

Operating Instructions **Gamma Modulator FHG65** **Synchronizer FHG66**

Radiometric measuring technology





A0023555

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1 System requirements

1.1 System requirements of FMG50

All versions of the Gammapilot FMG50 can evaluate the signal generated by the Gamma Modulator FHG65

1.2 System requirements of FMG60

To be able to evaluate the signal generated by the Gamma Modulator FHG65, the Gammapilot M FMG60 must be equipped with the following software at least:

- HART electronics
 - For SIL devices with short point level detectors (200 mm and 400 mm): SW 01.02.02 or higher
 - For all other devices: SW 01.03.02 or higher
- PROFIBUS PA electronics
SW 01.03.02 or higher
- FOUNDATION Fieldbus electronics
SW 01.03.02 or higher

2 About this document

2.1 Symbols used

2.1.1 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.

2.1.2 Symbols for certain types of information and graphics



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



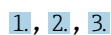
Reference to page



Reference to graphic



Notice or individual step to be observed



Series of steps



Result of a step



Operation via local display



Operation via operating tool



Write-protected parameter

1, 2, 3, ...

Item numbers

A, B, C, ...

Views



Safety instructions

Observe the safety instructions contained in the associated Operating Instructions

2.2 Documentation

The necessary documentation is available in the Download Area 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

3 Basic safety instructions

3.1 Requirements for personnel

The personnel for installation, commissioning, diagnostics and maintenance must fulfill the following requirements:

- Trained, qualified specialists must have a relevant qualification for this specific function and task
- Are authorized by the plant owner/operator
- Are familiar with federal/national regulations
- Before beginning work, the specialist staff must have read and understood the instructions in the Operating Instructions and supplementary documentation as well as in the certificates (depending on the application)
- Following instructions and basic conditions

The operating personnel must fulfill the following requirements:

- Being instructed and authorized according to the requirements of the task by the facility's owner-operator
- Following the instructions in these Operating Instructions

3.2 Intended use

The Gamma Modulator FHG65 is used to optimize the measuring signal during radiometric level measurement, point level measurement, density measurement and concentration measurement. The Synchronizer FHG66 is used to synchronize multiple Gamma Modulators FHG65 that are used together in a measuring point. The operational safety of the measuring device can be suspended as a result of incorrect use or use other than that intended. The manufacturer accepts no liability for any damage arising as a result.

3.3 Installation, commissioning and operation

The measuring system is designed to meet state-of-the-art safety requirements and complies with applicable standards and EU regulations. However, if it is used improperly or for applications for which it is not intended, application-related hazards may arise, e.g. product overflow due to incorrect installation or configuration.

Installation, electrical connection, commissioning, operation and maintenance of the measuring system must be carried out exclusively by trained specialists authorized to perform such work by the system operator.

Technical personnel must have read and understood these Operating Instructions and must adhere to them.

Modifications and repairs to the measuring system may only be carried out if they are expressly permitted in the Operating Instructions.

3.4 Hazardous area

If the measuring system is used in hazardous areas, the corresponding national standards and regulations must be observed. The device is accompanied by separate "Ex documentation", which is an integral part of these Operating Instructions. The installation specifications, connection values and safety instructions listed in this supplementary documentation must be observed.

- Technical personnel must be qualified and trained for the hazardous area.
- Comply with the metrological and safety-related requirements for the measuring point.

⚠ WARNING

- Observe the safety instructions associated with the device. These instructions depend on the certificate ordered.

3.5 Radiation protection

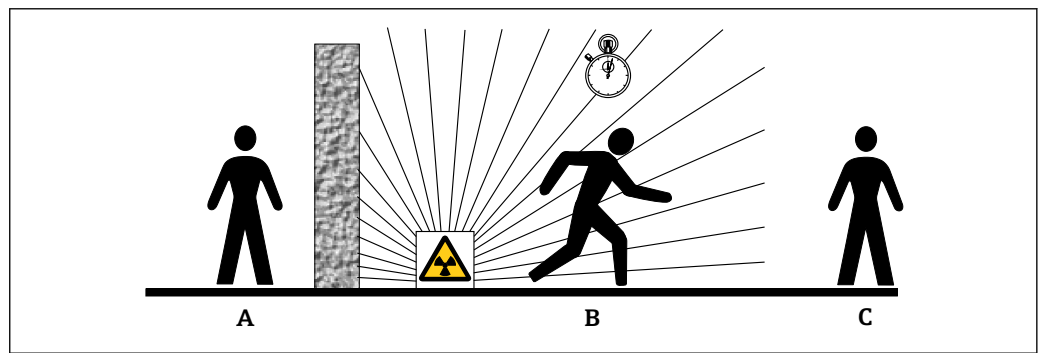
The Modulator FHG65 is not a source of ionizing radiation.

When working with radiation sources, the following instructions must be observed:

3.5.1 Basic radiation protection guidelines

⚠ WARNING

- When working with radiation sources, all unnecessary radiation exposure must be avoided. Keep all unavoidable radiation exposure to a minimum. Three basic concepts apply to achieve this:



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- A *Shielding*
- B *Time*
- C *Distance*

⚠ CAUTION

- When working with source containers, all the instructions for mounting and usage outlined in the following documents must be observed:

 Source container documentation

- **FQG61/FQG62:**

- TI00435F

- **FQG66:**

- TI01171F

- BA01327F

Shielding

Ensure the best possible shielding between the radiation source and yourself and all other persons. Effective shielding is provided by source containers (FQG61, FQG62, FQG66) and all high-density materials (lead, iron, concrete).

Time

Remain as short as possible in the area exposed to radiation.

Distance

Keep as far away from the radiation source as possible. The radiation intensity decreases in proportion to the square of the distance from the radiation source.

Legal regulations for radiation protection

The handling of radiation sources is legally controlled. The radiation protection regulations of the country in which the plant is operated are of overriding importance and must be strictly observed. In the Federal Republic of Germany, the current version of the Radiation Protection Ordinance applies. The following points derived from this Ordinance are particularly important for radiometric measurement:

Handling permit

A handling permit is required for operating a plant which uses gamma radiation. Permit applications are made to the local state government or the authority responsible (State Offices for Environmental Protection, Trade Inspection Offices, etc.). The Endress+Hauser sales organization will be happy to help you obtain the handling permit.

Radiation safety officer

The plant operator must appoint a radiation safety officer (RSO) who has the necessary specialist knowledge and who is responsible for observing the Radiation Protection Ordinance and all radiation protection procedures. Endress+Hauser offers training courses in which individuals can acquire the necessary specialist knowledge.

Controlled area

Only persons who are exposed to radiation during the course of their job and are subject to official personal dose monitoring procedures may work in controlled areas (i.e. areas where the local dose rate exceeds a specific value). The limit values for the controlled area are specified in the current Radiation Protection Ordinance. The Endress+Hauser sales organization will be pleased to provide further information on radiation protection and regulations in other countries.

3.6 Workplace safety

For work on and with the device:

- ▶ Wear the required personal protective equipment according to federal/national regulations.
- ▶ Switch off the supply voltage before connecting the device.

3.7 Operational safety

Risk of injury!

- ▶ Operate the device only if it is in proper technical condition, free from errors and faults.
- ▶ The operator is responsible for interference-free operation of the device.

Modifications to the device

Unauthorized modifications to the device are not permitted and can lead to unforeseeable dangers:

- ▶ If modifications are nevertheless required, consult with the manufacturer.

Repair

To ensure continued operational safety and reliability:

- ▶ Carry out repairs on the device only if they are expressly permitted.
- ▶ Observe federal/national regulations pertaining to the repair of an electrical device.
- ▶ Use only original spare parts and accessories from the manufacturer.

Hazardous area

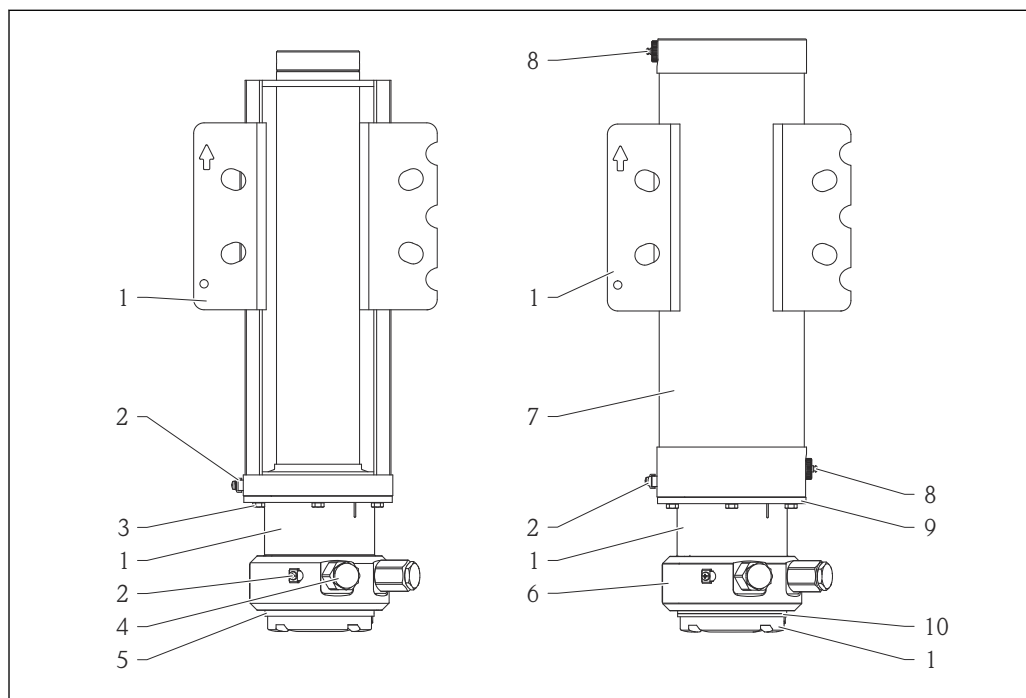
To eliminate danger to persons or the facility when the device is used in the hazardous area (e.g. explosion protection):

- ▶ Check the nameplate to verify if the device ordered can be put to its intended use in the hazardous area.
- ▶ Observe the specifications in the separate supplementary documentation that is an integral part of these instructions.

