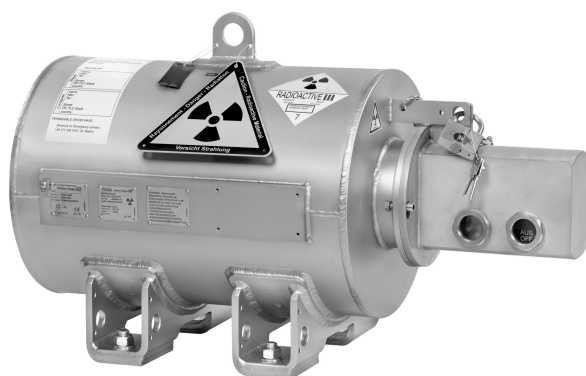


LENNTECH Technical Information *WATER TREATMENT SOLUTIONS* **Source container FQG66**

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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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

 Tip

Indicates additional information



Reference to documentation

Symbols in graphics

1, 2, 3, ...

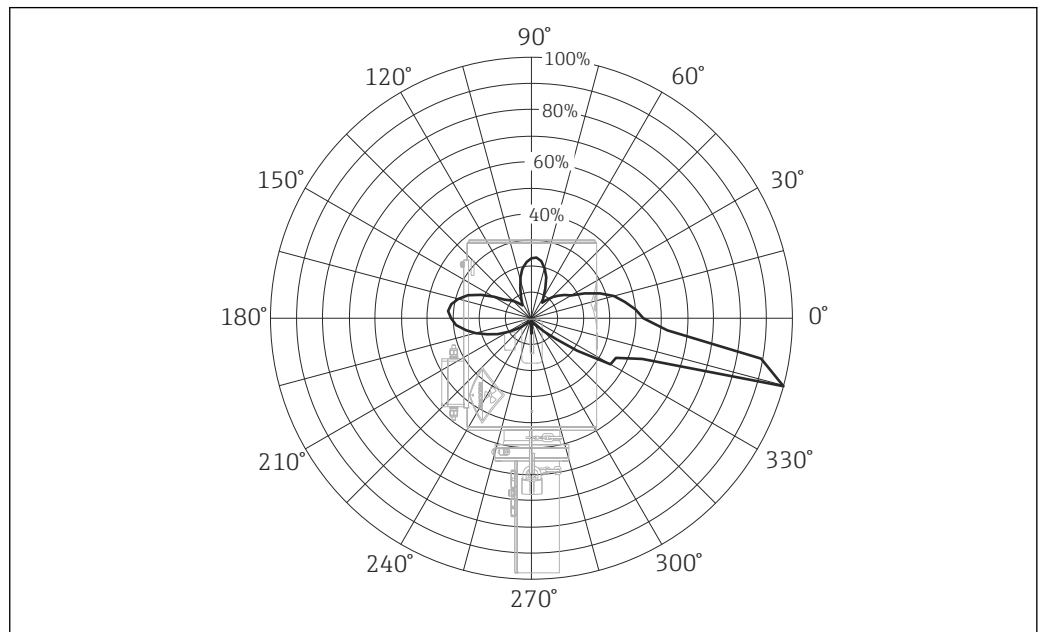
Item numbers

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"

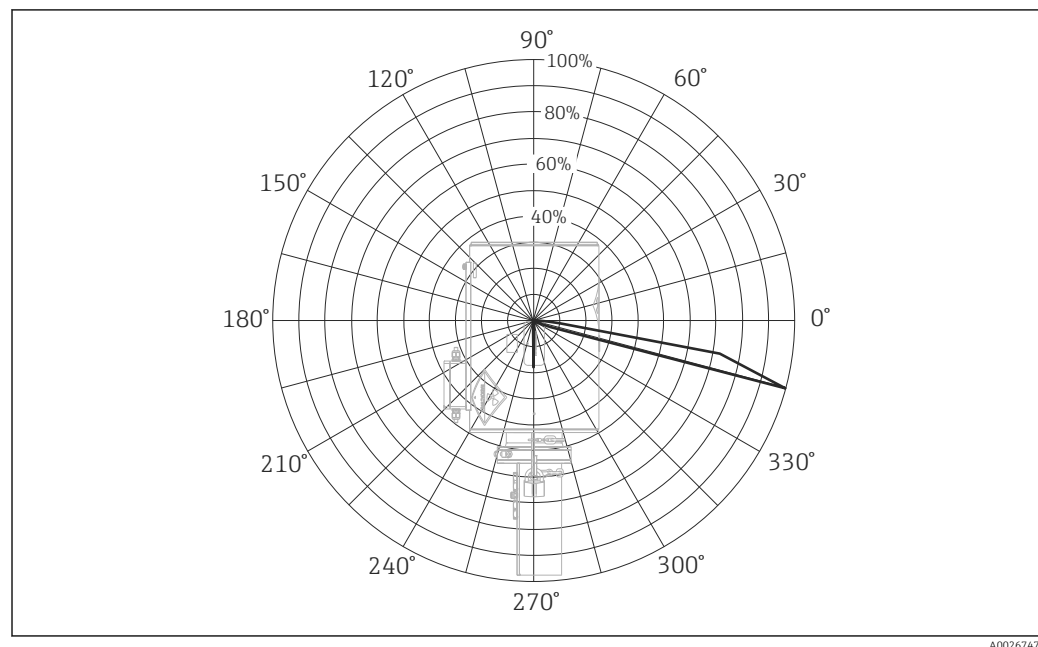
- **AA:**
 - Activity: 3.7 MBq
 - max. value (100 %) in $\mu\text{Sv/h}$: <0.01
- **AB:**
 - Activity: 7.4 MBq
 - max. value (100 %) in $\mu\text{Sv/h}$: <0.01
- **AC:**
 - Activity: 18.5 MBq
 - max. value (100 %) in $\mu\text{Sv/h}$: <0.01
- **AD:**
 - Activity: 37 MBq
 - max. value (100 %) in $\mu\text{Sv/h}$: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

