TI01171F/00/EN/02.19
71431343
2019-02-28

Technical Information
Source container FQG66

Radiometric level measurement

Container with radiation source insert and manual or pneumatic switch-on and switch-off

Application

The FQG66 source container is designed to hold the radioactive source during radiometric point level measurement, continuous level measurement and density measurement. The radiation is emitted almost unattenuated in one direction only, and is damped in all other directions.

This results in a directional, limited emission channel that is generally aligned with the detector opposite.

The maximum radiation source activities which the FQG66 can accommodate are as follows:
- ^{137}Cs: 740 GBq (20 Ci)
- ^{60}Co: 185 GBq (5 Ci)

Your benefits

- Optimum shielding for high source activity
- Highest safety classification for the source supplied (DIN 25426/ISO 2919, typical classification C66646)
- Various angles of emission for optimum adaptation to the application
- Manual switch-on/switch-off ("EIN/ON" and "AUS/OFF")
- Retaining element to fix switch position ("EIN/ON" and "AUS/OFF" respectively)
- Switch state easily identified
- Optional: manual or pneumatic drive with proximity switch to remotely control and monitor the switch state

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People for Process Automation

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About this document

Symbols used

Safety symbols

⚠ CAUTION

This symbol alerts you to a dangerous situation. Failure to avoid this situation can result in minor or medium injury.

⚠ DANGER

This symbol alerts you to a dangerous situation. Failure to avoid this situation will result in serious or fatal injury.

NOTICE

This symbol contains information on procedures and other facts which do not result in personal injury.

⚠ WARNING

This symbol alerts you to a dangerous situation. Failure to avoid this situation can result in serious or fatal injury.

Symbols for certain types of information

☢
Warns against radioactive substances or ionizing radiation

✓
Permitted
Procedures, processes or actions that are permitted

✓✓
Preferred
Procedures, processes or actions that are preferred

✗
Forbidden
Procedures, processes or actions that are forbidden

ℹ
Tip
Indicates additional information

📖
Reference to documentation

Symbols in graphics

1, 2, 3, ...
Item numbers

A, B, C, ...
Views

Function and system design

Function

Function of the radiation source container

In the FQG66 source container, the radioactive source is surrounded by a steel casing filled with lead which screens off gamma radiation. The radiation can be emitted, almost unattenuated, in one direction only through a channel (focused narrow radiation path). This radiation is used for radiometric measurement.

Switching the radiation ON and OFF

- The current switch position ("EIN/ON" or "AUS/OFF") is clearly visible from the outside
- The current switch position ("EIN/ON" or "AUS/OFF") is secured by a lock pin
- Optional pneumatics: "AUS/OFF" switch position - unpressurized; "EIN/ON" switch position - pressurized

Attenuation factor and half-value layers

In the direction of the beam
- Attenuation factor F_s:
  - For ^{60}Co: 1 270
  - For ^{137}Cs: 6 650
- Number of half-value layers:
  - For ^{60}Co: 10.3
  - For ^{137}Cs: 12.7

In the direction opposite to the beam (in the direction of the nameplate):
- Attenuation factor F_s:
  - For ^{60}Co: 4 096
  - For ^{137}Cs: 8 388 000
- Number of half-value layers:
  - For ^{60}Co: 12
  - For ^{137}Cs: 23

These are typical values that do not take into account production-related variations in the source activity and tolerances of the measuring devices.

Maximum activity of the radiation source

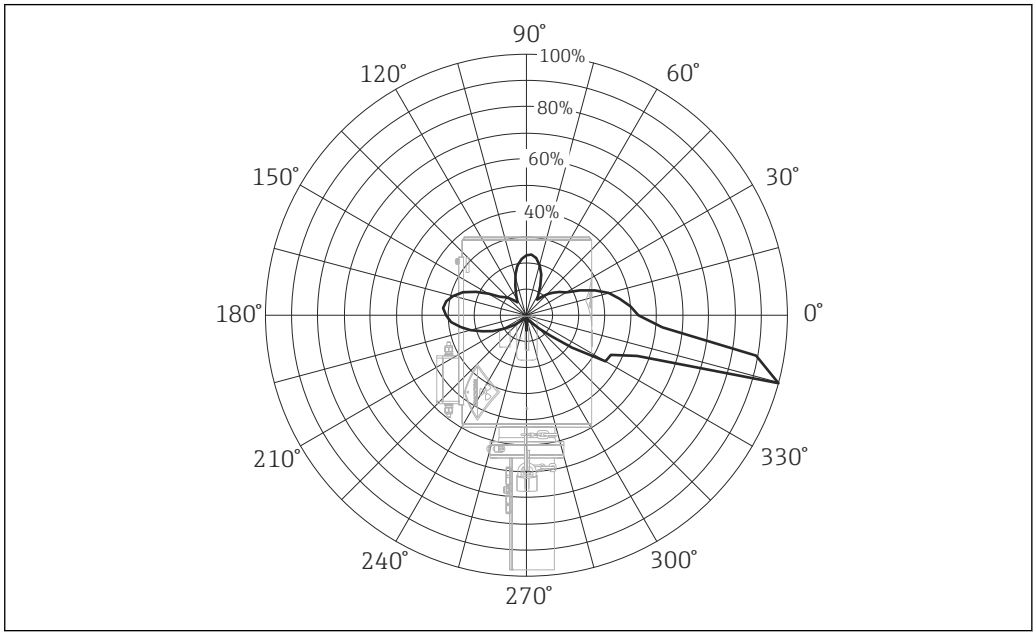
- ^{137}Cs: 740 GBq (20 Ci)
- ^{60}Co: 185 GBq (5 Ci)

The maximum admissible activity can be further restricted by country-specific approvals.

