# Microwave barrier FDR56/FQR56

- The microwave barrier uses a contact-free procedure for detection. It can be installed in containers, conduits, shafts or on free fall shafts. It is possible to take a measurement through non-metallic container materials from the outside.
- Transmitter FQR56 and transceiver FDR56 are compact devices with integrated power unit, the transceiver is additionally disposed with a switching amplifier, which means less effort is required for installation and mounting.
- Typical areas of application or bulk solids are:
  • Building materials industry: Cement, plaster, wood chips etc.
  • Chemical industry: Fertilizers, plastic powder, granules etc.
  • Food industry: Coffee, tea, tobacco, cereals, malt etc.
  • Energy production: Coal, carbon dust, fly-ash, coke etc.
- Suitable as level limit switch for all kinds of bulk solids and liquids and for counting piece goods (such as bags or boxes)
- Individual adjustments to the application are carried out by means of configurable functions (including automatic calibration). In addition, build-up, fouling etc. can be analyzed by the optional 4 - 20 mA current output.
- Detection range up to 100 m depending on bulk solids
- Process temperatures up to +70°C (+158°F) or +450°C (+842°F) with optional high temperature adapter
- Process pressure up to 680 kPa (6.8 bar) absolute or 2 MPa (20 bar) absolute with optional high pressure adapter
- For use in hazardous areas (dust 1/2D): ATEX, CSA, EAC and IECEx
- Flush-mounted installation, non-contact installation possible
- Easy mounting using R 1½, 1½ NPT or G 1½ thread or a suitable mounting bracket
- Electronics housing can be rotated by 360°, allowing orientation into optimum position after installation
- Easy electrical connection using the connectors (optional with suitable mating connectors or prefabricated connection cables)
- Mechanically compatible to FQR50/FDR50 and FQR57/FDR57 microwave barrier, existing process connections can continue to be used; likewise, accessories such as adapter flanges, installation brackets and sight glasses can still be used

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# Function and system design

## Measuring principle

The FQR56 transmitter emits a microwave signal via an integrated horn antenna. The FDR56 transceiver directly opposite detects this signal and generates the selected output signal (relay, solid-state relay or 4 - 20 mA current output).

The microwave barrier is typically used for notification when containers, silos or similar are full and/or empty. Full notification is used to protect against overflow while empty notification is used, for example, to protect downstream conveyor devices from running dry.
With the help of the analog output (current 4 to 20 mA), fouling and build-up can be detected; an increase in the fouling of a filter, for example, is indicated by a falling current value.

The range of the microwave signal is influenced by the different types of materials. The attenuation is dependent on the electrical properties of the damping material. Materials with the capacity to conduct electricity, such as metals, reflect the waves, while other materials with lower conductivity only weaken them or are even penetrated. The attenuation of the microwaves is reduced as the damping of the material to be permeated is lower.

The complete measuring system for limit detection consists of an FQR56 transmitter and a FDR56 transceiver.

Notice!
- The FQR56 transmitter and the FDR56 transceiver are compact devices for connection to one shared power supply or two separate power supplies.
- The FDR56 transceiver has an integrated switching amplifier; therefore, no external switching amplifier is required.
- The FQR56/FDR56 device types are mechanically compatible to the type FQR50/FDR50 and FQR57/FDR57; the same process adapter can be used for all types.
- The compact variant FQR56/FDR56 is electrically incompatible to the FQR50/FDR50 device type, as these devices have to be operated with the external switching amplifier FTR325.
- The compact variant FQR56/FDR56 is electrically incompatible to the FQR57/FDR57 device type, as these devices have to be operated with the external switching amplifier FTR525.

**Example: limit detection**

With the help of two microwave barriers, the overshoot of the upper (e.g. product overflow) and the undercut of the lower limit value (e.g. dry running of the discharge screw conveyor) can be detected safely.

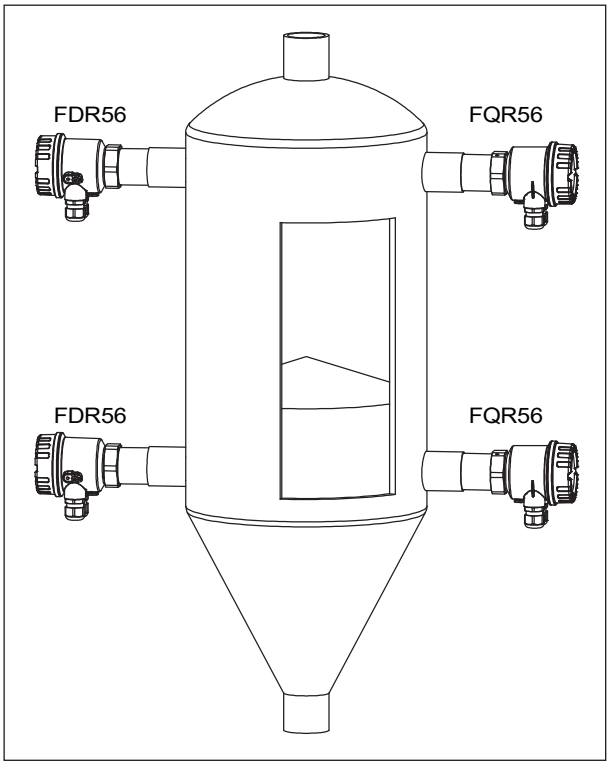



*Figure 1: Example: min/max limit detection of a vessel*

**Example: counting piece goods**

The microwave barrier detects piece goods reliably, even under dusty conditions. As the piece goods are being transported on a conveyor belt with a certain distance between them, their quantity can be determined through evaluation of the relay output (switches once for each piece good).

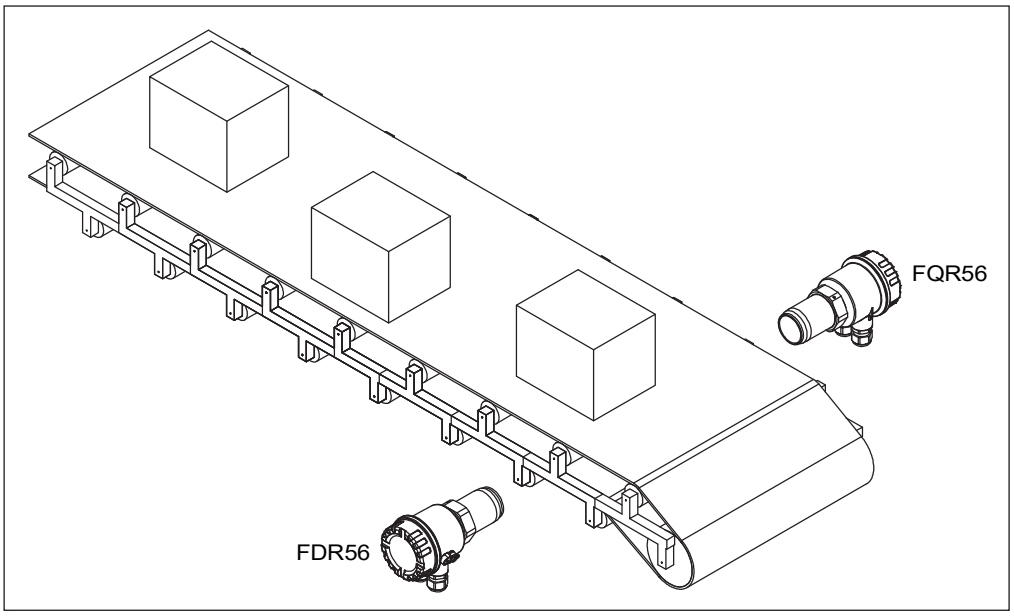



*Figure 2: Example of counting piece goods*

## Example: detection of build-up

Using the optional 4-20 mA current output, the microwave barrier can detect deposit build-ups or similar on container walls. With a free microwave path and increasing deposit build-up, the output current decreases, giving an indication of the grade of build-up which can be evaluated.

Thus, deposit build-up can be detected early to avoid critical conditions and plant standstills.

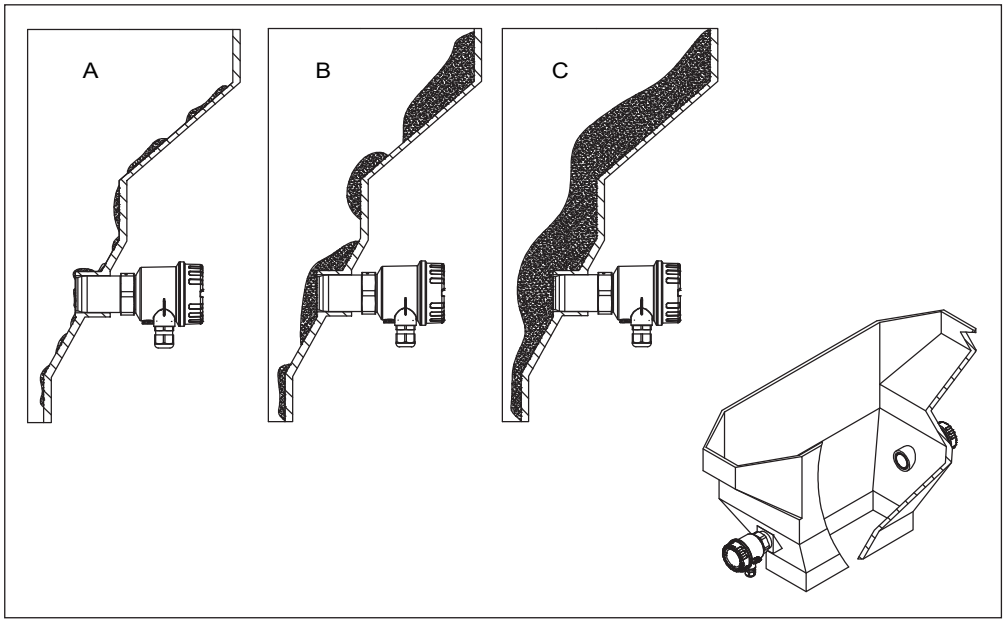



*Figure 3: Example build-up detection in an electrostatic filter*

*A Minimum build-up*
*B Medium build-up*
*C Strong build-up*

Notice!
- The mounting location must be selected such that application-specific influences are minimized.
- Mechanical protection of the devices (such as protection against larger falling product pieces) should be taken into account.
- Avoid interference from reflections off of metal parts.
- Details of the installation → page 13
- For optimal installation in the process, the FDR56/FQR56 devices of the microwave barrier can be extended with corresponding accessories such as weld-in nozzles, sight glasses or high temperature adapters for process separation (→ page 36).

## Safety

We shall only grant a guarantee if the device is installed and operated in accordance with the Operating Instructions. Safety measures in accordance with the user's safety standard, which provide additional protection for the device and its signal transfer, are to be implemented by the user.

## Safety instructions: General

- Staff must meet the following conditions for mounting, electrical installation, commissioning and maintenance of the device:
  - Be suitably qualified for their role and the tasks they perform
  - Be trained in explosion protection
  - Be familiar with national regulations (e.g. EN 60079-14)
- Install the device according to the manufacturer's instructions and any other valid standards and regulations.
- Do not operate the device outside the specified electrical, thermal and mechanical parameters.
- Only install the devices in media for which the wetted materials have sufficient durability.
- Modifications to the device can affect the explosion protection and must be carried out by staff authorized to perform such work by Kirchgaesser.

**Safety instructions: Special conditions**

Permitted ambient temperature range at the electronics housing:
-40°C (-40°F) ≤ Ta ≤ +70°C (+158°F)

**Safety instructions: Installation**

- Comply with the installation and safety instructions in the Operating Instructions.
- Install the device according to the manufacturer‘s instructions and any other valid standards and regulations (e.g. EN 60079-14).
- Pay attention to the maximum process conditions according to the manufacturer‘s Operating Instructions.
- To maintain the ingress protection of the housing IP66, install the housing cover and cable glands correctly.
- Seal unused entry glands with approved sealing plugs that correspond to the type of protection. The plastic transport sealing plug does not meet this requirement and must therefore be replaced during installation.
- Only rigidly laid lines and cables may be inserted. The operator must ensure corresponding strain relief.
- The maximum thermal load of the inserted lines and cables is to be observed.
- Signal output for connection to uncertified circuits with the following maximum values:
  - Potential-free relay contact:
    U~ max. 250 VAC, I~ max. 4 A or
    U= max. 125 VDC, I= max. 0.4 A or
    U= max. 30 VDC, I= max. 4 A
  - Current output:
    I = 4 - 20 mA, $R_L$ ≤ 600 Ω
  - Solid-state relay:
    U~ max. 30 VAC, I~ max. 0.4 A or
    U= max. 40 VDC, I= max. 0.4 A
- During operation, the cover must be screwed all the way in and the cover‘s safety catch must be fastened.

**Safety instructions: Zone 20**

- Only operate devices in potentially explosive vapour/air mixtures under atmospheric conditions:
  - Temperature: -40°C (-40°F) to +70°C (+158°F)
  - Pressure: 50 kPA (0.5 bar) to 680 kPA (6.8 bar)
- If no potentially explosive mixtures are present, or if additional protective measures have been taken, according to EN 1127-1, the transmitters may be operated under other atmospheric conditions in accordance with the manufacturer’s specifications.
- Only install the devices in media for which the wetted materials have sufficient durability (e.g. process connection seal).

**Safety instructions: Valid documentation**

Available certifications → page 46

# Input

| | |
|---|---|
| **Measured variable** | Absorption of the electromagnetic waves radiated by the FQR56 transmitter |
| **Measuring range (detection range)** | With an unobstructed radiation path between the FQR56 transmitter and the FDR56 transceiver, the maximum range is 100 m. The range also depends on the container walls to be penetrated. |
| **Operating frequency** | 24.15 GHz ± 80 MHz |
| **Transmitting power** | The power produced is maximum 100 mW e.i.r.p. (equivalent isotrope radiation performance).<br>• Power density directly in front of the device: Approx. 1 mW/cm²<br>• Power density at a distance of 1 m: Approx. 0.3 µW/cm²<br><br>Notice!<br>The power density is clearly below the recommended limit values of the ICNIRP guidelines "*Guidelines for Limiting Exposure to Time-Varying Electric, Magnetic, and Electromagnetic Fields (up to 300 GHz)*" and thus is completely harmless for humans. |
| **Switching frequency** | max. 2 Hz |
| **Antenna opening angle (3 dB)** | approx. ± 9° |

# Output

## Terminal and connector assignment FDR56

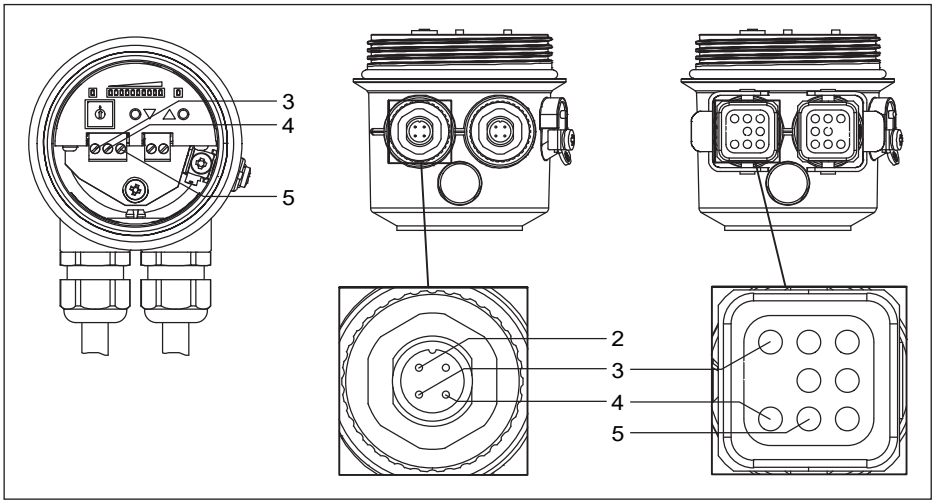
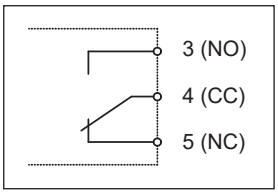



*Figure 4: Terminal and connector assignment of the signal output*

## Relay

- Potential-free change-over contact
- Switching capacity:
  250 VAC / 4 A (Harting connector type HAN8D max. 50 VAC), 125 VDC / 0.4 A or 30 VDC / 4 A
- Contact material: AgCdO (gold-flashed)
- Switching frequency: max. 4 Hz

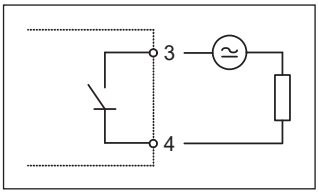



| Electrical connection | Relay | | |
|---|---|---|---|
| Connection terminals | Terminal 3 (NO) | Terminal 4 (CC) | Terminal 5 (NC) |
| M12 connector (Binder series 713/763) | Connector 2 | | |
| | Contact 2 (NO) | Contact 3 (CC) | Contact 4 (NC) |
| Harting connector type HAN8D | Connector 2 | | |
| | Contact 3 (NO) | Contact 4 (CC) | Contact 5 (NC) |

Notice!
- The contact material is also suitable for switching small signal circuits. However, this is possible only if no inductive loads or higher currents have been switched previously.
- The solid-state relay can be used to evaluate higher switching frequencies.