- **AP:**
 - Activity: 7.4 GBq
 - max. value (100 %) in $\mu\text{Sv/h}$: 2.06
- **AR:**
 - Activity: 11.1 GBq
 - max. value (100 %) in $\mu\text{Sv/h}$: 3.09
- **AT:**
 - Activity: 18.5 GBq
 - max. value (100 %) in $\mu\text{Sv/h}$: 5.15
- **AW:**
 - Activity: 29.6 GBq
 - max. value (100 %) in $\mu\text{Sv/h}$: 8.24
- **BB:**
 - Activity: 37 GBq
 - max. value (100 %) in $\mu\text{Sv/h}$: 10.31
- **BC:**
 - Activity: 55.5 GBq
 - max. value (100 %) in $\mu\text{Sv/h}$: 15.46
- **BD:**
 - Activity: 74 GBq
 - max. value (100 %) in $\mu\text{Sv/h}$: 20.61
- **BF:**
 - Activity: 111 GBq
 - max. value (100 %) in $\mu\text{Sv/h}$: 30.92
- **BG:**
 - Activity: 148 GBq
 - max. value (100 %) in $\mu\text{Sv/h}$: 41.22
- **BH:**
 - Activity: 185 GBq
 - max. value (100 %) in $\mu\text{Sv/h}$: 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 $\mu\text{Sv/h}$: <0.01
- **AB:**
 - Activity:7.4 MBq
 - max. value (100 %) in $\mu\text{Sv/h}$: <0.01
- **AC:**
 - Activity:18.5 MBq
 - max. value (100 %) in $\mu\text{Sv/h}$: <0.01
- **AD:**
 - Activity:37 MBq
 - max. value (100 %) in $\mu\text{Sv/h}$: <0.01
- **AE:**
 - Activity:74 MBq
 - max. value (100 %) in $\mu\text{Sv/h}$: <0.01
- **AF:**
 - Activity:111 MBq
 - max. value (100 %) in $\mu\text{Sv/h}$: <0.01
- **AG:**
 - Activity:185 MBq
 - max. value (100 %) in $\mu\text{Sv/h}$: <0.01
- **AH:**
 - Activity:370 MBq
 - max. value (100 %) in $\mu\text{Sv/h}$: <0.01
- **AK:**
 - Activity:740 MBq
 - max. value (100 %) in $\mu\text{Sv/h}$: 0.01
- **AL:**
 - Activity:1.11 GBq
 - max. value (100 %) in $\mu\text{Sv/h}$: 0.02
- **AM:**
 - Activity:1.85 GBq
 - max. value (100 %) in $\mu\text{Sv/h}$: 0.03
- **AN:**
 - Activity:3.7 GBq
 - max. value (100 %) in $\mu\text{Sv/h}$: 0.05
- **AP:**
 - Activity:7.4 GBq
 - max. value (100 %) in $\mu\text{Sv/h}$: 0.11
- **AR:**
 - Activity:11.1 GBq
 - max. value (100 %) in $\mu\text{Sv/h}$: 0.16
- **AT:**
 - Activity:18.5 GBq
 - max. value (100 %) in $\mu\text{Sv/h}$: 0.26
- **AW:**
 - Activity:29.6 GBq
 - max. value (100 %) in $\mu\text{Sv/h}$: 0.42
- **BB:**
 - Activity:37 GBq
 - max. value (100 %) in $\mu\text{Sv/h}$: 0.53
- **BC:**
 - Activity:55.5 GBq
 - max. value (100 %) in $\mu\text{Sv/h}$: 0.79
- **BD:**
 - Activity:74 GBq
 - max. value (100 %) in $\mu\text{Sv/h}$: 1.06
- **BF:**
 - Activity:111 GBq
 - max. value (100 %) in $\mu\text{Sv/h}$: 1.59
- **BG:**
 - Activity:148 GBq
 - max. value (100 %) in $\mu\text{Sv/h}$: 2.11