Dose rate diagrams

A dose rate diagram specifies the local dose rate at a specified distance from the surface of the radiation source container. Examples of dose rate diagrams for a distance of 1 m (3.3 ft) are provided in the following section. All the dose rate diagrams and maximum values indicated refer to the "AUS/OFF" switch setting and order code 240 "Angle of emission", option 5 "40° horizontal".

Dose rate diagrams for ^{60}Co



A0026748

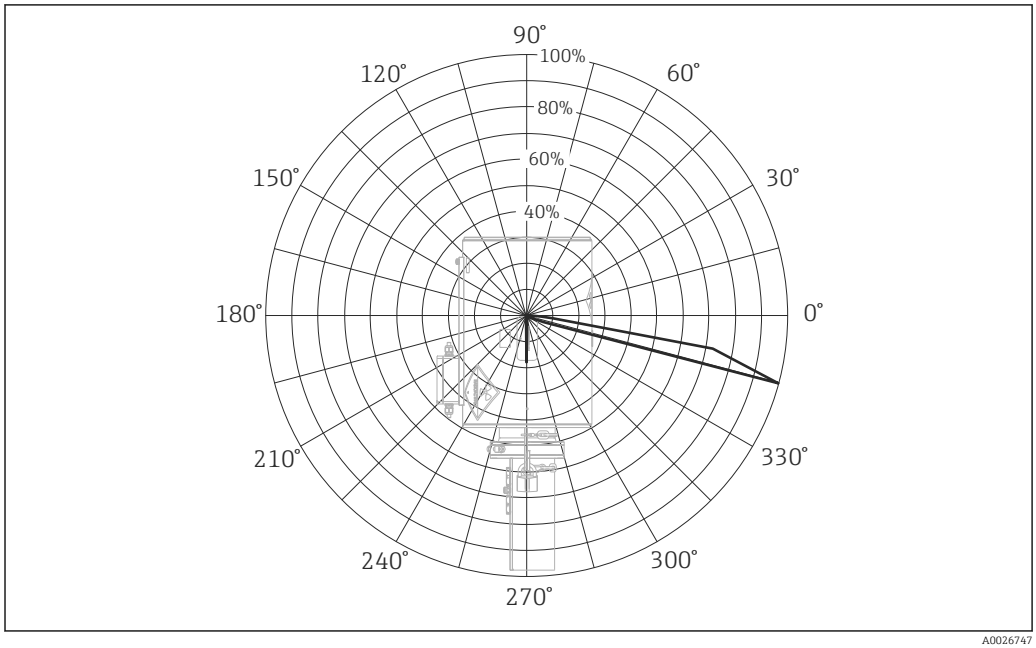
Option in order code 100 "Prepared for source activity"

- **AA:**
  - Activity:3.7 MBq
  - max. value (100 %) in µSv/h: <0.01
- **AB:**
  - Activity:7.4 MBq
  - max. value (100 %) in µSv/h: <0.01
- **AC:**
  - Activity:18.5 MBq
  - max. value (100 %) in µSv/h: <0.01
- **AD:**
  - Activity:37 MBq
  - max. value (100 %) in µSv/h: 0.01
- **AE:**
  - Activity:74 MBq
  - max. value (100 %) in µSv/h: 0.02
- **AF:**
  - Activity:111 MBq
  - max. value (100 %) in µSv/h: 0.03
- **AG:**
  - Activity:185 MBq
  - max. value (100 %) in µSv/h: 0.05
- **AH:**
  - Activity:370 MBq
  - max. value (100 %) in µSv/h: 0.10
- **AK:**
  - Activity:740 MBq
  - max. value (100 %) in µSv/h: 0.21
- **AL:**
  - Activity:1.11 GBq
  - max. value (100 %) in µSv/h: 0.31
- **AM:**
  - Activity:1.85 GBq
  - max. value (100 %) in µSv/h: 0.52
- **AN:**
  - Activity:3.7 GBq
  - max. value (100 %) in µSv/h: 1.03

- **AP:**
  - Activity:7.4 GBq
  - max. value (100 %) in µSv/h: 2.06
- **AR:**
  - Activity:11.1 GBq
  - max. value (100 %) in µSv/h: 3.09
- **AT:**
  - Activity:18.5 GBq
  - max. value (100 %) in µSv/h: 5.15
- **AW:**
  - Activity:29.6 GBq
  - max. value (100 %) in µSv/h: 8.24
- **BB:**
  - Activity:37 GBq
  - max. value (100 %) in µSv/h: 10.31
- **BC:**
  - Activity:55.5 GBq
  - max. value (100 %) in µSv/h: 15.46
- **BD:**
  - Activity:74 GBq
  - max. value (100 %) in µSv/h: 20.61
- **BF:**
  - Activity:111 GBq
  - max. value (100 %) in µSv/h: 30.92
- **BG:**
  - Activity:148 GBq
  - max. value (100 %) in µSv/h: 41.22
- **BH:**
  - Activity:185 GBq
  - max. value (100 %) in µSv/h: 51.53

Version assignment, see Product Configurator

Dose rate diagrams for ^{137}Cs



A0026747

Option in order code 100 "Prepared for source activity"