4 Product description

4.1 Product design

4.1.1 Components of the FHG65

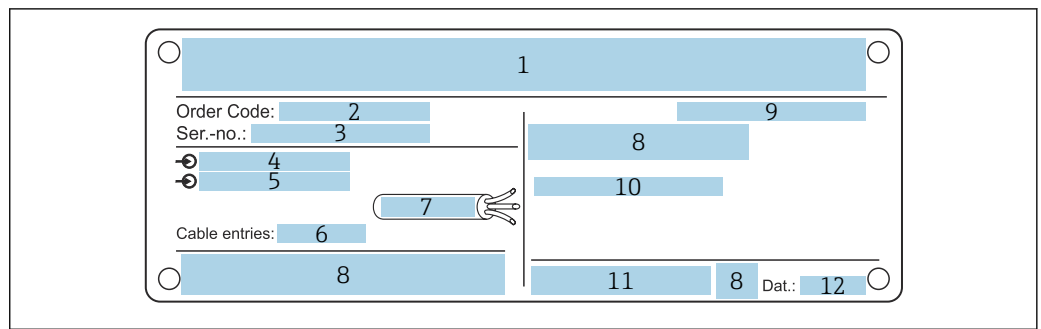


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1 Gamma Modulator FHG65

- 1 Housing
- 2 Ground connection
- 3 Screws
- 4 O-ring
- 5 Cable entry with seal
- 6 Nameplate and dowel pin
- 7 Water cooling jacket
- 8 Coolant connection
- 9 O-ring
- 10 Cover clamp

4.2 FHG65 nameplate



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- 1 Manufacturer-specific data and device name
- 2 Order code
- 3 Serial number (Ser. no.)
- 4 Synchronization connection
- 5 Supply voltage and power consumption
- 6 Cable entries
- 7 Necessary temperature resistance of the connection cables
- 8 Certificate- and approval-related data
- 9 Degree of protection
- 10 Permitted ambient temperature range
- 11 Reference to additional, safety-related documentation
- 12 Date

4.3 Scope of delivery

- Gamma Modulator FHG65
- Accessories as ordered

4.3.1 Accompanying documentation

- Operating Instructions
- The Operating Instructions describe how to install and commission the Gamma Modulator FHG65



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5 Mounting

5.1 Incoming acceptance, product identification, transport, storage

5.1.1 Incoming acceptance

Check the following during incoming acceptance:

- ☐ Are the order codes on the delivery note and the product sticker identical?
- ☐ Are the goods undamaged?
- ☐ Do the nameplate data match the ordering information on the delivery note?
- ☐ If required (see nameplate): Are the safety instructions (XA) provided?

 If one of these conditions is not met, please contact the manufacturer's sales office.

5.1.2 Product identification

The device can be identified in the following ways:

- Nameplate specifications
- Extended order code with breakdown of the device features on the delivery note
- ▶ Enter serial number from nameplates in *W@M Device Viewer* (www.endress.com/deviceviewer)
 - ↳ All of the information on the measuring device and on the scope of the technical documentation pertaining to the device is displayed.
- ▶ Enter the serial number from the nameplate in the *Endress+Hauser Operations app* or scan the 2-D matrix code on the nameplate with the camera
 - ↳ All of the information on the measuring device and on the scope of the technical documentation pertaining to the device is displayed.

5.1.3 Manufacturer address

Endress+Hauser SE+Co. KG
Hauptstraße 1
79689 Maulburg, Germany
Place of manufacture: See nameplate.

5.1.4 Transporting to the measuring point

CAUTION

Risk of injury

- ▶ Follow the safety instructions and transport conditions for devices weighing more than 18 kg (39.69 lb).

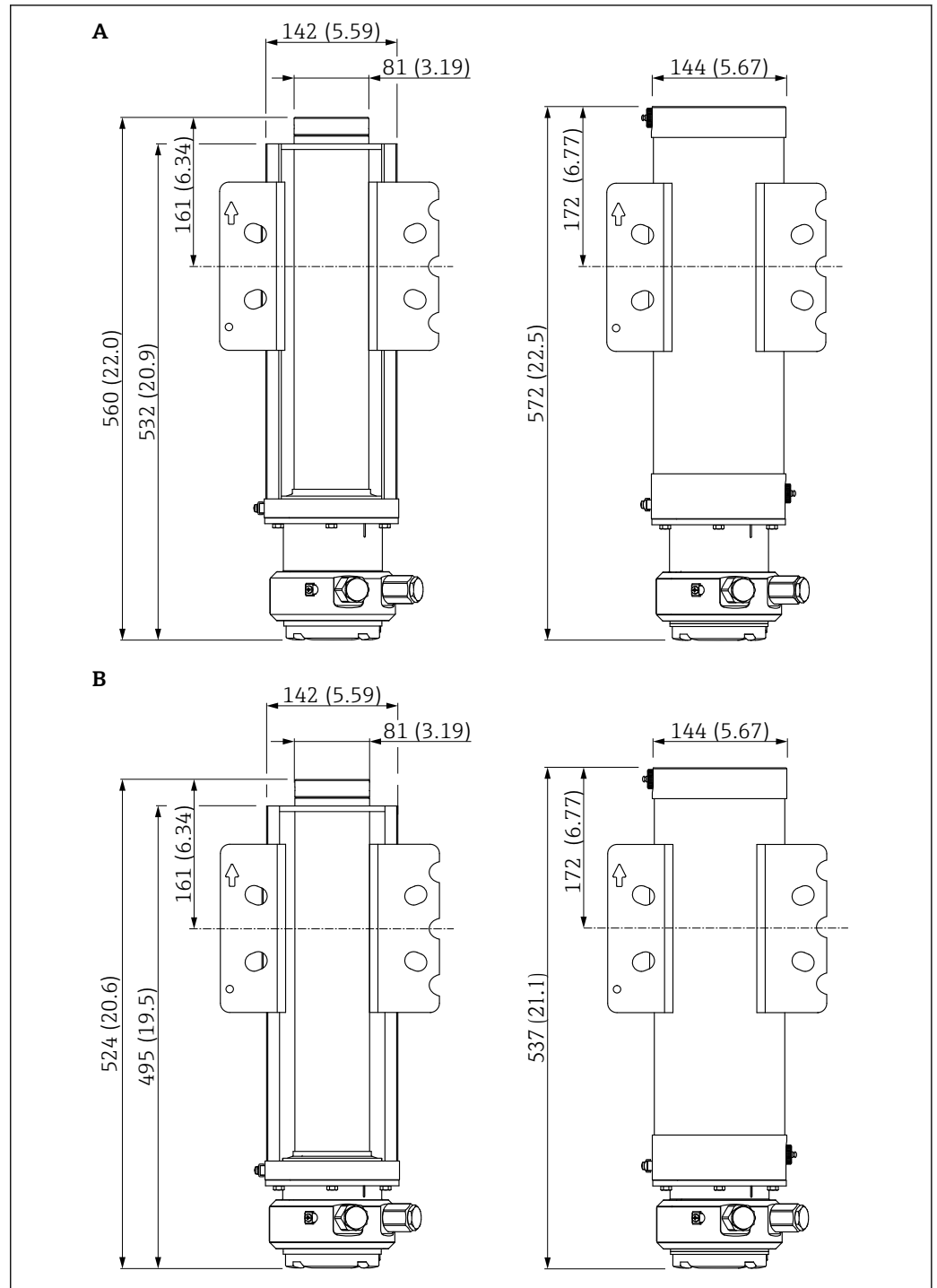
5.1.5 Storage

Pack the device so that it is protected against impact for storage and transport. The original packaging provides optimum protection.

Permitted storage temperature (without water in the water cooling jacket):

–40 to +75 °C (–40 to +167 °F)

5.2 Dimensions of the Gamma Modulator



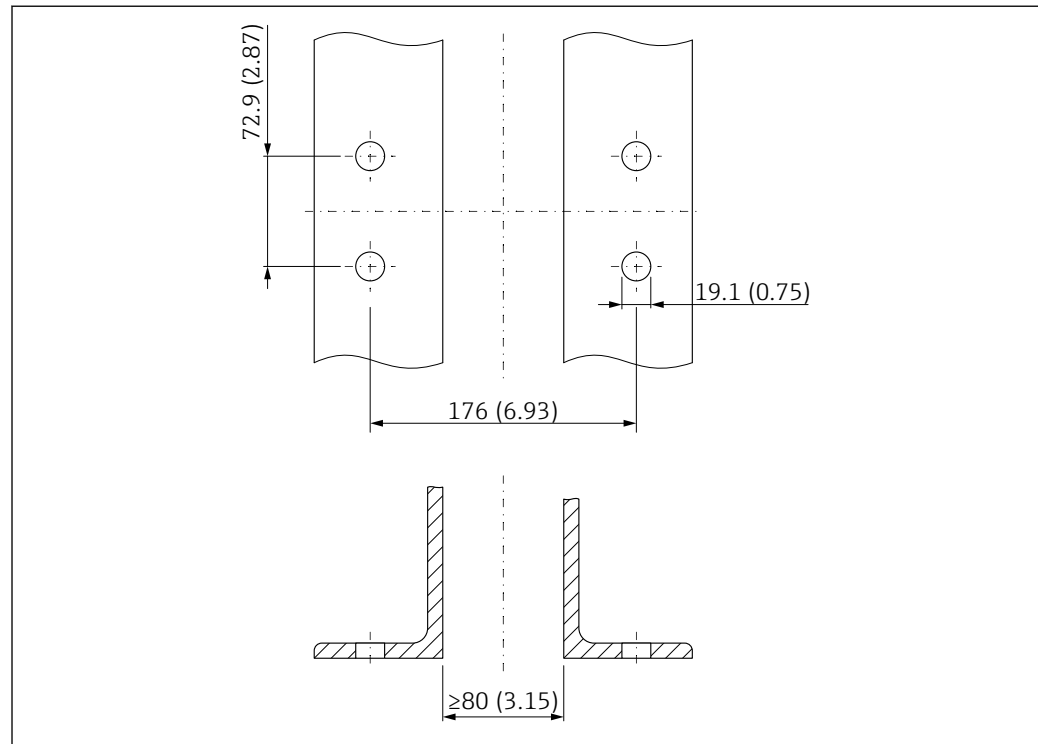
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2 Engineering unit: mm (in)