- **BH:**
 - Activity:185 GBq
 - max. value (100 %) in $\mu\text{Sv/h}$: 2.64
- **BJ:**
 - Activity:222 GBq
 - max. value (100 %) in $\mu\text{Sv/h}$: 3.17
- **BK:**
 - Activity:259 GBq
 - max. value (100 %) in $\mu\text{Sv/h}$: 3.70
- **BL:**
 - Activity:296 GBq
 - max. value (100 %) in $\mu\text{Sv/h}$: 4.23
- **BM:**
 - Activity:333 GBq
 - max. value (100 %) in $\mu\text{Sv/h}$: 4.76
- **BN:**
 - Activity:370 GBq
 - max. value (100 %) in $\mu\text{Sv/h}$: 5.29
- **BP:**
 - Activity:740 GBq
 - max. value (100 %) in $\mu\text{Sv/h}$: 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.

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.

CAUTION

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.

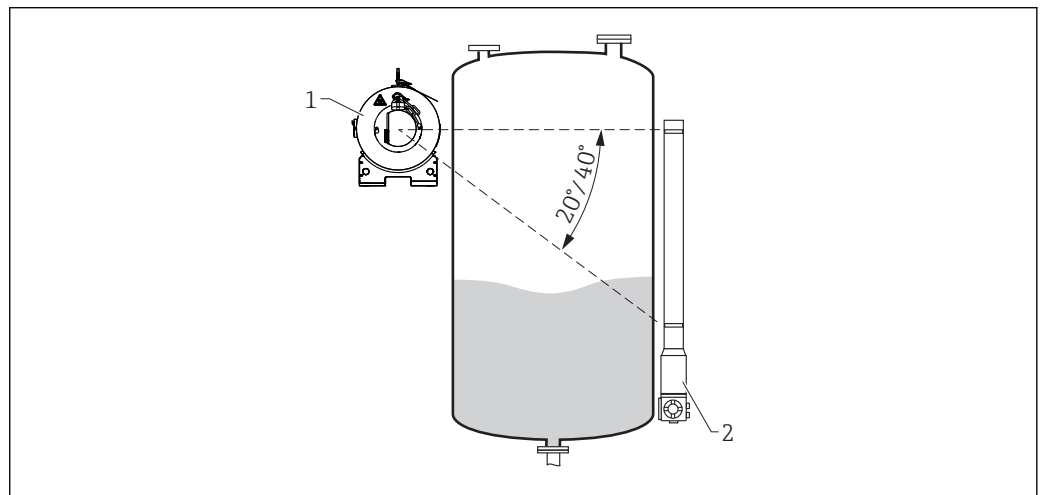
Installation

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.

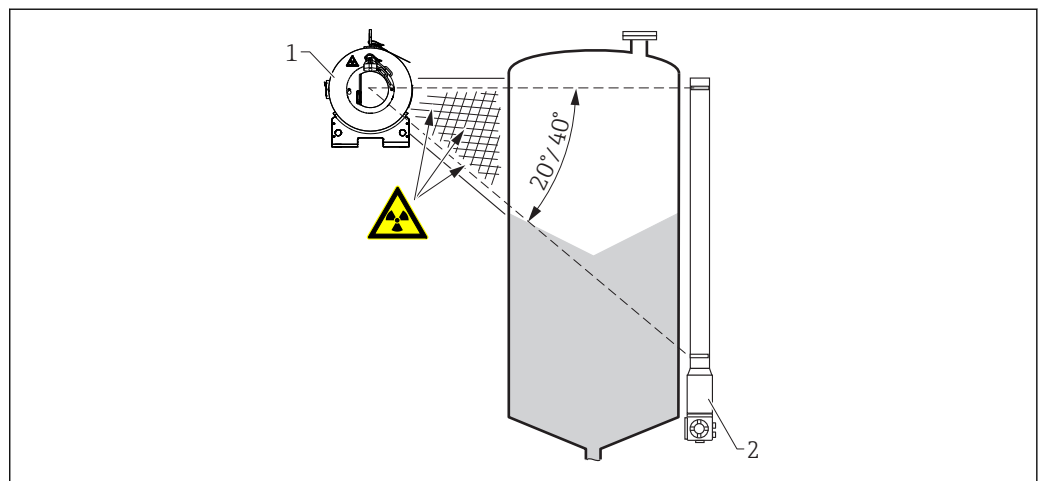
The radiation must be aligned exactly with the detector mounted on the opposite side. The source container and detector should be mounted as close as possible to the product vessel to avoid control zones.



