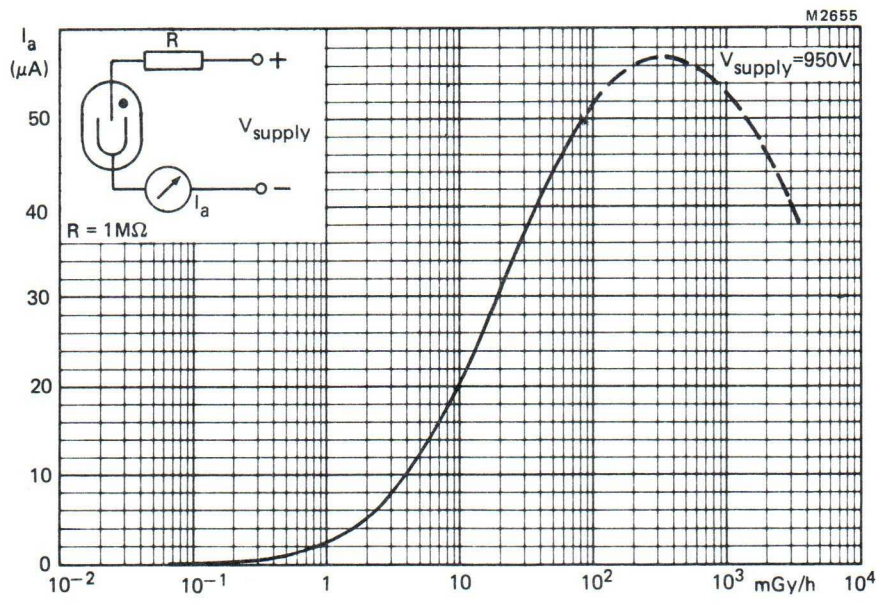
MEASURING CIRCUIT

M2700

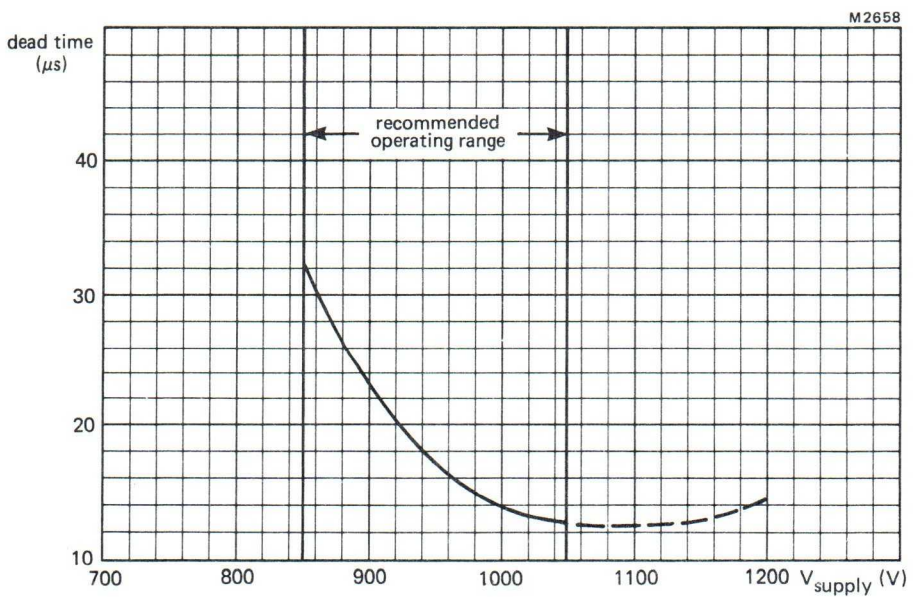
Fig.2



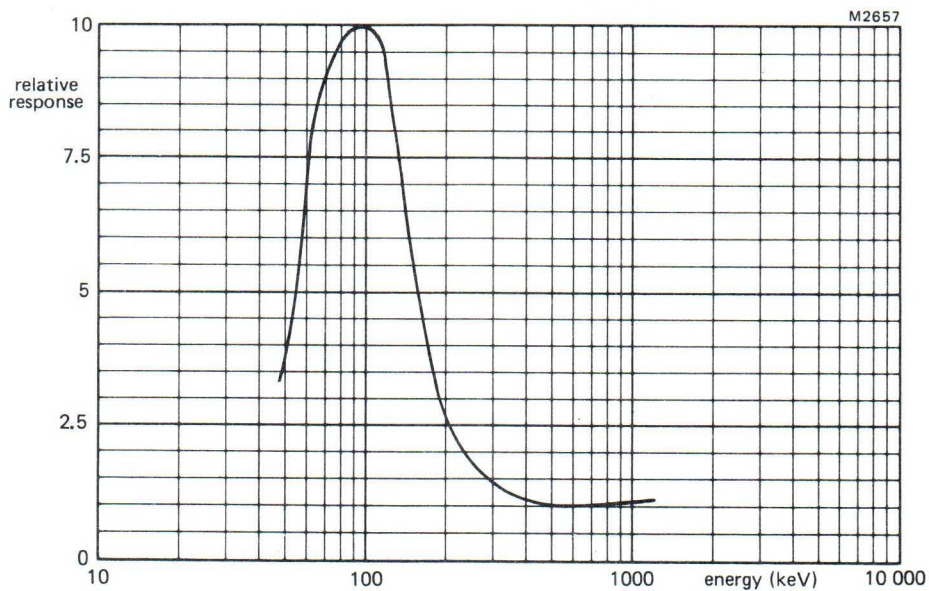
Typical counting rate as a function of dose rate (¹³⁷Cs)



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



Typical dead time as a function of supply voltage

Typical energy response relative to ^{137}Cs

GEIGER-MÜLLER TUBE

Halogen quenched β and γ radiation counter tube for use at temperatures up to 75 °C. The temperature response is flat to within 7% over the range -35 °C to +75 °C.

QUICK REFERENCE DATA

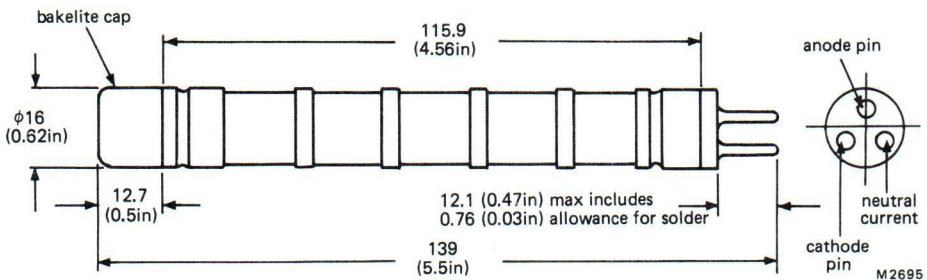
Dose rate range	10 ⁻³ to 20 10 ⁻⁴ to 2	mGy/h R/h
Plateau threshold voltage	875	V
Plateau length	200	V
Recommended supply voltage	975	V
Chrome-iron cathode		

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

MECHANICAL DATA

Dimensions in mm (and inches)

Fig.1



tube must not be clamped within 30mm of either end

