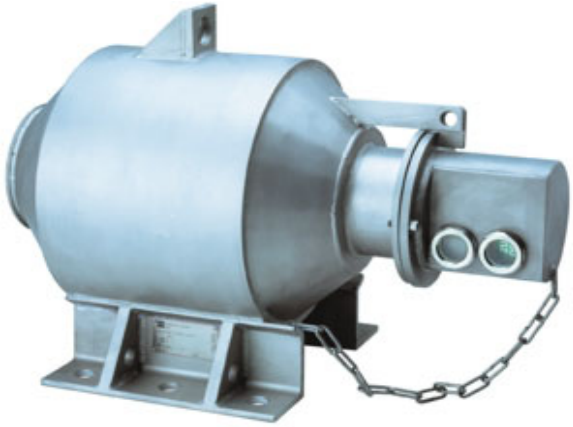
Technical Information
Source Container QG2000
Radiometric Measurement



Compact transmitter for non-contact point level detection (including protection equipment) level, interface and density measurement

Application
The source container QG2000 encloses the radioactive source used for radiometric limit, level and density measurement. It allows the beam to emerge unattenuated only in one direction and gives an extremely high attenuation in all other directions. When operating with very high sensitivity rod scintillation detectors, the QG2000 provides the lowest possible radiation loads in the surrounding.
It is therefore always used if the shielding effects of smaller source containers (FQG60, FQG61, FQG62) are too low due to the high activity of the source or if no control area is permitted. The QG2000 complies to all international standards and fulfils the strict requirements of the chemical industry.

Your benefits
- Extremely high shielding ensure that no control areas are generally required and that installation in accessed areas is possible.
- Simple and safe source replacement.
- Highest safety classification for the source supplied (DIN 25426/ISO 2919, Classification C 66646).
- Additional metallic protective capsule with O-ring seal to protect the source against mechanical and chemical influences.
- Various angles of emission for optimum adaption to the application.
- Padlock for fixing the ON/OFF switch position and to protect against theft.
- Easy identification of switch status through sight glasses on the cover or by remote display with proximity switches.
- Optional with pneumatic ON/OFF circuit.

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Function and system design

Function

The radioactive source is surrounded by a lead sheathing in the QG2000 source container to screen the gamma radiation. The radiation can only be emitted along one channel almost unattenuated. The limit values set for local dosages are not exceeded even with maximum activity.

System Design

The stainless steel housing ensures that the radiation source and lead shielding cannot be lost when the housing is heated above the melting point of lead (tested to DIN VDE 0412-1, Section 6.4, i.e. 30 min at +800 °C (+1472 °F)).
The source itself is protected from mechanical and chemical influences by a stainless steel protective capsule with an O-ring seal and can be placed in the emission channel (switching on the radiation) and removed from it (switching off) by sliding the source support rod. The mechanical resistance of the switching device has been tested according to DIN VDE 0412-1, Section 9.4.
The switch position is secured by a padlock. It can easily be observed through the sight glasses from outside the container or can be transmitted to a remote electronic display in the control room.
The QG2000 can also be optionally supplied with a pneumatic ON/OFF switching device.

Attenuation factor and half-value layers

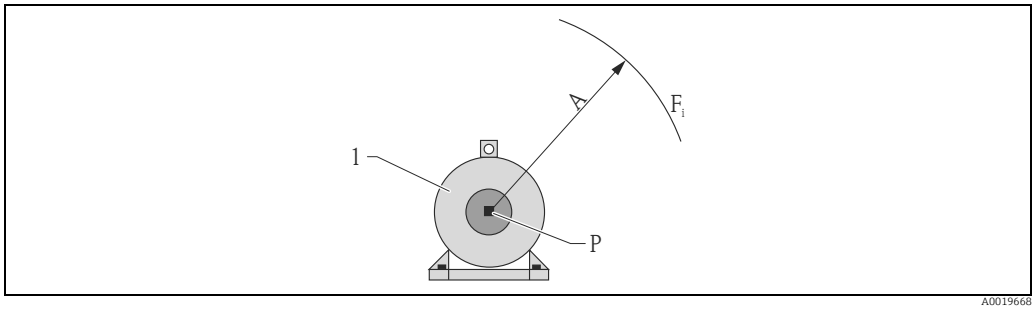
	^{60}Co	^{137}Cs
Attenuation factor F_S	4.096	8.388.000
Number of half-value layers	12	23

Maximum source-activity

^{60}Co	^{137}Cs
2000 mCi respectively 74 GBq	20 Ci respectively 740 GBq

Calculating the local dose rate or control area

The control area is defined as that particular distance A from the source by which the local dose rate is attenuated to a value F_i when using an activity P.



