



## GP Series

GP100, GP100SI  
GP100C, GP100CS  
GP100M, GP100MS  
GP110, GP110SI

## Features

- Canberra patented Time-to-Count technique eliminates dead time and saturation effects of conventional GM tubes
- SMART Probe retains probe information in non-volatile memory
- Excellent linearity and accuracy
- Detectors are easily interchanged
- Detectors do not require operator adjustments
- Calibration cycles of up to two years
- Optional mounting brackets
- Optional connection to Canberra's area monitor and display units

## Quality

- Commitment to meet or exceed your quality expectations
- Cost-effective for safety and compliance

# Geiger Mueller Detectors – GP Series

## Description

A pair of rugged halogen-quenched GM tubes serves as the basic detection elements in the GP Series detectors used for wide range gamma radiation measurement. The GM tubes operate under the unique and patented Canberra Time-to-Count technique which removes many of the limitations associated with the use of GM tubes operated in conventional mode.

In addition, the GP Series of detectors are SMART probes, which retain probe information in non-volatile memory.

When calibrated, data such as probe calibration constants and identifying information are stored and verified in the EEPROM memory in the probe circuitry. This arrangement allows the Canberra GP Series detectors to be interchangeable.

The GP Series of detectors are “maintenance free” in design and require no routine servicing or preventive maintenance.

The GP100C and GP100CS detectors have an internally mounted 0.1  $\mu\text{Ci}$   $^{90}\text{Sr}$  Check Source Assembly.

The GP100M and GP100MS are used in conjunction with a preamplifier, PA100M. This arrangement allows components that are susceptible to damage by extended exposure to radiation to be placed up to 200 feet away from the detectors.

The GP Series can be connected to multifunction control and display unit such as ADM600, ADM606, ADM606M, ADM616, and ADM616S.



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## Geiger Mueller Detectors – GP Series

Tube Type/Characteristics	GP100	GP100SI	GP100C	GP100CS	GP100M <sup>(1)</sup>	GP100MS <sup>(1)</sup>	GP110	GP110SI
<b>Detector Sensitivities, Low Range</b>	1800 CPM/mR/h	3 CPS/μSv/h	700 CPM/mR/h	1.16 CPS/μSv/h	700 CPM/mR/h	1.16 CPS/μSv/h	10800 CPM/mR/h	18 CPS/μSv/h
<b>Detector Sensitivities, High Range</b>	4.2 CPM/mR/h	0.007 CPS/μSv/h	4.2 CPM/mR/h	0.007 CPS/μSv/h	4.2 CPM/mR/h	0.007 CPS/μSv/h	4.2 CPM/mR/h	0.007 CPS/μSv/h
<b>Detector Dynamic, Low Range</b>	10 μR/h	0.1 μSv/h	10 μR/h	0.1 μSv/h	10 μR/h	0.1 μSv/h	1 μR/h	0.01 μSv/h
<b>Detector Dynamic, High Range</b>	10 000 R/h	100 Sv/h	10 000 R/h	100 Sv/h	10 000 R/h	100 Sv/h	1000 R/h	10 Sv/h
<b>Weight kg (lb)</b>	0.45 kg (1 lb)	0.45 kg (1 lb)	0.68 kg (1.5 lb)	0.68 kg (1.5 lb)	0.45 kg (1 lb)	0.45 kg (1 lb)	0.9 kg (2 lb)	0.9 kg (2 lb)
<b>Size, W x H x L or L x Dia., mm (inch)</b>	38 x 48 x 175 mm (1.5 x 1.9 x 6.9 in.)	40.64 x 40.64 x 152.4 mm (1.6 x 1.6 x 6 in.)	190.5 x 63.5 mm (7.5 x 2.5 in. dia.)	190.5 x 63.5 mm (7.5 x 2.5 in. dia.)	38 x 38 x 158.75 mm (1.5 x 1.5 x 6.25 in.)	40.64 x 40.64 x 152.4 mm (1.6 x 1.6 x 6 in.)	304.8 x 76.2 mm (12 in. L x 3 in. dia.)	304.8 x 76.2 mm (12 in. L x 3 in. dia.)
<b>Typical Application</b>	Area Monitor	Area Monitor	Area Monitor with Check Source Assembly	Area Monitor with Check Source Assembly	Area Monitor – Gamma, High TID Fields <100 000 R	Area Monitor – Gamma, High TID Fields <1000 Sv	Area Monitor – Low Level Environmental	Area Monitor – Low Level Environmental

Note: (1) Requires PA100M

### Principle of Operation

A pair of halogen quenched GM tubes serves as the gamma radiation detector in the GP Series of detectors. This design allows for wide range measurements – the low range tube monitors daily environmental changes while the high range tube is able to cover accident levels of radiation.