A Ex de - version (left: without water cooling jacket; right: with water cooling jacket)

B Ex d, Ex t, non-Ex - version (left: without water cooling jacket; right: with water cooling jacket)

5.2.1 Example of mounting with angle bracket (supplied by customer)



3 L-angle bracket; engineering unit: mm (in)

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5.3 Weight

- Weight without water cooling jacket: max. 18 kg (39.69 lb)
- Weight with water cooling jacket (empty): max. 21 kg (46.31 lb)
- Weight with water cooling jacket (full): max. 25 kg (55.13 lb)

5.4 Installation requirements

5.4.1 Safety instructions

⚠ WARNING

Even when the source container is closed, it is possible that the Modulator FHG65 is in the controlled area for ionizing radiation.

- In this case, the Modulator FHG65 must be cordoned off and made inaccessible.

For this reason, observe the following sequence of steps when mounting the modulator and source container:

1. Mount the Gamma Modulator FHG65 on the tank or pipe
2. Establish the electrical connection of the Gamma Modulator
3. If a water cooling jacket is provided:
 - ↳ Connect the water supply
4. Mount the source container on the modulator and cordon it off

5. CAUTION

- ▶ All other work, such as servicing and replacement of the modulator, may only be carried out by staff whose radiation exposure is monitored in accordance with the existing handling permit and the existing license or the relevant Radiation Protection Ordinance. For details, please contact your radiation safety officer.

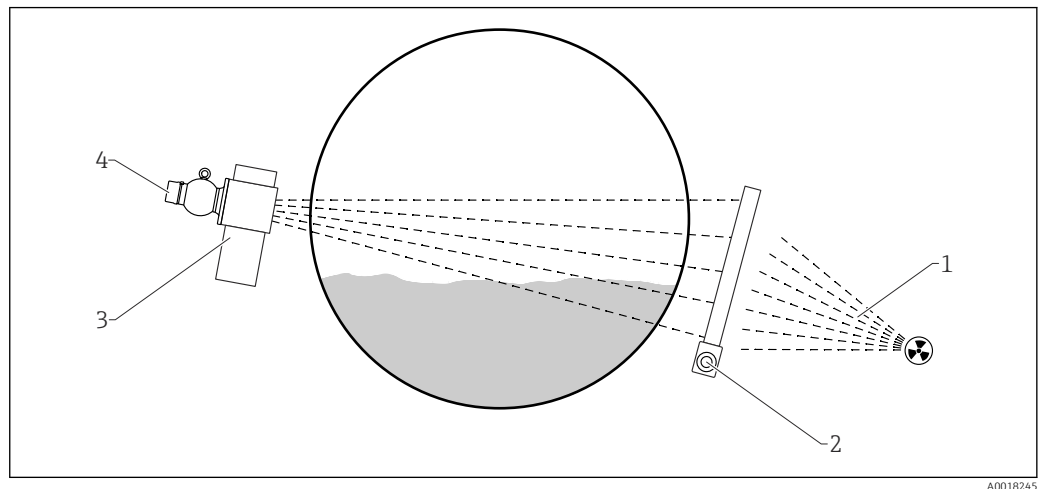
Switch on the modulator(s).

6. Measure and cordon off controlled areas.**CAUTION**

- ▶ When measuring the local dose rate to determine the controlled areas, the modulator must be running and the measuring time selected must be long enough for a stable measured value to be displayed.

5.4.2 Gamma Modulator FHG65

In a radiometric measuring point, the Gamma Modulator FHG65 is mounted in front of the beam exit channel of the source container. It contains a shaft slotted along the longitudinal axis. This shaft rotates continuously and alternately screens off, or allows through, the useful beam at a frequency of 1 Hz. Due to this frequency, the useful beam differs from fluctuating ambient interference radiation and from interference radiation occurring sporadically (e.g. from nondestructive material testing). Using a frequency filter, the FMG50 or FMG60 can thus separate the useful signal from interference radiation. In this way, it is possible to continue measuring even if interference radiation occurs. This significantly increases the measuring certainty and system availability.



- 1 Interference radiation
- 2 FMG50/FMG60
- 3 FHG65
- 4 FQG61/FQG62



The Gamma Modulator FHG65 and the Gammapiot FMG50/FMG60 are not interconnected electrically. When adjusting the FMG50/FMG60, the "beam type" parameter must be set to "modulated".

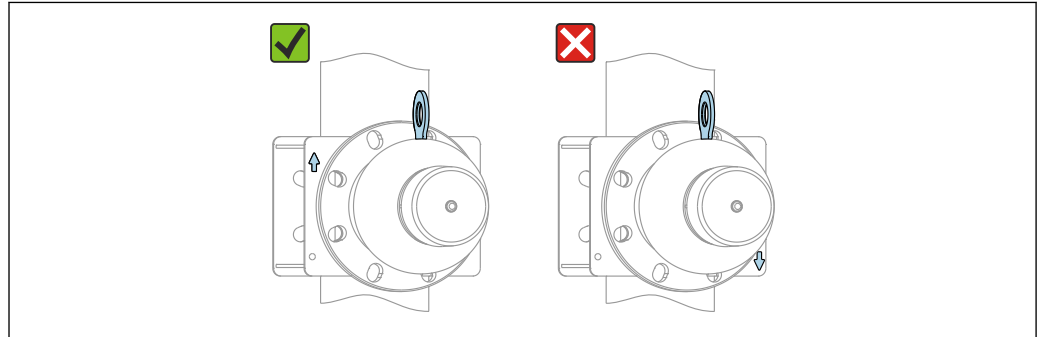
5.4.3 General installation conditions

The Gamma Modulator FHG65 is mounted directly on the mounting flange of the source container FQG61 or FQG62. ¹⁾

1) For applications with the source container FQG66: contact your local Endress+Hauser sales office

⚠ CAUTION

- ▶ As the beam exit channel is not located in the middle of the source container, it is absolutely essential to ensure the device is oriented correctly when mounting. The arrow on the mounting plate of the Gamma Modulator must point in the direction of the transporting lug of the source container. Measurement is not possible otherwise.



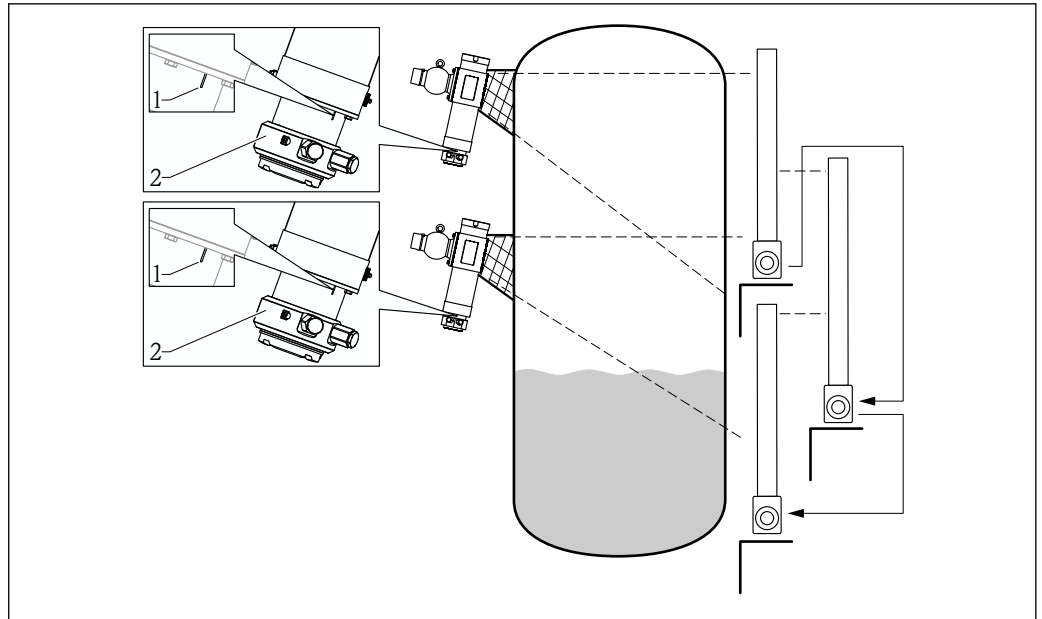
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- The source container with the Gamma Modulator must be mounted as close as possible to the tank or measuring tube
- The unit must be mounted on a low-vibration construction
- Fasten with at least 4 M16 threaded bolts; torque:
 - Steel: 210 Nm (154.88 lbf ft)
 - Stainless steel: 144 Nm (106.20 lbf ft)
- When mounting, consider the total weight consisting of the source container and the Gamma Modulator FHG65. Ensure sufficient stability is guaranteed. Provide an additional support if necessary
- After mounting, measure the local dose rate in the vicinity of the source container and the Gamma Modulator. Cordon off any controlled areas, see also TI00435F (FQG61/FQG62)
- The use of the modulator reduces the effectively useful horizontal angle of the beam path from 6 ° to approx. 2 °. **Check that the detector is completely covered by the radiation beam!**

5.4.4 Mounting multiple Gamma Modulators FHG65

If multiple Gamma Modulators FHG65 are used in a measuring point, they must operate synchronously. The Synchronizer FHG66 is used for this purpose.