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1 *QG2000*
P *Activity of source[GBq]*
A *Distance from source (control area) [m]*
F_i *Local dose rate [µSv/h]*

Formula for the local dose rate	Formula for the distance from source
$F_i = \frac{P \cdot K}{F_A \cdot F_S}$	$A = \sqrt{\frac{P \cdot K}{F_i \cdot F_S}}$

$F_A = A^2$

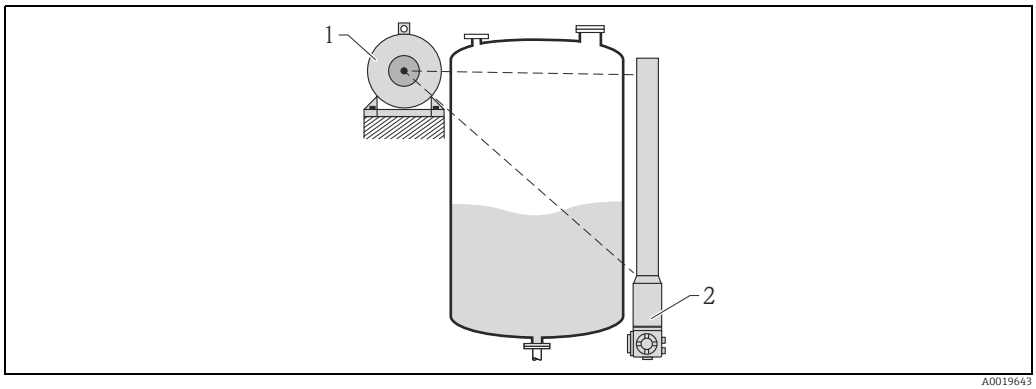
$K = 356{,}7\ \mu Sv/h \cdot m^2\ GBq$ for ^{60}Co

$K = 95{,}95\ \mu Sv/h \cdot m^2\ GBq$ for ^{137}Cs

The "Applicator" program can be used to select the source containers that suits your application.
See: www.endress.com/applicator

Operating conditions

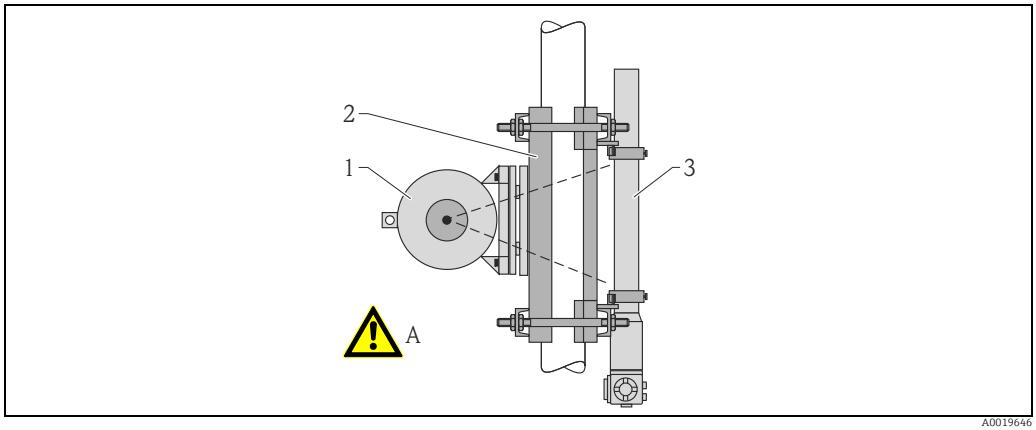
Level Measurement



1 QG2000; firm bracket (supplied by customer) = 350 kg (771,75 lbs)
2 Detector Gammapilot M FMG60

In order to ensure stable measurement and lasting radiation protection, the QG2000 must be tightly screwed onto a rugged, low-vibration bracket that can withstand a weight of 350 kg (771.75 lbs) under all operating conditions. Additional supports are generally required when mounting directly onto the vessel. A fastening for a crane on the QG2000 is provided for transporting it.

Density measurement



1 QG2000; 350 kg (771.75 lbs)
2 Clampind device (supplied by customer)
3 Detector Gammapilot M FMG60
A Support clamping device separately, especially when using the QG2000 on ships or dredgers

The clamp connection must be separately supported to ensure that the weight of the source container (350 kg (771.75 lbs)) does not cause the pipe to bend. When using the QG2000 on ships or dredgers, the fastenings on the piping must be suited to the loads occuring and appropriate supports should be provided.