A0023674

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

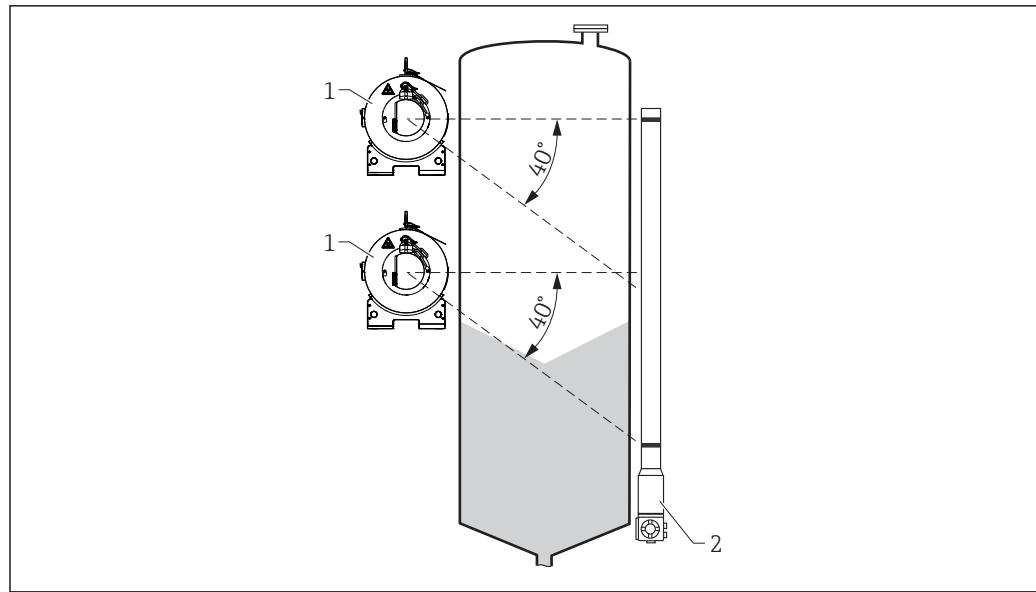
A distance between the source container and the product vessel is often unavoidable if the measuring range is large and the container diameter small. This space must then be secured by grip protection and marked accordingly.



A0023677

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

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.

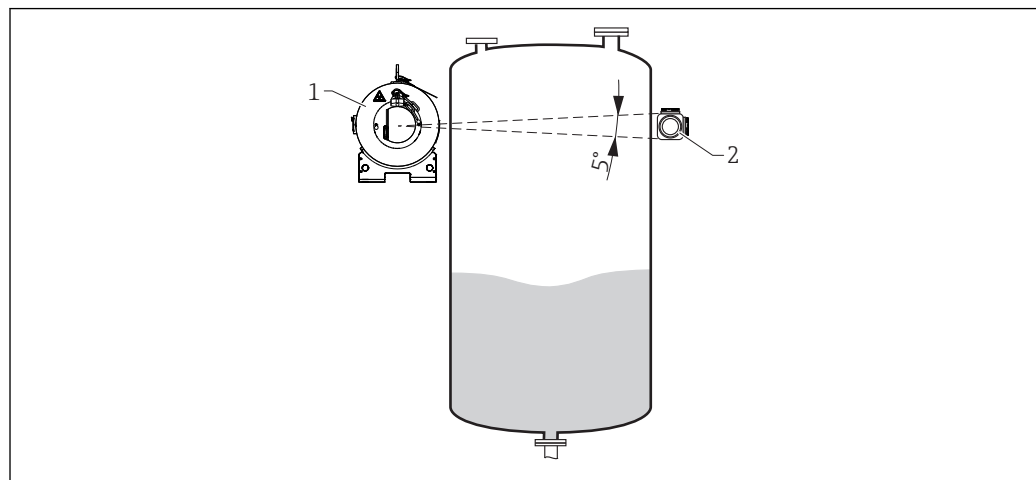


A0023679

- 1 FQG66: Order code 240 "Angle of emission", option 5 "40 degrees"
 2 Gammapiot

Orientation for point level detection

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



A0023681

- 1 FQG66: Order code 240 "Angle of emission", option 1 "5 degrees, horizontal"
 2 Gammapiot