CATHODE

Thickness	30 — 40	mg/cm ²
Sensitive length	89 3.5	mm inches
Material	chrome iron	

FILLING

neon, argon, halogen

CAPACITANCE

Anode to cathode	4	pF
------------------	---	----

TUBE WEIGHT

15	g
----	---

OPERATING CHARACTERISTICS (Ambient temperature $\approx 25^\circ\text{C}$)

Measured in circuit of Fig.2

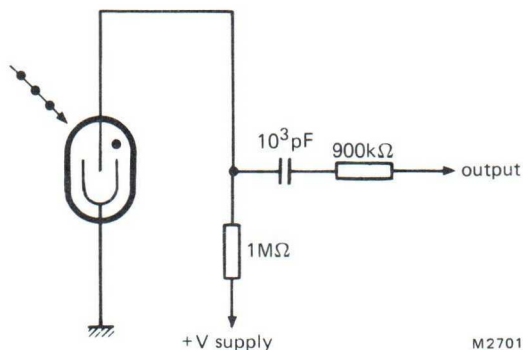
Starting voltage	max.	825	V
Plateau threshold voltage	max.	875	V
Plateau length		200	V
Recommended supply voltage		975	V
Plateau slope	max.	0.1	%/V
Background (shielded with 50 mm Pb with an inner liner of 6 mm Al), at recommended supply voltage	max.	50	count/min
Dead time, at recommended supply voltage	max.	100	μs

LIMITING VALUES (Absolute max. rating system)

Anode resistor	min.	0	$\text{M}\Omega$
Anode voltage	max.	1075	V
Ambient temperature			
continuous operating	max.	+75	$^\circ\text{C}$
	min.	-35	$^\circ\text{C}$
storage	max.	+75	$^\circ\text{C}$