- i** The synchronization requires that all the Gamma Modulators FHG65 be aligned in the same way. A mark is provided at the top of the Gamma Modulator FHG65 to align the units. This mark must be aligned in the same way relative to the source container on all the Gamma Modulators FHG65 used.



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- 1 Marking for aligning multiple Gamma Modulators
2 FHG65

5.4.5 Water cooling

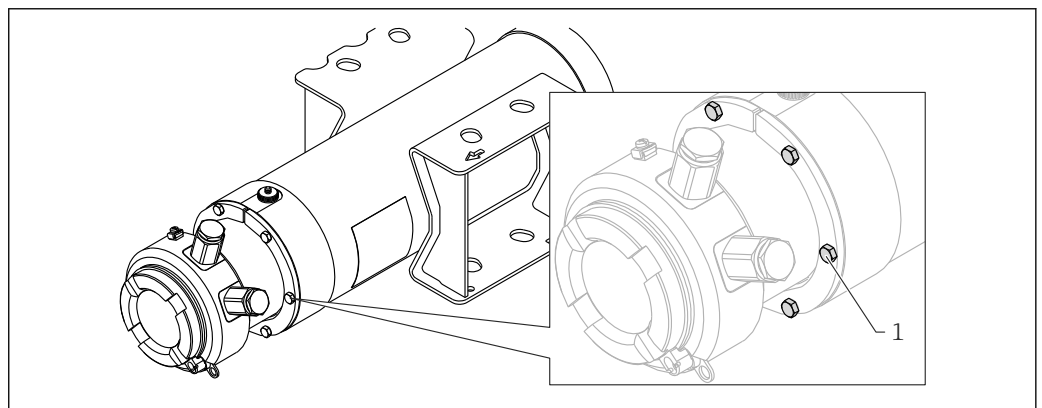
The following applies to the Gamma Modulator FMG60 version with water cooling:

- Material: 316L and 304
- Water connection: 2 x G 1/4"A, DIN ISO 228
- Outlet temperature: max. +40 °C (104 °F); temperature monitoring is recommended
- Water pressure: 4 to 6 bar (58 to 87 psi)
- Water flow: min. 60 l/h
- Drain sensor with water cooling jacket in the event of frost or protect against freezing.

⚠ WARNING

Pressurized water cooling system!

- Do not open the cylinder screws (see diagram below) when pressurized



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- 4 Application with water cooling

- 1 Cylinder screws

⚠ WARNING

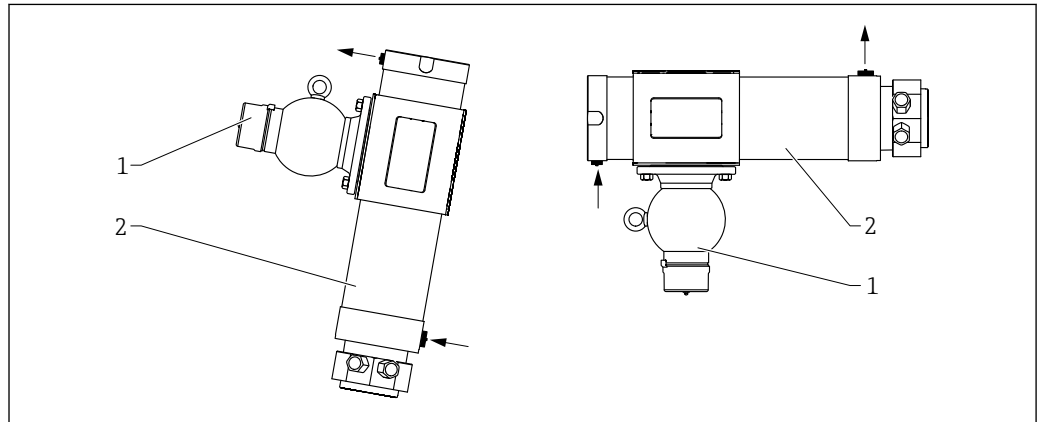
Falling source containers can cause injury

- Always remove the source container before loosening the fixing screws of the modulator. Observe the safety instructions for radiation protection!

⚠ CAUTION

Detector or cooling jacket can become damaged if the cooling water freezes

- Empty cooling jacket or protect against freezing



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- 1 FQG61, FQG62
2 FHG65

⚠ CAUTION

- The water must always be introduced from the bottom to ensure that the water cooling jacket is completely filled.

5.5 Post-installation check

After installing the device, carry out the following checks:

- ☐ Is the Gamma Modulator FHG65 mounted securely on the vessel and source container? ?
- ☐ Does the arrow on the mounting plate of the Gamma Modulator point in the direction of the transporting lug of the source container?
- ☐ Are the source container and the Gamma Modulator FHG65 securely mounted on a low-vibration console that can safely bear the total weight of the source container and the Gamma Modulator under all conditions that can be expected?
- ☐ Has the local dose rate been measured in the vicinity of the source container and Gamma Modulator FHG65 and have controlled areas (if present) been cordoned off?
- ☐ Is the device undamaged (visual inspection)?
- ☐ Does the device match the measuring point specifications (ambient temperature, measuring range etc.)?
- ☐ If available: are the measuring point number and labeling correct (visual inspection)?
- ☐ Is the measuring device sufficiently protected against sunlight?
- ☐ Are the cable glands tightened correctly?

If multiple Gamma Modulators are deployed at one measuring point:

- ☐ Are all the Gamma Modulators aligned the same (check marking)?
- ☐ Are all the Gamma Modulators connected to **one** synchronizer (or to a cascaded synchronizer)?
- ☐ Is the synchronizer configured correctly -> is the green LED lit?

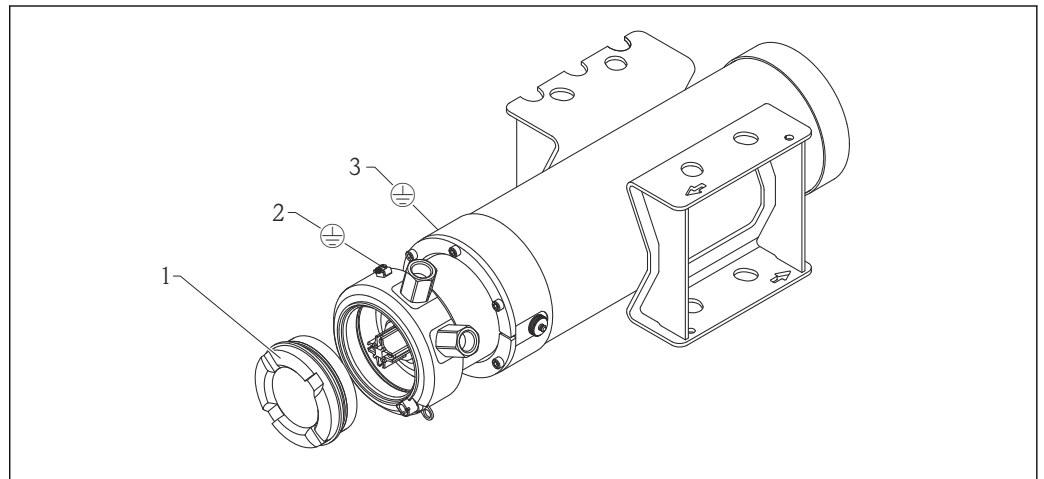
6 Electrical connection

6.1 Potential equalization

CAUTION

Before wiring, connect the potential matching line to the outer ground terminal (see next graphic)

- If a water cooling jacket is provided, it must be separately connected to the potential matching line. For optimum electromagnetic compatibility, the potential matching line should be as short as possible and have a cross-section of at least 2.5 mm² (13 AWG).



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- 1 Cover of the connection compartment
- 2 Ground terminal on modulator
- 3 Ground terminal on water cooling jacket

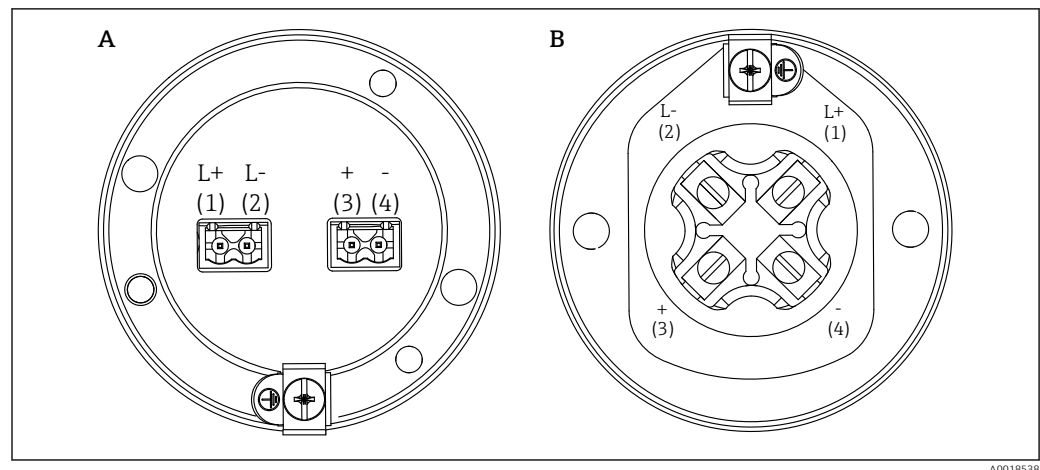
6.2 Cable entries

Versions of the two cable entries (for supply voltage and synchronization connection)

- M20 gland
- M20 thread
- G ½ thread
- NPT ½ thread

- i** Connecting cables should be routed away from the housing from below to prevent moisture from penetrating the connection compartment. Otherwise, a drip loop should be provided or the Gamma Modulator should be fitted with a weather protection cover.