- **AA:**
  - Activity:3.7 MBq
  - max. value (100 %) in µSv/h: <0.01
- **AB:**
  - Activity:7.4 MBq
  - max. value (100 %) in µSv/h: <0.01
- **AC:**
  - Activity:18.5 MBq
  - max. value (100 %) in µSv/h: <0.01
- **AD:**
  - Activity:37 MBq
  - max. value (100 %) in µSv/h: <0.01
- **AE:**
  - Activity:74 MBq
  - max. value (100 %) in µSv/h: <0.01
- **AF:**
  - Activity:111 MBq
  - max. value (100 %) in µSv/h: <0.01
- **AG:**
  - Activity:185 MBq
  - max. value (100 %) in µSv/h: <0.01
- **AH:**
  - Activity:370 MBq
  - max. value (100 %) in µSv/h: <0.01
- **AK:**
  - Activity:740 MBq
  - max. value (100 %) in µSv/h: 0.01
- **AL:**
  - Activity:1.11 GBq
  - max. value (100 %) in µSv/h: 0.02
- **AM:**
  - Activity:1.85 GBq
  - max. value (100 %) in µSv/h: 0.03
- **AN:**
  - Activity:3.7 GBq
  - max. value (100 %) in µSv/h: 0.05
- **AP:**
  - Activity:7.4 GBq
  - max. value (100 %) in µSv/h: 0.11
- **AR:**
  - Activity:11.1 GBq
  - max. value (100 %) in µSv/h: 0.16
- **AT:**
  - Activity:18.5 GBq
  - max. value (100 %) in µSv/h: 0.26
- **AW:**
  - Activity:29.6 GBq
  - max. value (100 %) in µSv/h: 0.42
- **BB:**
  - Activity:37 GBq
  - max. value (100 %) in µSv/h: 0.53
- **BC:**
  - Activity:55.5 GBq
  - max. value (100 %) in µSv/h: 0.79
- **BD:**
  - Activity:74 GBq
  - max. value (100 %) in µSv/h: 1.06
- **BF:**
  - Activity:111 GBq
  - max. value (100 %) in µSv/h: 1.59
- **BG:**
  - Activity:148 GBq
  - max. value (100 %) in µSv/h: 2.11

- **BH:**
  - Activity:185 GBq
  - max. value (100 %) in µSv/h: 2.64
- **BJ:**
  - Activity:222 GBq
  - max. value (100 %) in µSv/h: 3.17
- **BK:**
  - Activity:259 GBq
  - max. value (100 %) in µSv/h: 3.70
- **BL:**
  - Activity:296 GBq
  - max. value (100 %) in µSv/h: 4.23
- **BM:**
  - Activity:333 GBq
  - max. value (100 %) in µSv/h: 4.76
- **BN:**
  - Activity:370 GBq
  - max. value (100 %) in µSv/h: 5.29
- **BP:**
  - Activity:740 GBq
  - max. value (100 %) in µSv/h: 10.57

Version assignment, see Product Configurator

Hazardous area

NOTICE

The suitability of the radiometric measurement method and of the device for applications in hazardous areas must be checked by the plant operator according to the national rules and regulations that apply.

► Compliance with national rules and regulations is mandatory.

NOTICE

Source containers with a proximity switch or pneumatic drive are not suitable for hazardous areas.

► Do not use source containers with a proximity switch or pneumatic drive in hazardous areas.
► Source containers with a manual drive and without a proximity switch can be used in hazardous areas.

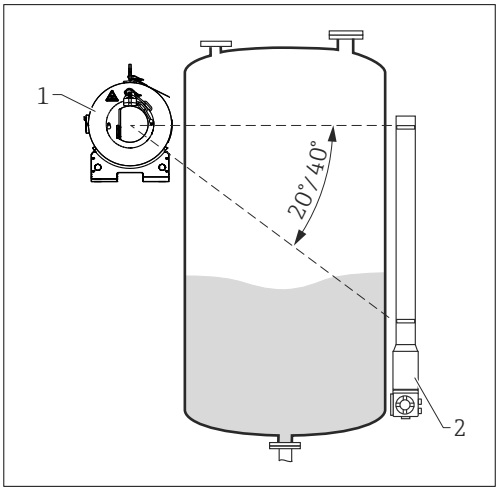
The following must be observed:
- Avoid electrostatic charge at the device. Do not rub synthetic surfaces dry.
- Avoid friction sparks and impact sparks.
- The device must be integrated in the plant potential equalization system.

Installation

Orientation

Orientation for level measurement

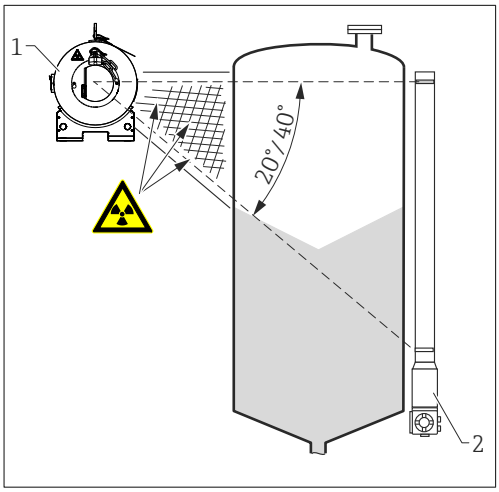
For continuous level measurement, the source container must be mounted at the height of, or slightly above, the maximum level.
The radiation must be aligned exactly with the detector mounted on the opposite side. The source container and detector should be mounted as close as possible to the product vessel to avoid control zones.



A0023674

1 *FQG66: Order code 240 "Angle of emission", option 3 "20 degrees, horizontal" or option 5 "40 degrees, horizontal"*
2 *Gammapilot M FMG60*

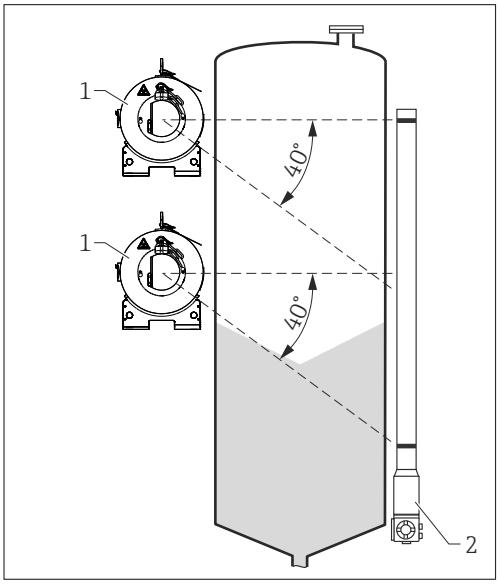
A distance between the source container and the product vessel is often unavoidable if the measuring range is large and the container diameter small. This space must then be secured by grip protection and marked accordingly.