## Solid-state relay

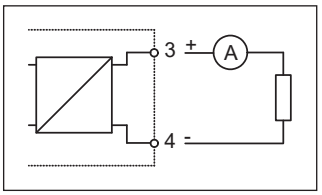
- Switching contact of a semiconductor relay
- Switching capacity:
  30 VAC / 0.4 A or 40 VDC / 0.4 A
- Switching frequency: max. 4 Hz




| Electrical connection | Solid-state relay |
|---|---|
| Connection terminals | Terminal 3 − 4 |
| M12 connector (Binder series 713/763) | Connector 2, contact 3 − 4 |
| Harting connector type HAN8D | Connector 2, contact 3 − 4 |

## Current

- Current output 4 ... 20 mA
- Active
- Max. load: 600 Ω




| Electrical connection | Stromausgang |
|---|---|
| Connection terminals | Terminal 3 (+) − 4 (−) |
| M12 connector (Binder series 713/763) | Connector 2, contact 3 (+) − 4 (−) |
| Harting connector type HAN8D | Connector 2, contact 3 (+) − 4 (−) |

Notice!
The value of the current output corresponds to the signal strength.

# Power supply

## Terminal and connector assignment

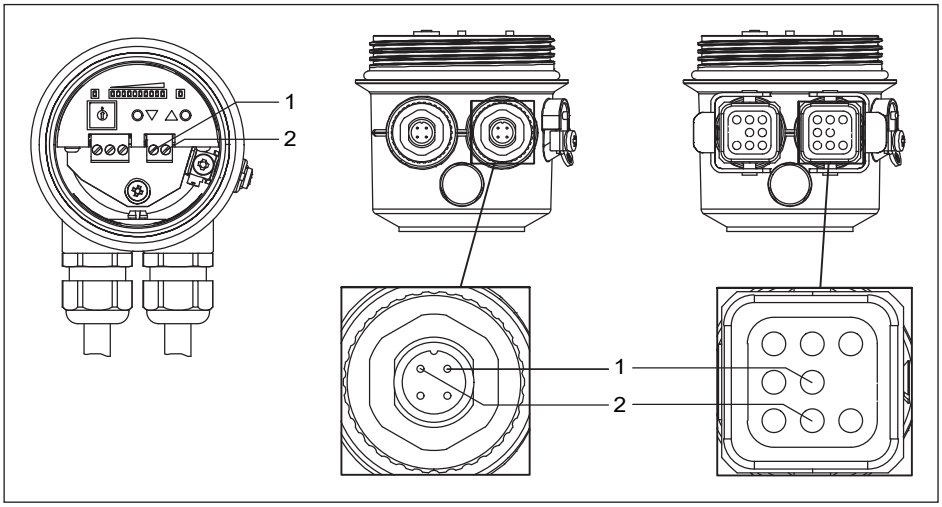



*Figure 5: Terminal and connector assignment of the power supply (example FDR56)*

| Electrical connection | Power supply |
|---|---|
| Connection terminals | Terminal 1 − 2 |
| M12 connector (Binder series 713/763) | Connector 1, contact 1 − 2 |
| Harting connector type HAN8D | Connector 1, contact 1 − 2 |

A suitable wire (→ page 11) is used to connect the FDR56/FQR56 to the power supply.

## Supply voltage

- 85 ... 253 VAC, 50/60 Hz
- 20 ... 60 VDC or 20 ... 30 VAC, 50/60 Hz

Notice!
- The polarity of the supply voltage can be set as required.
- When using the public powers supply, install an easily accessible power switch in the proximity of the instrument. Mark the power switch as a disconnector for the instrument (EN/IEC 61010).
- You should use a fuse to protect the power supply against short-circuit.
- The electrical connection with Harting connector type HAN8D is only available for the power supply with 20 ... 60 VDC or 20 ... 30 VAC, 50/60 Hz.

## Power consumption

- FQR56:
  - max. 2.5 VA (85 ... 253 VAC, 50/60 Hz)
  - max. 1 W (20 ... 60 VDC) or 1.2 VA (20 ... 30 VAC, 50/60 Hz)
- FDR56:
  - max. 4.8 VA (85 ... 253 VAC, 50/60 Hz)
  - max. 2.2 W (20 ... 60 VDC) or 3 VA (20 ... 30 VAC, 50/60 Hz)

## Potential equalization

Requirements:
- The potential equalization should be connected to the outer ground terminal.
- For optimum electromagnetic compatibility, the potential matching line should be as short as possible.
- The recommended minimum cable cross-section is 2.5 $mm^2$.
- Potential equalization of the FDR56/FQR56 should be incorporated in the local potential equalization.

Notice!
For devices intended for use in hazardous locations, please observe the safety instructions (→ page 5).

**Terminals**

Max. 1.5 mm²

**Cable entries**

- Cable gland M20 x 1.5 or cable entry ½ NPT
- Degree of protection: min. IP66
- Cable gland for non-hazardous areas:
  - Material: Plastic
  - Color: gray
  - Clamping range: 5 to 10 mm (EN 61444) or 7 to 10 mm (UL-514 B)
- Cable gland for hazardous areas:
  - Material: Nickel-plated brass
  - Color: silver
  - Clamping range: 7 to 10.5 mm
- Quantity: 2 pieces per device

Notice!
The cable gland is only admissible for the connection of fixed-installation lines and cables. The operator must ensure corresponding strain relief.

**Device connector**

- M12 connector (Binder series 713/763)
- Harting connector type HAN8D

Notice!
- Suitable mating connectors are available as an order variant (→ page 33).
- Suitable mating connectors and prefabricated connection cables are available as accessories (→ page 36).

**Cable specification**

- Normal installation cable is sufficient
- Conductor cross-section: max. 1.5 mm²

# Performance characteristics

**Reference operating conditions**

Every application is different in terms of its shape (such as influential reflexion edges), medium as well as the properties of the medium (such as attenuation and moisture levels) and therefore always requires an individual basic setup of the microwave barrier.

**Influence of ambient temperature**

The ambient temperature has no direct influence on the measuring system (devices are temperature-compensated internally).

**Vibration effects**

Vibration resistance – continuous load with sliding frequency in accordance with EN 60068-2-6:
- -40 to +80°C (-40 to +176°F)
- Excitation: Sine
- Frequency range: 10 to 55 Hz
- Amplitude: 0.75 mm
- Throughput speed: 1 octave per minute
- Test axes: Three directions (X, Y, Z)
- Number of frequency cycles: 20 per axis
- Test duration: Approx. 1 h 38 min per axis
- Test temperature: Room temperature

# Installation

## Mounting location

The mounting location must be selected such that application-specific influences are minimized.

Notice!
- Mechanical protection of the devices (such as protection against larger falling product pieces) should be taken into account.
- Depending on the installation locations, different process adapters are available as accessories (→ page 36).
- For devices intended for use in hazardous locations, please observe the safety notes.

## Orientation

The installed position of the microwave barrier is generally arbitrary, but transmitter FQR56 and transceiver FDR56 must face each other within the detection range (maximum angle between both devices (angle of radiation) = 9°).

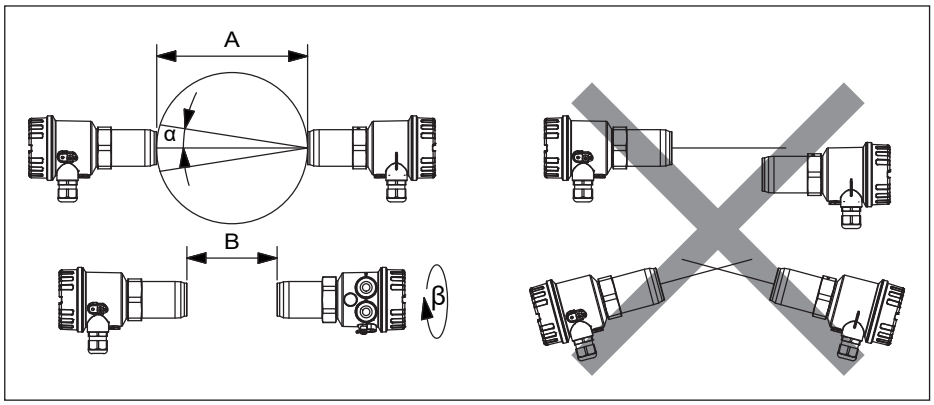



*Figure 6: Orientation*

*A Detection range 0.3 ... 100 m*
*B Detection range 0.03 ... 0.3 m*
*α Angle of radiation approx. 9°*
*β 90°*

## Installation instructions

- Since the microwaves are polarised, the FQR56 and FDR56 must not be out of alignment with one another along their longitudinal axis (exception: They may be installed at an angle of 180° relative to one another or 90° if the detection range is under 500 mm).
- A minimum distance of 30 mm should be maintained between the FQR56 and the FDR56.
- If the detection range is under 500 mm, the FQR56 and FDR56 should be installed at an angle of 90° relative to one another to avoid possible overrangings.

## Improvement of signal quality

An improvement of signal quality can be attained by installing the FQR56 transmitter and FDR56 transceiver so that they can be moved along their longitudinal axis.

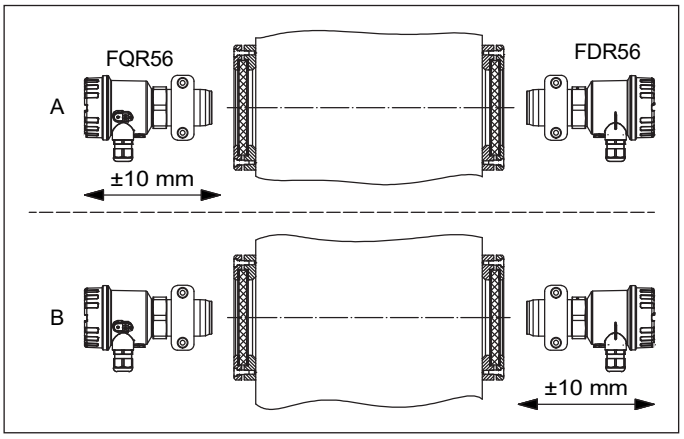



*Figure 7: Improvement of signal quality*

Notice!
Following any repositioning of the devices (horizontal in this case), a new setup should be performed.

## Using reflectors

If structural design factors do not allow the FQR56 and FDR56 to be installed directly opposite one another, the microwave beam can be redirected by means of flat metal mirrors (reflectors).

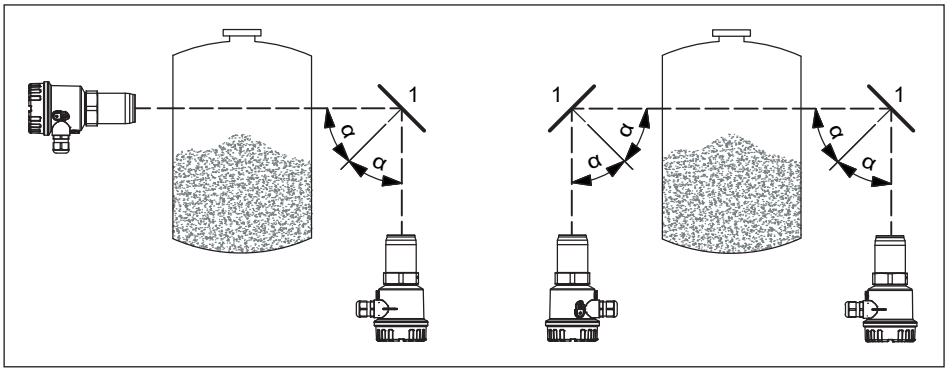



*Figure 8: Using reflectors*

*1 Reflector*
*α Angle of entrance = angle of emission*

Notice!
- Please note that the FQR56 and FDR56 must be positioned symmetrically with respect to the reflector (angle of entrance = angle of emission), as otherwise the FDR56 will not receive a signal that it can evaluate.
- Using reflectors reduces the range of the microwave barrier by approximately 10% per reflector.

## Parallel mode

In practice, in some instances, multiple microwave barriers are to be operated in parallel at one location (e.g. for multiple level limit detections in a pipe). To prevent the microwave barriers from influencing each other, you can select a separate channel (1 to 5) for each microwave barrier at the FQR56. Additionally, every second microwave barrier should be rotated by 90 °.

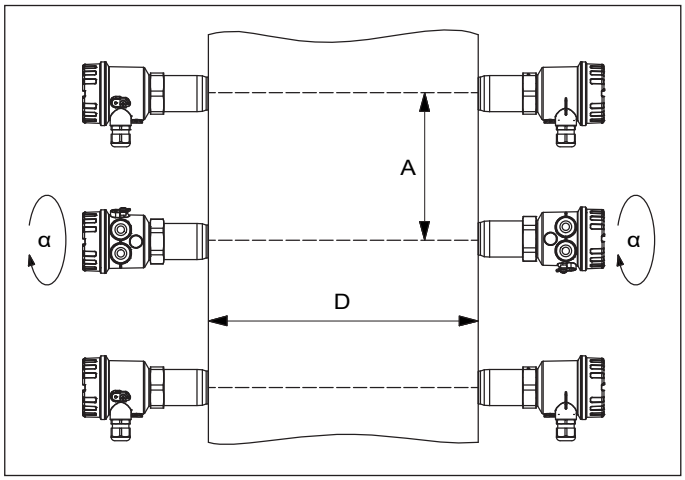



*Figure 9: Parallel mode*

*A Distance between microwave barriers*
*D Detection distance*
*α 90°*

When using different channels (operating frequencies) and operation as shown in the example for parallel operation, the following dependency of the detection distance **D** to the distance **A** of the individual microwave barriers applies.