Readings of the radiation rate are a function of the number of pulses (counts) produced by the tube per unit time. Conventionally, a GM tube operated with a fixed dc voltage continuously applied is characterized by “dead-time”, increasing non-linearity as the field intensity increases and saturation.

In the Time-to-Count technique employed in Canberra GM tube detectors GP Series, the dead time and saturation effects are eliminated.

A low dc bias voltage is abruptly raised to 500 V dc carrying the tube into its operating region. The rise time of this voltage is less than 0.2 microseconds. At the same time, this rapid increase in voltage is applied, a crystal controlled, 1 megacycle oscillator (clock) is gated on and time, in the form of 1 microsecond cycles, starts being counted. Time counting continues until a GM tube pulse is obtained. At that point, time counting is stopped and the accumulated time is recorded. At the same time, the anode voltage is reduced to the low bias level. The anode voltage is maintained at the low bias level for 1.5 to 2 milliseconds, a time period which is long compared to the dead time and recovery time of the tube. Voltage at anode is applied again when the GM tube is fully recovered.

R/hr	GP Series	Conventional Instrument Range				Sv/hr
10 <sup>6</sup>						10 <sup>4</sup>
10 <sup>5</sup>						10 <sup>3</sup>
10 <sup>4</sup>						10 <sup>2</sup>
10 <sup>3</sup>	█					10 <sup>1</sup>
10 <sup>2</sup>	█				█	10 <sup>0</sup>
10 <sup>1</sup>	█			█	█	10 <sup>-1</sup>
10 <sup>0</sup>	█		█	█	█	10 <sup>-2</sup>
10 <sup>-1</sup>	█		█	█	█	10 <sup>-3</sup>
10 <sup>-2</sup>	█	█	█	█	█	10 <sup>-4</sup>
10 <sup>-3</sup>	█	█	█	█		10 <sup>-5</sup>
10 <sup>-4</sup>	█	█	█			10 <sup>-6</sup>
10 <sup>-5</sup>	█	█				10 <sup>-7</sup>
10 <sup>-6</sup>	█					10 <sup>-8</sup>

## Geiger Mueller Detectors – GP Series

R/hr	Sv/hr	LINEARITY ±5%												
10 <sup>4</sup>	10 <sup>2</sup>													
10 <sup>3</sup>	10 <sup>1</sup>													
10 <sup>2</sup>	10 <sup>0</sup>													
10 <sup>1</sup>	10 <sup>-1</sup>													
10 <sup>0</sup>	10 <sup>-2</sup>													
10 <sup>-1</sup>	10 <sup>-3</sup>													
10 <sup>-2</sup>	10 <sup>-4</sup>													
10 <sup>-3</sup>	10 <sup>-5</sup>													
10 <sup>-4</sup>	10 <sup>-6</sup>													
10 <sup>-5</sup>	10 <sup>-7</sup>													
	Sv/hr	10 <sup>-7</sup>	10 <sup>-6</sup>	10 <sup>-5</sup>	10 <sup>-4</sup>	10 <sup>-3</sup>	10 <sup>-2</sup>	10 <sup>-1</sup>	10 <sup>0</sup>	10 <sup>1</sup>	10 <sup>2</sup>			
	R/hr	10 <sup>-5</sup>	10 <sup>-4</sup>	10 <sup>-3</sup>	10 <sup>-2</sup>	10 <sup>-1</sup>	10 <sup>0</sup>	10 <sup>1</sup>	10 <sup>2</sup>	10 <sup>3</sup>	10 <sup>4</sup>			

Only one GM tube pulse can occur in any one ‘on’ time. Since the tube is fully recovered between ‘on’ times, the pulses produced by the tube are full size. The process is repeated many times to obtain a statistically reliable average time-to-count.

Thus, the radiation field intensity is proportional to the reciprocal of the time required to obtain a GM count. This precise microprocessor controlled relationship forms the design basis for the GP Series and enables many decades of linear performance for the GM tubes involved.

# Geiger Mueller Detectors – GP Series

## Specifications

### Generic Specifications

(Applicable to GP100, GP100SI, GP100C, GP100CS, GP100M, GP100MS, GP110, GP110SI)

DETECTOR TYPE – (2 ea) Halogen Quenched GM Tubes.