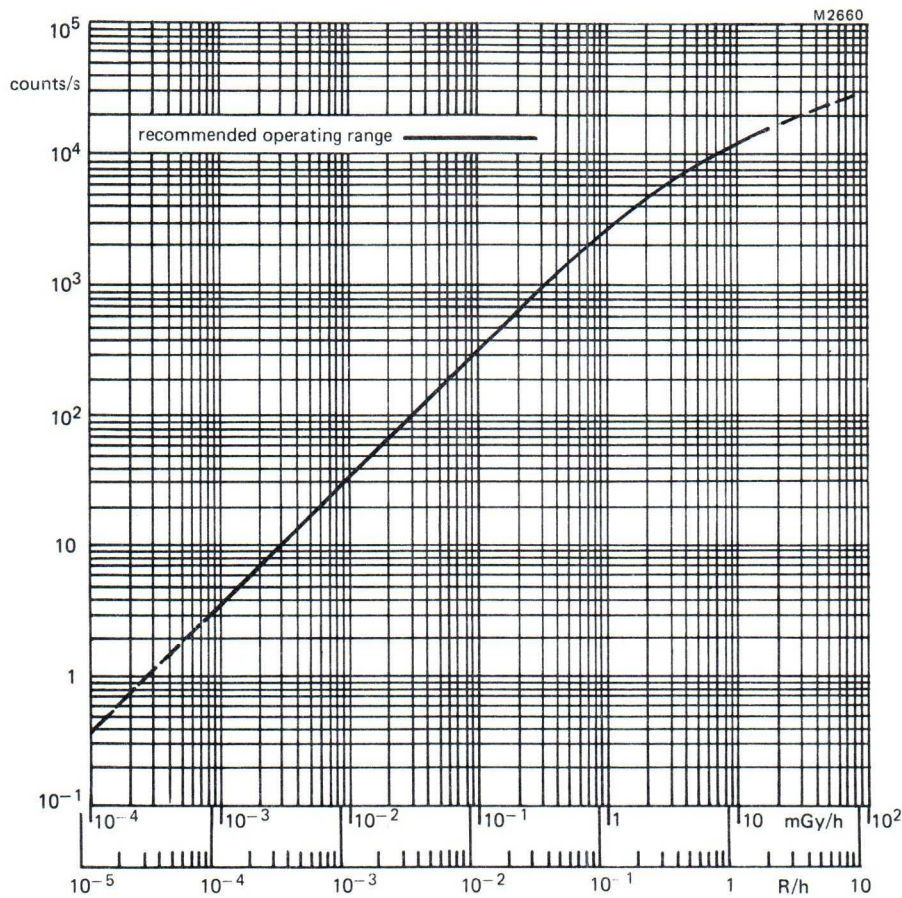
LIFE EXPECTANCY

Life expectancy at $\approx 25^\circ\text{C}$	10^{10}	count
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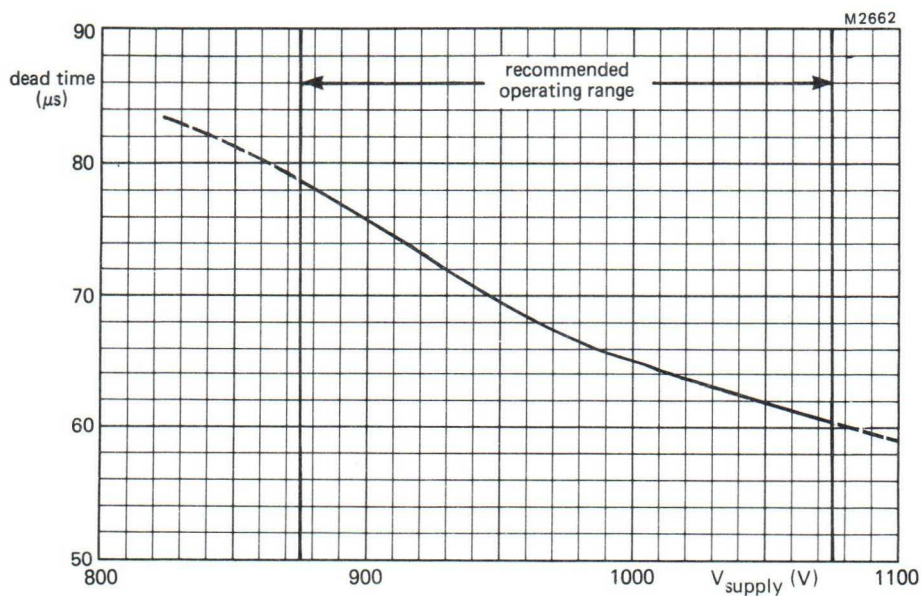
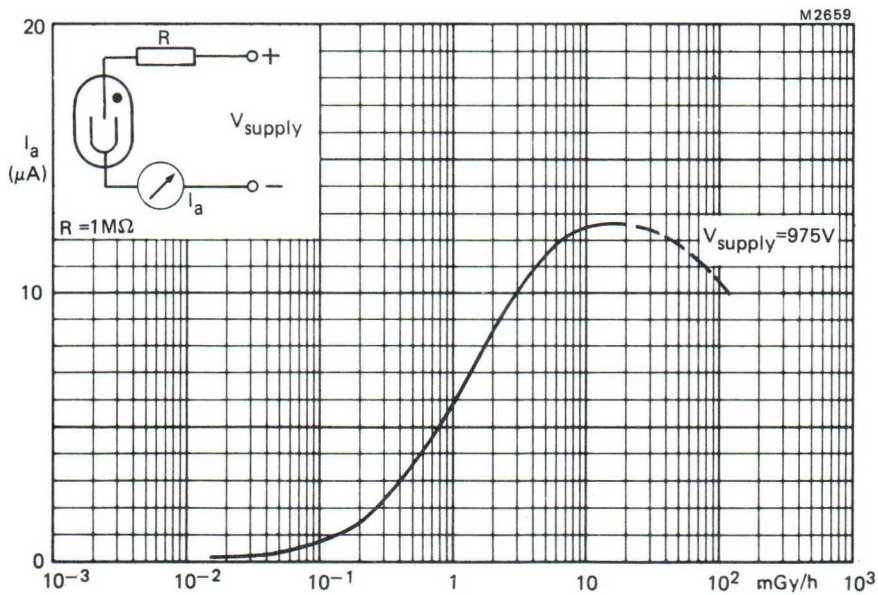
MEASURING CIRCUIT