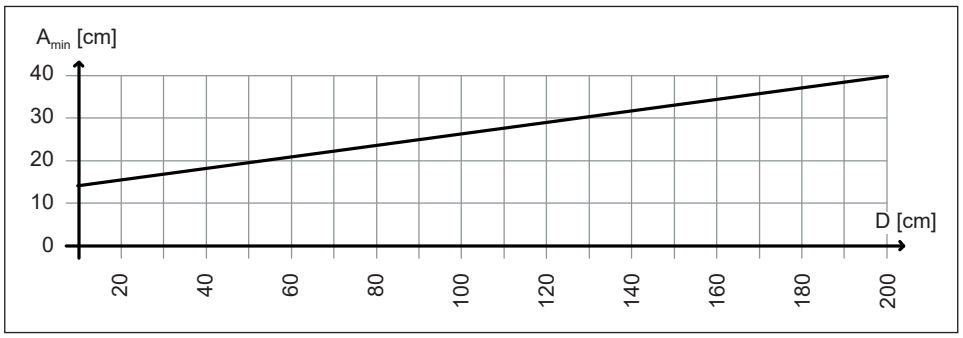



*Figure 10: Dependency of detection distance to the distance of the microwave barriers*

Notice!
- Use the channels in sequential order, i.e. 1, 2, etc. to 5, then back to 1, etc.
- No settings are necessary on the FDR56 transceiver.
- Details on the settings → page 29

## Installation instructions

The FDR56/FQR56 comes with a standard thread (R 1½ as per EN 10226, 1½ NPT as per ANSI/ASME B1.20.1 or G 1½ as per ISO 228-1) as a process connection. This enables easy installation in existing container couplings or nozzles. For optimal orientation after installation in the process, the electronics housing can be rotated as desired (by 360°).

### Installation with self-sealing connection thread (R 1½ and 1½ NPT)

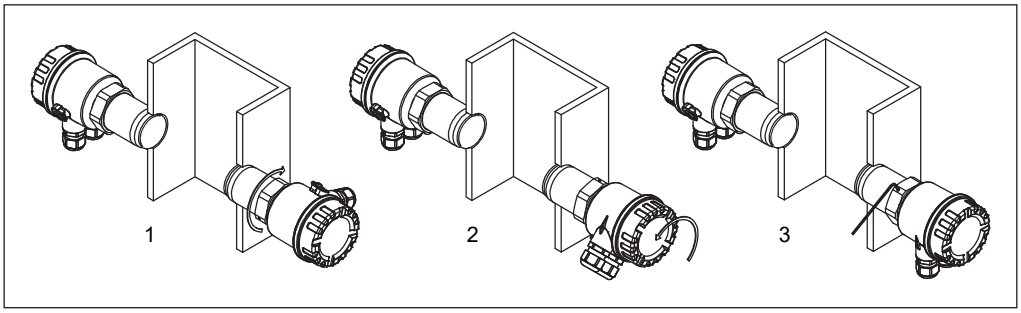



*Figure 11: Installation with self-sealing connection thread*

1. Turn self-sealing connection thread R 1½ or 1½ NPT into the process (SW55 hexagon).
2. Align electronic housing.
3. Secure the housing (2.5 mm hex socket).

### Installation with non-self-sealing connection thread (G 1½)

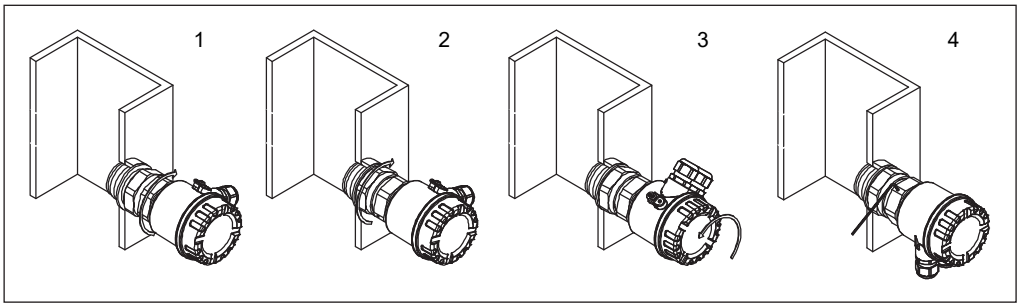



*Figure 12: Installation with non-self-sealing connection thread*

1. Screw non-self-sealing connection thread G 1½ with the enclosed process seal into the process (hexagon 55 AF).
2. Tighten the counter nut of the thread (also hexagon 55 AF).
3. Align electronic housing.
4. Secure the housing (2.5 mm hex socket).

Notice!
- If the process connection is not screwed far enough into the process wall, there is a risk that material will accumulate in front of the FDR56/FQR56 and cause attenuation of the microwave signal.
- If, on the other hand, the process connection is screwed too far into the process, there is a risk of damage due to large falling product pieces.

## Direct mounting with threaded connection

The simplest mounting method is by screwing into the process wall. To do this, a corresponding internal thread (Rp 1½, 1½ NPT or G 1½) must be available in the process.

Notice!
- Weld-in adapters of type FAR52-A*, with corresponding internal thread, are available as accessories.
- If the internal threads available in the process wall are different (R 2 to R 4 or 2 NPT to 4 NPT), additional screw-in adapters of type FAR52-B* are available as accessories.
- Accessories → page 36

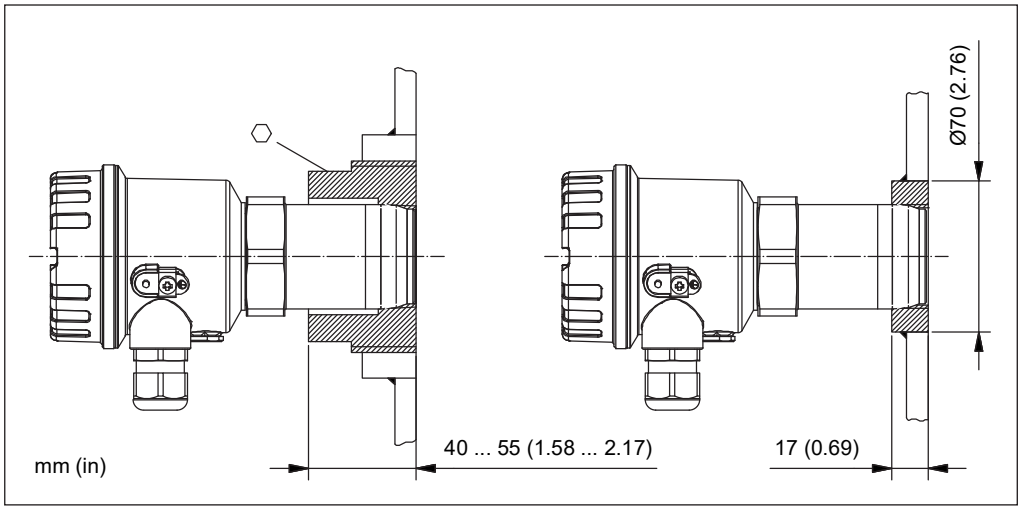



*Figure 13: FAR52 weld-in or screw-in adapter*

With direct mounting in the process wall, it must be ensured that the front edge of the process connection is flush with the internal edge.

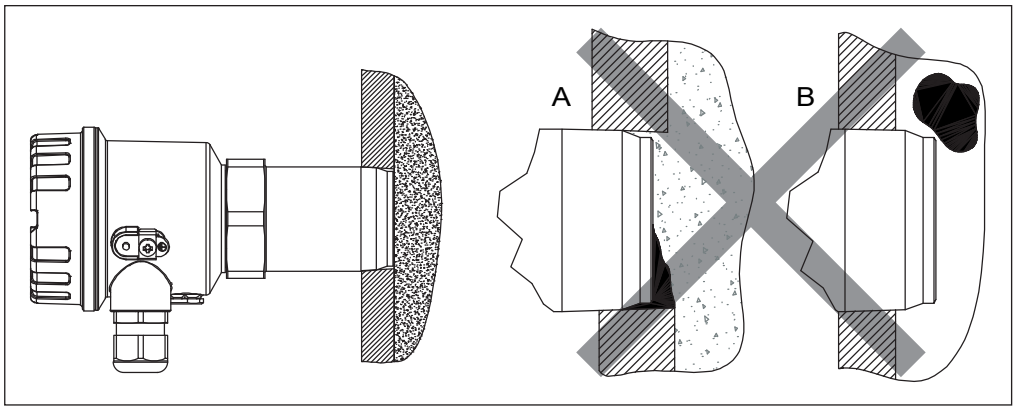



*Figure 14: Direct mounting with threaded connection*

Notice!
- If the process connection is not screwed far enough into the process wall (**A**), there is a risk that material will collect in front of the devices and cause attenuation of the microwave signal.
- If, on the other hand, the process connection is screwed too far into the process (**B**), there is a risk of damage due to large falling product pieces.
- When using the G 1½ -process connection (standard thread to ISO 228-1, hexagon 55 AF) with integrated counter nut, the devices can be flush mounted especially easily, as a parallel thread is used.

## Mounting with high pressure adapter

For applications with a high process pressure up to 2 MPa (20 bar) absolute, we recommend the following high pressure adapter (accessories → page 39).

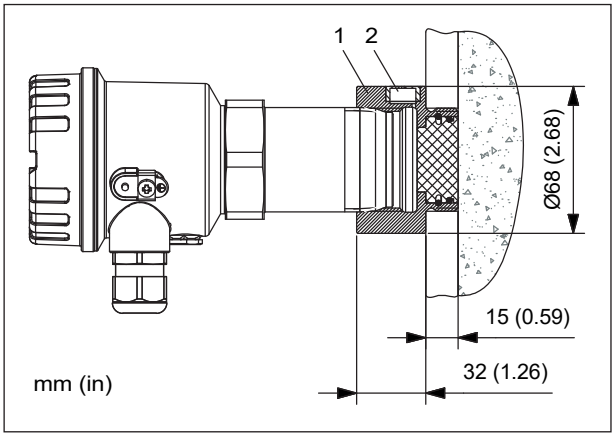



*Figure 15: Mounting with high pressure adapter*

Notice!
The maximum temperature at the FDR56/FQR56 must be observed.

## Mounting in front of microwave-impermeable process wall

If, due to the process conditions (such as high temperatures, high pressures or hazardous nature of the material), no direct installation in the microwave-impermeable process wall is possible, the microwave barrier can emit its signal through an additionally installed plug.

The following materials have been tested and are suitable for radiation:
- Plastics (virginal, unfilled) such as polytetrafluorethylene (PTFE), polyethylene (PE) or polypropylene (PP)
- Aluminum oxide ceramic (purity min. 99.5 %, uncoloured)
- Borosilicate glass (uncoloured)

Notice!
Colorations or added (coloured) substances can cause a potentially high signal attenuation, depending on the material, and are therefore not suitable for this purpose.

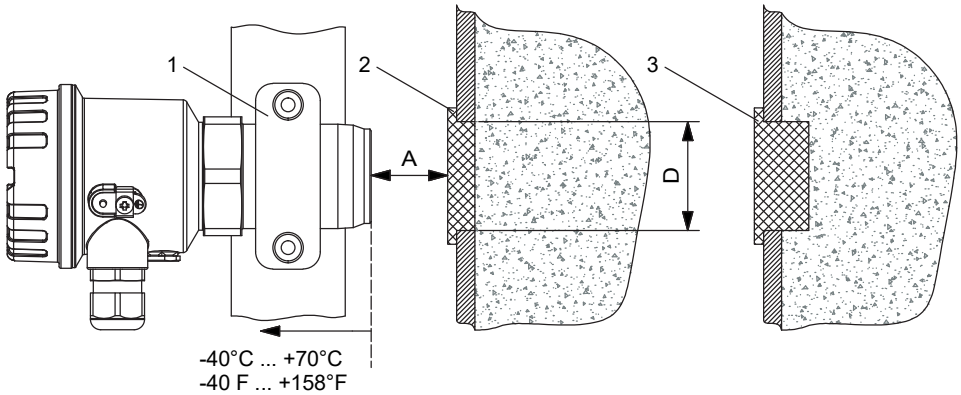



*Figure 16: Bracket mounting in front of a microwave-impermeable process wall*

*1 Bracket*
*2 Microwave-permeable plug*
*3 Microwave-permeable plug on formation of condensate on the inner wall*

Notice!
- With bracket mounting in front of a microwave-permeable plug and the risk of the formation of condensate on the inner wall of the container, we recommend a plug protruding into the process.
- The maximum temperature at the FDR56/FQR56 must be observed.
- Distance **A** is based on the free transition area **D**. To prevent possible signal attenuation, we recommend keeping the distance as short as possible (e.g. max. 40 mm at DN50).
- Suitable mounting brackets made of plastic or aluminum are available as accessories (→ page 36).
- Suitable plugs made of PTFE or aluminum oxide ceramic of type FAR54 are available as accessories in different lengths and diameters (→ page 39).

## Mounting in front of microwave-permeable sight glass fitting

If the process wall is not permeable, it is possible to have the microwave barrier emit its signal from outside through a suitable sight glass fitting. The sight glass in this fitting is made of uncoloured borosilicate glass.

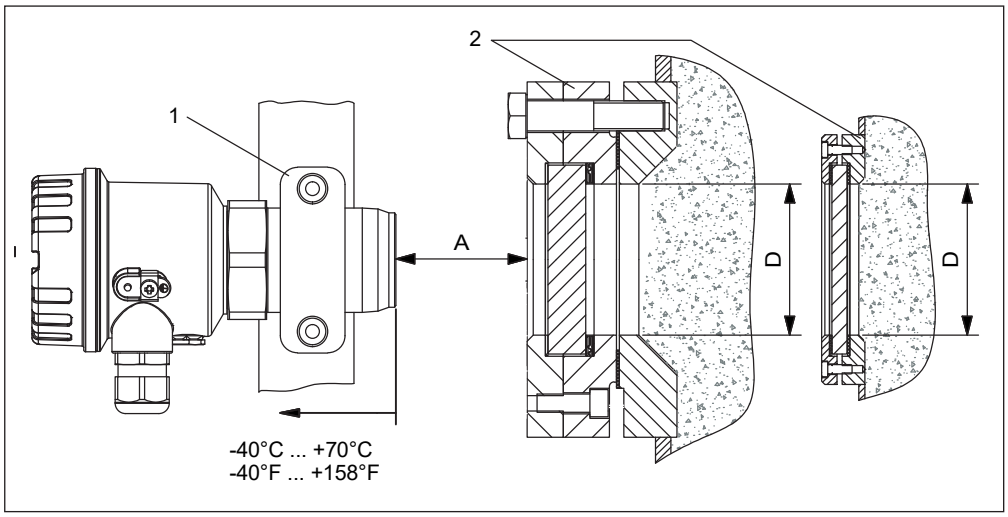



*Figure 17: Bracket mounting in front of microwave-permeable sight glass fitting*

*1 Mounting bracket*
*2 Sight glass*

Notice!
- Distance **A** is based on the free transition area **D** and the temperature in this area. To prevent possible signal attenuation, we recommend keeping the distance as short as possible (e.g. max. 40 mm at DN50).
- Sight glass fittings should in principle only be installed at places where no material can collect on the process side (danger of faulty measurements).

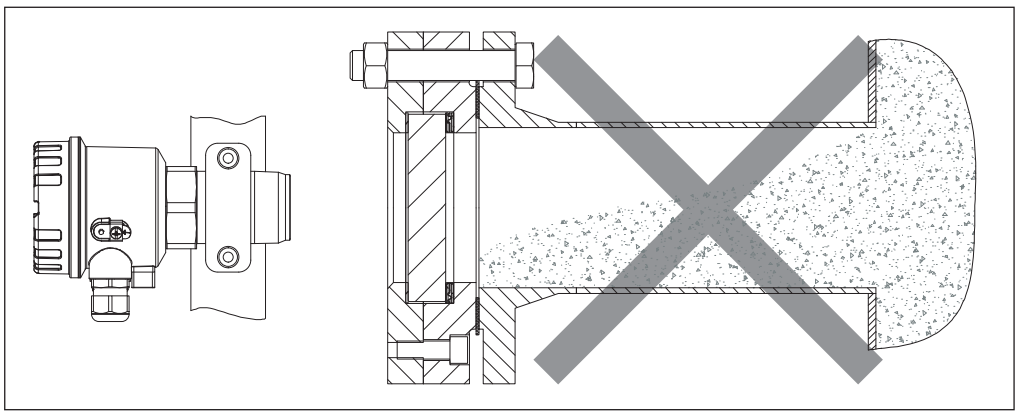


*Figure 18: Impermissible mounting with the risk of material collection*

## Mounting on process nozzles

Mounting on a process nozzle offers the following advantages:
- By using available nozzles, no modifications of the process are required.
- The use of suitable plugs can prevent material from collecting in the nozzle.
- At the same time, the plug acts as wear protection for the devices and can be replaced easily in the event of significant wear.
- Mounting or disassembly of the devices can be carried out during ongoing operation, which significantly simplifies the service process.