A0023677

1 *FQG66: Order code 240 "Angle of emission", option 3 "20 degrees, horizontal" or option 5 "40 degrees, horizontal"*
2 *Gammapilot M FMG60*

Two or more source containers are used for large measuring ranges. The use of several sources can be necessary not only due to large measuring ranges but also for accuracy reasons.



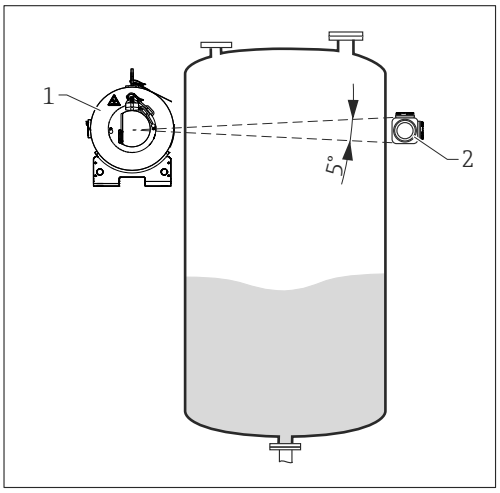
A0023679

1 FQG66: Order code 240 "Angle of emission", option 5 "40 degrees"
2 Gammapilot M FMG60

Orientation for point level detection

For point level detection, the radiation source container is mounted at the same height as the detector.

- Keep the distance between the FQG66 and the vessel wall to a minimum!
- Secure any intermediate area between the source container and wall by grip protection, if necessary!



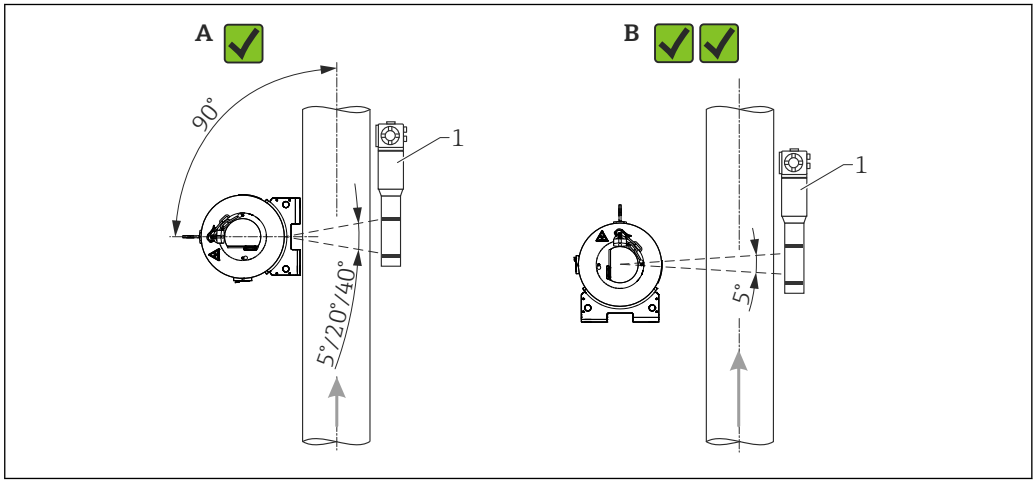
A0023681

1 FQG66: Order code 240 "Angle of emission", option 1 "5 degrees, horizontal"
2 Gammapilot M FMG60

Orientation for density measurement

Vertical pipes

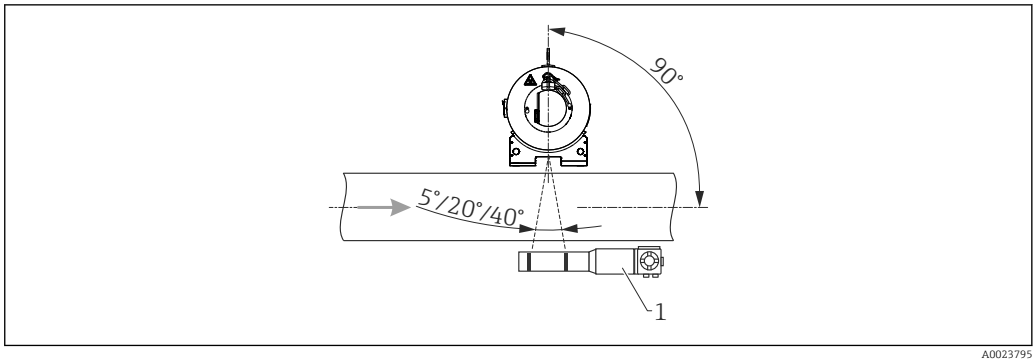
If possible, density should be measured with forward flow from bottom to top. With this type of measuring arrangement, the detector (e.g. Gammapilot M FMG60) should preferably be positioned so that it is mounted with the terminal head at the top. If this arrangement is not possible, an additional bracket must be used to secure the detector (e.g. Gammapilot M FMG60) against slipping.



A Order code 240 "Angle of emission", option 2, 4 or 6 "5, 20 or 40 degrees, vertical"
B Order code 240 "Angle of emission", option 1 "5 degrees, horizontal"
1 Gammapilot M FMG60

Horizontal pipes

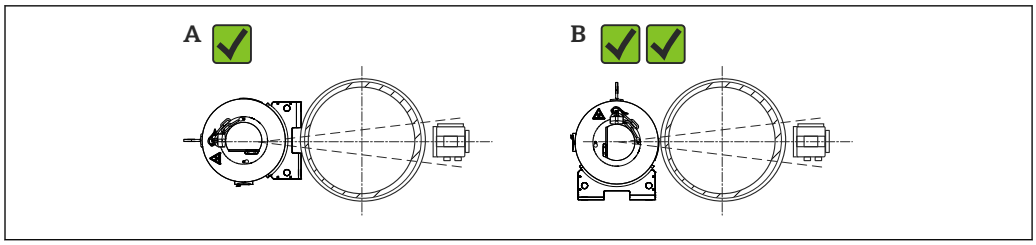
With this type of orientation, it is advisable to mount the FQG66 above the pipe. Attention must be paid to the effect of air bubbles and material buildup in the pipe.



