



# GP Series – Geiger Mueller Detectors

## GP Series

- GP100, GP100SI, GP100C, GP100C2, GP100C2S, GP100CS, GP100M, GP100MS, GP110, GP110SI

## Features

- CANBERRA's unique Time-to-Count technique eliminates dead time and saturation effects of conventional GM detectors
- 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

## Description

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



In addition, the GP Series of detectors are SMART probes, which retain probe information in nonvolatile 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/GP100C2 and GP100CS/GP100C2S detectors have an internally mounted (nominal) 3.7 kBq (0.1  $\mu$ Ci) <sup>90</sup>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 iR7040, ADM606, ADM606M and ADM616.

## Principle of Operation

A pair of halogen-quenched GM detectors serves as the gamma radiation detector in the GP Series of detectors. This design allows for wide range measurements – the low range detector monitors daily environmental changes while the high range detector 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 detector per unit time. Conventionally, a GM detector operated with a fixed dc voltage continuously applied is characterized by "dead-time", increasing non-linearity as the field intensity increases and saturation.

# GP Series – Geiger Mueller Detectors

## Specifications by category

Detector Type/Characteristics	GP100	GP100SI	GP100C/GP100C2	GP100CS/GP100C2S
Detector Sensitivities, Low Range	1800 CPM/mR/h	3 CSP/ $\mu$ Sv/h	700 CPM/mR/h	1.16 CPS/ $\mu$ Sv/h
Detector Sensitivities, High Range	4.2 CPM/mR/h	0.007 CPS/ $\mu$ Sv/h	4.2 CPM/mR/h	0.007 CPS/ $\mu$ Sv/h
Detector Dynamic, Low Range	10 $\mu$ R/h	0.1 $\mu$ Sv/h	10 $\mu$ R/h	0.1 $\mu$ Sv/h
Detector Dynamic, High Range	10000 R/h	100 Sv/h	10000 R/h	100 Sv/h
Weight kg (lb)	0.45 kg (1 lb)	0.45 kg (1 lb)	0.68 kg (1.5 lb)	0.68 kg (1.5 lb)
Size, W x H x L or L x Dia., mm (inch)	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.)
Typical Application	Area Monitor	Area Monitor	Area Monitor with Check Source Assembly	Area Monitor with Check Source Assembly

In the Time-to-Count technique employed in CANBERRA GM 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 detector 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 detector 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 detector. Voltage at anode is applied again when the GM detector is fully recovered.

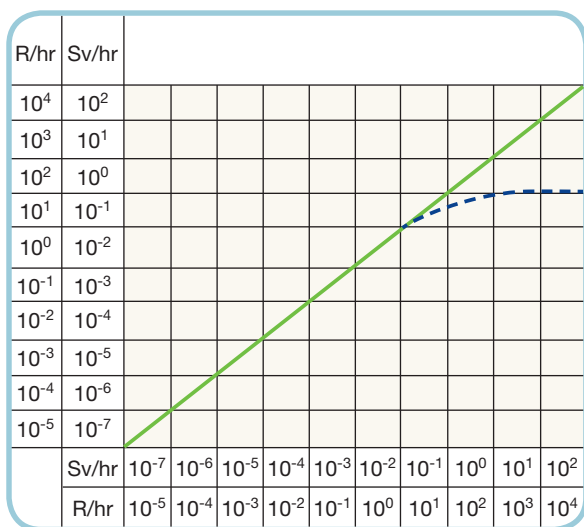
R/hr	GP Series	Conventional Instrument Range				Sv/hr
$10^6$						$10^4$
$10^5$						$10^3$
$10^4$						$10^2$
$10^3$						$10^1$
$10^2$						$10^0$
$10^1$						$10^{-1}$
$10^0$						$10^{-2}$
$10^{-1}$						$10^{-3}$
$10^{-2}$						$10^{-4}$
$10^{-3}$						$10^{-5}$
$10^{-4}$						$10^{-6}$
$10^{-5}$						$10^{-7}$
$10^{-6}$						$10^{-8}$

# GP Series – Geiger Mueller Detectors

## Specifications by category continued

Detector Type/Characteristics	GP100M <sup>(1)</sup>	GP100MS <sup>(1)</sup>	GP110	GP110SI
Detector Sensitivities, Low Range	700 CPM/mR/h	1.16 CPS/μSv/h	10 800 CPM/mR/h	18 CPS/μSv/h
Detector Sensitivities, High Range	4.2 CPM/mR/h	0.007 CPS/μSv/h	4.2 CPM/mR/h	0.007 CPS/μSv/h
Detector Dynamic, Low Range	10 μR/h	0.1 μSv/h	1 μR/h	0.01 μSv/h
Detector Dynamic, High Range	10 000 R/h	100 Sv/h	10 000 R/h	100 Sv/h
Weight kg (lb)	0.45 kg (1 lb)	0.45 kg (1 lb)	0.9 kg (2 lb)	0.9 kg (2 lb)
Size, W x H x L or L x Dia., mm (inch)	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.)
Typical Application	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.



— Typical CANBERRA GP Series Detectors Linearity with TTC.

- - - Without TTC.

Only one GM detector pulse can occur in any one 'on' time. Since the detector is fully recovered between 'on' times, the pulses produced by the detector are full sized. 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 detectors involved.

# GP Series – Geiger Mueller Detectors

## Specifications

### GENERIC SPECIFICATIONS

(Applicable to GP100, GP100SI, GP100C, GP100C2, GP100CS, GP100CS2, GP100M, GP100MS, GP110, GP110SI).

- DETECTOR OUTPUT – (2 ea) Halogen Quenched GM Detectors.
- 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 –  $\pm 10\%$ .
- 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 or Stainless Steel.

The **GP100C/GP100C2** and **GP100CS/GP100C2S** detectors have an internally-mounted (nominal) 3.7 kBq (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 nominally 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 test 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 60 meters (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

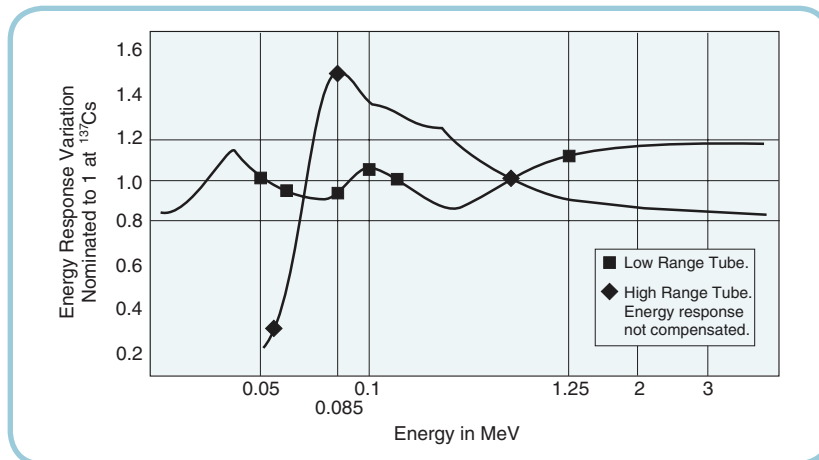
(used with GP100M and GP100MS)

- 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