Ambient conditions

Entry of particles or water

The source support rod of the QG 2000 has an additional metallic capsule with an O-ring seal to prevent particles and streams of water from entering.
(Ingress protection IP 65 to DIN 40050, page 1 and EN 60529 resp.).

Ambient temperature:

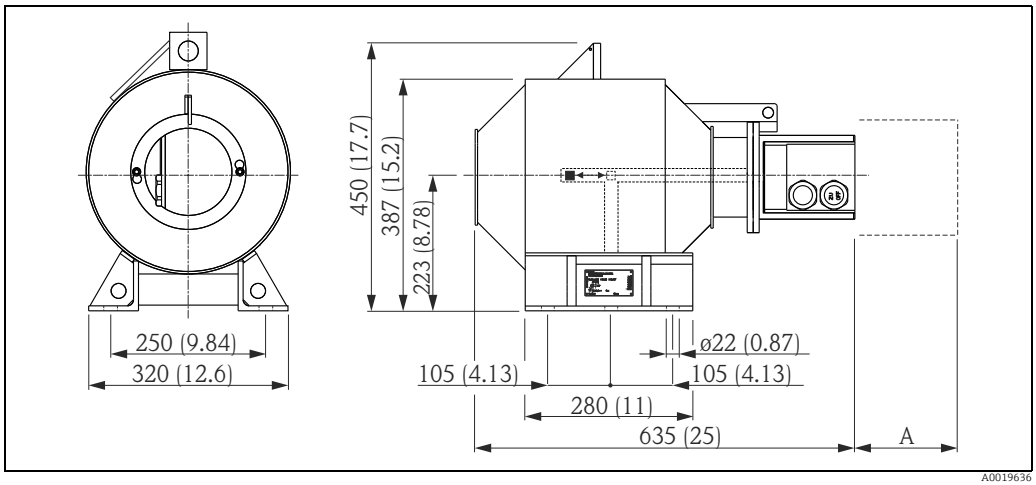
- Without proximity switches for remote display:
  T = -20 to +200 °C (-4 to +392 °F); Class 3 to DIN VDE 0412-01
- With proximity switches for remote display:
  T = -20 to +100 °C (-4 to +212 °F); Class 2 to DIN VDE 0412-01

Fire resistance

Tested to DIN VDE 0412-01, Section 6.4, i.e. 30 min at +800 °C (+1472 °F).

Mechanical construction

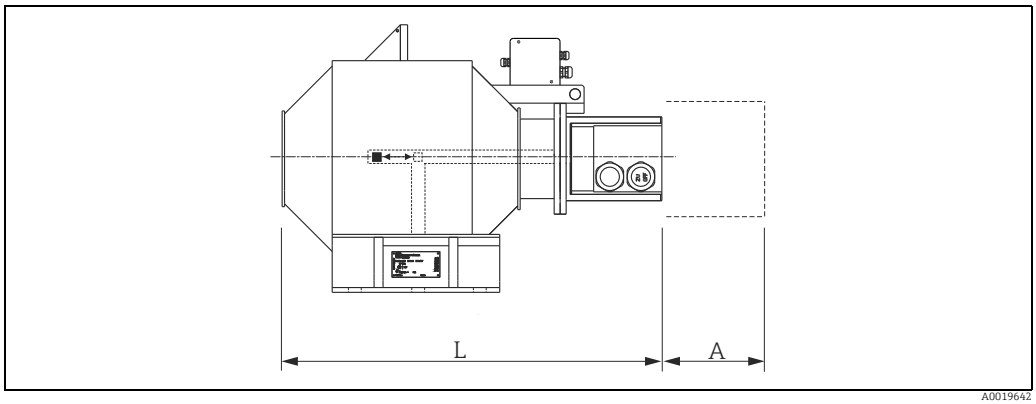
Standard design



A Space is necessary for taking off the protective hood: see table below

The standard design can be upgraded to the designs with remote display and pneumatic ON/OFF circuit by a set.