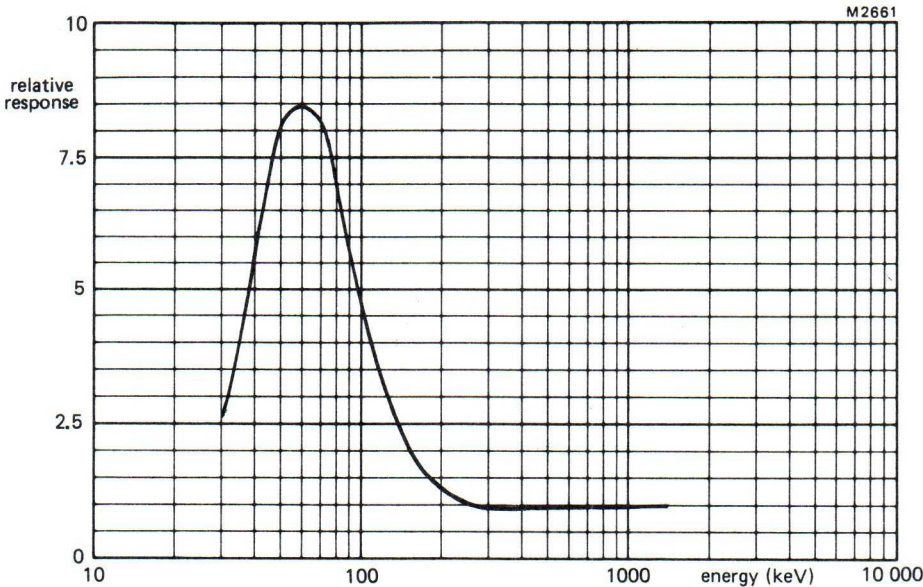
M2701

Fig.2



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





Typical energy response relative to ^{137}Cs



GEIGER-MÜLLER TUBE

Halogen quenched β and γ radiation counter tube for use at temperatures up to 75 °C. The temperature response is flat to within 7% over the range -35 °C to +75 °C.