RESOLVING TIME – 1  $\mu$ s.

PLATEAU SLOPE – 4% per 100 V max.

OPERATING VOLTAGE – 450–550 V dc.

DYNAMIC RANGE – 9 decades.

BACKGROUND – less than 5 CPM.

ENERGY RANGE – 80 keV to 3.0 MeV.

ENERGY RESPONSE – See Energy Response Curve figure below.

- Responsive to energy above 50 keV.
- $\pm 20\%$  uniform from 80 keV to 3 MeV (tested up to  $^{60}\text{Co}$  energy of 1.25 MeV).

LINEARITY –  $\pm 5\%$ .

RESPONSE TIME – 2 to 5 s.

OPERATING TEMPERATURE RANGE –  $-30\text{ }^{\circ}\text{C}$  to  $+50\text{ }^{\circ}\text{C}$  ( $-22\text{ }^{\circ}\text{F}$  to  $+122\text{ }^{\circ}\text{F}$ ).

OPERATING HUMIDITY – 0–95% non-condensing.

POWER – +5 V dc.

HV SUPPLY, INTERNALLY GENERATED –  $\pm 250$  V.

OUTPUT, PULSE TRAIN – +5 V and ground.

HOUSING – Moisture Proof Aluminum.

The **GP100C** and **GP100CS** detectors have an internally mounted 0.1  $\mu\text{Ci}$   $^{90}\text{Sr}$  Check Source Assembly. This assembly is solenoid actuated and is controlled from the check source switch of the appropriate ratemeter. In Check Source Mode, the solenoid is

energized for 30 seconds and causes a rise in the rate display between 6 and 10 mR/h (60 to 100  $\mu\text{Sv/h}$ ) depending on the age of the source. At the end of the 30 second interval, the ratemeter automatically releases the solenoid and returns to normal monitoring.

The **GP100M** and **GP100MS** are used in conjunction with a preamplifier, PA100M. This arrangement allows components that are susceptible to damage by extended exposure to radiation to be placed up to 200 feet away from the detectors. Once calibrated the detector and preamplifier must be kept together as a pair to maintain the calibration. Functionally, the GP100M/GP100MS detector and its pair preamplifier operates as a SMART probe.

### Specifications for Preamplifier PA100M

(used with GP100M and GP100MS).

HOUSING – Moisture Proof Aluminum.

SIZE – 38 x 38 x 158.75 mm (1.5 x 1.5 x 6.25 in.) (W x H x L).

WEIGHT – 0.45 kg (1 lb).

POWER – +5 V dc from the ratemeter.

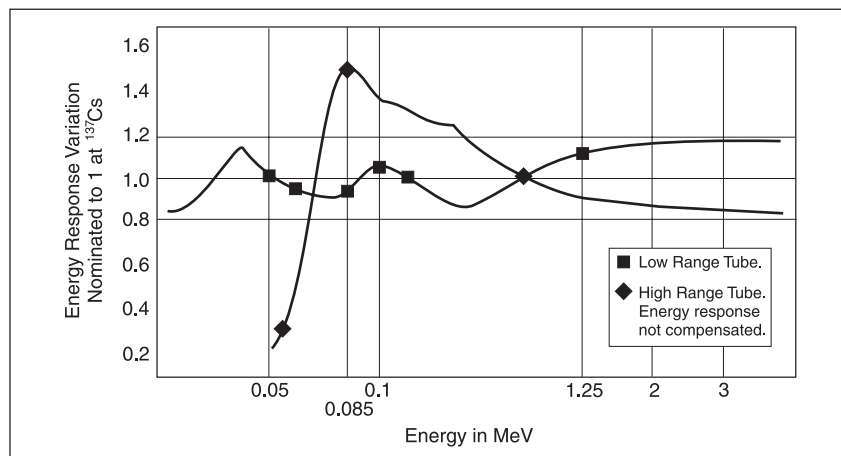
HIGH VOLTAGE SUPPLY – Internally generated  $\pm 250$  V.

OUTPUT – Pulse train, +5 V and ground.

### Quality

The GP Series detectors are designed and manufactured under a quality system in compliance with the following standards and requirements:

- ISO 9001
- 10CFR21
- 10CFR50, Appendix “B”
- IEEE-730
- ANSI/ASME NQA-1, ANSI/ASME NQA-2, Part 2.7



Energy Response Curve