

Microwave barrier FDR57/FQR57



- ▶ 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.
- ▶ The transmitter FQR57 and the transceiver FDR57 are parameterized via the process transmitter with control unit FTR525, which also provides the supply voltage.
- ▶ 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, for counting piece goods (such as bags or boxes) and optional for monitoring of bulk flow.
- ▶ The individual adaptation to the application takes place with the help of parameterizable functions such as automatic adjustment or switching delays directly on the FTR525.
- ▶ Detection range up to 100 m (level limit detection) and 10 m (bulk flow detection) 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 1D, 1/2D and gas 1G, 1/2G): ATEX 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 FQR56/FDR56 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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Document information

Used symbols

Symbol	Meaning
	Free path Indicates a free path (level limit detection)
	Covered path Indicates a covered path (level limit detection)
	Minimum bulk flow Indicates a minimum or absent bulk flow (bulk flow monitoring)
	Maximum bulk flow Indicates a maximum bulk flow (bulk flow monitoring)

Function and system design

Level limit detection

The FQR57 transmitter emits a microwave signal, which is detected by the FDR57 transceiver directly opposite, which then sends the corresponding serial output signal to the FTR525.

Notice!

Details on the extensive functions of the FTR525

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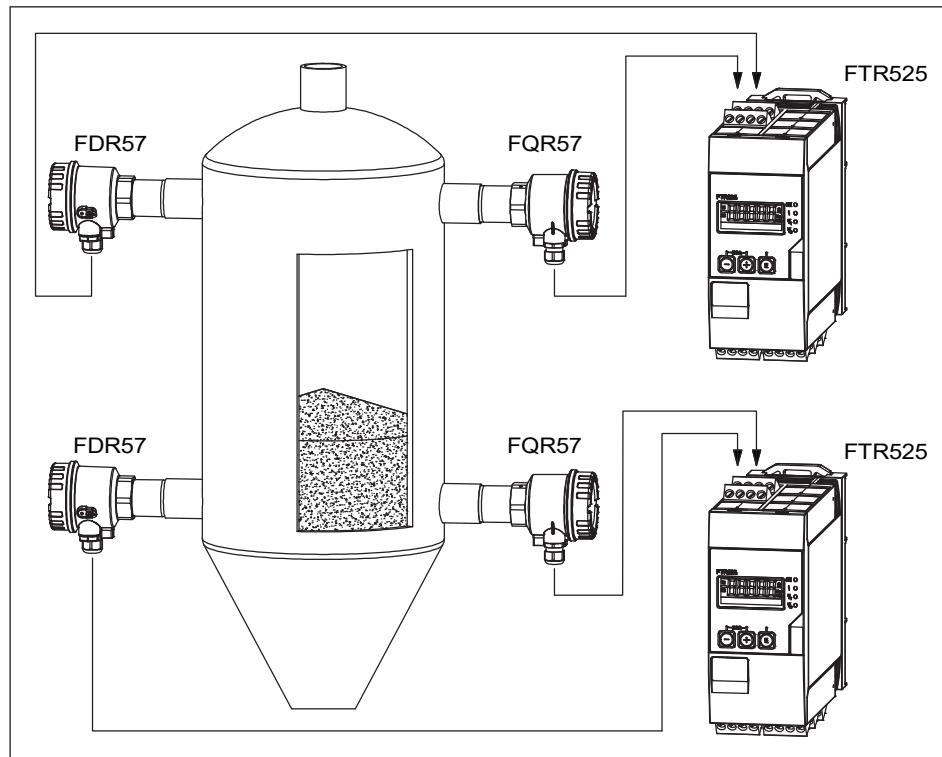


Figure 1: Example of level limit detection

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 accumulations can be detected; an increase in the fouling of a filter is, for example, indicated by a falling current value.

Optional integrated bulk flow detection

The FDR57 transceiver also emits a signal, which is reflected by the moving bulk solids. It measures the strength of the reflected frequency-shifted energy (Doppler effect) and sends the corresponding serial output signal to the FTR525.