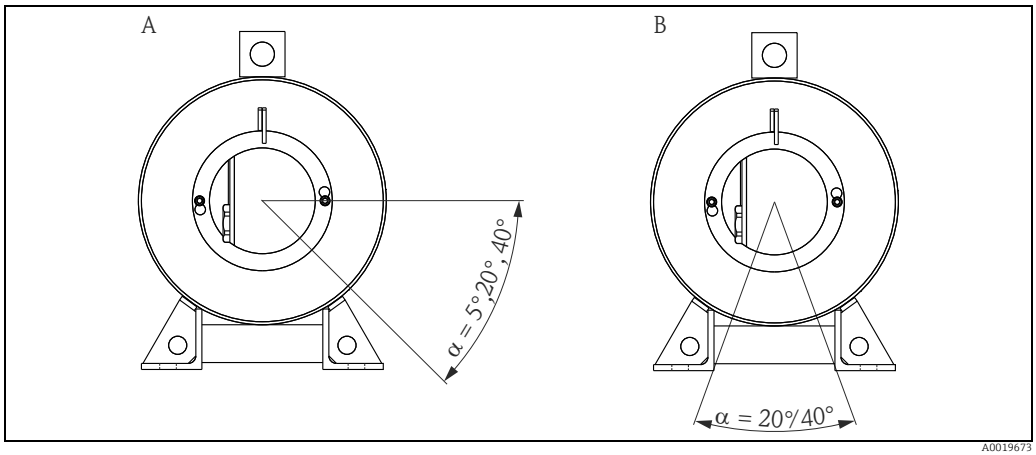
Design with remote display / with pneumatic ON/OFF circuit



A Space is necessary for taking off the protective hood: see table below

Version	L in mm (in)	A in mm (in)
Remote display	635 (25)	145 (5.71)
Pneumatic ON/OFF circuit	735 (28.9)	245 (9.65)

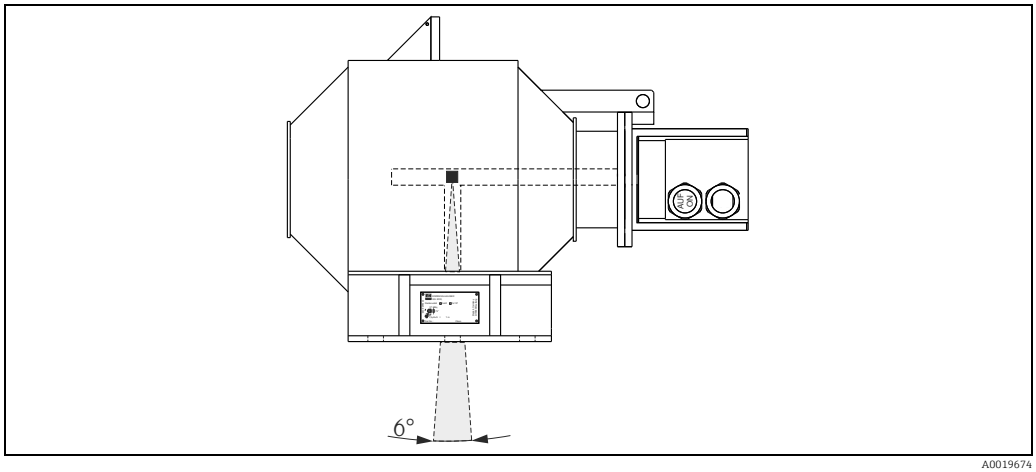
Fitting position/emission angle (when switched on)



A Design with horizontal radiation exit
B Design with vertical radiation exit

Width of the beam emission channel (when switched on)

The width of the emission channel is 6° for all designs. The emission channel is marked on the external container wall.



Weight

approx. 350 kg (771.75 lbs); for all designs

Housing materials

Stainless steel 316Ti (1.4571), for surface treated versions:
- Glass bead blasted
- Epoxy enamel coated
- Seawater-resistant coated

Shielding material

Lead

Operating elements

Standard design

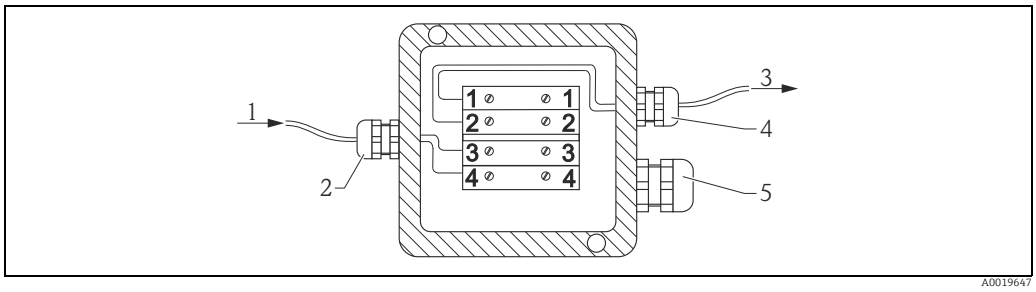
- ON/OFF switching by manually sliding the source support rod
- Fixing and securing the switching status (ON/OFF) with a padlock
- Reading of the switching status through the sight glasses