QUICK REFERENCE DATA

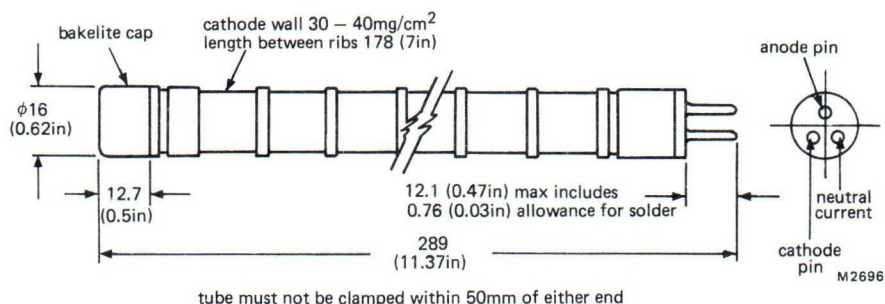
Dose rate range	4×10^{-4} to 4 5×10^{-5} to 4×10^{-1}	mGy/h R/h
Plateau threshold voltage	875	V
Plateau length	200	V
Recommended supply voltage	975	V
Chrome-iron cathode		

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

MECHANICAL DATA

Dimensions in mm (and inches)

Fig. 1



CATHODE

Thickness	30 – 40	mg/cm ²
Sensitive length	220	mm
	8.7	inches
Material	chrome iron	

FILLING

neon, argon, halogen

CAPACITANCE

Anode to cathode	6	pF
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TUBE WEIGHT

20	g
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OPERATING CHARACTERISTICS (Ambient temperature $\approx 25^\circ\text{C}$)

Measured in circuit of Fig.2

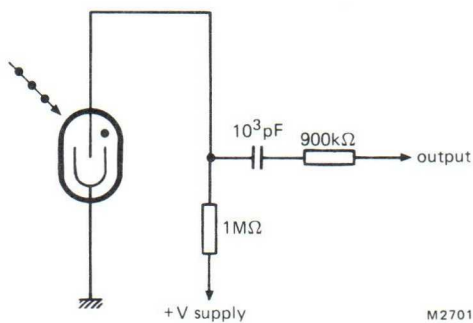
Starting voltage	max.	825	V
Plateau threshold voltage	max.	875	V
Plateau length		200	V
Recommended supply voltage		975	V
Plateau slope	max.	0.1	%/V
Background (shielded with 50 mm Pb with an inner liner of 6 mm Al), at recommended supply voltage	max.	75	count/min
Dead time, at recommended supply voltage	max.	100	μs

LIMITING VALUES (Absolute max. rating system)

Anode resistor	min.	0	$\text{M}\Omega$
Anode voltage	max.	1075	V
Ambient temperature continuous operating	max.	+75	$^\circ\text{C}$
	min.	-35	$^\circ\text{C}$
storage	max.	+75	$^\circ\text{C}$

