Technical
Information
TI 197F/00/en

Operating Instructions
017276-1000

Radiometric Measurement
Detectors DG 17, DG 27

Geiger-Müller counters for non-invasive level limit detection in tanks and silos









Detector DG 17/ DG 27
standard version

Detector DG 17/DG 27
with water jacket

Detector DG 17/DG 27
with flange and water
jacket

Application
The detector DG 17 /DG 27 is used together with a Gammapilot transmitter and a source container for non-invasive level limit detection in tanks, mixers, reactors, bunkers or silos containing, e.g. flammable, poisonous or aggressive liquids and bulk solids.

Features and Benefits
- Accurate and reliable non-invasive level detection
- Safe measurement: for use with point source, tested and certified to ISO 2919/DIN 25 426, Part 1 (Classification C 66 646, i.e. strictest specification)
- Can be connected to Gammapilot FTG 470 Z and FTG 671
- Detector sensitivity can be matched to application:
  DG 17 with one counter
  DG 27 with two counters
- Signal transmission over (unscreened) two-core cable or multicore cable by interference-immune pulse frequency modulation (PFM) method
- Suitable for use in radiometric overspill protection systems.

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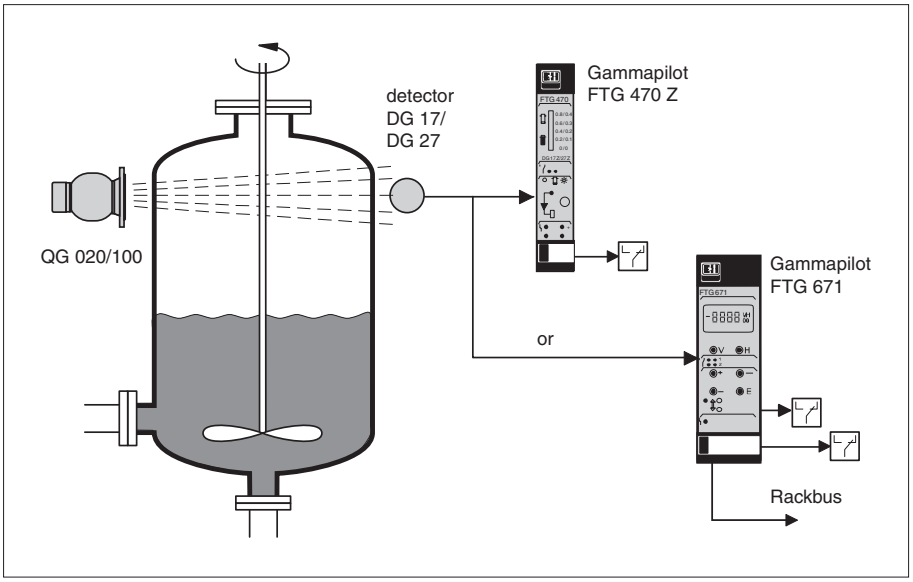
Measurement Principle



Measuring system for level limit detection with the DG 17 / DG 27 detector

Measuring System
The measuring system comprises:

- Gammapilot transmitter FTG 671 or FTG 470 Z
- Source container QG 020/100 with Co 60 or Cs 137 source
- Detector DG 17 /DG 27

Mounted on one side of the vessel is a source container with a radiation cut-off mechanism and double-encapsulated radioactive source. On the other side is a detector. The gamma radiation emitted by the source penetrates through the walls and interior of the vessel and is detected on the other side. The counter in the detector converts the radiation into current pulses which are transmitted to the Gammapilot via a two-core cable. Here they are integrated to a current signal which is used to switch the limit relays.

Detector Versions
There are different detector versions:

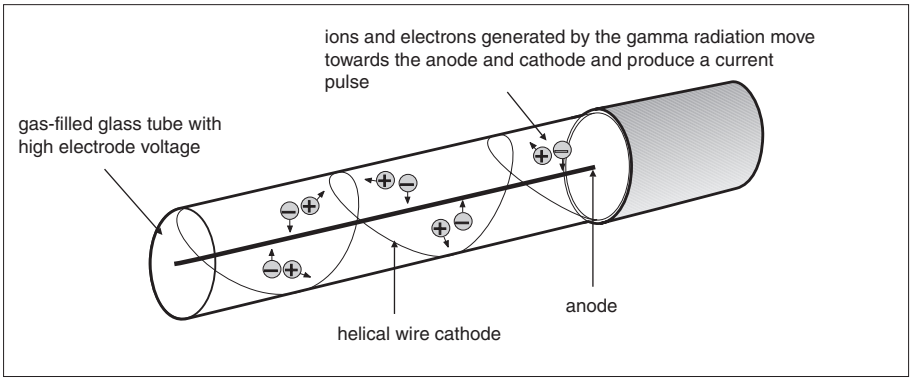
- DG 17 (1 Geiger-Müller counter)
- DG 27 (2 Geiger-Müller counters)

In addition, the standard detectors can be equipped with a water jacket for use in hot environments > 60°C.