1 Feature 240 "Angle of emission", option model 2, 4 or 6 "5, 20 or 40 degrees, vertical"

1 Gammapilot M FMG60

Lateral installation is only permitted in low-vibration applications, while taking safety instructions into consideration (regular inspection of the "EIN/ON" or "AUS/OFF" mechanism, padlock or retaining element and mounting clamps).



A Source container FQG66 with vertical beam emission
B Source container FQG66 with horizontal beam emission

General information

The clamping device must be fitted in such a way as to withstand the weight of the source container and the detector (e.g. Gammapilot M FMG60) under all anticipated operating conditions (e.g. vibrations). If necessary, the customer should provide additional support with a separate, stable, low-vibration construction.

Note the weights:
- Gammapilot M FMG60: 14 to 29 kg (30.87 to 63.95 lb)
- Gammapilot FTG20: 15.5 kg (34.18 lb)
- Source container FQG66: 435 kg (959.18 lb)

Mounting screw tightening torque (supplied by customer)

Screw diameter M20 or G1/2
- **Material:** stainless steel
- **Min. tensile strength:** 700 N/mm² (157.36 lbf)
- **Friction coefficient (μ):** 0.14
- **Torque:** 32 Nm (23.6 lbf ft)

Environment

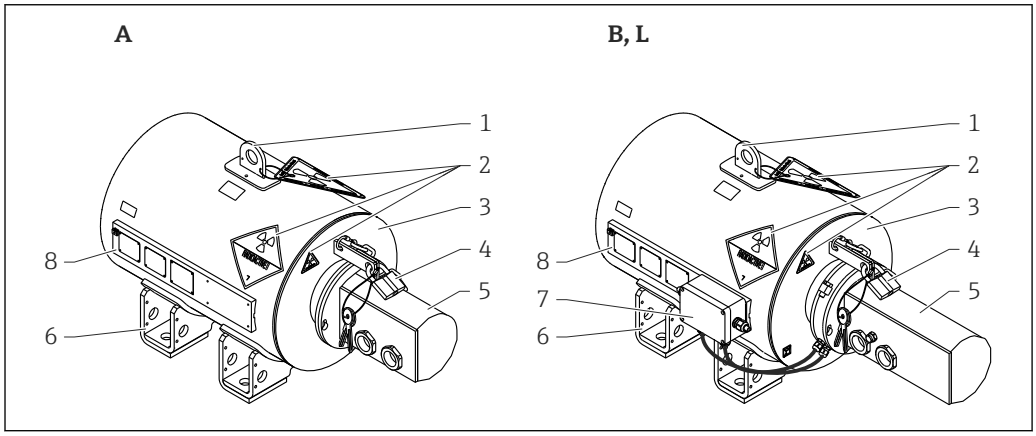
Ambient and storage temperature	▪ Order code 020 "Version", option A "Manual operation": −55 to +100 °C (−67 to +212 °F) ▪ Order code 020 "Version" Option B "Manual operation + proximity switch", Option L "Pneumat. drive + proximity switch": −20 to +80 °C (−4 to +176 °F) (manual and pneumatic, with proximity switch)
Sources	▪ Temperature class 6: −40 to +800 °C (−40 to +1 472 °F) ▪ Operating temperature range: see TI00439F/00
Ambient pressure	Atmospheric pressure
Vibration resistance	DIN EN 60068-2-64 test Fh; 10 to 2 000 Hz; 1 $(m/s^2)^2$ /Hz
Shock	IEC-60068-2-27 test Ea (15 g; 11 ms; 3 shocks/direction/axis)
Degree of protection	▪ without terminal box for proximity switch (order code 020, option A): IP65/67, TYPE 4, TYPE 6P ▪ with terminal box for proximity switch (order code 020, option B, C): IP65/67, TYPE 4, TYPE 6
Fire resistance	+945 °C (+1 733 °F) / 60 minutes The specification can be restricted by country-specific approvals.
Compressed air connection	G1/8"
Switching pressure	▪ EIN/ON: 5.5 to 7 bar (80 to 101 psi) ▪ AUS/OFF: 0 bar (0 psi)
Required compressed air quality	Class 5 as per ISO 8573-1, pressure dew point 10 K below operating temperature

Mechanical construction

Design

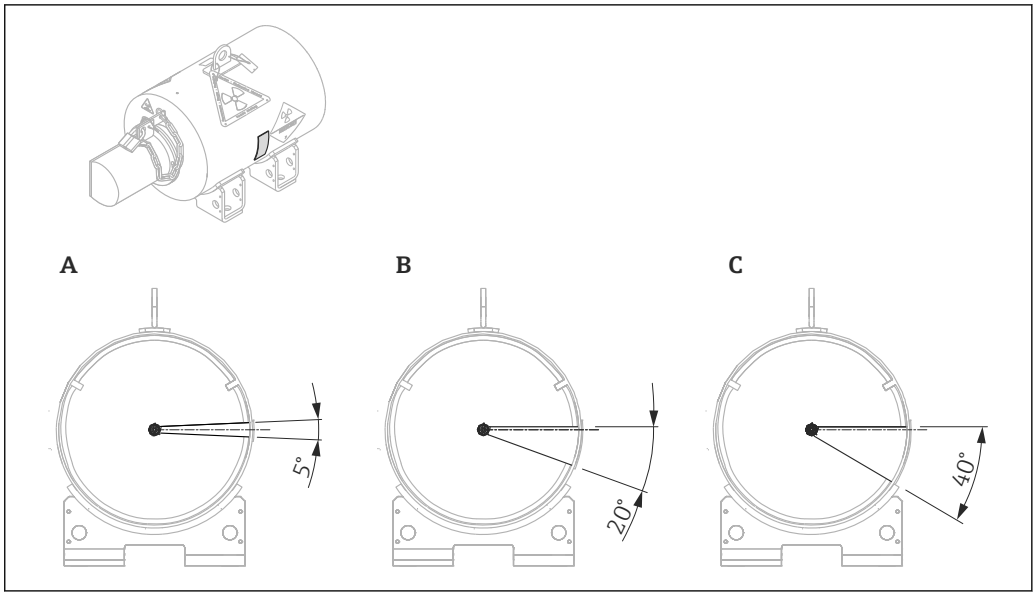
Feature 020 "Version"