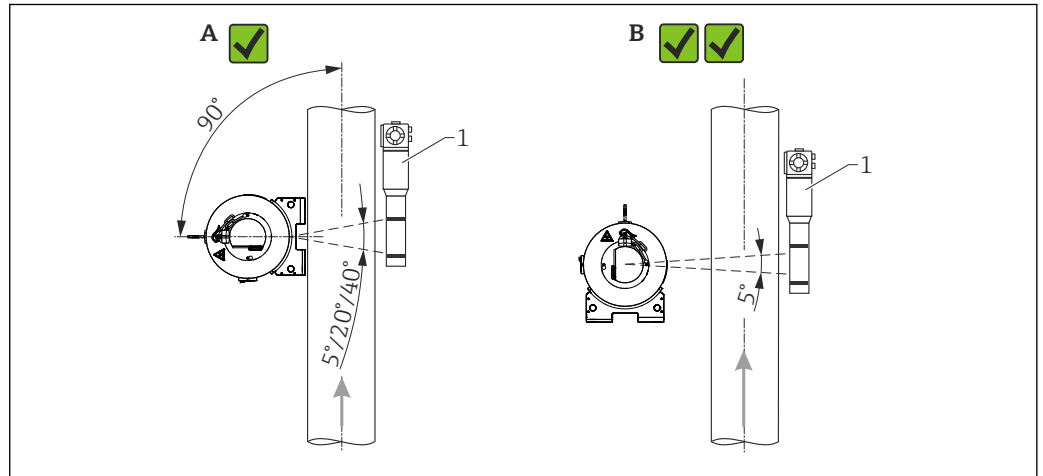


- Keep the distance between the FQG66 and the vessel wall to a minimum!
- Secure any intermediate area between the source container and wall by grip protection, if necessary!

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. Gammapiot 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 against slipping.



A0023787

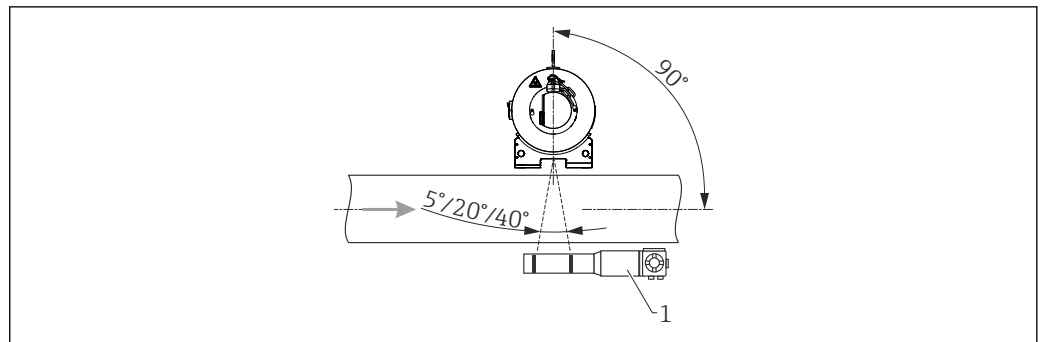
A Order code 240 "Angle of emission", option 2, 4 or 6 "5, 20 or 40 degrees, vertical"

B Order code 240 "Angle of emission", option 1 "5 degrees, horizontal"

1 Gammapiot

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.

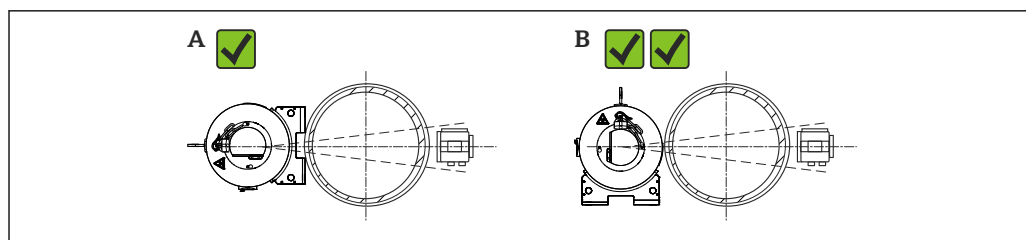


A0023795

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

1 Gammapiot

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).



A0023796

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

General information

The clamping device must be installed in such a way as to withstand the weight of the source container and the detector (e.g. Gammapiot) 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:

- Gammapiot FMG60: 14 to 29 kg (30.87 to 63.95 lb)
- Gammapiot 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

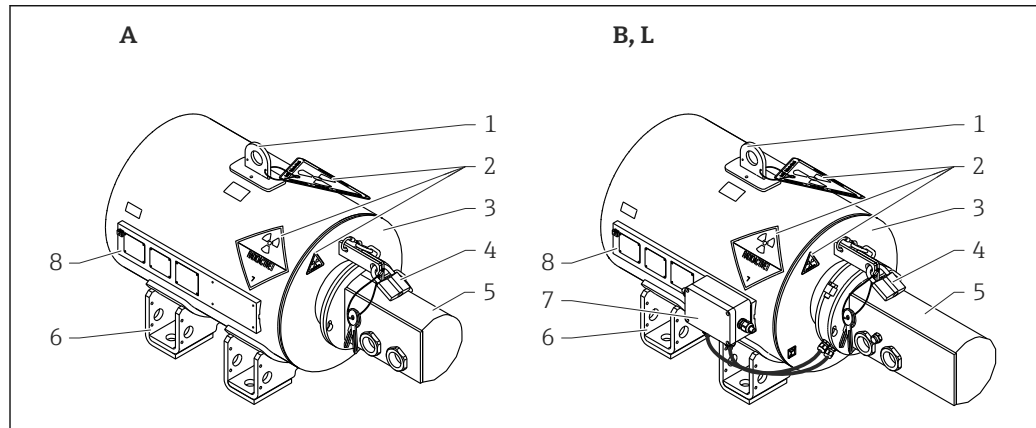
Ambient and storage temperature	▪ Order code 020 "Version", option A "Manual operation": –55 to +100 °C (–67 to +212 °F) ▪ Order code 020 "Version" Option B "Manual operation + proximity switch", Option L "Pneumat. drive + proximity switch": –20 to +80 °C (–4 to +176 °F) (manual and pneumatic, with proximity switch)
Sources	Operating temperature range and temperature class are dependent on the source.  TI00439F/00
Ambient pressure	Atmospheric pressure
Vibration resistance	IEC 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.
Pneumatic version	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"