Geiger-Müller Counter
The Geiger-Müller counter comprises a cylindrical glass tube filled with noble gas, with a helical wire cathode and a centrally mounted, isolated anode. The tube is mechanically protected by a 0.2 mm thick stainless steel sleeve.

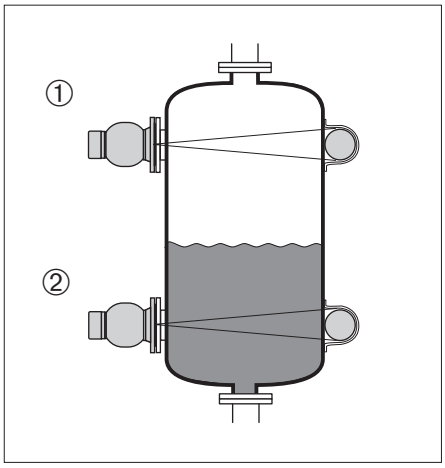
The counter tube is connected to a high-voltage DC supply via a high-impedance drop resistor. In the absence of radioactive particles the system behaves as an almost ideal isolator. When gamma radiation passes through the tube, the noble gas within is ionised, producing so-called primary electrons. These move towards the anode, creating on their way avalanches of secondary electrons. As a result, the impedance of the counter drops temporarily and a short current pulse is emitted.

The number of current pulses output by the Geiger-Müller counter is dependent upon the number of impinging gamma particles, and thus from the local dose rate at the tube.

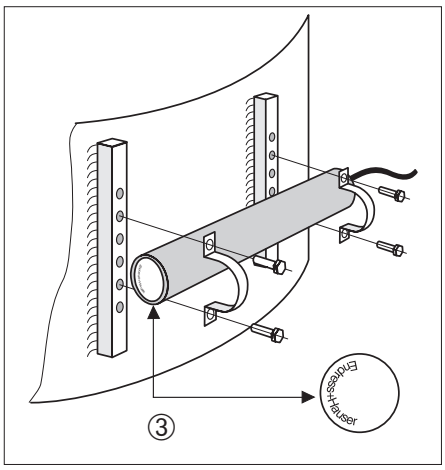


Functional principle of Geiger-Müller counter

Installation



Standard mounting
① maximum limit detection
② minimum limit detection

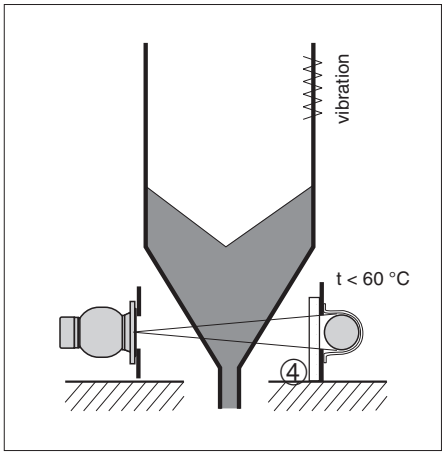


Mounting and position of counter
③ Endress+Hauser

Mounting

The detector contains a sensitive Geiger-Müller counter: handle carefully during transport and installation.

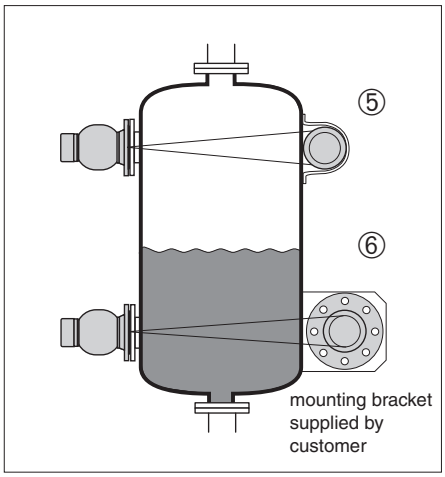
- The position chosen for mounting must correspond exactly to that used when planning the system because the source activity has been selected for this configuration
- The detector can be clamped (or flanged) directly to the vessel or to a separate mounting
- The detector is at its most sensitive when mounted lateral to the radiation beam. This is also the position which produces the most accurate switchpoints.
- Turn the detector such that the Geiger-Müller counters face the vessel wall - this avoids additional attenuation through detector components. The labels on the counter end and body indicate the correct position (see Technical Data).