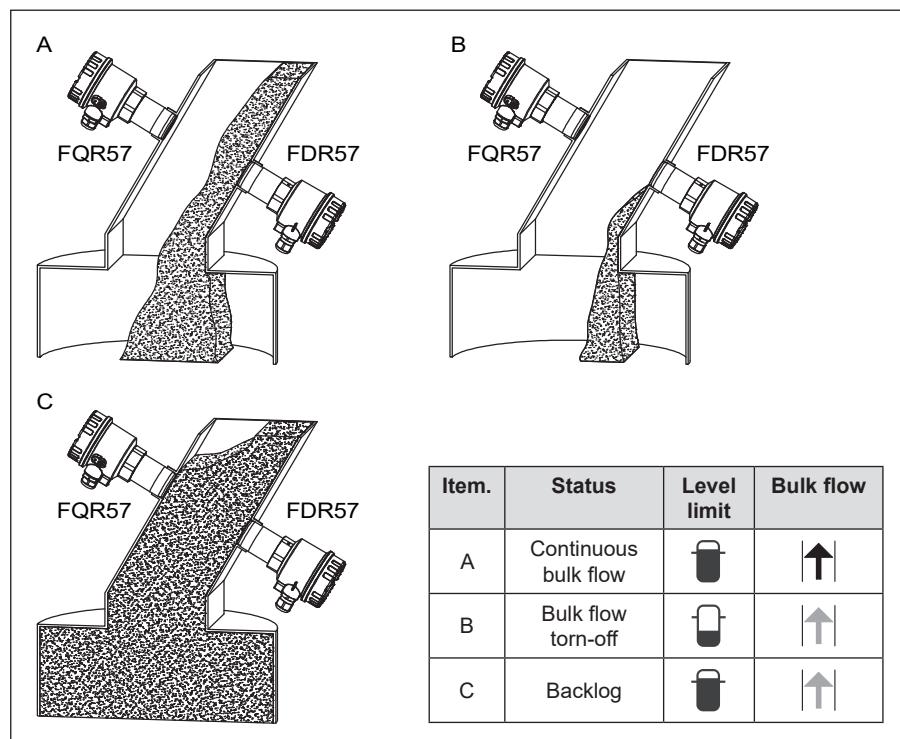


Figure 2: Example bulk flow detection

Notice!

- As only the FDR57 transceiver detects the bulk flow, it should be mounted as close as possible to the bulk flow.
- If the detection range is under 500 mm, the FQR57 and FDR57 should be installed at an angle of 90° relative to one another, to avoid possible overrangings and therefore faulty measurements (→ page 13).

Application example: backlog monitoring

Microwave barriers with integrated bulk flow detection are typically used to monitor shafts, feed hoppers or similar with regard to material flow and backlog.

Previously, two microwave barriers were required for this. The first to monitor continuous material transport by means of the continuous attenuation of the microwave signal. The second, which must be installed above the material flow, to detect the backlog by means of a sudden increase in the attenuation of the microwave signal.

The microwave barrier with integrated bulk flow detection now performs both these tasks. The FDR57 transceiver now detects the continuous material transport. In combination with the signal from the microwave barrier, it is possible to detect whether the material flow is interrupted or if there is a backlog.

Notice!

- 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 becomes lower.

Measuring system

The complete system consists of the FQR57/FDR57 devices of the microwave barrier as well as the FTR525 remote process transmitter with control unit.

Notice!

Details on the extensive functions of the FTR525
→ page 34

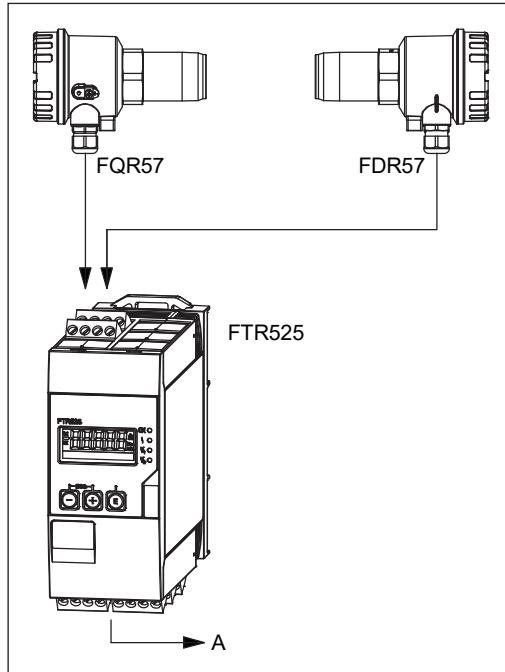


Figure 3: Overview of the complete measuring system

A Power supply and signal outputs

Notice!