6.3 Terminal assignment



A *Ex d, Ex t, non-Ex - version*

B Ex de - version

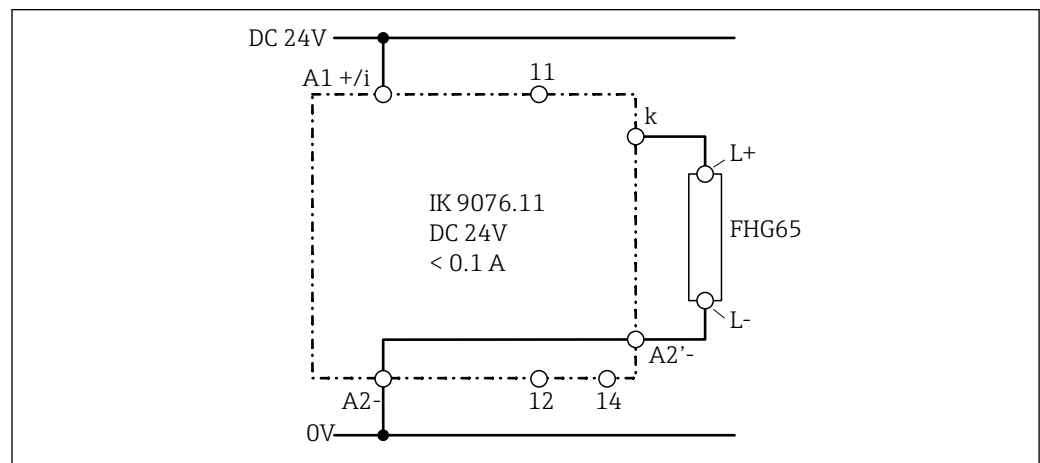
- Terminal 1 (L+), terminal 2 (L-): supply voltage; 18 to 35 VDC or 18 to 36 VDC (see nameplate)
- Terminal 3 (SYNC+), terminal 4 (SYNC-): synchronization connection (to connect the Synchronizer FHG66); 12 VDC, 5 mA

- Install a circuit breaker in the power supply line
- Use a cable with a minimum diameter of 0.5 mm² (20 AWG)
- Mount the earth tag of the ground connector in the position direction indicated in the graphic

6.4 Alarm output

The Gamma Modulator FHG65 does not have an alarm output of its own. Operating errors are reported as follows:

- **If a Synchronizer FHG66 is connected:** The FHG65 reports the error to the FHG66 via the synchronization input. The alarm relay of the FHG66 reports the error.
- **If a Synchronizer FHG66 is not connected:** The FHG65 switches off its motor completely in the event of an error. This reduces the current consumption to less than 30 mA. This can be detected by an external current monitor (e.g. Dold IK9076.11). Cannot be used in cascading mode.



 5 *Connection diagram for external current monitor Dold IK9076.11*

6.5 Post-connection check

After wiring the device, carry out the following checks:

- ☐ Are the potential matching lines connected correctly?
- ☐ Is the terminal assignment correct?
- ☐ Are the cable glands and dummy plugs screwed tight?
- ☐ Is the cover screwed down correctly?

WARNING

- Only operate the device when the cover is closed

7 Commissioning

7.1 Configuring the beam type on the FMG50/FMG60

When using the Gamma Modulator, set the beam type to "modulated" (see also the Operating Instructions for FMG50/FMG60)

This function is used to specify whether the radiation source used emits radiation continuously or whether it is modulated (for interference radiation suppression). The setting is made at the FMG50/FMG60.

Options:

- Standard/continuous (permanent, continuous radiation)
- Modulated (modulated radiation source)

7.2 Recalibration

Following the installation of the Gamma Modulator FHG65, the FMG50/FMG60 must be recalibrated. The recalibration includes:

- Background calibration
- Empty or free calibration
- Full or covered calibration
- In the case of density and concentration measurements: one or multiple calibration points

 Details on the calibration are provided in the Operating Instructions pertaining to the FMG50/FMG60

8 Maintenance and repair

8.1 Maintenance

No special maintenance work is required.

8.2 Cleaning

When cleaning the exterior, always use cleaning agents that do not corrode the surface of the housing and the seals.

Only dry cleaning is permitted for the label with the terminal assignment in the terminal compartment.

8.3 Repair

8.3.1 Repair concept

Under the Endress+Hauser repair concept, devices have a modular design and repairs can be carried out by Endress+Hauser Service or by properly trained customers.

Spare parts are grouped into logical kits with the associated replacement instructions.

For more information on service and spare parts, please contact Endress+Hauser Service.

8.3.2 Repairs to devices with an Ex-certificate

When repairing devices with an Ex-certificate, please also note the following:

- Only specialist personnel or Endress+Hauser Service may carry out repairs on Ex-certified devices.
- Comply with the prevailing standards, national Ex-area regulations, Safety Instructions (XA) and certificates.
- Only use original spare parts from Endress+Hauser.
- A certified device may only be converted into a different certified device version by Endress +Hauser Service in Endress+Hauser workshops.
- Document Ex-related repairs and Ex-related modifications.



Observe the information in the "Functional Safety Manual" for SIL devices

8.4 Return

The measuring device must be returned if it is in need of repair or a factory calibration, or if the wrong measuring device has been delivered or ordered. Legal specifications require Endress+Hauser, as an ISO-certified company, to follow certain procedures when handling products that are in contact with the medium.

To ensure safe, swift and professional device returns, please refer to the procedure and conditions for returning devices provided on the Endress+Hauser website at

<http://www.endress.com/support/return-material>

8.5 Spare parts

Enter the serial number into *W@M Device Viewer* (www.endress.com/deviceviewer).

All the spare parts for the measuring device, along with the order code, are listed here and can be ordered. If available, users can also download the associated Installation Instructions.



Serial number:

- Located on the device and spare part nameplate.
- Can be read out via the "Serial number" parameter in the "Device information" submenu.

8.6 Disposing of the device



Dangerous media can endanger staff and the environment!

- Ensure that the device and all cavities are free of medium residues that are hazardous to health or the environment, e.g. substances that have permeated into crevices or diffused through plastic.

8.6.1 WEEE²⁾ Directive 2012/19/EU

Pursuant to Directive 2012/19/EU of the European Parliament and of the Council of 4 July 2012 on waste electrical and electronic equipment (WEEE), the device is marked with the depicted symbol in order to minimize the disposal of WEEE as unsorted municipal waste.



 6 *Symbol for the separate collection of electrical and electronic equipment*

- Do not dispose of devices bearing this marking as unsorted municipal waste. Instead, return them to Endress+Hauser for disposal under the applicable conditions.
- Observe applicable federal/national regulations.
- Ensure proper separation and reuse of the device components.

8.7 Contact addresses at Endress+Hauser

Contact addresses are available at www.endress.com/worldwide or from your local Endress+Hauser branch office.

²⁾ Waste of Electrical and Electronic Equipment

9 Technical data

9.1 Additional technical data

For additional technical data, see:

 TI00423F

9.2 Supplementary documentation

9.2.1 Gamma Modulator FHG65; Synchronizer FHG66

Technical Information for Gamma Modulator FHG65 and Synchronizer FHG66

 TI00423F

Operating Instructions for Gamma Modulator FHG65 and Synchronizer FHG66

 BA00373F

9.2.2 Gammapilot FMG50

Technical Information for Gammapilot FMG50

 TI01462F

Operating Instructions for Gammapilot FMG50

 BA01966F

9.2.3 Gammapilot M FMG60

Technical Information for Gammapilot M FMG60

 TI00363F

Operating Instructions for Gammapilot M FMG60

 BA00278F

9.2.4 Source container FQG61, FQG62

Technical Information for source containers FQG61 and FQG62

 TI00435F

9.2.5 Radiation source FSG60, FSG61

- Technical Information for radiation source FSG60/FSG61
- Returning source containers
- Type A packaging

 TI00439F

9.2.6 Other documentation



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 the nameplate
- *Endress+Hauser Operations App*: Enter the serial number from the nameplate or scan the matrix code on the nameplate