Mounting where strong vibrations or high temperatures are present
④ insulation: low density material

Vibration, High Vessel Temperatures

- If the vessel vibrates or is subject to impacts, it is recommended that the detector be mounted so that there is no mechanical contact between it and the vessel wall.
- This method of mounting is also recommended when the temperature of the product is high.



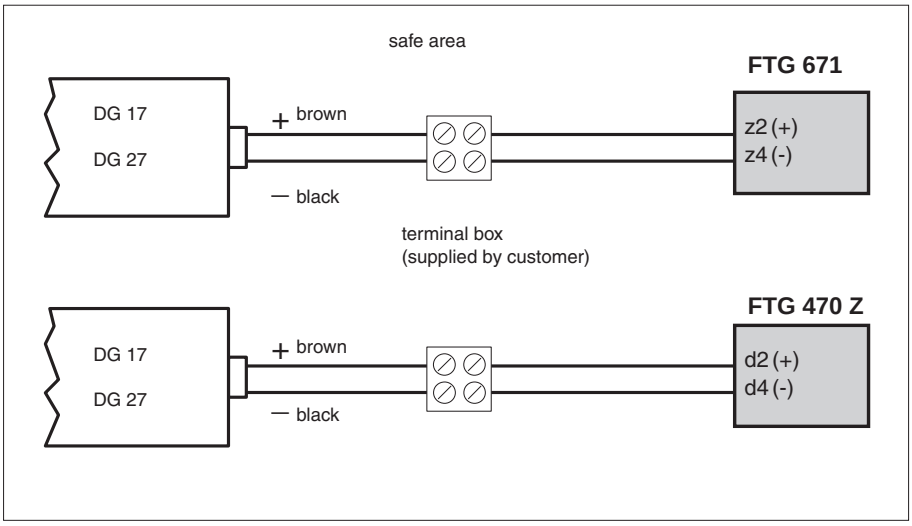
Mounting in the case of high temperature
⑤ water jacket with clamps
⑥ water jacket with flange

High Ambient Temperature

- If the ambient temperature at the mounting point exceeds +60 °C (140 °F) a detector with a water jacket must be used
- In this case, we also recommend that the water circulation is monitored with a flowmeter.

Electrical Connection

Connect the detector to the Gammapilot transmitter by a two-core screened or unscreened cable or two cores of a multicore cable: max. resistance 25 Ω per core.

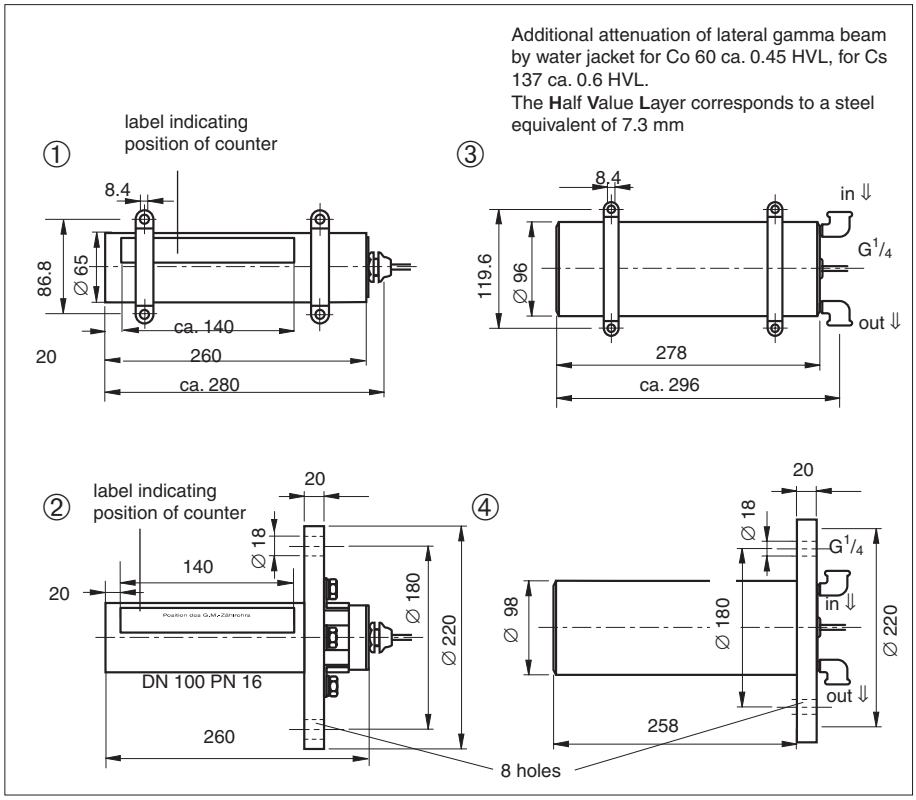


Connection diagram for DG 17/ DG 27 in safe areas

Note:

- For standard applications all detectors (DG 17 / DG 27) can be connected to the Gammapilot FTG 470 Z or FTG 671

Technical Data



Dimensions in mm of Geiger-Müller counters DG 17 /DG 27
1" = 25.4 mm
① standard, mounting with 2 clamps
② standard with water jacket, mounting with 2 clamps
③ flange version, mounting supplied by customer
④ flange version with water jacket, mounting supplied by customer

Construction

- Housing: Aluminium (option stainless steel 1.4571 ≅ SS 316 Ti)
- Dimensions: see figure
- Weight: ca. 2 kg
  with flange: ca. 7 kg
- Protection to DIN 40 050: IP 55
- Permissible ambient temperature:
  -20°C…+60°C (-4°F…+140°F)
  Storage temperature:
  -20°C…+70°C (-4°F…+158°F).

Counter

- No. of counter tubes:
  DG 17 one, DG 27 two
- Dosage sensitivity constants
  for Co 60: 10 [cps/(µSv/h)]
  for Cs 137: 7.8 [cps/(µSv/h)]
- Service life: ≥ 6 x 10^{10} pulses
  at U_B ≤ 480 V, n = 500 cps
  T = 20°C…+25°C (68°F…+77°F)
- Gas mixture: neon/halogen
- Local dosage range: see table.

Electrical

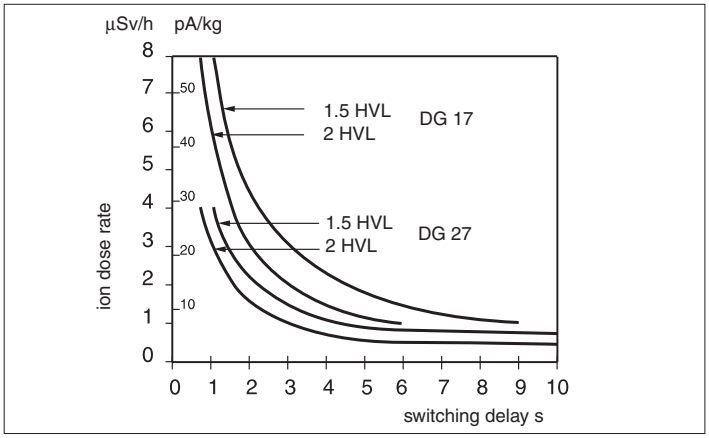
- Cable: supplied with 3 m, two-core cable (1.5 mm^2)
- Power: 12 V=, ca. 10 mA supplied by Gammapilot, with protection against reverse polarity
- Output: pulse frequency modulation superimposed on supply current (PFM)
- Pulse frequency: ca. 10…80 Hz, depending on ion doserate
- Ignition protection:
  DG 17, DG 27: none
- Interference Emission to EN 61326 ; Electrical equipment Class B
  Interference Immunity to EN 61326

Water Jacket

- Housing: steel, both faces open
- Dimensions: see figure
- Weight: ca. 5 kg
  with flange: ca. 10 kg
- Water connection: G 1/4
- Permissible ambient temperature:
  0°C…+180°C (-32°F…+356°F) with a flowrate of 30 l/h at 20°C (68°F).

Local dosage range

Type	mounted horizontally	mounted face-on
DG 17	8.4...60 pA/kg 1.2...8 µSv/h	16.8...120 pA/kg 2,4...16 µSv/h
DG 27	4.2...30 pA/kg 0.6...4 µSv/h	8.4...60 pA/kg 1.2...8 µSv/h



Switching delay as a function of detector, ion dose rate on detector and attenuation

Product Structure

Type	Order Number
DG 17 (one Geiger-Müller counter)	915935-0000
DG 27 (two Geiger-Müller counters)	915936-0000
Water cooling jacket	915509-0000
Water cooling jacket (with flange DN 100 PN 16)	915510-0000
3 m metal hose (with connection for watertight-gland)	915508-0000
Flange DN 100 PN 16 for mounting detector face-on	915498-0000

Supplementary Documentation

- ❑ Gammapilot FTG 671
  Technical Information TI 177F/00/en
- ❑ Gammapilot FTG 470 Z
  Technical Information TI 218F/00/en
- ❑ Gamma Radiation Sources
  Technical Information TI 213F/00/en
- ❑ Radiometric Measurement
  System Information SI 16F/00/en
- ❑ Source Container QG 020/100
  Technical Information TI 264F/00/en
- ❑ Source Container QG 2000
  Technical Information TI 346F/00/en

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