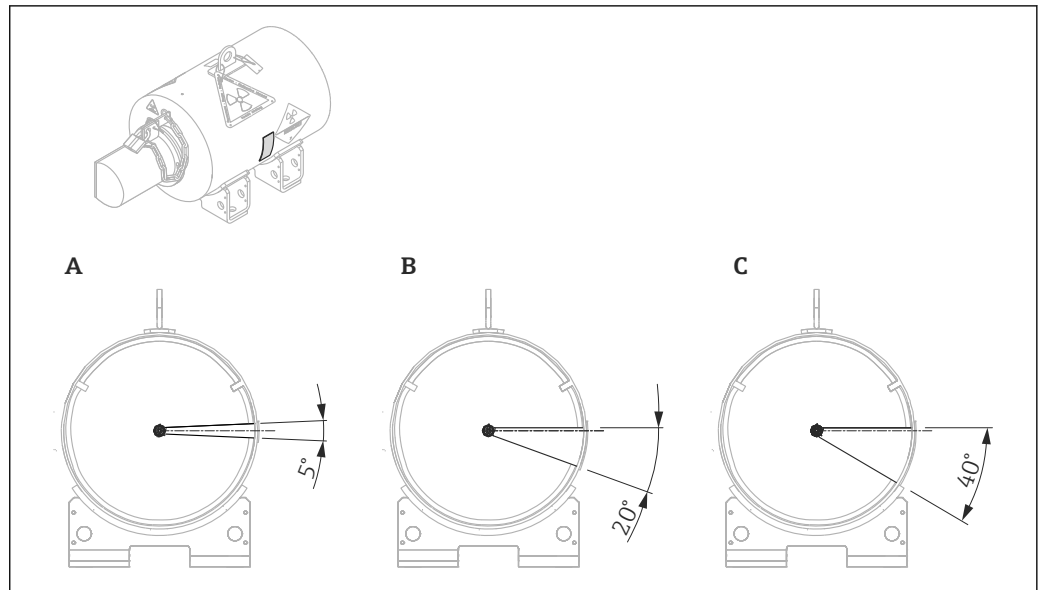
- **A "Manual operation"**
 - Lock pin to secure the "EIN/ON" and "AUS/OFF" switch position
- **B "Manual operation + proximity switch"**
 - Lock pin to secure the "EIN/ON" and "AUS/OFF" switch position
 - with proximity switch
- **L "Pneumat. drive + proximity switch"**
 - Pneumatic drive with proximity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