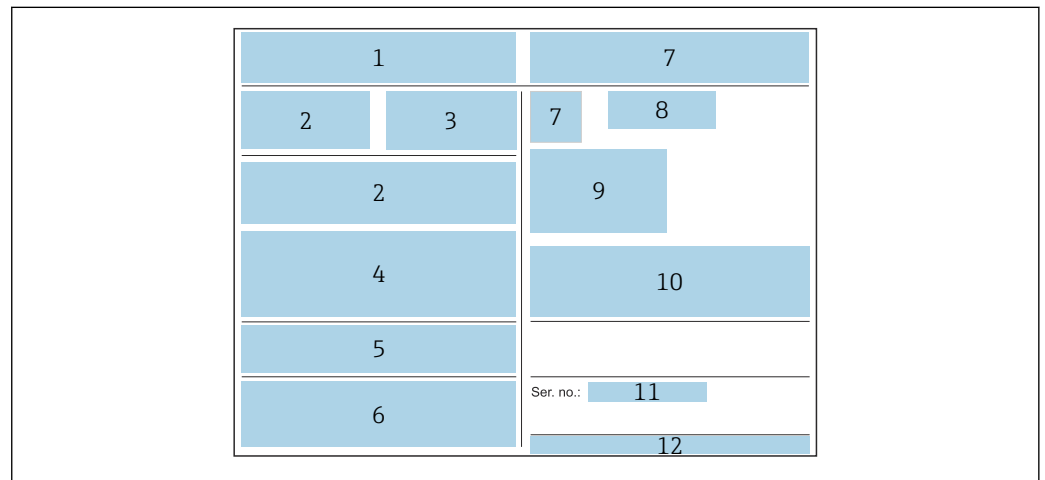
10 Accessories

10.1 Synchronizer FHG66

The Synchronizer FHG66 is available as an accessory. Order number: 71060806

10.1.1 FHG66 identification

Nameplate



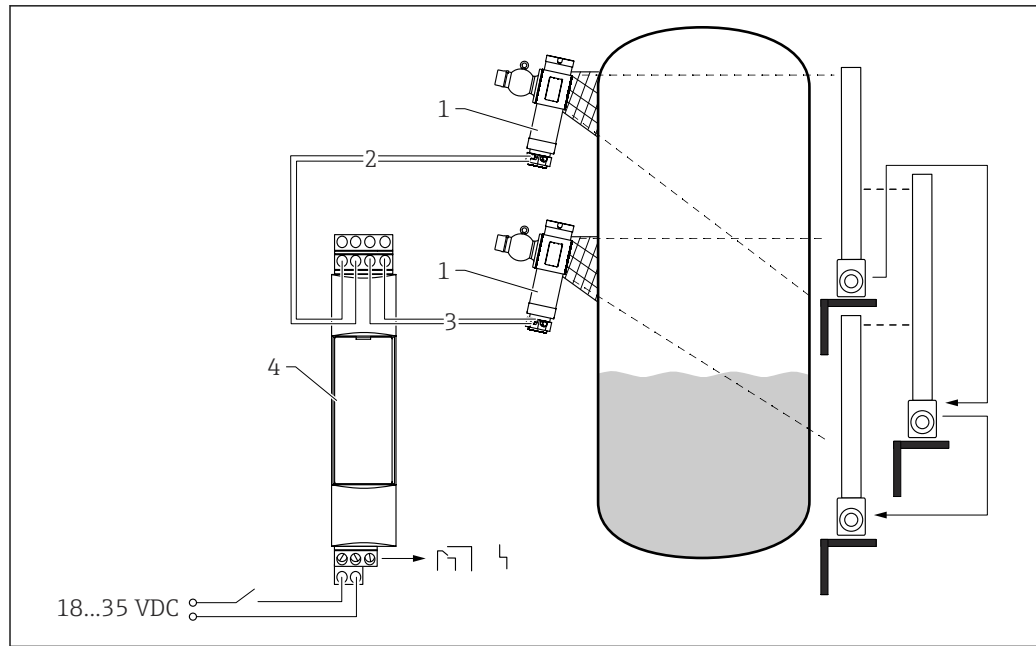
A0048656

- 1 Manufacturer-specific data and device name
- 2 Terminal assignment of the supply voltage and power consumption
- 3 Protection class, additional electrotechnical information
- 4 Alarm relay: terminal assignment and switching power
- 5 Permitted ambient temperature range
- 6 Barcode of serial number
- 7 Certificate- and approval-related data
- 8 Reference to additional documentation
- 9 Terminal assignment (synchronization and cascade mode)
- 10 Supply voltage and current consumption when connecting to FHG65
- 11 Serial number (Ser. no.)
- 12 Manufacturer address

10.1.2 Use of the FHG66

Synchronization of multiple Gamma Modulators FHG65

In a measuring point with multiple radiation sources, a Gamma Modulator FHG65 must be mounted on every source container. The Synchronizer FHG66 synchronizes the individual modulators to common mode. A Synchronizer FHG66 can synchronize up to three Gamma Modulators FHG65. (For more than three modulators, see the "Cascading multiple Synchronizers FHG66" section). In addition, the synchronizer offers a straightforward diagnostic solution for the connected Modulators FHG65, which is beneficial when only one Modulator FHG65 is in operation.

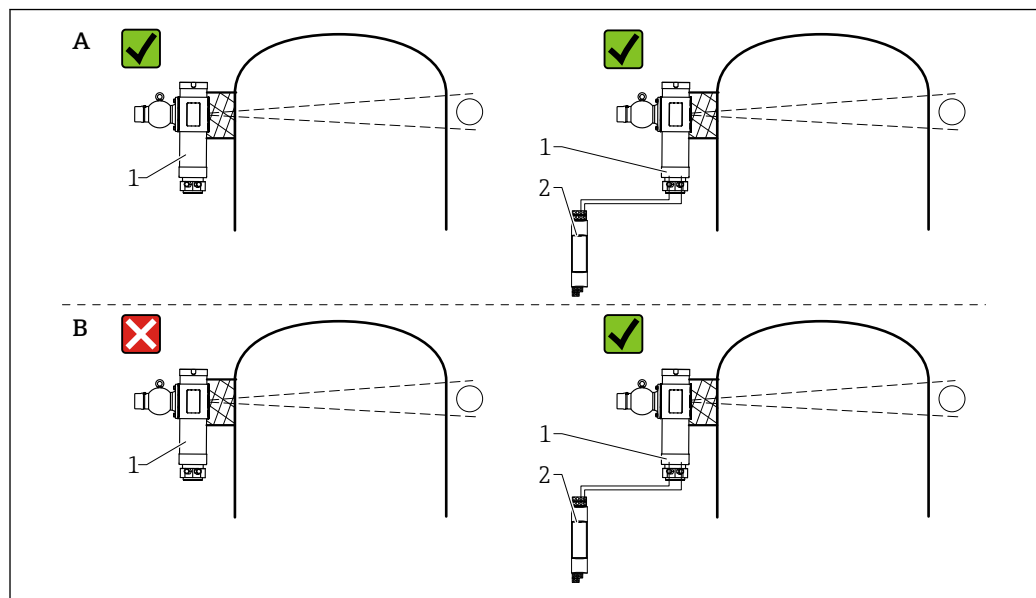


A0018540

- 1 FHG65
- 2 Electrical connection between FHG66 and FHG65 (1)
- 3 Electrical connection between FHG66 and FHG65 (2)
- 4 FHG66

i It is recommended to install the switch for the supply voltage near the device and to mark it as a disconnecter for the device.

i Use of the Synchronizer FHG66, and particularly of its alarm output, is recommended for minimum point level detection, as an undetected failure of the Modulator FHG65 may result in faulty switching behavior

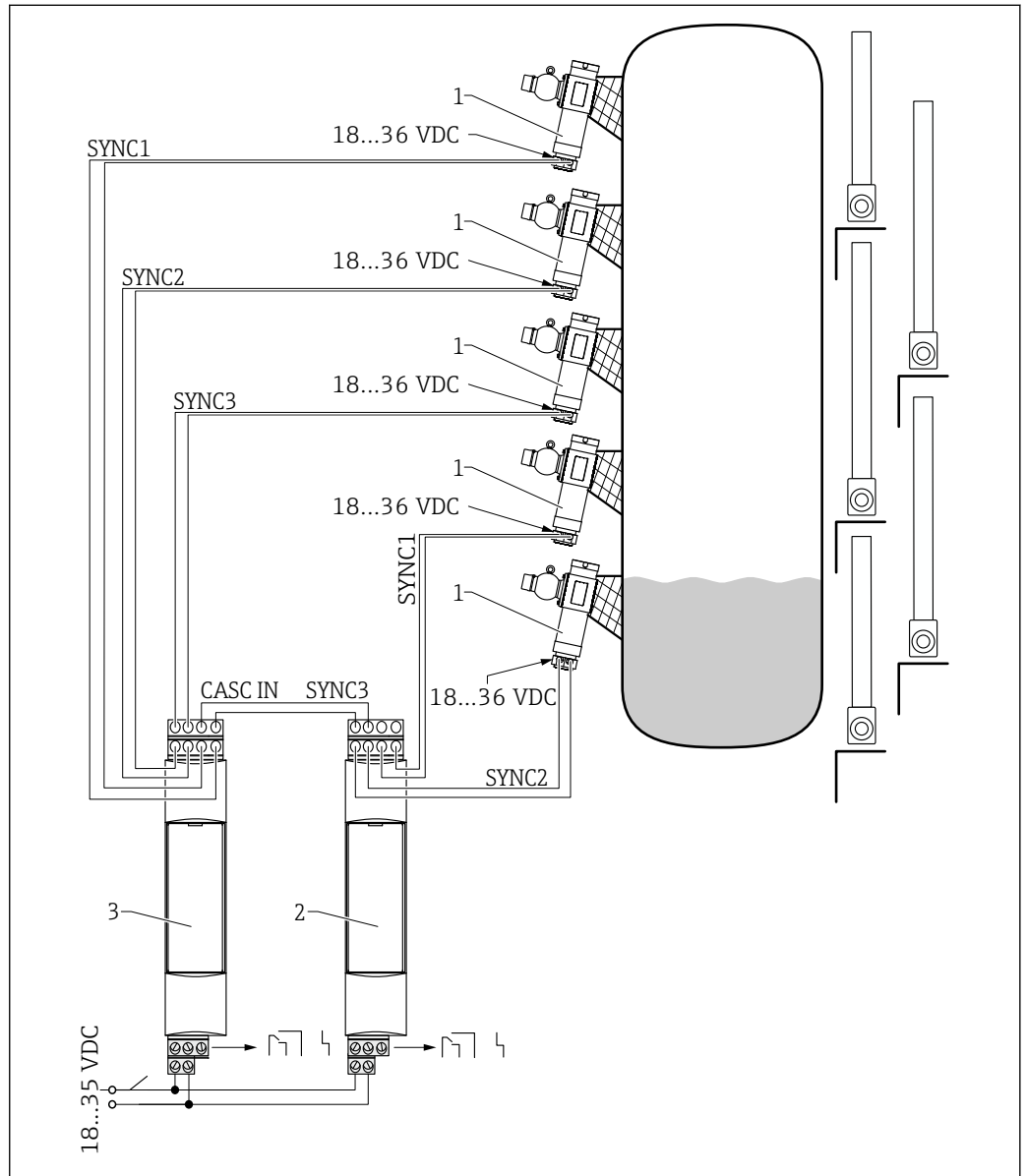


A0021133

- A Maximum point level detection
- B Minimum point level detection
- 1 FHG65
- 2 FHG66

Cascading multiple Synchronizers FHG66

If more than three radiation sources are used, the synchronization chain must be extended by cascading: here, an additional synchronizer (3) is connected to one of the outputs of the synchronizer (2) instead of a modulator. All connected Gamma Modulators then operate in common mode. By interconnecting this cascading function, any number of modulators can be synchronized with one another.