- **A "Manual operation"**
  Lock pin to secure the "EIN/ON" and "AUS/OFF" switch position
- **B "Manual operation + proximity switch"**
  - Lock pin to secure the "EIN/ON" and "AUS/OFF" switch position
  - with proximity switch
- **L "Pneumat. drive + proximity switch"**
  - Pneumatic drive with proximity switch
  - "EIN/ON" switch position: pressurized
  - "AUS/OFF" switch position: unpressurized



A Manual operation
B Manual operation + proximity switch
L Pneumatic drive + proximity switch
1 Lifting eye
2 Radiation symbols: fitted when FQG66 is loaded
3 Source container
4 Padlock
5 Operating unit with protection cap
6 Bracket for mounting
7 Terminal housing
8 Sign holders (for fitting nameplates and connection for potential equalization)

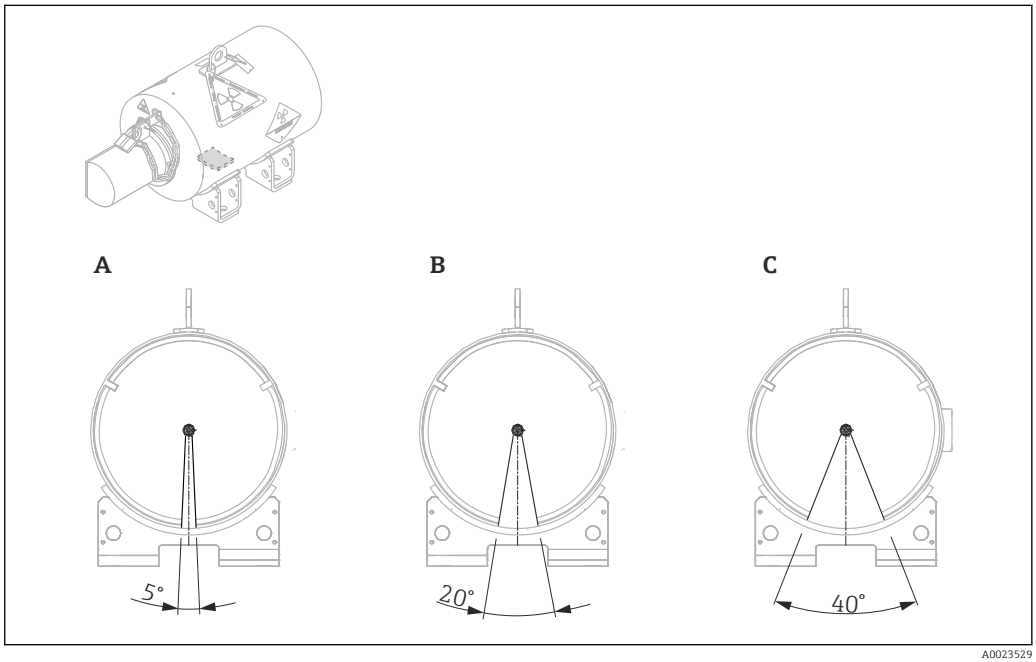
Horizontal radiation emission channel



2 *Horizontal radiation emission channel*

A Order code 240 "Angle of emission", option 1 "5 degrees, horizontal"
B Order code 240 "Angle of emission", option 3 "20 degrees, horizontal"
C Order code 240 "Angle of emission", option 5 "40 degrees, horizontal"

Vertical radiation emission channel

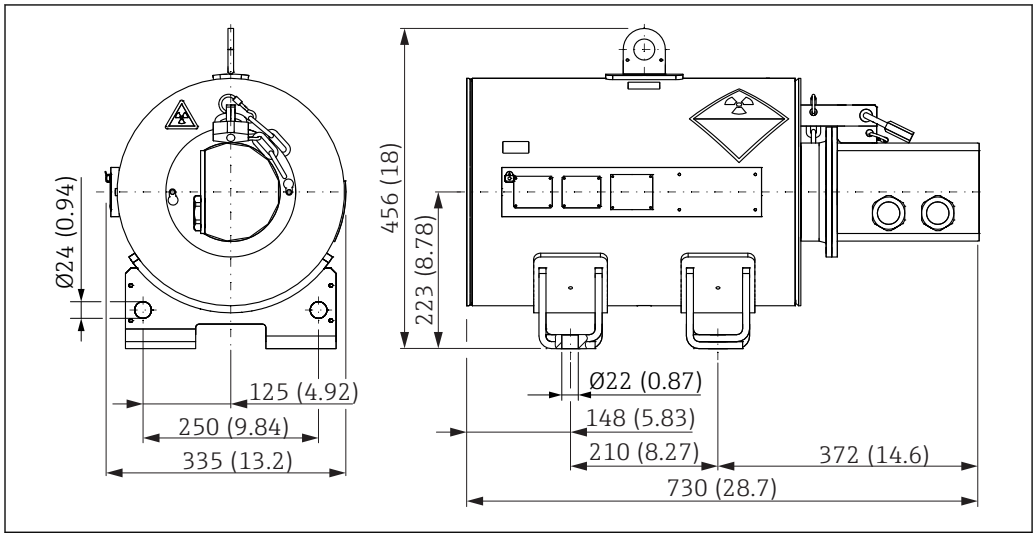


3 *Vertical radiation emission channel*

A Order code 240 "Angle of emission", option 2 "5 degrees, vertical"
B Order code 240 "Angle of emission", option 4 "20 degrees, vertical"
C Order code 240 "Angle of emission", option 6 "40 degrees, vertical"