A0023516

- 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

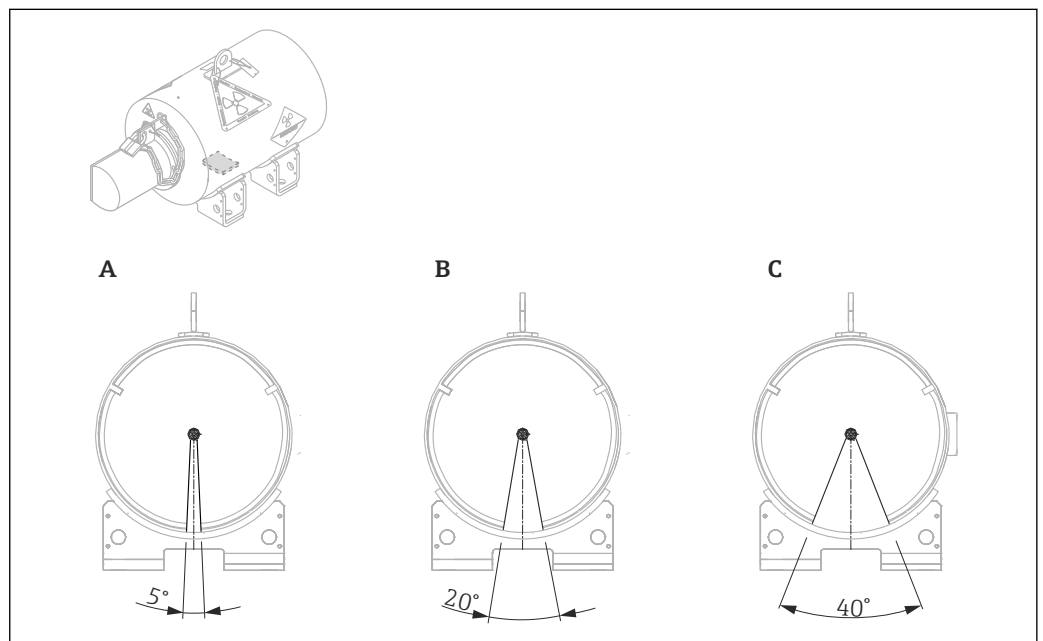


A0023523

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



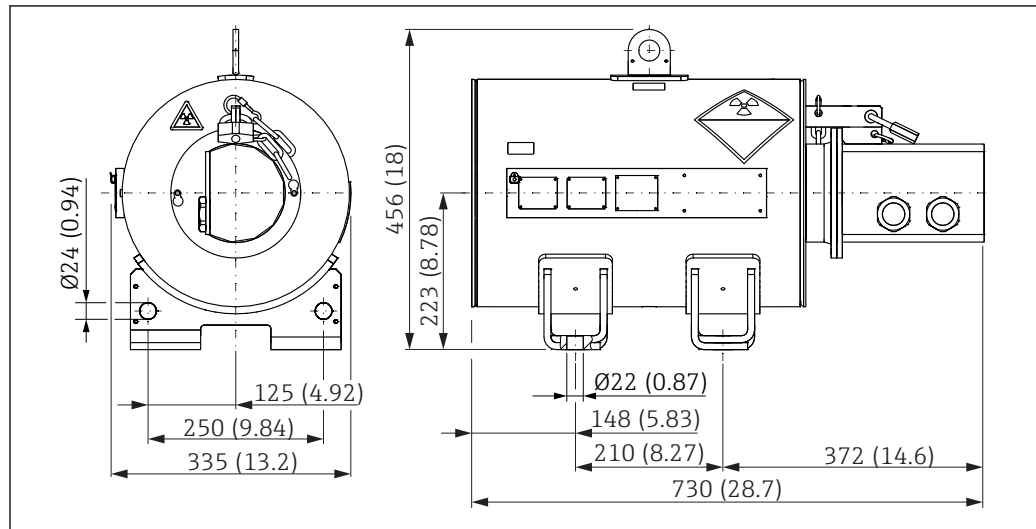
A0023529

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

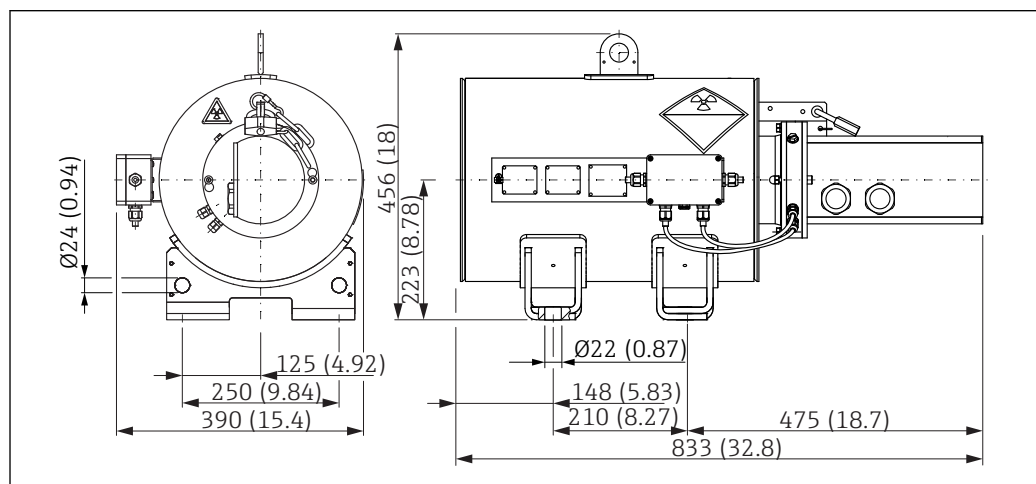
Manual version (order code 020, option A)