A0018541

- 1 FHG65
- 2 Primary synchronizer
- 3 Cascaded synchronizer

10.1.3 Technical data

Input

Cascading input

- For connection to a Synchronizer FHG66
- Galvanically isolated from additional power supply and output
- Connecting cable: twin-core; shielding not required (except in the event of strong electromagnetic interference)
- Cable requirements:
 - Max. capacitance: 120 nF
 - Max. resistance: 1 000 Ω
 - Max. inductance: 0.65 mH
 - Cable: not shielded/not twisted
- Signal transmission: closed current loop 0 to 5 mA, max. 12 V

Output

Alarm relay

- **Type:** Potential-free change-over contact
- **Switching delay:** 0 to 3 s
- **Switching capacity (DC voltage):**
 - U: maximum 40 V
 - I: maximum 2 A
 - P: maximum 80 W
- **Switching capacity (AC voltage):**
 - U: maximum 250 V
 - I: maximum 2 A
 - P: maximum 500 VA at $\cos \phi \geq 0.7$
- **Operating life:** Min. 10^5 switching cycles with maximum contact load
- **Function indicator:** Light emitting diodes for operation, faults and error assignment; device detects and reports errors in the configuration and in the connected devices
- **Overvoltage category:** II
- **Protection class:** 2 (double/reinforced isolation)

Signal on alarm

- Fault indicated by red LED
- Fault assignment by yellow LEDs
- Alarm relay deenergized

Power supply

- Supply voltage: 18 to 35 VDC (power supply with safe isolation required)
- Power consumption: max. 1 W
- Overvoltage category: II
- Protection class: 2
- Pollution degree: 2

Environment

- **Ambient temperature:**
 - Mounted individually: -20 to +60 °C (-4 to +140 °F)
 - Mounted in a row without lateral spacing: -20 to +50 °C (-4 to +122 °F)
 - When installed in protective housing: -20 to +40 °C (-4 to +104 °F)
- **Storage temperature:** -20 to +85 °C (-4 to +185 °F), preferably at 20 °C (68 °F)
- **Climate and mechanical application class:**
 - K3 according to DIN EN 60721-3-3
 - M2 according to DIN EN 60721-3-3
- **Degree of protection:**
 - IP20
 - Mechanical degree of protection IK06 (1J) according to IEC 62262
- **Electromagnetic compatibility:**
 - Interference emission according to EN 61326, Class B equipment
 - Interference immunity according to EN 61326, Appendix A (Industrial) and NAMUR Recommendation NE 21

10.1.4 Electrical connection

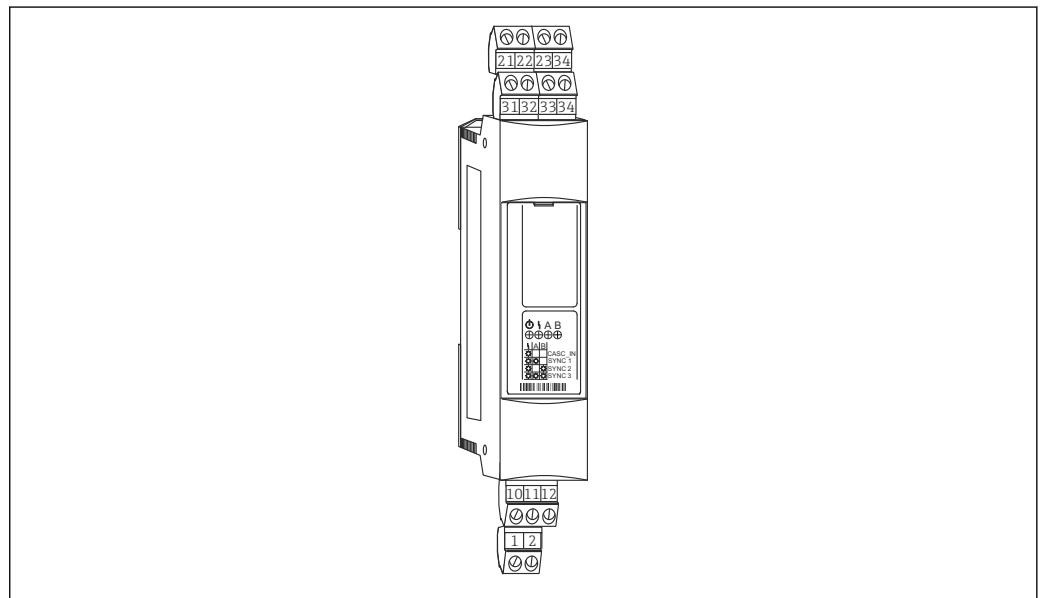
Terminals

Plug-in screw terminals. Wire cross-section:

- 1.0 to 2.5 mm² (17 to 13 AWG) for power supply and relay
- 0.5 to 2.5 mm² (20 to 13 AWG) for signal lines

CAUTION

- The terminals may only be replaced with terminals of the same type



 7 Synchronizer FHG66 with terminals

A0018546

Terminal assignment

Power supply

- Terminal 1 (L+): supply voltage; 18 to 35 VDC power supply with safe isolation required
- Terminal 2 (L-): supply voltage; 18 to 36 VDC power supply with safe isolation required

Alarm relay

- Terminal 10 (changeover)
- Terminal 11 (NC contact): is connected to terminal 10 if an error occurs
- Terminal 12 (NO contact): is connected to terminal 10 during error-free operation

Outputs

- Terminal 33/34 (synchronization output 1)
- Terminal 31/32 (synchronization output 2)
- Terminal 21/22 (synchronization output 3)

- i** ■ One Gamma Modulator FHG65 or an additional Synchronizer FHG66 (for cascading) can be connected to each output terminal.
- Synchronization signal: 12 V / 5 mA
 - Any polarity is possible

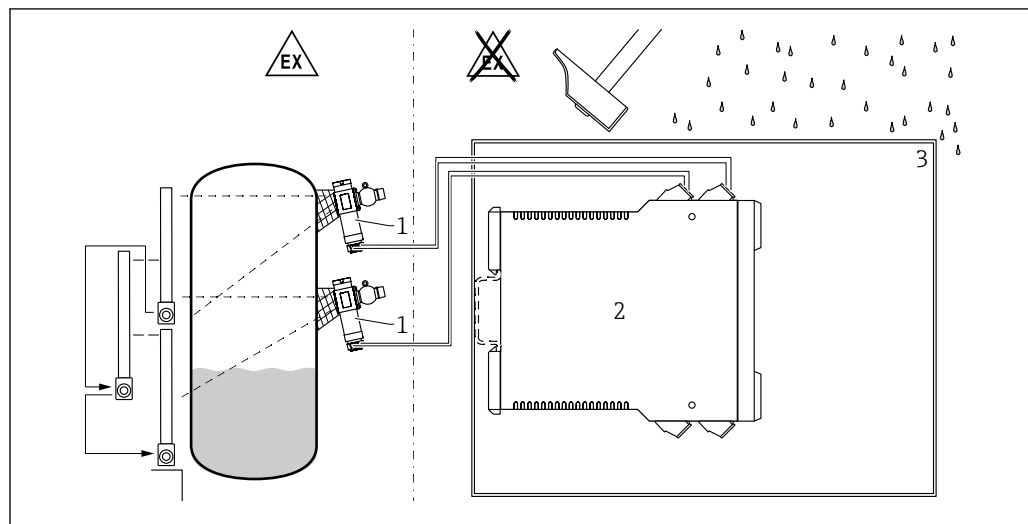
Inputs

Terminal 23/24 (cascading input)

- i** ■ For connecting an additional, upstream Synchronizer FHG66
- All the Gamma Modulators connected to the synchronizers then run in common mode.
 - Cascading signal: 12 V / 5 mA

10.1.5 Installation requirements**Mounting location**

The Synchronizer FHG66 must be accommodated in a cabinet outside the hazardous area and protected against mechanical influences. If mounting outdoors, a protective housing (min. IP65) must be used.