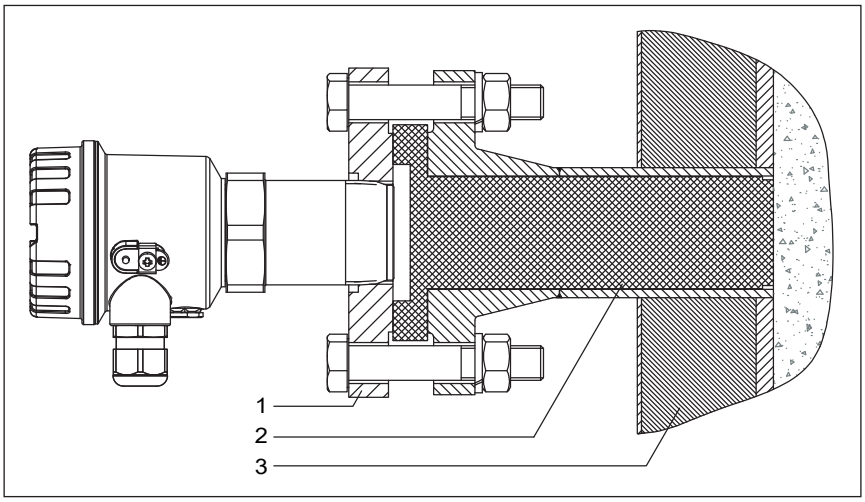



*Figure 19: Mounting on available process nozzles*

*1 Mounting flange*
*2 Plug*
*3 Process insulation*

Notice!
- Suitable mounting flanges with corresponding connection threads made of stainless steel and plugs made of PTFE or aluminum oxide ceramic of type FAR54 for the available process nozzles are available as accessories.
- Process nozzles of type FAR50, consisting of connection nozzle, plug and mounting flange, are available as accessories in different sizes and materials.
- For non-vertical process walls, we recommend mounting the process nozzle far enough into the process that no material can collect in front of it (**A**).
- For process nozzle mounting and when there is a risk of material building up on the inner wall of the container, we recommend a nozzle that protrudes into the process (**B**).
- The maximum plug length is dependent on the attenuation and water absorption of the material. Please note the manufacturer's instructions in this regard.

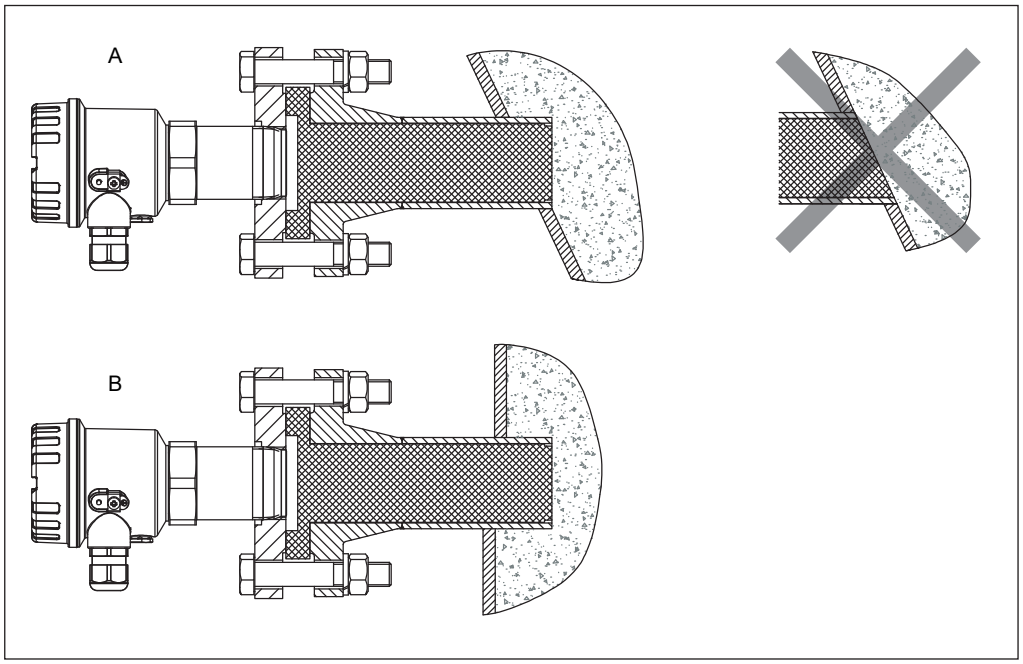



*Figure 20: Mounting with the risk of accumulations*

Notice!

- When there is a risk of condensate forming between the process connection of the FDR56/ FQR56 and the plug, we recommend using the process nozzle type FAR50 (→ page 43), which is equipped with a mounting flange with a pressure equalization element.
- For process temperatures of +70 to +450°C (+158 to +842°F), plug-in adapters for stainless steel flange nozzles of type FAR51 are available as accessories (→ page 43).

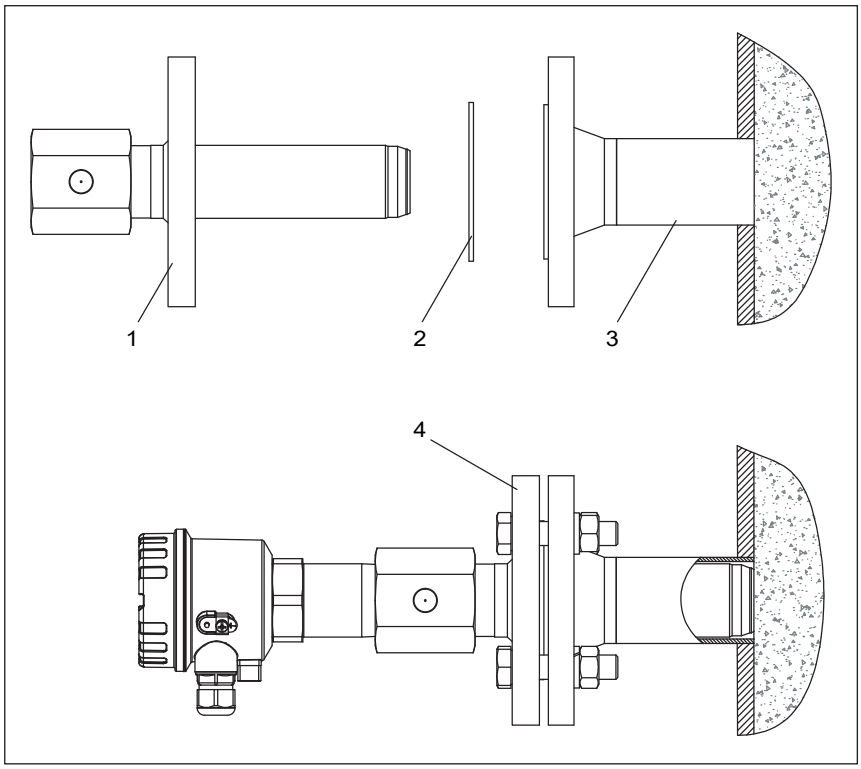



*Figure 21: Mounting with FAR51 insertion adapter*

*1 Insertion adapter*
*2 Customer-supplied gasket*
*3 Process nozzle*
*4 Customer-supplied installation material*

## Mounting with high temperature adapter and length extensions

For simple and easily accessible high temperature applications in the range from +70 to +450°C (+158 to +842°F) there is a simple adapter with flush-mounted aluminum oxide ceramic, which can be extended with length extensions.

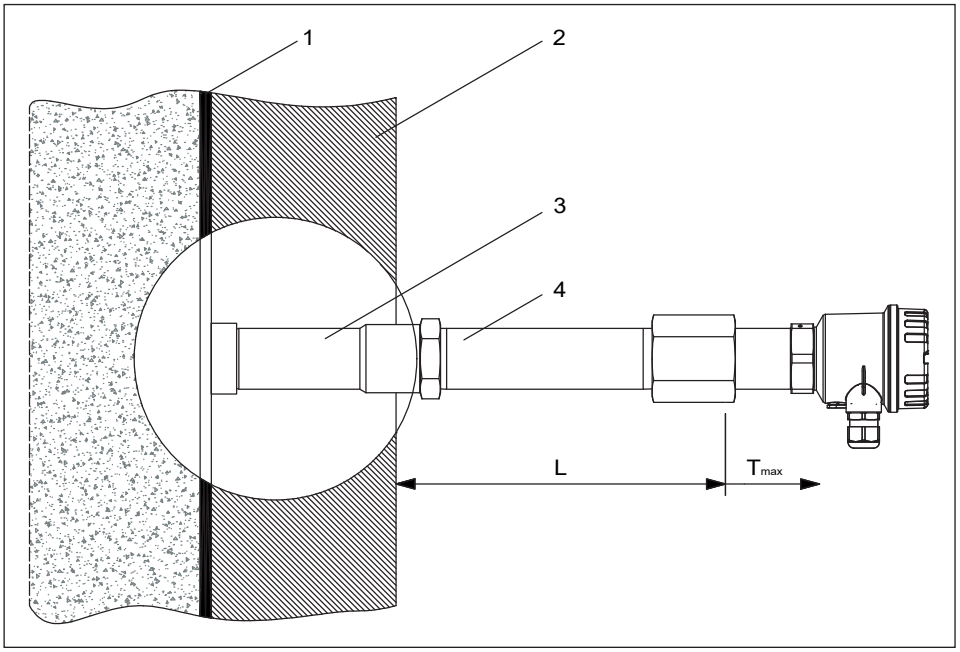



*Figure 22: Mounting with high temperature adapter and length extensions*

*1 Wall*
*2 Insulation*
*3 High temperature adapter*
*4 Extension*

Notice!
- The maximum process pressure of 80 to 510 kPa (0.8 to 5.1 bar) abs. at the high temperature adapter must be observed.
- The maximum temperature **Tmax** of +70°C (+158°F) at the process connection of FDR56/FQR56 devices must be observed (**L** is to be selected according to the process and ambient temperatures), exceeding this temperature will cause destruction.
- Suitable high temperature adapters and length extensions made of stainless steel are available as accessories (→ page 45).

## Mounting with spacer tube (wave guide)

For many processes, mounting with a spacer tube is a simple and cost-effective way of separating the devices of the device from the high process temperatures of +70 to +450°C (+158 to +842°F).

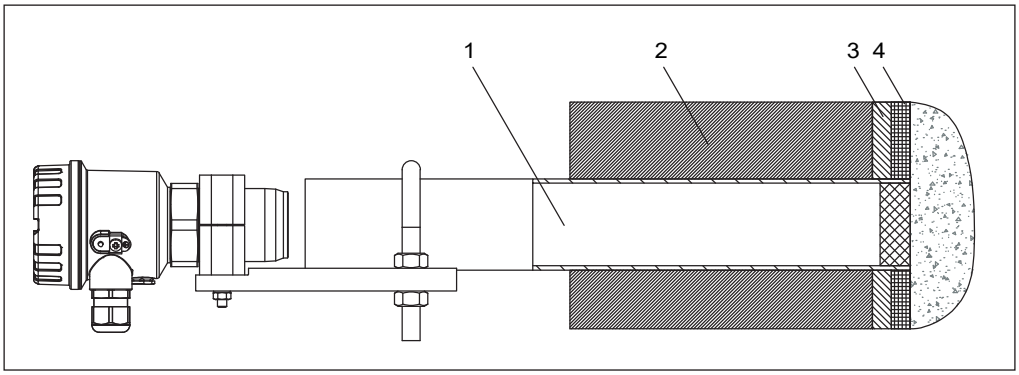



*Figure 23: Mounting with spacer tube*

*1 Spacer tube*
*2 Process insulation*
*3 Container wall*
*4 Inner lining*

The spacer tube can be secured in place in various ways, depending on the application conditions (e.g. screwed into the process wall, bolted-on mounting brackets, welded or clamped to available cross beams).
We also recommend this mounting method for processes that are lined with clay or similar materials on the inside. The spacer tube can be glued into place, for example.

Notice!
- Suitable spacer tubes of type FAR53, made of steel or stainless steel, are available as accessories in different versions (→ page 44).
- When there is a risk of condensate forming in the spacer tube, we recommend using process nozzle type FAR50 (→ page 43), which is equipped with a mounting flange with a pressure equalization element.

For structural or space reasons, it may be necessary to mount the FDR56/FQR56 devices at an angle to the planned mounting location. In this case, a spacer tube can be used as a wave guide, meaning that no additional signal attenuation occurs due to the wave guide effect.

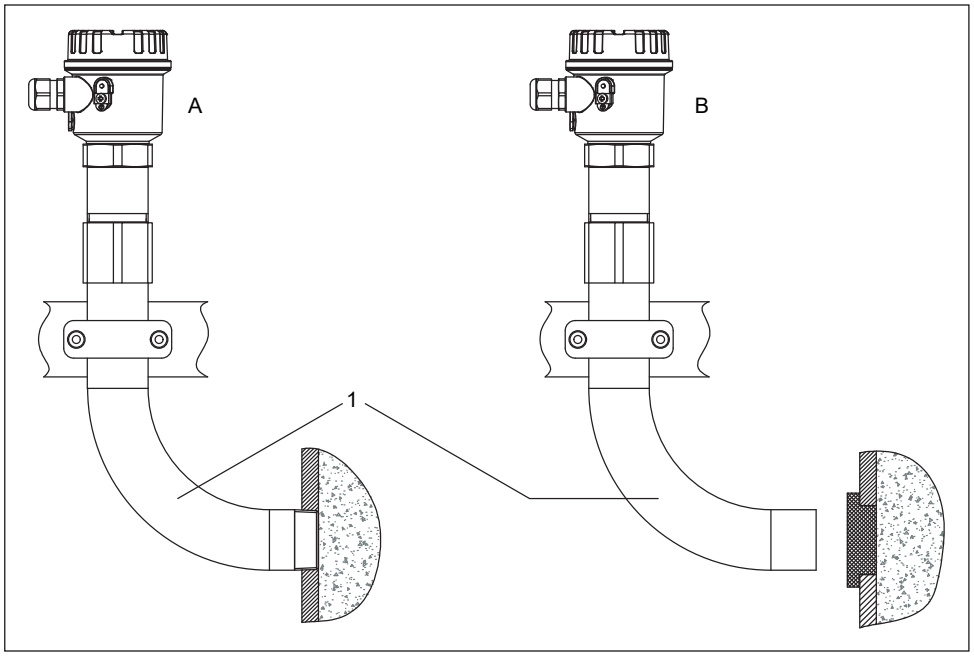



*Figure 24: Mounting with wave guide*

*A Mounting directly in the process with connection thread*
*B Mounting in front of the process plug without connection thread*
*1 Wave guide*

Notice!
- The pipe can be made of any desired metallic material.
- Edges inside the pipe (for example at transitions) can cause signal attenuation and thus should be avoided wherever possible.
- Suitable stainless steel wave guides of type FAR55 are available as accessories in different versions (→ page 44).