Design with proximity switches for remote display of switch status

In addition to the sight glasses supplied, with this design the switching status is also detected by two proximity switches NJ4-12GK-SN supplied by Pepperl+Fuchs. For signal evaluation, the following isolating switch amplifiers from, e.g. Pepperl+Fuchs can be used:

- KFA6-SH-Ex1 (230 V AC)
- KFD2-SH-Ex1 (24V DC)

The PG7 cable glands on the connecting box are assigned to the proximity switches on delivery. The PG9 cable gland connects the isolating switch amplifier



1 From initiator 2 (OFF)
2 PG7
3 From initiator 1 (ON)
4 PG7
5 PG9

Design with pneumatic ON/OFF circuit

In this design:

- The beam is switched ON by compressed air, 4 to 6 bar (58 to 87 psi), to be connected to a G1/8" thread in the additional ring.
- When the pressure falls below 4 bar (58 psi) the radiation beam is automatically switched OFF.
- There should be a pressure relief hole to ensure automatic switch-off in all cases.
- Proximity switches for remote display of the switching status are built in (see above).

Technical Data

The technical data of source container QG2000 with pneumatic actuator are identical to the technical data listed in Operating Manual or Technical Information of the standard version. Additional or differing data are listed below:

Pneumatic actuator

- Comp. air connection G1/8"
- Actuating pressure :
  - ON: 6 bar (87 psi)
  - OFF: 0 bar (0 psi)
- In unpressurised operation the QG2000 is switched off, reset by means of spring

Display of switching status

- Sight glasses in the protection hood
- Initiator signal

Certificates and Approvals

PTB	Isodose curve with 60Co (37GBq/1000 mCi)
Germanischer Lloyd	For applications on dredgers
Proximity switches supplied by Pepperl+Fuchs	Ingress protection IP 67 to IEC 60529
CNSC Certificate	For application in Canada the following CNSC Certificate is available: QG2000: No. 094-0159-0-2017 When using the CNSC Certificate, the additional Safety Instructions SD00142F/00/EN has to be observed.

Ordering information

Ordering information

Detailed ordering information is available as follows:
- In the Product Configurator on the Endress+Hauser website: www.endress.com → Select country → Instruments → Select device → Product page function: Configure this product
- From your Endress+Hauser sales center: www.endress.com/worldwide

Product Configurator - the tool for individual product configuration
- Configuration data updated on a daily basis
- Depending on the device: Direct input of data specific to measuring point, such as measuring range or operating language
- Automatic verification of exclusion criteria
- Automatic generation of order code with breakdown in PDF or Excel output format
- Possibility to order directly from the Endress+Hauser online shop

Delivery

Germany

Radioactive sources may only be delivered when we have received a copy of the authorisation for handling radioactive materials. Endress+Hauser will gladly help you acquire the necessary documents. Please contact your nearest Sales Organisation.
For reasons of safety and cost, the radioactive source is usually shipped already loaded in the source container. Arrangements can also be made to ship the source seperately in a special transport drum. They will only be transported by approved shipping agents according to current GGVS/ADR guidelines, with all safety regulations being observed.

Other countries

Radioactive sources may only be delivered when we have received a copy of the import license. Endress+Hauser will gladly help you acquire the necessary documents. Please contact your nearest Sales Organisation.
They will only be transported by approved shipping agents according to current GGVS/ADR and DGR/IATA guidelines, with all safety regulations being observed.

Supplementary documentation

System Information	▪ **PK00001F/00/EN** Radiometric measurement - Applications in all industries
Operating Instructions	▪ **BA00223F/00/EN** Operating instructions for the source container QG2000
Technical Information	▪ **TI00363F/00/EN** Technical Information for Gammapilot M FMG60 ▪ **TI00439F/00/EN** Technical Information for Gamma Source FSG60/61 ▪ **TI01023F/00/EN** Technical Information for Gammapilot FTG20
Certificates	▪ **ZE00251F/00/EN** Test certificate Germanischer Lloyd (for applications on dredgers)
Special documentation	▪ **SD00142F/00/EN** Supplementary Safety Instructions for Radioactive Sources and Source Containers approved for use in Canada. ▪ **SD00276F/00/EN** Supplementary Instruction Manual, especially for QG020/100 and QG2000 for the USA

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