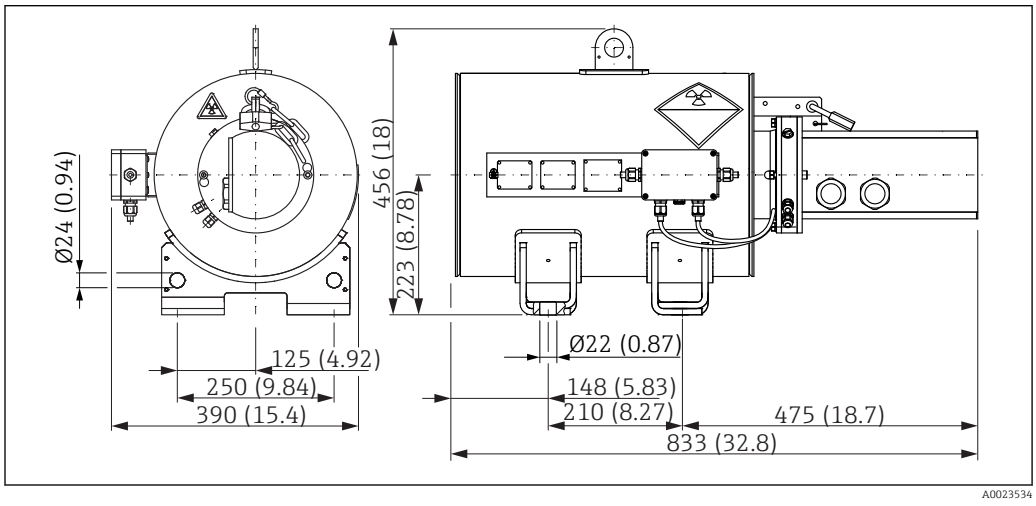
Dimensions

Manual version (order code 020, option A)



4 Engineering unit: mm (in)

Manual version with proximity switch (order code 020, option B) or Pneumatic version (order code 020, option L)



5 Engineering unit: mm (in)

Weight

Max. 435 kg (959.18 lb)

Materials

Housing:
316L (1.4404)

Protective hose:
VMQ

Source holder rod and internal parts:
316L (1.4404)

Pneumatic cylinder:
Steel, high alloy, stainless / aluminum, anodized / NBR / polyurethane (PUR)

Extension spring:
301 (1.4310)

Terminal box:
PVC

Padlock:
- **Lock body:** brass
- **Internal part:** corrosion-free

Seals:
FVMQ

Screws and nuts:
A4

Compressed air connection G1/8":
- **Swivel connector:** Al
- **Seal:** NBR
- **Banjo bolt:** nickel-plated brass
- **Internal parts:** brass

Proximity switches:
VA

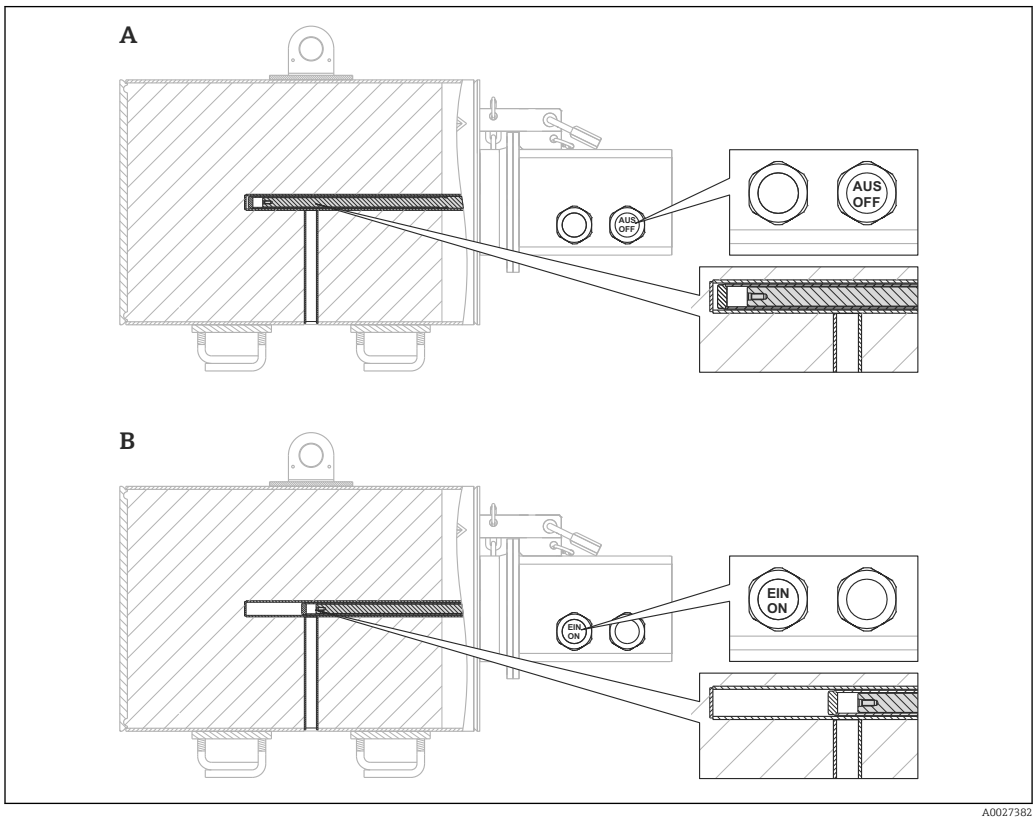
Connecting cables of primary switches:
PVC

This device contains more than 0.1% lead with CAS no. 7439-92-1

Safety equipment
- Lock pin to secure switch position "EIN/ON" or "AUS/OFF"
- Lockable cover provides protection from theft

Operability

Operating concept



A Switched-off state
B Switched-on state

Switching on and off

For additional information about switching the device on and off, see BA01327F/00.