## Environment

| | |
|---|---|
| **Ambient temperature** | -40 to +70°C (-40 to +158°F) |
| **Storage temperature** | -40 to +80°C (-40 to +176°F) |
| **Degree of protection** | • IP66 (with closed housing)<br>• IP20 (with open housing) |
| **Vibration resistance** | see vibration influence (→ page 12) |
| **Electromagnetic compatibility (EMC)** | • Interference emission to EN 61326, Electrical Equipment Class B<br>• Interference immunity to EN 61326, Appendix A (Industrial)<br>• Normal installation cable is sufficient for the wiring. |

# Process

| | |
|---|---|
| **Process temperature** | • Without optional process adapter: -40 to +70°C (-40 to +158°F)<br>• With optional high temperature adapter: -40 to +450°C (-40 to +842°F)<br>• Note deviating temperature ranges with the accessories offered! |
| **Process pressure range** | • 50 to 680 kPa (0.5 to 6.8 bar) absolute, only to be observed with device installed directly in the process<br>• 80 to 510 kPa (0.8 to 5.1 bar) absolute, with use of the optional high temperature adapter<br>• 50 to 2000 kPa (0.5 to 20 bar) absolute, with use of the optional high pressure adapter<br>• Note deviating pressure ranges with the accessories offered. |
| **Vibration** | see vibration influence (→ page 12) |

# Mechanical construction

## Dimensions

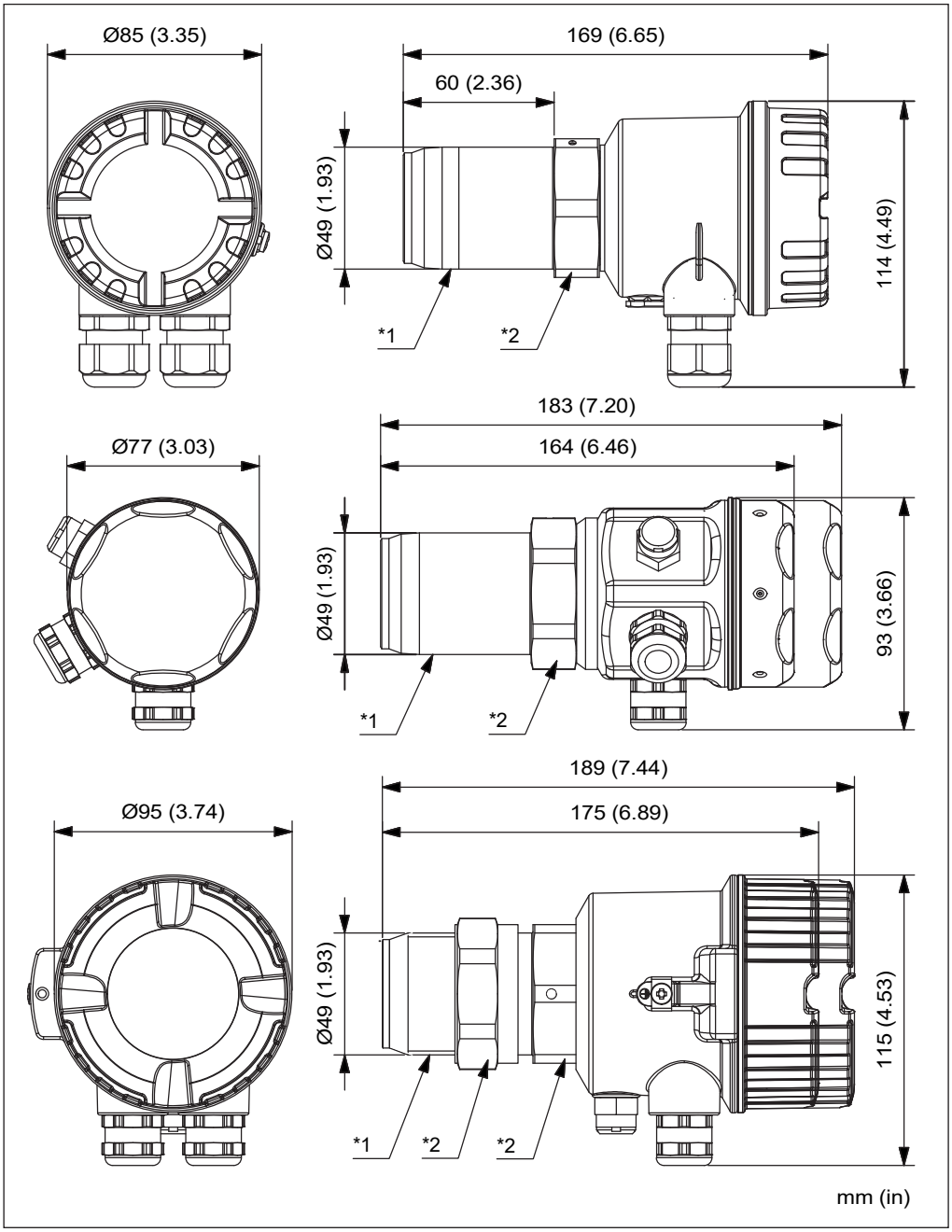



*Figure 25: Dimensions*

*1 Connection thread R 1½, 1½ NPT or G 1½*
*2 Hexagon SW55*

## Weight

0.7 to 1.7 kg (1.54 to 3.75 lbs), depending on the selected housing and process connection

Notice!
On device variants with connector and extended ordering option “Electronics, encapsulated” (→ page 34) the weight increases by 0.2 kg (0.44 lbs).

**Materials**

- Stainless steel 316Ti (1.4571):
  - Process connection
  - Pressure equalization element (housing made of stainless steel and aluminum)
- Stainless steel 316L (1.4435):
  - Housing
  - Adapter ½ NPT (housing made of stainless steel and aluminum)
- Aluminum:
  - Housing
- Plastic:
  - Housing
  - M20 cable gland, adapter ½ NPT and pressure equalization element (housing made of plastic)
- Die-cast zinc:
  - M12 connector, nickel-plated
  - Harting connector, powder-coated
- Brass, nickel-plated:
  - M20 cable gland (housing made of stainless steel and aluminum)

**Process connections**

Connection thread:
- R 1½ in accordance with EN 10226
- 1½ NPT in accordance with ANSI/ASME
- G 1½ in accordance with ISO 228-1

# Operability

By using frequencies in the 24 GHz range, products with low attenuation can be detected, even if the product quantities are low. The calibration options for the microwave barrier offer the necessary flexibility to ensure that the devices can be easily adapted to the application:

- Adjustable sensitivity
- Switchable limit signal function:
  - Switch point exceeded = max. safety or
  - Switch point not reached = min. safety
- Adjustable switching hysteresis (not for current output)
- Switching delay (not at current output):
  - 100 ms to 20 s
  - Response and drop-out delay, can be selected separately
- LED field strength indicator as an adjustment and positioning aid

## Operating concept FDR56

The microwave barrier is configured on the FDR56 using a function selection switch (encoding switch) and two operating buttons. With these, among other things, the adjustment of the sensitivity is carried out for clear and unambiguous limit detection of the product. Upon sufficient attenuation, the microwave barrier reacts with a corresponding output signal.

The parameter configuration is stored internally and is retained even after the supply voltage is disconnected. No other operator intervention is necessary during operation. The adaptation to the application is required during initial installation only. However, subsequent changes can be made and stored at any time.

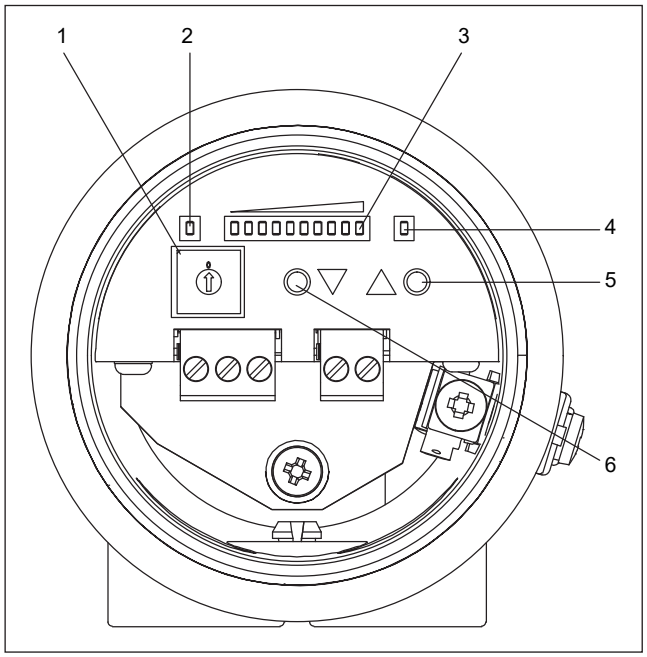



*Figure 26: Display and control elements of the FDR56*

*1 Rotary coding switch function selection*
*2 LED operate (green)*
*3 Bar graph*
*4 LED switch output (yellow)*
*5 Operation key (+)*
*6 Operation key (-)*

## Display

The signal strength as well as the configured values (in the function selection) are displayed locally using a bar graph display. In addition, a green LED indicates that the device is ready to operate (supply voltage is present) and a yellow LED displays the status of the switch output (LED off: relay in rest position, solid-state relay high-impedance).

## Signal output FDR56

The following overview exemplarily shows the behaviour of the possible signal outputs with regard to the display of the signal strength during overshoot or undercut (depending on the chosen switching behaviour, here minimum safety) of the limit (with an optimally performed synchronization).

| Limit | Signal strength | LED switch output | Signal output | | |
|---|---|---|---|---|---|
| | | | Relay | SSR | 4-20 mA |
|  |  |  | Contact 3-4 closed | Contact closed (low-resistance) | 20 mA |
|  |  |  | Contact 4-5 closed | Contact open (high resistance) | 4 mA |

Notice!
The value of the current output corresponds to the signal strength (1 LED ≙ 1.6 mA).

## Operating concept FQR56

To prevent intermodulation interference from microwave barriers operated close to each other, different channels (operating frequencies) for parallel operation (→ page 14) can be configured with the rotary coding switch on the FQR56 transmitter.

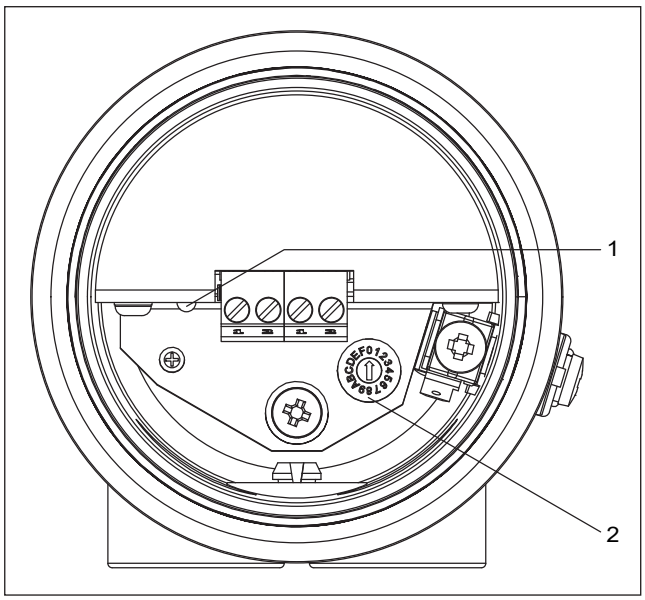



*Figure 27: Display and control elements of the FQR56*

*1 LED operate (green)*
*2 Rotary coding switch parallel operation*

The green LED shows the operative readiness of the device (power supply present).

## Local operation

### Transceiver FDR56

Parameter configuration on the FDR56 is performed as follows:

1. Select any function (the available functions can be found in the section “Programming functions”)
   → Encoding switch (1) = 1 to F
   → The display shows the selected function for two seconds.
   Example function 3: 
2. Setting the selected function
   Example: Function 3 (manual adjustment of the sensitivity on free radiation path)
   → Using the (6) ▼ key, the sensitivity can be reduced in 10% increments.
   
   → Using the (5) ▲ key, the sensitivity can be increased in 10% increments.
   
3. The configured value is stored as soon as the function is switched. The value can be displayed again at any time by selecting the corresponding programming function and changed if necessary.
4. Once parameter configuration is complete (i.e. once the microwave barrier has been adapted to the bulk solids in question), the encoding switch must be returned to the “0” position. The FDR56 is now ready for operation.

Notice!
- Toggling the encoding switch position unequal “0” (function selection) puts the FDR56 into parameter configuration mode. The limit detection continues to work in the background, changed settings are taken into account directly.
- Remember to set the encoding switch to position “0” (= operation) when you have finished configuring settings.
- For current output, the yellow LED (4) has no function and remains off.

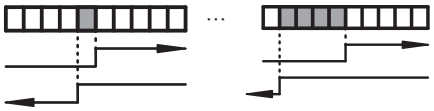
### Transmitter FQR56

The different channels (operating frequencies) can be select by rotating the coding switch as follows.

| Channel | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|
| Switch position |  |  |  |  |  |

Notice!
- Use the channels in sequential order, i.e. 1, 2, etc. to 5, then back to 1, etc.
- The switch positions 5 ... F are without function, the channel resembles switch position 0 in these settings.

## Parameterisation functions

| Function/meaning | Value range |
|---|---|
| 1 =  <br>Automatic adjustment of the sensitivity with free radiation path | — |
| 2 =  <br>Automatic adjustment of the sensitivity with covered radiation path | — |
| 3 =  <br>Manual adjustment of the sensitivity (upper limit, 10% increment/LED) | Upper limit from function 1:<br>  minimum<br>…<br>  maximum |
| 4 =  <br>Manual adjustment of the sensitivity (lower limit, 10% increment/LED) | Lower limit from function 1:<br>  minimum<br>…<br>  maximum |
| 5 =  <br>Hysteresis setting |  |
| 6 =  <br>Selection of the limit signal function (Min./Max. safety, relay output only) |  Relay switches when microwave barrier is covered<br>  Relay switches when microwave barrier is free |
| 7 =  <br>Switching delay setting (response delay) |  off (no delay)<br>  100 ms<br>… (200/300/500 ms, 1/2/3/5/10 s)<br>  20 s |
| 8 =  <br>Switching delay setting (drop-out delay) | |
| 9 =  <br>Enable simulation mode |  Covered radiation path<br>…<br>  Free radiation path |
| A =  <br>Attenuation setting |  off (no attenuation)<br>  100 ms (200/300/500 ms, 1/2/3/5/10 s)<br>…<br>  20 s |
| B =  | without function |
| C =  | |
| D =  | |
| E =  | |
| F =  <br>Reset to factory settings | — |

Notice!
Further information on settings and parameter configuration can be found in the Operating Instructions (→ page 35).

# Certificates and approvals

**CE mark**

The microwave barrier meets the legal requirements of the applicable EU guidelines. These are listed in the corresponding EU Declaration of Conformity, together with the applied standards. By applying the CE mark, Kirchgaesser confirms that the device has passed the necessary tests.

**Ex approval**

The measuring device is certified for use in hazardous areas and the safety instructions are to be observed (→ page 5).