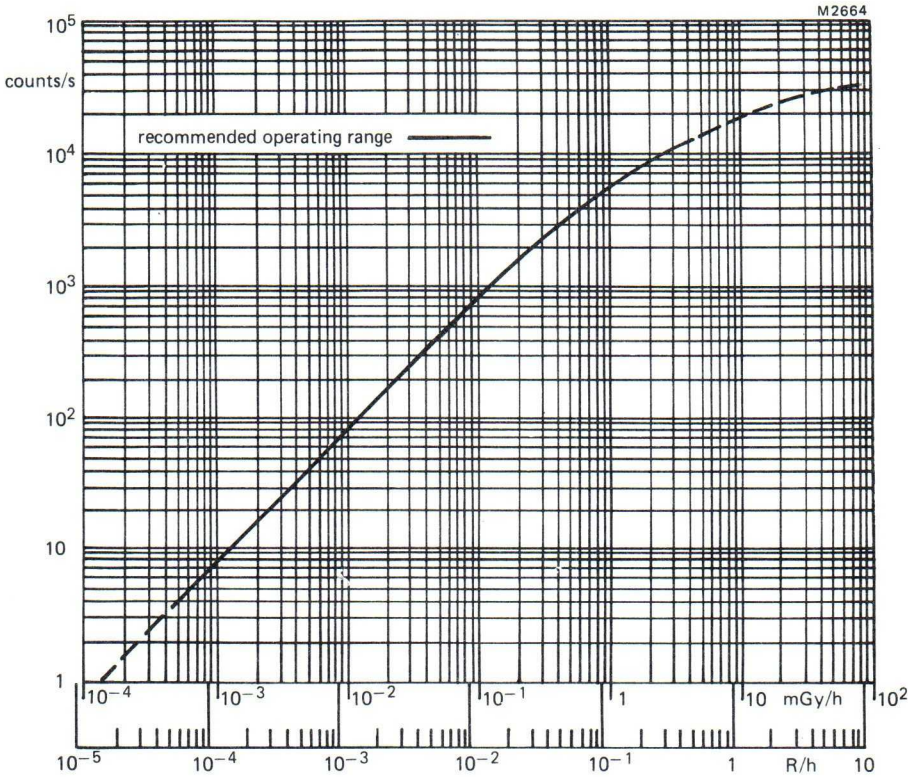
LIFE EXPECTANCY

Life expectancy at $\approx 25^\circ\text{C}$	10^{10}	count
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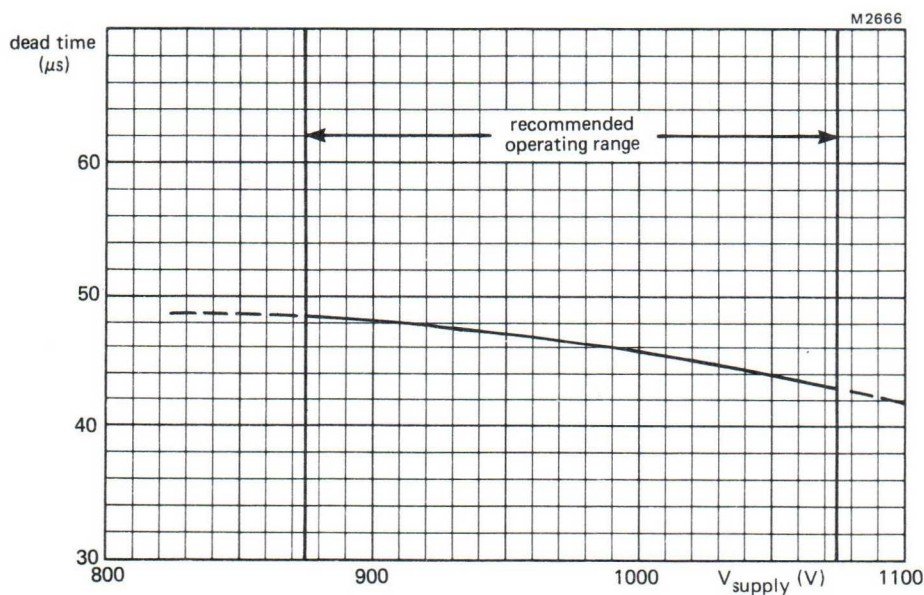
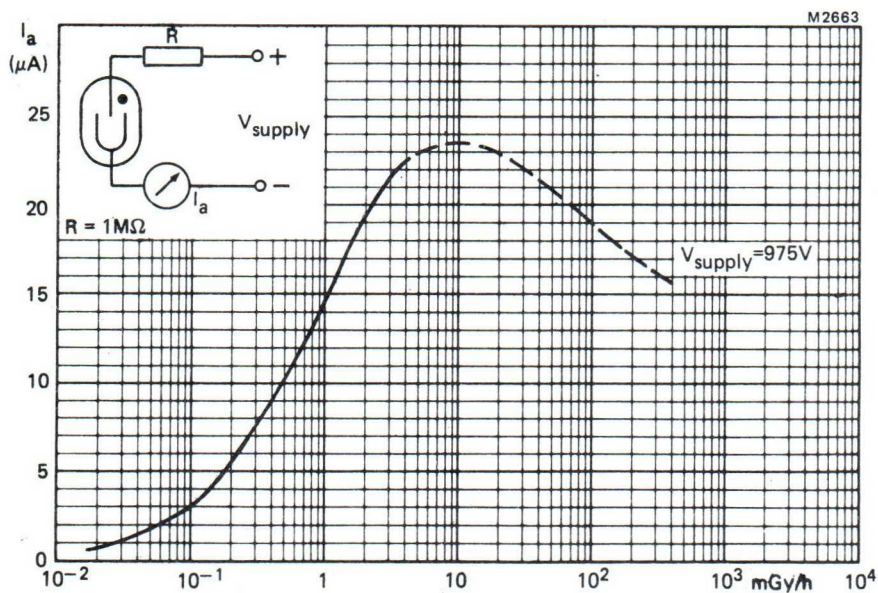
MEASURING CIRCUIT