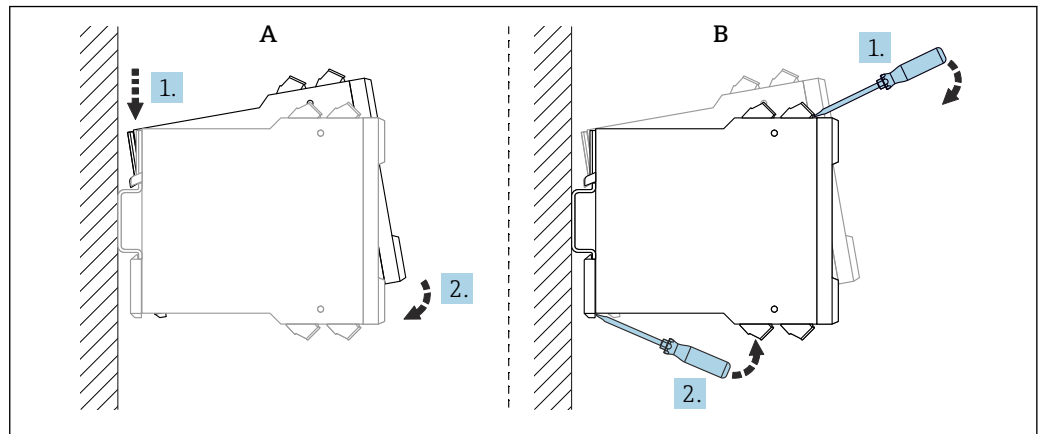


- 1 FHG65
 2 FHG66
 3 Cabinet or protective housing (min. IP65)

CAUTION**Observe the following conditions:**

- ▶ Mechanical degree of protection for FHG66: see "Technical data" section
- ▶ The ventilation slots of the housing must not be blocked

Installation



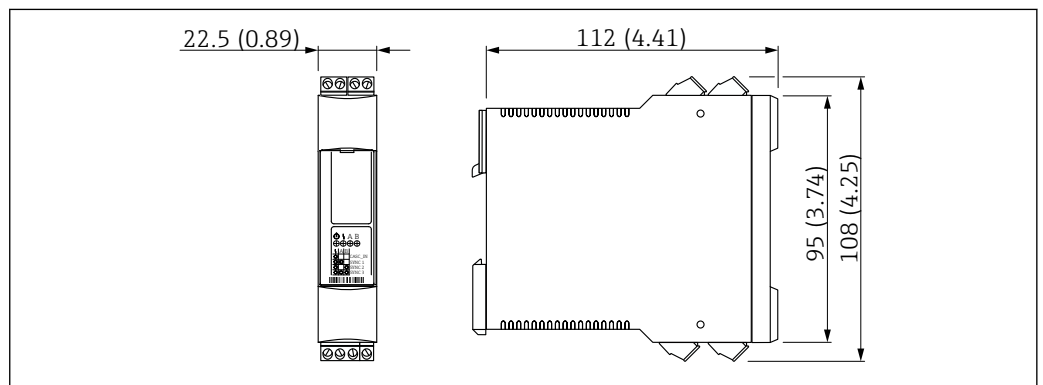
A0018545

A Mounting on DIN rail (1. Hook into DIN rail; 2. Swivel until device clicks into place)

B Disassembly (1. Remove terminal blocks; 2. Remove device)

10.1.6 Mechanical construction

Dimensions



A0018543

8 Engineering unit: mm (in)

Weight

Weight: approx. 150 g (5.29 oz)

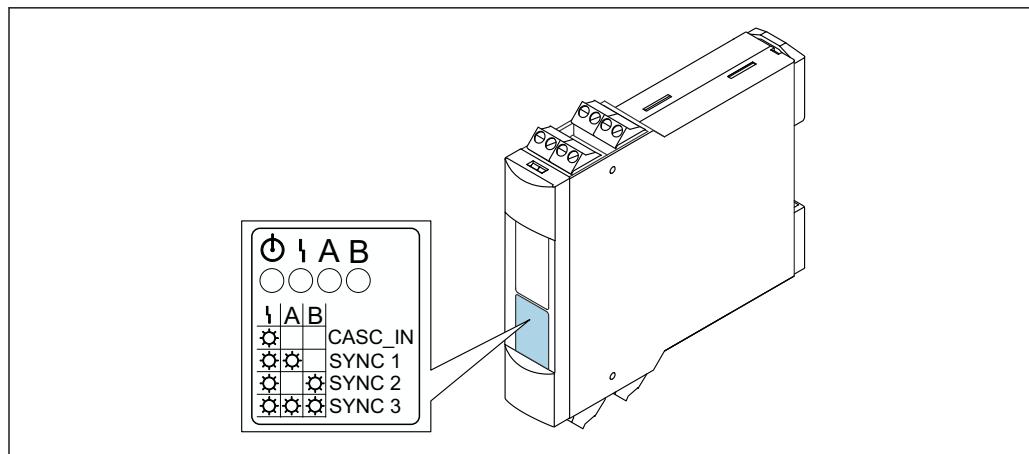
Materials

- **Housing:** polycarbonate
- **Front cover:** polyamide PA6
- **Fixing slide (to secure on DIN rail):** polyamide PA6

10.1.7 Human interface

Display elements

The LEDs are visible when the front panel is closed.



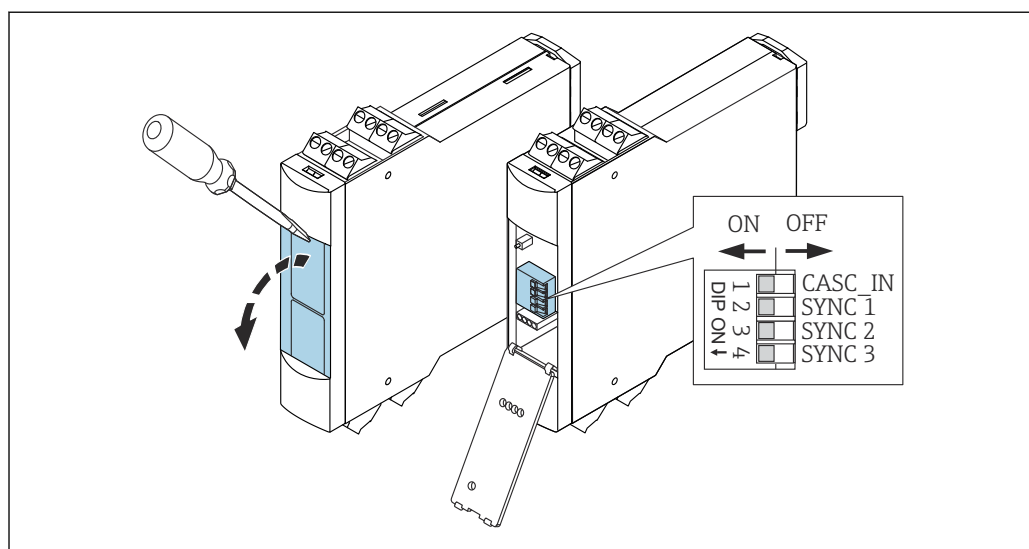
A0018547

9 Arrangement of the display LEDs

- **Green LED; operational safety:** Is lit as soon as the supply voltage is switched on
- **Red LED; error:** Is lit if an error is present at one of the synchronization outputs or the cascading input
- **A, B**
Yellow LEDs; error identification: Indicate the synchronization output where the error has occurred:
 - **A:** Error at SYNC 1
 - **B:** Error at SYNC 2
 - **A and B:** Error at SYNC 3
 - **A and B off, but red LED on:** Error at cascading input (CASC_IN)

Operating elements

The DIP switches are located behind the swing-down front panel.



A0018548

10 Visualization of the operating elements (DIP switches)

The DIP switches are used to switch the synchronization outputs and the cascading input on and off in accordance with the diagram above.

- **DIP switch 1:** Cascading input (terminals 23/24)
- **DIP switch 2:** Synchronization output 1 (terminals 33/34)
- **DIP switch 3:** Synchronization output 2 (terminals 31/32)
- **DIP switch 4:** Synchronization output 3 (terminals 21/22)

10.1.8 Ordering information

Order number: 71060806

Ordering information

Ordering information

Detailed ordering information is available from the following sources:

- In the Product Configurator:
www.us.endress.com/en/field-instruments-overview/product-finder -> Select product -> Configure
- From an 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

11 Certificates and approvals

11.1 CE mark

The measuring system meets the legal requirements of the EC Directives. Endress+Hauser confirms that the device has been successfully tested by applying the CE mark.

11.2 Explosion protection

Gamma Modulator FHG65

11.3 Additional approvals

Synchronizer FHG66

CSA GP

11.4 Overfill protection

- May be used in max point level applications in connection with the Gammapiot M FMG60 (200/400 mm) in SIL 2/3 according to IEC 61508.
- Not tested for overfill protection according to WHG

11.5 Other standards and guidelines

- **IEC 60529:**
Degrees of protection provided by enclosures (IP code)
- **IEC 61326**
Electromagnetic compatibility (EMC requirements)
- **IEC 61010**
Safety requirements for electrical equipment for measurement, control and laboratory use
- **NAMUR:**
Association for Standards for Control and Regulation in the Chemical Industry

12 Supplementary documentation

12.1 Gamma Modulator FHG65; Synchronizer FHG66

Technical Information for Gamma Modulator FHG65 and Synchronizer FHG66



TI00423F

Operating Instructions for Gamma Modulator FHG65 and Synchronizer FHG66



BA00373F

12.2 Gammapilot FMG50

Technical Information for Gammapilot FMG50



TI01462F

Operating Instructions for Gammapilot FMG50



BA01966F

12.3 Gammapilot M FMG60

Technical Information for Gammapilot M FMG60



TI00363F

Operating Instructions for Gammapilot M FMG60



BA00278F

12.4 Source container FQG61, FQG62

Technical Information for source containers FQG61 and FQG62



TI00435F

12.5 Radiation source FSG60, FSG61

- Technical Information for radiation source FSG60/FSG61
- Returning source containers
- Type A packaging



TI00439F

12.6 Other documentation



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 the nameplate
- *Endress+Hauser Operations App*: Enter the serial number from the nameplate or scan the matrix code on the nameplate



www.addresses.endress.com