Notice!
Certificates → page 46

**Telecommunications**

- EN 300440
  Short range radio devices (SRD) – radio devices for operation in a frequency range of 1 GHz to 40 GHz
- FCC Rule Parts 15C
- IC according to RSS-210 Issue 8, RSS-GEN Issue 3 and RSS-102 Issue 4

**Other standards and guidelines**

- EN 60529
  Degrees of protection provided by enclosures (IP code)
- EN 61010-1
  Protection measures for electrical equipment for measurement, control, regulation and laboratory use
- EN 61326-X
  EMC product family standard for electrical equipment for measurement, control and laboratory use

# Ordering information

## Order code

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **10** | | | | | | **Approval:** | |
| | **AA** | | | | | Non-hazardous area | |
| | **BA** | | | | | ATEX II 1/2D Ex ta/tb IIIC T102°C Da/Db IP66 / ATEX II 2D Ex tb IIIC T102°C Db IP66 | |
| | **CA** | | | | | CSA C/US General Purpose | |
| | **CB** | | | | | CSA C/US Class II, Div. 1, Group E-G | |
| | **GA** | | | | | EAC Ex ta/tb IIIC T102°C Da/Db / EAC Ex tb IIIC T102°C Db | |
| | **GR** | | | | | Non-hazardous area + EAC | |
| | **IA** | | | | | IECEx Ex ta/tb IIIC T102°C Da/Db IP66 / IECEx Ex tb IIIC T102°C Db IP66 | |
| | **99** | | | | | Special version, to be specified | |
| **20** | | | | | | **Output (only FDR56):** | |
| | | **1** | | | | Relay SPDT | |
| | | **2** | | | | Current 4 - 20 mA | |
| | | **3** | | | | Solid-state relay | |
| | | **9** | | | | Special version, to be specified | |
| **30** | | | | | | **Power supply:** | |
| | | | **A** | | | 85 - 253 VAC, 50/60 Hz | |
| | | | **E** | | | 20 - 60 VDC | |
| | | | | | | 20 - 30 VAC, 50/60 Hz | |
| | | | **Y** | | | Special version, to be specified | |
| **40** | | | | | | **Housing:** | |
| | | | | **A** | | Polyester, IP66 | |
| | | | | **B** | | Stainless steel, IP66 | |
| | | | | **C** | | Stainless steel, IP66 + sight glass | |
| | | | | **D** | | Aluminum, IP66 | |
| | | | | **E** | | Aluminum, IP66 + sight glass | |
| | | | | **Y** | | Special version, to be specified | |
| **50** | | | | | | **Electrical connection:** | |
| | | | | | **A** | Cable gland M20 | |
| | | | | | **D** | Thread ½ NPT | |
| | | | | | **E** | 2x plug M12 Binder series 713/763 | |
| | | | | | **F** | 2x plug M12 Binder series 713/763 | |
| | | | | | | + suitable mating connectors | |
| | | | | | **H** | 2x Harting connector HAN8D | |
| | | | | | **J** | 2x Harting connector HAN8D | |
| | | | | | | + suitable mating connectors | |
| | | | | | **Y** | Special version, to be specified | |
| **60** | | | | | | **Process connection:** | |
| | | | | | | **GG2** | Thread ISO 228 G 1½, 316Ti |
| | | | | | | **XFA** | Thread EN 10226 R 1½, Alu |
| | | | | | | **VEA** | Thread ANSI 1½ NPT, Alu |
| | | | | | | **XF2** | Thread EN 10226 R 1½, 316Ti |
| | | | | | | **VE2** | Thread ANSI 1½ NPT, 316Ti |
| | | | | | | **YYY** | Special version, to be specified |

| 70 | | | | | | | Window transmission: |
|---|---|---|---|---|---|---|---|
| | | | | | | | 1 PTFE |
| | | | | | | | 2 Ceramic |
| | | | | | | | 9 Special version, to be specified |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| FDR56 - | | | | | | | |
| FQR56 - | | ■ | | | | | |

## Extended order code

The following order code is optional:

| 80 | | | | | | | | Services: *1 |
|---|---|---|---|---|---|---|---|---|
| | | | | | | | | IM User-specific settings |

| 90 | | | | | | | | | Test, report, declaration: *1 |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | JA Inspection certificate EN10204-3.1, wetted metallic parts |
| | | | | | | | | | KH Final inspection report |

| 100 | | | | | | | | | | Accessory mounted: *1 |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | NA Electronics encapsulated |

| 110 | | | | | | | | | | | Accessory enclosed: *1 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | R9 Special version, to be specified |

| 120 | | | | | | | | | | | | Tag: *1 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | Z1 Stainless steel |
| | | | | | | | | | | | | Z2 Paper |
| | | | | | | | | | | | | Z3 Additionally provided |

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| FDR56 - | | | | | | | | | | | | |
| FQR56 - | | ■ | | | | | | | | | | |

*1 Multiple selection possible

## Comments regarding the product structure

For devices with certification options **BA**, **GA** and **IA**, the following restrictions apply:
- **Housing (40)**: only (**B**) to (**E**)
- **Electrical connection (50)**: only (**A**) and (**D**)
- **Window transmission (70)**: only (**1**)

For devices with certification option **CA**, the following restrictions apply:
- **Housing (40)**: only (**A**) to (**C**)
- **Electrical connection (50)**: only (**A**) and (**D**)

For devices with certification option **CB**, the following restrictions apply:
- **Housing (40)**: only (**B**) and (**C**)
- **Electrical connection (50)**: only (**A**) and (**D**)
- **Window transmission (70)**: only (**1**)

For the optional ordering options, the following restrictions apply:
- **Accessory mounted (100), electronics encapsulated (NA)**: only with electrical connection (**E**) to (**J**)

## Documentation

The following documents can be downloaded from *www.kirchgaesser.com*:
- Operating Instructions FDR56/FQR56, German (ba060000en)
- EU-Type Examination Certificate BVS 11 ATEX E 032 (bp060000a1)
- EAC Certificate of Conformity TC RU C-DE.AA87.B.01096 (tr060001ru)
- IECEx Certificate of Conformity IECEx BVS 11.0016 (ec060000en)
- CSA Certificate of Compliance 2609701 (cs060000en)

## Scope of delivery

The scope of delivery includes the FDR56 or FQR56 in a box with operating instructions included.

## User-specific settings

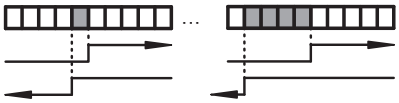
Ordering a device with the extended option "**User-specific settings**", it will be programmed according to the customers specification during assembly, in this case the following form must be completed and added.

### Einstellungen / Settings FDR56/FQR56

Kirchgaesser Industrieelektronik GmbH

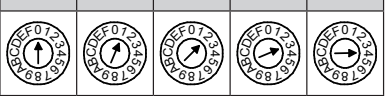
| Bestellcode / Order code | FDR56 - | FQR56 - |
|---|---|---|
| Bestellnummer / Order number | | |
| Gerätenummer / Device number | | |

**FDR56:**

| Funktion, Bedeutung / Function, meaning | Wertebereich / Range of values | Einstellung / Setting |
|---|---|---|
| 5 = Einstellung der Hysterese / Hysteresis setting |  | |
| 6 = Grenzsignalfunktion (Min./Max. Sicherheit, nur Relaisausgang) / Limit signal function (min./max. safety, relay output only) | Relais schaltet bei bedeckter Mikrowellenschranke / Relay switches when microwave barrieris covered<br>Relais schaltet bei unbedeckter Mikrowellenschranke / Relay switches when microwave barrier is uncovered | |
| 7 = Einstellung der Schaltverzögerung (Anzugverzögerung) / Switching delay setting (response delay) | aus / off<br>100 ms (200/300/500 ms, 1/2/3/5/10 s)<br>…<br>20 s | |
| 8 = Einstellung der Schaltverzögerung (Abfallverzögerung) / Switching delay setting (drop-out delay) | | |
| A = Einstellung der Dämpfung / Attenuation setting | | |

***Beispiel / Example:***
- *Hysterese / Hysteresis = 1*
- *Relais schaltet bei bedeckter Schranke / Relay switches when barrier is covered*
- *Anzugverzögerung / Response delay = aus / off*
- *Abfallverzögerung / Drop-out delay = 300 ms*
- *Dämpfung / Attenuation = 1 s*

**FQR56:**

| Kanal / Channel | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|
| Schalterstellung Kanalwahl für Parallelbetrieb / Switch setting channel for parallel operation mode |  | | | | |
| | ❑ | ❑ | ❑ | ❑ | ❑ |

ad060086a1; Rev. 1.0

# Accessories

Various accessories are available for the device, and can be ordered with the device or at a later stage from Kirchgaesser.

## Mating connectors

For the device variants with connectors the following mating connectors an be used:
- Order no.:
  307409, M12 Binder series 713/763, 4-pole
  307412, Harting HAN8D

Notice!
On device variants with electrical connection **F** and **J** the mating connectors are part of the delivery.

## Prefabricated connection cables

For the device variants with connectors the following prefabricated connection cables can be used:
- Order no.:
  307407, M12 Binder series 713/763, 4 x 0.34 mm², PUR, length 2 m (6.45 ft)
  307408, M12 Binder series 713/763, 4 x 0.34 mm², PUR, length 5 m (16.40 ft)
  307410, Harting HAN8D, 4 x 0.75 mm², PUR, length 2 m (6.45 ft)
  307411, Harting HAN8D, 4 x 0.75 mm², PVC, length 5 m (16.40 ft)
- Weight: approx. 0.19 kg (M12 series 713/763, 2 m) / 0.45 kg (Harting HAN8D, 5 m)

## Mounting bracket

For mounting on frames, cross beams or similar which are already available, the following mounting brackets can be used:
- Order no.:
  307287, aluminum
  307288, plastic
- Weight: approx. 0.06 kg (plastic) / 0.22 kg (aluminum)
- The delivery does not include any mounting screws, as the type and length are dependent on on-site conditions.

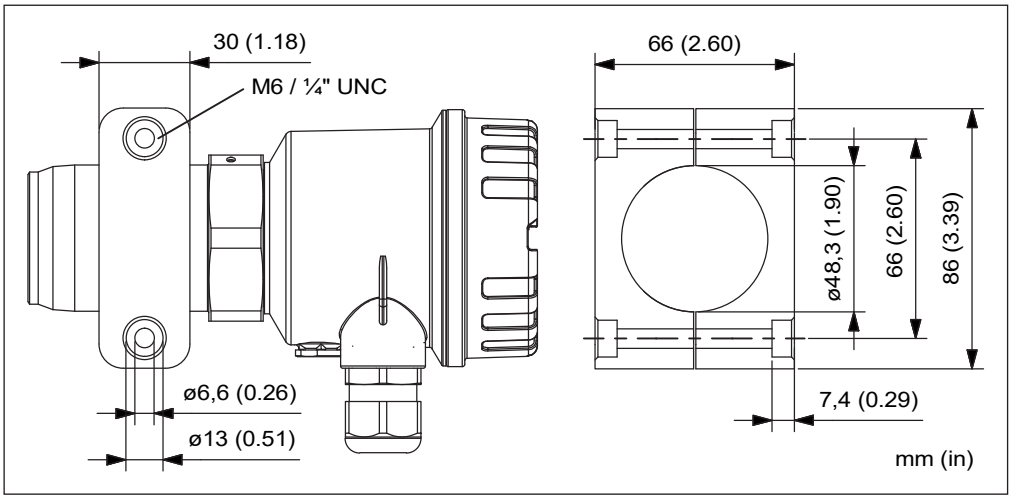



*Figure 28: Mounting bracket dimensions*

## Mounting flange

The following mounting flanges can be used for mounting on available process nozzles with connection dimensions in accordance with DIN EN 1092-1:

• Order no.:
104830, DN40 PN16, Rp 1½ internal thread
307378, DN40 PN16, Rp 1½ internal thread, inspection certificate acc. to EN 10204-3.1
307413, DN40 PN16, G 1½ internal thread
307414, DN40 PN16, G 1½ internal thread, inspection certificate acc. to EN 10204-3.1
307371, DN50 PN16, Rp 1½ internal thread
307380, DN50 PN16, Rp 1½ internal thread, inspection certificate acc. to EN 10204-3.1
307415, DN50 PN16, G 1½ internal thread
307416, DN50 PN16, G 1½ internal thread, inspection certificate acc. to EN 10204-3.1
106114, DN100 PN16, Rp 1½ internal thread
307382, DN100 PN16, Rp 1½ internal thread, inspection certificate acc. to EN 10204-3.1
307417, DN100 PN16, G 1½ internal thread
307418, DN100 PN16, G 1½ internal thread, inspection certificate acc. to EN 10204-3.1
• Material: Stainless steel 316Ti (1.4571)
• Weight: DN40 approx. 2.3 kg (5.07 lbs) to DN100 approx. 5.8 kg (12.79 lbs)

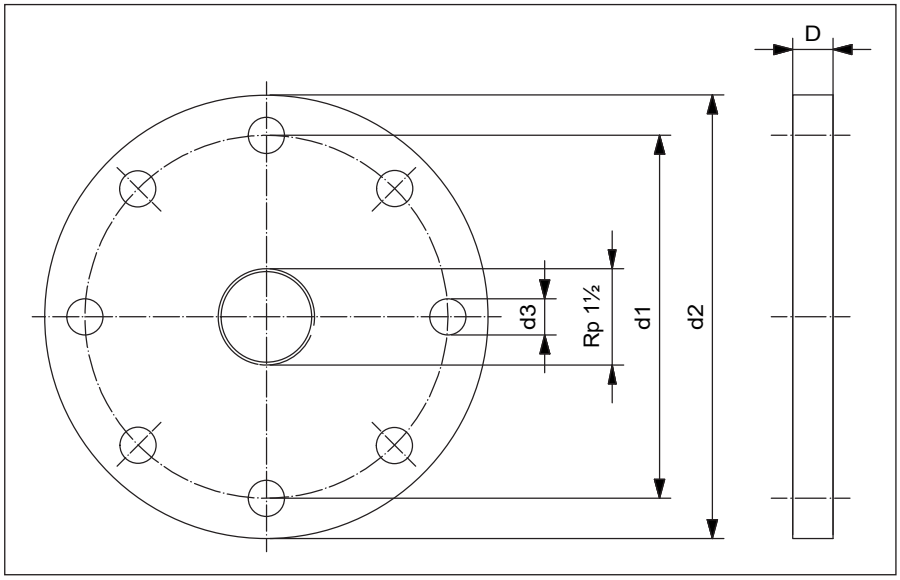



*Figure 29: Dimensions of mounting flange (connection dimensions in accordance with EN 1092-1)*

| Flange | d1 mm (in) | d2 mm (in) | d3 mm (in) | D mm (in) | Holes |
|---|---|---|---|---|---|
| DN40/PN16 | 110 (4.33) | 150 (5.91) | 18 (0.71) | 18 (0.71) | 4 |
| DN50/PN16 | 125 (4.92) | 165 (6.50) | 18 (0.71) | 18 (0.71) | 4 |
| DN100/PN16 | 180 (7.09) | 220 (8.66) | 18 (0.71) | 20 (0.79) | 8 |

The following mounting flanges can be used for mounting on available process nozzles with connection dimensions in accordance with ANSI/ASME B16.5:

• Order no.:
307370, 1½" 150 lbs, 1½ NPT internal thread
307379, 1½" 150 lbs, 1½ NPT internal thread, inspection certificate acc. to EN 10204-3.1
307372, 2" 150 lbs, 1½ NPT internal thread
307381, 2" 150 lbs, 1½ NPT internal thread, inspection certificate acc. to EN 10204-3.1
307374, 4" 150 lbs, 1½ NPT internal thread
307383, 4" 150 lbs, 1½ NPT internal thread, inspection certificate acc. to EN 10204-3.1
• Material: Stainless steel 316Ti (1.4571)
• Weight: 1½" approx. 1.5 kg (3.31 lbs) to 4" approx. 6.8 kg (15.0 lbs)