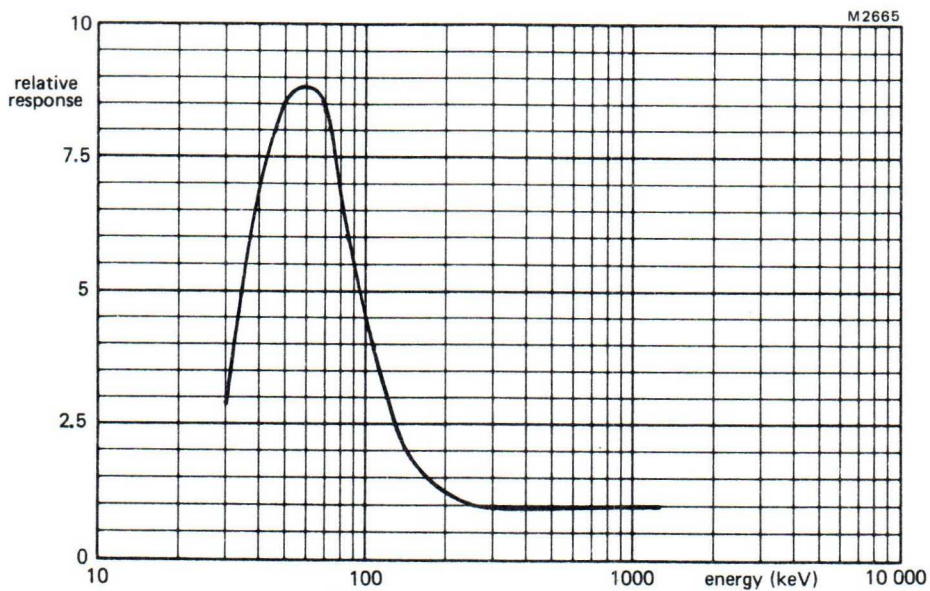
M2701

Fig.2

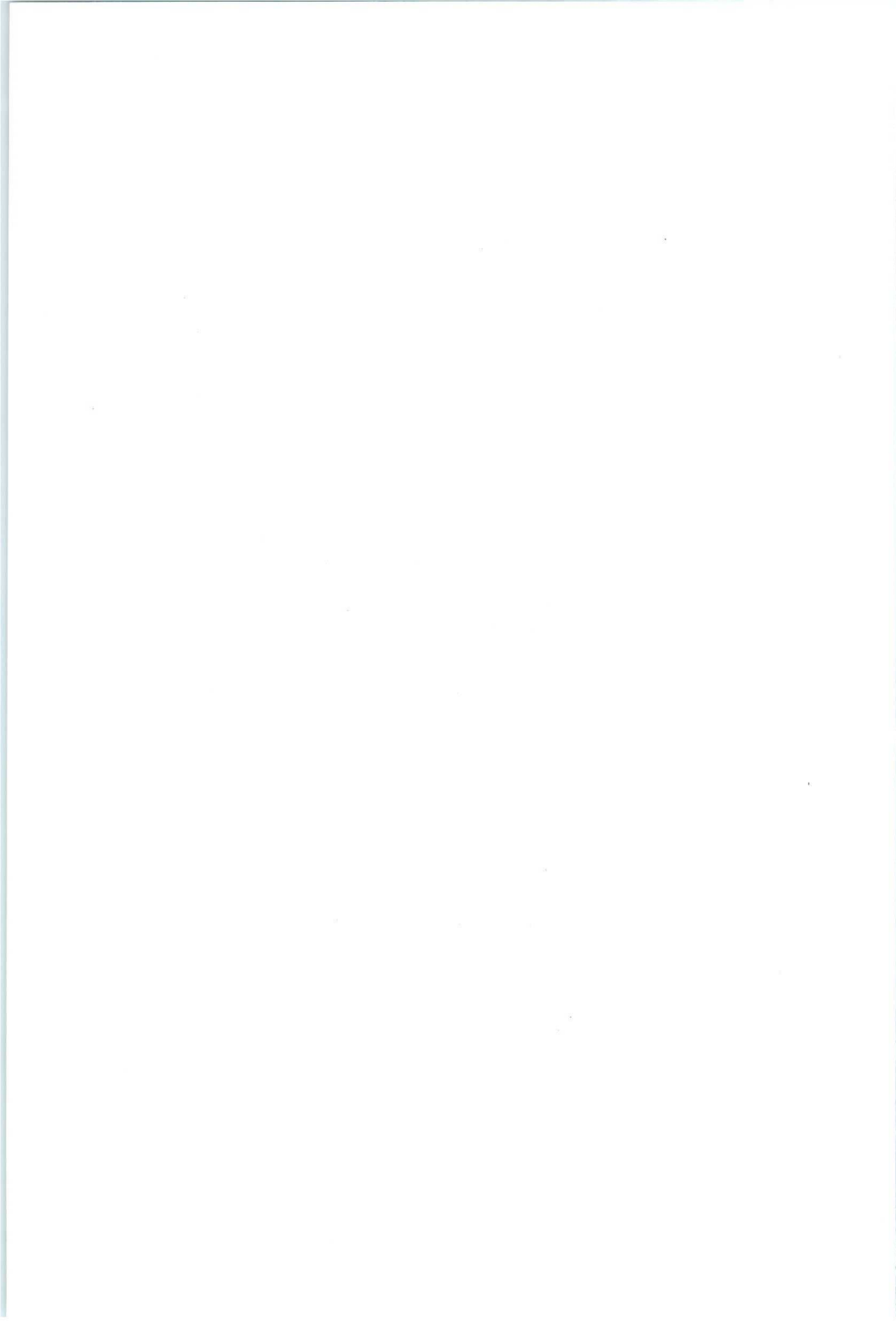


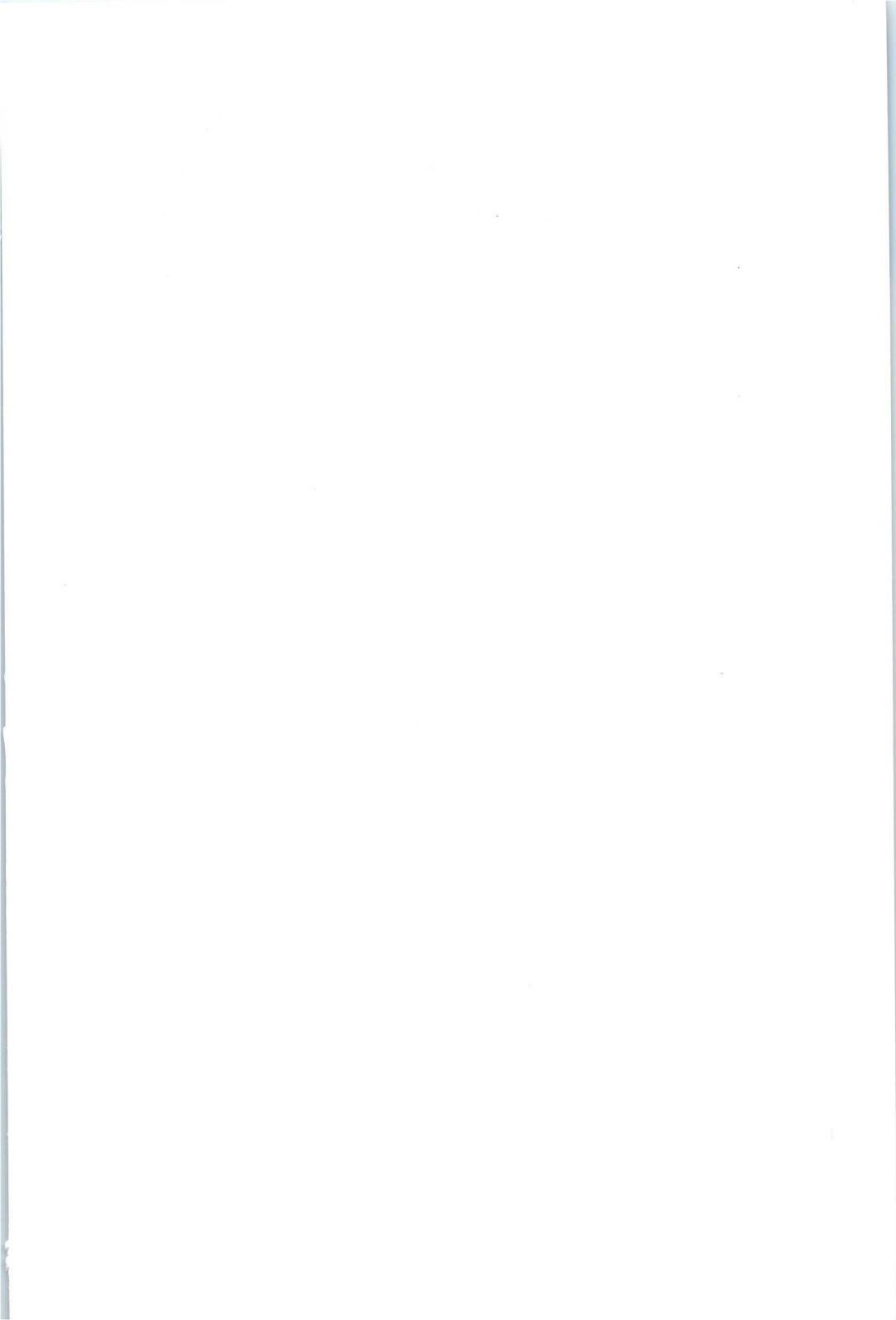
Typical counting rate as a function of dose rate (¹³⁷Cs)





Typical energy response relative to ^{137}Cs





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