A0023533

4 Engineering unit: mm (in)

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



A0023534

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



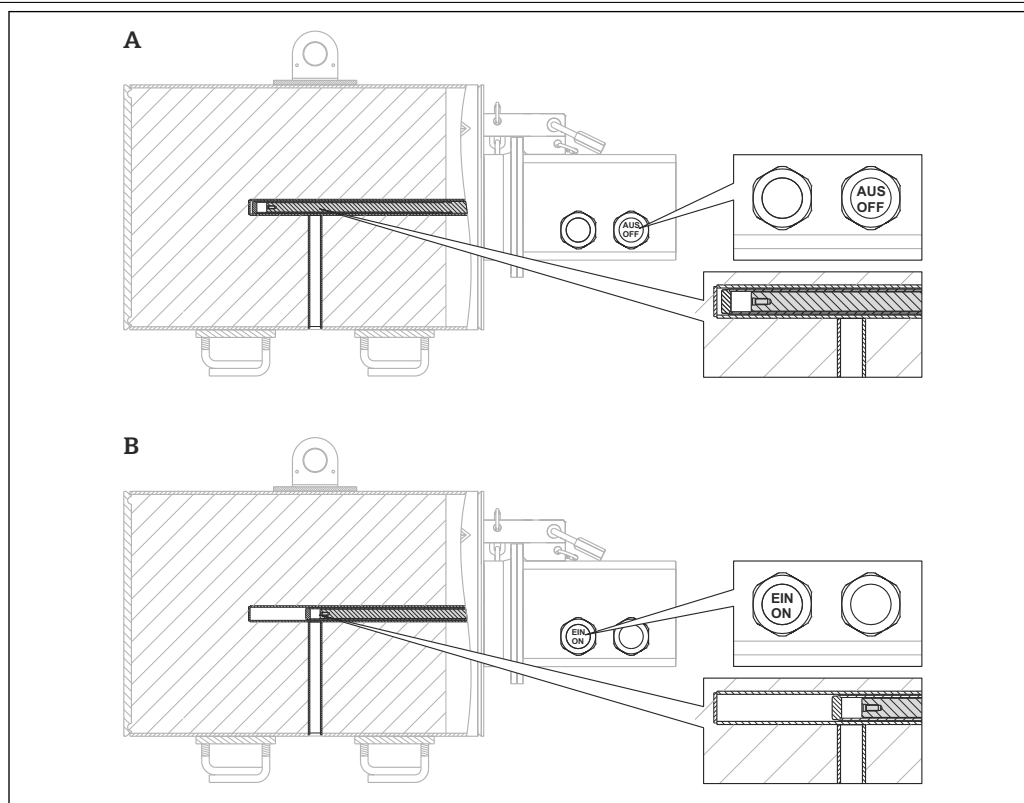
This device contains more than 0.1% lead with CAS no. 7439-92-1

Safety equipment

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

Operability

Operating concept



A0027382

- 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

Eignungsbescheinigung
Manufacturer Declaration

Endress+Hauser 
People for Process Automation

Company

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

erklärt als Hersteller, dass das folgende Produkt
declares as manufacturer, that the following product

Product

Strahlenschutzbehälter/ Radiation Source Container
Typ FQG60, FQG61, FQG62, FQG63, FQG66

den Anforderungen über die internationale Beförderung gefährlicher Güter ADR/RID (2020) und IATA/DGR (2020) 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-TS-R-1 (2005) 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-GGR016 Rev. 0 vom 10. Nov. 2014. Der Ablauf ist im Qualitätssicherungsprogramm für Typ A Versandstücke (Dokumenten-ID GL_0372) beschrieben

confirms the requirements on international transportation of hazardous materials ADR/RID (2020) and IATA/DGR (2020) 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-TS-R-1 (2005) 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 TRV006 and BAM-GGR016 Rev. 0 from 2014.Nov.10. It is described in the quality program for Type A packaging (document-ID GL_0372).

Maulburg, 4-März-2020
Endress+Hauser SE+Co. KG

i.A. Dr. Karl Barton
Gefahrgutbeauftragter
Safety advisor for the
transport of dangerous goods

HE_00042_03.20

1/1

A0037353

Ordering information

Ordering information

Detailed ordering information is available for your nearest sales organization www.addresses.endress.com or in the Product Configurator under www.endress.com :

1. Click Corporate
2. Select the country
3. Click Products
4. Select the product using the filters and search field
5. Open the product page

The Configuration button to the right of the product image opens the Product Configurator.



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)
- Documentation (depends on specific version)

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).

Documentation

The following documentation types are available in the Downloads section of the Endress+Hauser website (www.endress.com/downloads):



- For an overview of the scope of the associated Technical Documentation, refer to the following:
- *W@M Device Viewer* (www.endress.com/deviceviewer): Enter the serial number from nameplate
 - *Endress+Hauser Operations App*: Enter the serial number from the nameplate or scan the 2D matrix code (QR code) on the nameplate

Brief Operating Instructions (KA)	Guide that takes you quickly to the 1st measured value The Brief Operating Instructions contain all the essential information from incoming acceptance to initial commissioning.
Operating Instructions (BA)	Your reference guide These Operating Instructions contain all the information that is required in various phases of the life cycle of the device: from product identification, incoming acceptance and storage, to mounting, connection, operation and commissioning through to troubleshooting, maintenance and disposal.
Safety Instructions (XA)	Depending on the approval, the following Safety Instructions (XA) are supplied with the device. They are an integral part of the Operating Instructions.  The nameplate indicates the Safety Instructions (XA) that are relevant to the device.



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