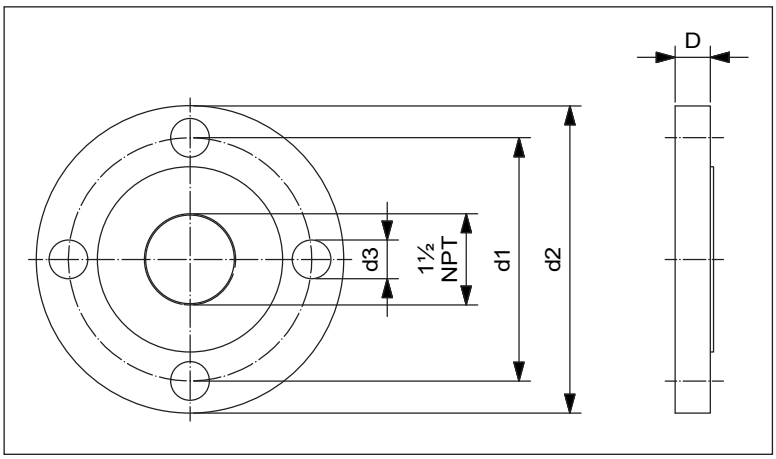



*Figure 30: Dimensions of mounting flange (connection dimension in accordance with ANSI/ASME B16.5)*

| Flange | d1 mm (in) | d2 mm (in) | d3 mm (in) | D mm (in) | Holes |
|---|---|---|---|---|---|
| 1½" 150 lbs | 98.6 (3.88) | 127 (5.00) | 15.7 (0.62) | 17.5 (0.69) | 4 |
| 2" 150 lbs | 120.7 (4.75) | 152.4 (6.00) | 19.1 (0.75) | 19.1 (0.75) | 4 |
| 4" 150 lbs | 190.5 (7.50) | 228.6 (9.00) | 19.1 (0.75) | 23.9 (0.94) | 8 |

## Weld-in or screw-in adapter

For mounting in process walls with existing threads or bores, adapters of type FAR52 can be used (→ Catalogue extract zu070002en):

- Weld-in adapter with internal thread Rp 1½, 1½ NPT and G 1½
- Screw-in adapter for thread R 2 to R 4 and 2 NPT to 4 NPT, with internal thread R 1½ or 1½ NPT
- Material: Stainless steel 316Ti (1.4571) and steel P235GH (1.0345)
- Weight: FAR52-AAAA1A approx. 0.3 kg (0.66 lbs) to FAR52-BVL22B approx. 1.8 kg (4 lbs)

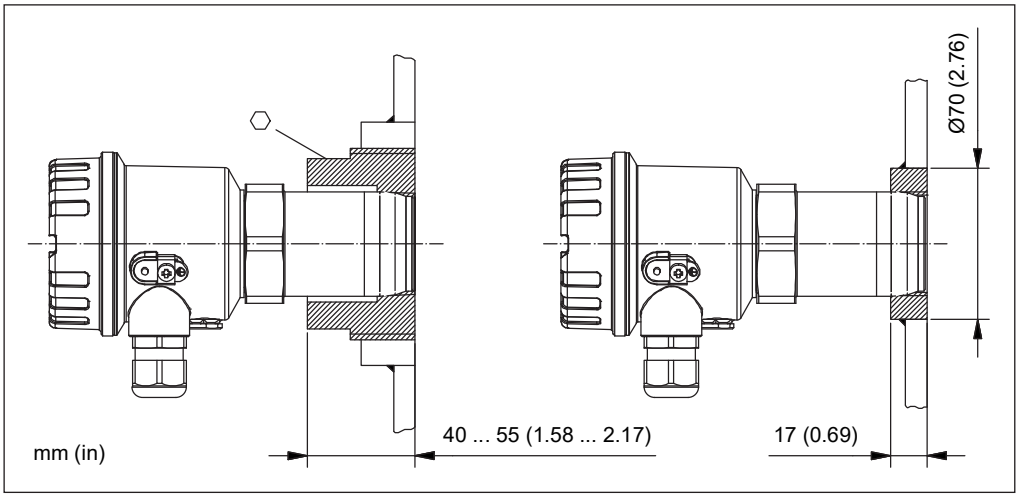



*Figure 31: Dimensions of weld-in or screw-in adapter FAR52*

## High pressure adapter

For mounting of with a microwave-impermeable process wall and high process pressure up to 2000 kPa (20 bar) absolute, the following high pressure adapters (→ page 18) can be used:

- Order no.:
  - 307419: Process and device connecting thread G 1½ acc. to ISO 228-1
  - 307420: Process and device connecting thread G 1½ acc. to ISO 228-1, inspection certificate acc. to EN 10204-3.1
  - 307421: Process connecting thread G 1½ acc. to ISO 228-1, device connection thread 1½ NPT acc. to ANSI/ASME
  - 307422: Process connecting thread G 1½ acc. to ISO 228-1, device connection thread 1½ NPT acc. to ANSI/ASME, inspection certificate acc. to EN 10204-3.1
- Material: Stainless steel 316Ti, PTFE window transmission
- Weight: approx. 0.8 kg (1.76 lbs)

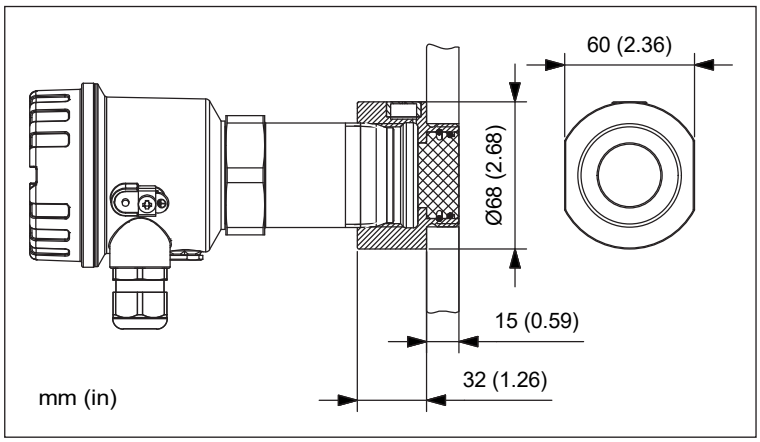



*Figure 32: Dimension of the high pressure adapter*

## Plug

For mounting with microwave-impermeable process walls, plugs of type FAR54 can be used (→ Catalogue extract zu070004en):

- Material: PTFE and aluminium oxide ceramic
- Process temperature: max. -40 to +800°C (-40 to +1472°F)
- Weight: FAR54-ABCBFAAAA2 approx. 0.06 kg (0.13 lbs) to FAR54-CCBCABEBJ3 approx. 3.2 kg (7.05 lbs)

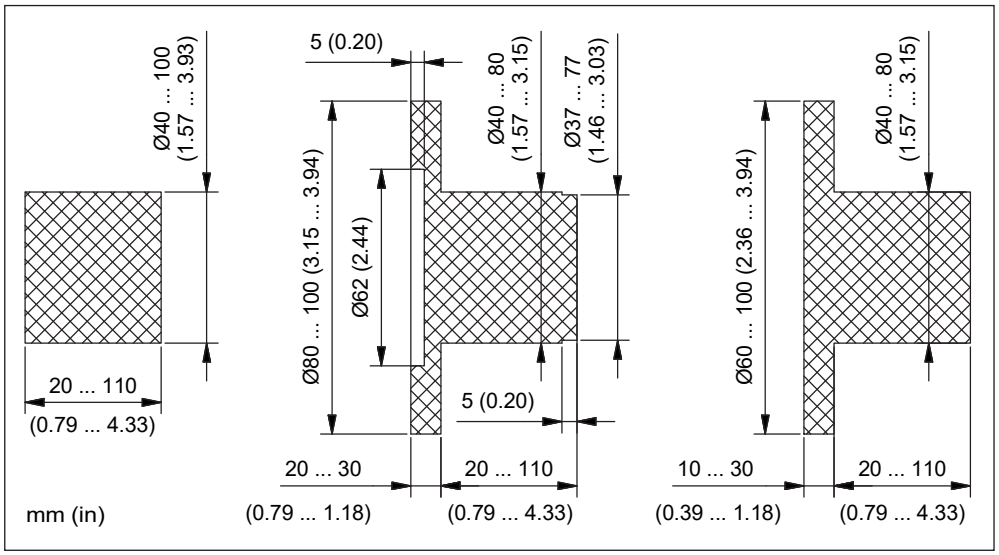



*Figure 33: Dimensions of FAR54 plugs*

## Sight glass fitting

For mounting with microwave-impermeable process walls and unpressurized process, the following sight glass fittings can be used for welding on or in:

- Order no.:
  307281, DN50
  307283, DN80
  307279, DN100
- Material: Stainless steel 316Ti, silicon seal (max. +200°C/+392°F)
- Weight: DN50 approx. 2.4 kg (5.29 lbs) to DN100 approx. 4.1 kg (9.04 lbs)
- The delivery includes the inspection glass fitting, incl. seals and mounting screws.

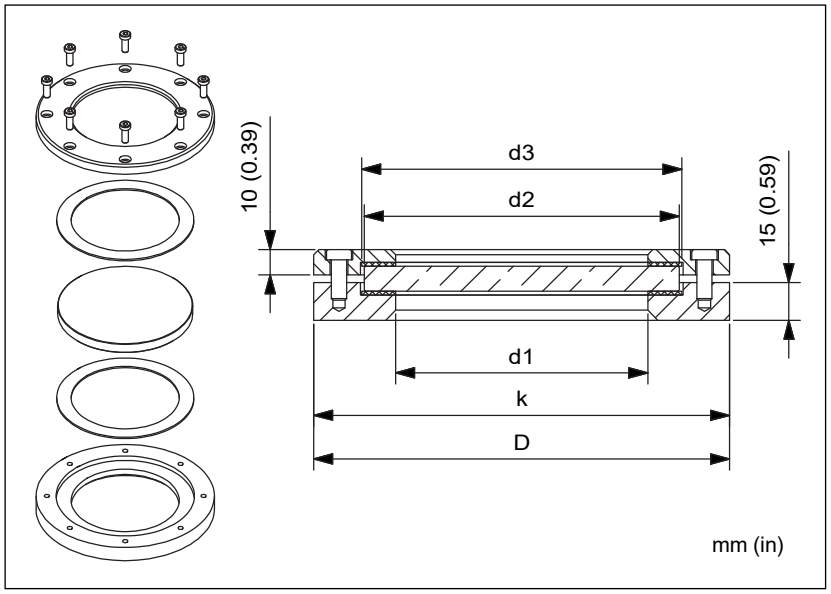



*Figure 34: Dimensions of sight glass fitting for welding on/in for unpressurized processes*

| DN | d1<br>mm (in) | d2<br>mm (in) | d3<br>mm (in) | D<br>mm (in) | k<br>mm (in) |
|---|---|---|---|---|---|
| 50 | 80 (3.15) | 100 (3.94) | 102 (4.02) | 140 (5.51) | 120 (4.72) |
| 80 | 100 (3.94) | 125 (4.92) | 127 (5.00) | 165 (6.50) | 145 (5.71) |
| 100 | 125 (4.92) | 150 (5.91) | 152 (5.98) | 190 (7.48) | 170 (6.69) |

For mounting with microwave-impermeable process walls and process up to max. 1 MPa (10 bar), the following sight glass fittings can be used for welding on or in:

- Order no.:
  307280, DN50
  307282, DN80
  300726, DN100
- Material: Stainless steel 316Ti, silicone seal (max. +200°C/+392°F)
- Weight: DN50 approx. 6.7 kg (14.77 lbs) to DN100 approx. 13 kg (28.66 lbs)
- The delivery includes the inspection glass fitting, seals and mounting screws.

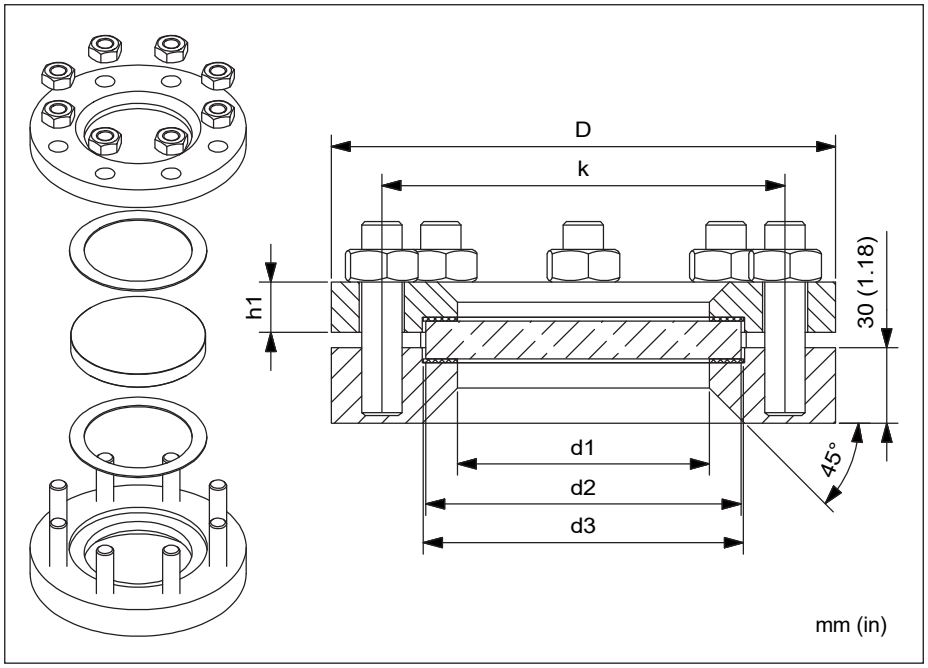



*Figure 35: Dimensions of sight glass fitting for welding on/in for processes up to 1 MPa*

| DN | d1 mm (in) | d2 mm (in) | d3 mm (in) | D mm (in) | k mm (in) | h1 mm (in) |
|---|---|---|---|---|---|---|
| 50 | 80 (3.15) | 100 (3.94) | 102 (4.02) | 165 (6.50) | 125 (4.92) | 16 (0.63) |
| 80 | 100 (3.94) | 125 (4.92) | 127 (5.00) | 200 (7.87) | 160 (6.30) | 20 (0.79) |
| 100 | 125 (4.92) | 150 (5.91) | 152 (5.98) | 220 (8.66) | 180 (7.09) | 22 (0.87) |

For mounting on available block flanges or counter flanges (process pressure up to max. 2.5 MPa (25 bar), the following bolt-on sight glass fittings can be used:

- Order no.:
  307285, DN50
  307286, DN80
  307284, DN100
- Material: Stainless steel 316Ti, PTFE and C4400 seals (max. +200°C/+392°F)
- Weight: DN50 approx. 5.4 kg (11.90 lbs) to DN100 approx. 15.9 kg (35.05 lbs)
- The delivery includes the sight glass fitting incl. seals but does not include mounting screws (type and length are dependent on the structural situation).