Certificates and approvals

Manufacturer's Declaration

Herstellerbescheinigung
Manufacturer Declaration

Endress+Hauser
People for Process Automation

Company **Endress+Hauser SE+Co. KG, Hauptstraße 1, 79689 Maulburg**

erklärt als Hersteller, dass die unten aufgeführten Strahlenschutzbehälter
declares as manufacturer, that the source containers stated below

Product **Source container**
FQG60-, FQG61-, FQG62-, FQG63-, FQG66-

den Anforderungen über die internationale Beförderung gefährlicher Güter ADR/RID (2017) und IATA/DGR (2018) an ein Typ A Versandstück entspricht. Die Strahlenschutzbehälter sind für den Transport von umschlossenen radioaktiven Stoffen und von umschlossenen radioaktiven Stoffen in besonderer Form vorgesehen.

Die Eignung als Typ A Versandstück wurde durch eine Baumusterprüfung nach den Anforderungen von IAEA-SSR-6 (2012) Kapitel 6 nachgewiesen und in den internen Dokumenten 961000072, 960009590, 961000169, 961000170 niedergelegt.

Die Qualitätssicherung während der Entwicklung, der Herstellung und der Prüfung der Strahlenschutzbehälter erfolgt gemäß BAM-Cefahrgutregel BAM-GGR016 (veröffentlicht im BAM Amts- und Mitteilungsblatt Band 44, Ausgabe 4/2014, in Kraft gesetzt mit Verkehrsblatt Nr. 23/2014, Seite 834, Nr. 201, vom 20.11.2014). Der Ablauf ist im Qualitätssicherungsprogramm für Typ A Versandstücke (Dokumenten-ID 15355 Version 11) beschrieben.

is in conformity with the requirements on international transportation of hazardous materials ADR/RID (2017) and IATA/DGR (2018) for Type A packaging and is suitable for the transportation of sealed radioactive material and sealed special form radioactive material.

The qualification as type A packaging is tested by an type approval according to IAEA-SSR-6 (2012) section 6 and documented by the internal reports 961000072, 960009590, 961000169, 961000170.

The quality management during development, manufacturing and testing of the source containers is following the requirements of BAM-GGR016 (published in BAM official gazette Volume 44, Issue 4/2014, enacted with official gazette No. 23/2014, page 834, No. 201, of 20.11.2014). It is described in the quality program for Type A packaging (document-ID 15355 in release 11).

Maulburg, 19-April-2018
Endress+Hauser SE+Co. KG

i.V. Dr.-Ing. Dietmar Frühauf
Dept. Manager Gamma + Level Limit
Research & Development Devices

HE_00042_05.15 1/1

A0037353

Ordering information

Ordering information

Detailed ordering information is available from the following sources:
- 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
- Up-to-the-minute configuration data
- Depending on the device: Direct input of measuring point-specific information such as measuring range or operating language
- Automatic verification of exclusion criteria
- Automatic creation of the order code and its breakdown in PDF or Excel output format
- Ability to order directly in the Endress+Hauser Online Shop

Scope of delivery

- Source container FQG66
- Radiation source (installed; depends on version)
- Radiation symbol (depends on specific version)
- Technical Information: TI01171F/00
- Operating Instructions: BA0132F/00
- Technical Information: TI00439F/00
- Special Documentation: SD00297F/00 (source replacement)
- Safety Instructions: SD00292F/00 (Safety instructions for Canada)
- Safety Instructions: SD01561F/00 (Safety instructions for USA)

Delivery

Germany

Endress+Hauser can only ship radioactive sources once we have received a copy of the handling permit. Endress+Hauser is more than happy to assist in procuring the necessary documents. Please contact your local sales center.

For safety reasons and to save costs, Endress+Hauser usually supplies the source container loaded, i.e. with the radiation source installed. If the user requires the source container to be delivered first and if the source must be delivered subsequently, transportation casks are used for shipping.

Other countries

Endress+Hauser can only ship radioactive sources once we have received a copy of the import license. Endress+Hauser is more than happy to assist in procuring the necessary documents. Please contact your local sales center. In the case of deliveries abroad, radioactive sources can only be delivered installed in the source container.

The source container is in the "AUS/OFF" position when the container is delivered. This switch position is secured by a padlock. The loaded source containers are transported by a company commissioned by Endress+Hauser and officially certified to perform this type of transportation work. Transportation is in compliance with the regulations of the European Agreement on the International Transportation of Hazardous Substances on Roads (ADR and DGR/IATA).

Supplementary documentation

The following document types are available:
In the Download Area of the Endress+Hauser web site: www.endress.com → Downloads

Standard documentation

Operating Instructions: BA01327F/00

Device-dependent additional documentation

Gamma radiation source FSG60/FSG61
Technical Information: TI00439F/00

Gammapilot M FMG60
- Technical Information: TI00363F/00
- Operating Instructions (HART): BA00236F/00
- Operating Instructions (PROFIBUS PA): BA00329F/00
- Operating Instructions (FOUNDATION Fieldbus): BA00330F/00

Gammapilot FTG20
- Technical Information: TI01023F/00
- Operating Instructions: BA01035F/00

Loading and replacing the source container
Special Documentation: SD00297F/00

www.addresses.endress.com

Endress+Hauser

People for Process Automation