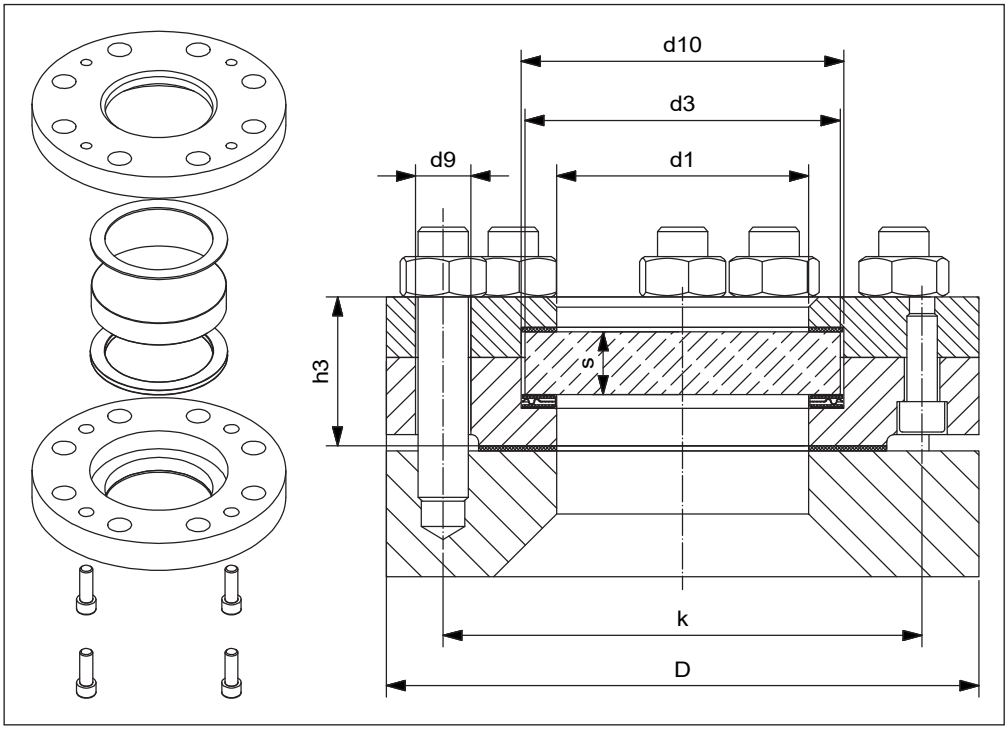



*Figure 36: Dimensions of sight glass fitting for bolting on for processes up to 2.5 MPa*

| DN | d1 mm (in) | d2 mm (in) | s mm (in) | D mm (in) | k mm (in) | h3 mm (in) | d9 mm (in) | d10 mm (in) |
|---|---|---|---|---|---|---|---|---|
| 50 | 65 (2.56) | 80 (3.15) | 15 (0.59) | 165 (6.50) | 125 (4.92) | 41 (1.61) | 18 (0.71) | 82 (3.23) |
| 80 | 80 (3.15) | 100 (3.94) | 20 (0.79) | 200 (7.87) | 160 (6.30) | 50 (1.97) | 18 (0.71) | 102 (4.02) |
| 100 | 100 (3.94) | 125 (4.92) | 25 (0.98) | 235 (9.25) | 190 (7.48) | 59 (2.32) | 22 (0.87) | 127 (5.00) |

## Insertion adapter

For mounting on existing process nozzles, insertion adapters of type FAR51 can be used (→ Catalogue extract zu070001en):
- Process nozzle DN50 to DN100 PN16 shape A, 2 NPT to 4 NPT 150 lbs RF
- Nozzle lengths: 100 to 300 mm
- Connection thread R 1½, 1½ NPT and G 1½
- Optional with PTFE or aluminum oxide ceramic disc
- Process temperature: max. -40 to +450°C (-40 to +842°F)
- Process pressure: max. 80 to 510 kPa (0.8 to 5.1 bar) absolute
- Material: 316Ti stainless steel (1.4571)
- Weight: approx. 5 to 10 kg (11 to 22 lbs)

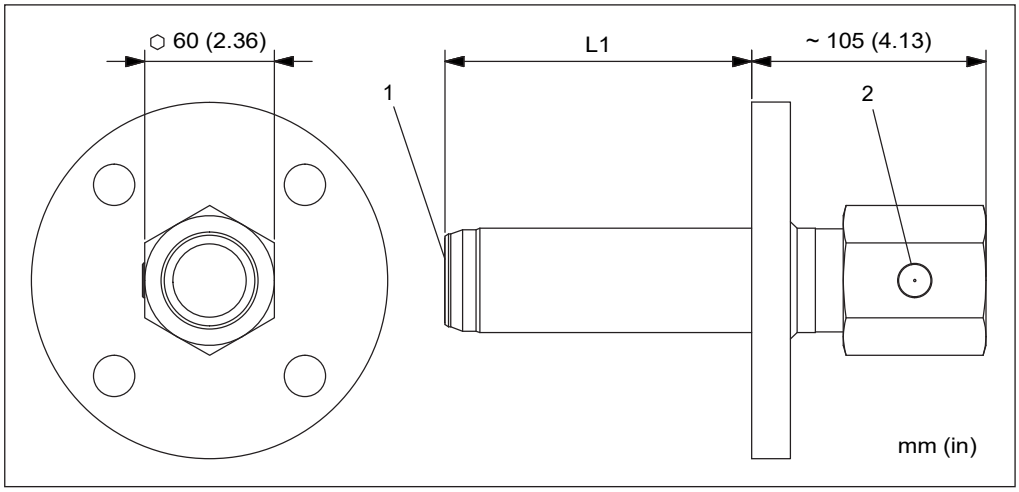



*Figure 37: Dimensions of plug-in adapters*

*1 Sealed disc, optional*
*2 Venting element*

## Weld-in nozzles

For nozzle mounting, weld-in nozzles of type FAR50 can be used (→ Catalogue extract zu070000en):
- Process nozzle DN50 to DN100 PN16 shape A, 2 NPT to 4 NPT 150 lbs RF
- Nozzle lengths: 150 to 300 mm
- Connection thread R 1½, 1½ NPT and G 1½
- With optional PTFE disc
- Process temperature: max. -40 to +200°C (-40 to +392°F)
- Material: 316Ti stainless steel (1.4571)
- Weight: approx. 6 to 28 kg (13 to 62 lbs)

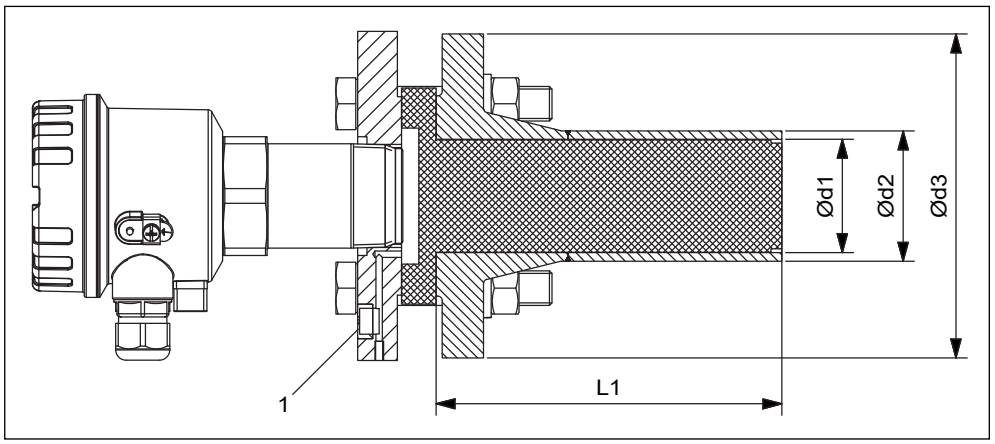



*Figure 38: Dimensions of weld-in nozzles*

*1 Venting element*

## Spacer tube

For mounting in open processes or processes with an internal lining, such as clay, spacer tubes of type FAR53 can be used (→ Catalogue extract zu070003en):

- Process connection: With or without thread R 2, 2 NPT and G 2
- Pipe lengths (L1): 200 to 2000 mm
- With optional aluminum oxide ceramic disc
- Process temperature: max. -40 to +450°C (-40 to +842°F)
- Material: 316Ti stainless steel (1.4571) or P235GH steel (1.0345)
- Weight: 200 mm approx. 5.3 kg (11.7 lbs) to 2000 mm approx. 22.2 kg (48.9 lbs)

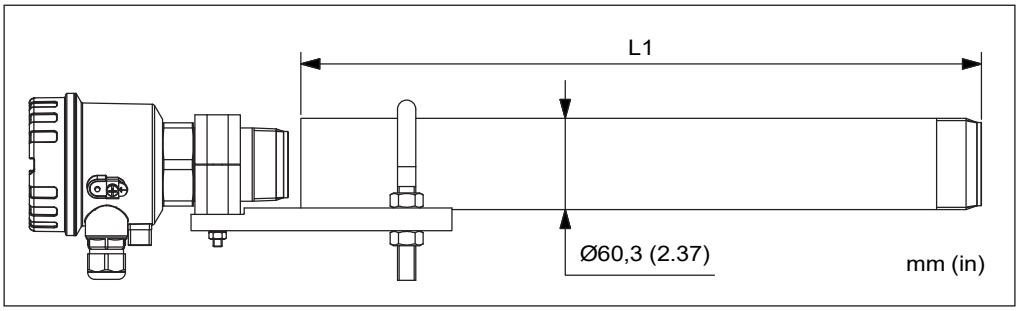



*Figure 39: Dimensions of spacer tube (wave guide)*

## Wave guide

For mounting in structurally restricted installation positions, wave guides of type FAR55 can be used (→ Catalogue extract zu070005en).

- Process connection: With or without thread R 1½ and 1½ NPT
- Lengths: L1 = 200 to 1500 mm, L2 = 200 to 2000 mm
- Process temperature: max. -40 to +450°C (-40 to +842°F)
- Device connection: Receptacle, suitable for thread R 1½, 1½ NPT and G 1½
- Material: 316Ti stainless steel (1.4571)
- Weight: FAR55-AAAACGAA2* approx. 2.0 kg (4.41 lbs) to FAR55-BAAADGDL2* approx. 17.8 kg (39.24 lbs)

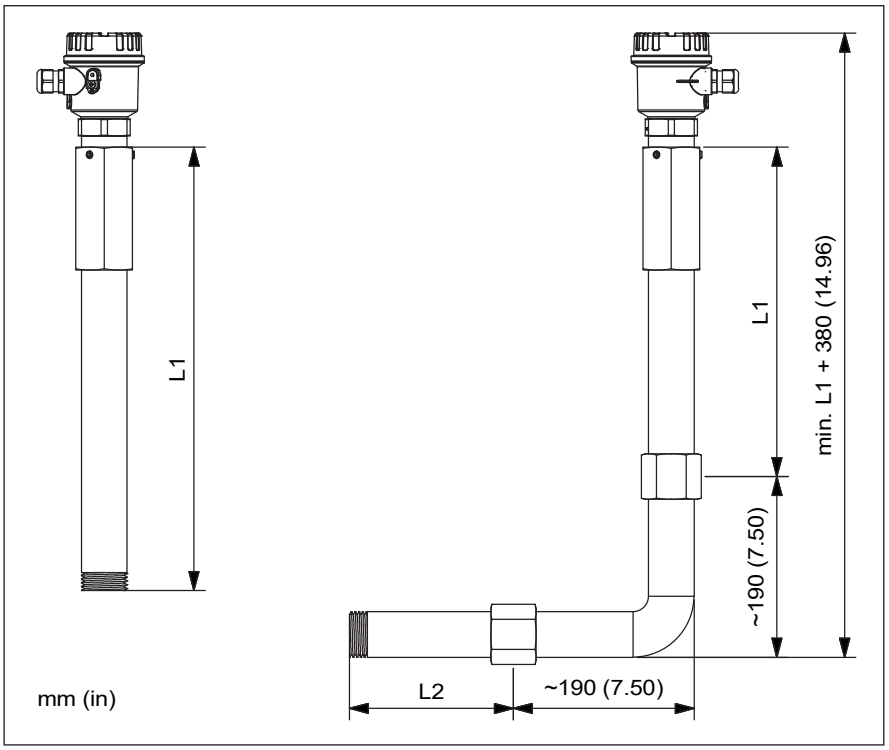



*Figure 40: Dimensions of wave guide*

## High temperature adapter with length extensions

For mounting with connection thread in processes with temperatures up to max. +450°C (+842°F), the following high temperature adapters (SW55) and length extensions can be used (→ page 22):

- Order no. (high temperature adapter with flush-mounted ceramic disc and pressure equalization element):
  307384, thread R 1½/Rp 1½
  307385, thread 1½ NPT
- Order no. (extension):
  307386, thread R 1½/Rp 1½, L = 225 mm
  307387, thread R 1½/Rp 1½, L = 325 mm
  307388, thread R 1½/Rp 1½, L = 525 mm
  307390, thread 1½ NPT, L = 225 mm
  307391, thread 1½ NPT, L = 325 mm
  301747, thread 1½ NPT, L = 525 mm
- Material: Stainless steel 316Ti (1.4571)
- Weight:
  - High temperature adapter approx. 1.4 kg (3.09 lbs)
  - Extension 225 mm approx. 1.1 kg (2.43 lbs) to 525 mm approx. 2.2 kg (4.85 lbs)

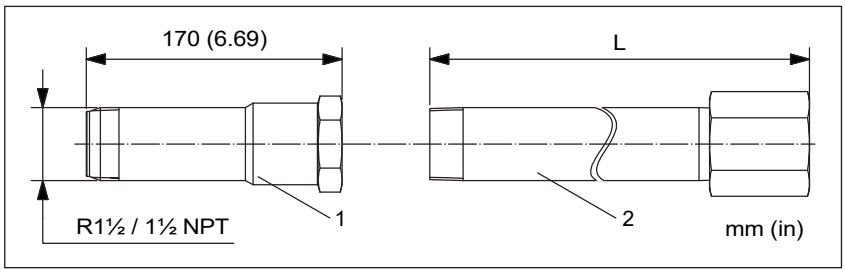



*Figure 41: Dimensions of high temperature adapter and extensions*

*1 High temperature adapter*
*2 Extension*

# Technical data

**Power supply**

- 85 ... 253 VAC, 50/60 Hz
- 20 ... 60 VDC or 20 ... 30 VAC, 50/60 Hz

Notice!
The electrical connection with Harting connector type HAN8D is only available for the power supply with 20 ... 60 VDC or 20 ... 30 VAC, 50/60 Hz.

**Power consumption**

- FQR56:
  - max. 2.5 VA (85 ... 253 VAC, 50/60 Hz)
  - max. 1 W (20 ... 60 VDC) or 1.2 VA (20 ... 30 VAC, 50/60 Hz)
- FDR56:
  - max. 4.8 VA (85 ... 253 VAC, 50/60 Hz)
  - max. 2.2 W (20 ... 60 VDC) or 3 VA (20 ... 30 VAC, 50/60 Hz)

**Signal output**

- Relay:
  - Switching capacity: 250 VAC / 4 A, 125 VDC / 0.4 A or 30 VDC / 4 A
  - Switching frequency: max. 4 Hz
- Solid-state relay:
  - Switching capacity 30 VAC / 0.4 A or 40 VDC / 0.4 A
  - Switching frequency: max. 4 Hz
- Current output
  - Output current: 4 ... 20 mA
  - Load: max. 600 Ω

Notice!
The maximum switching voltage for the Harting connector type HAN8D is 50 VAC.

**Ambient conditions**

- Ambient temperature: -40 to +70°C (-40 to +158°F)
- Ambient pressure: 80 to 110 kPa (0.8 to 1.1 bar) absolute

**Process conditions**

- Process temperature: -40 to +70°C (-40 to +158°F)
- Process pressure: 50 to 680 kPa (0.5 to 6.8 bar) absolute

Notice!
Using the optional accessories (→ page 36) the process conditions can be expanded:
- High temperature adapter: -40 to +450°C (-40 to +842°F)
- High pressure adapter: 50 to 2000 kPa (0.5 to 20 bar) absolute

**Degree of protection**

- IP66 (with closed housing)
- IP20 (with open housing)

**Certifications**

- EU-Type Examination Certificate (BVS 11 ATEX E 032)
  ATEX II 1/2D Ex ta/tb IIIC T102°C Da/Db IP66 / ATEX II 2D Ex tb IIIC T102°C Db IP66
- IECEx Certificate of Conformity (IECEx BVS 11.0016)
  IECEx Ex ta/tb IIIC T102°C Da/Db IP66 / IECEx Ex tb IIIC T102°C Db IP66
- CSA Certificate of Compliance (2609701)
  CSA C/US Class II, Div. 1, Group E-G
- EAC Certificate of Conformity (TC RU C-DE.AA87.B.01096)
  EAC Ex ta/tb IIIC T102°C Da/Db / EAC Ex tb IIIC T102°C Db

Subject to change!

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