For optimal installation in the process, the FQR57/FDR57 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 35).

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.

Input

Measured variable	<ul style="list-style-type: none">• Level limit detection: Absorption of the electromagnetic waves emitted by the FQR57 transmitter• Bulk flow detection: Doppler frequency
Measuring range	<ul style="list-style-type: none">• Max. 100 m (level limit detection)• Max. 10 m (bulk flow detection) depending on the bulk solids
Operating frequency	24.05 to 24.25 GHz ISM
Transmitting power	<p>The power produced by the FQR57/FDR57 is maximum 100 mW e.i.r.p. (equivalent isotropic radiation performance).</p> <ul style="list-style-type: none">• Power density directly in front of the device: Approx. 1 mW/cm²• Power density at a distance of 1 m: Approx. 0.3 µW/cm²
	<p>Notice!</p> <p>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.</p>
Antenna opening angle	approx. ± 9°
Detectable speed of bulk flow	0.3 ... 31 m/s

Output

Output signal	Serial signal for the FTR525 process transmitter with control unit
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Notice!

Details on the output signals of the FTR525 (4 to 20 mA, max. two relays or SSR, open collector)

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Power supply

Terminal assignment

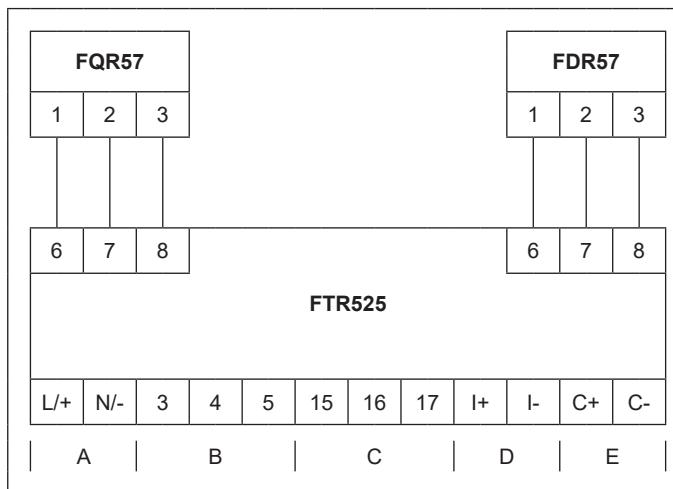


Figure 4: Terminal assignment of the microwave barrier with the process transmitter

- A Power supply
- B Switching output 1
- C Switching output 2 (optional)
- D Current output
- E Switching output (Open Collector)

Power supply

The supply voltage is provided by the FTR525.

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 mm².
- Potential equalization of the FDR57/FQR57 should be incorporated in the local potential equalization.

Notice!

For devices intended for use in hazardous locations, please observe the safety instructions of the Operating Instructions.

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Terminal assignment

Device versions with an electrical connection **A** (M20 cable gland) or **D** (1/2 NPT thread) have a terminal on the inside.

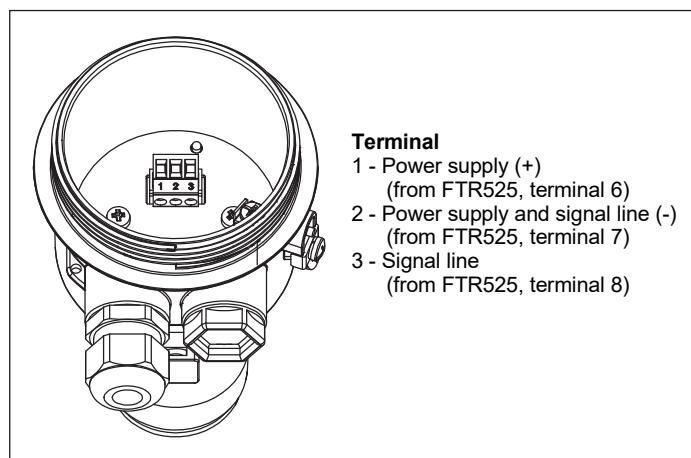


Figure 5: Terminal

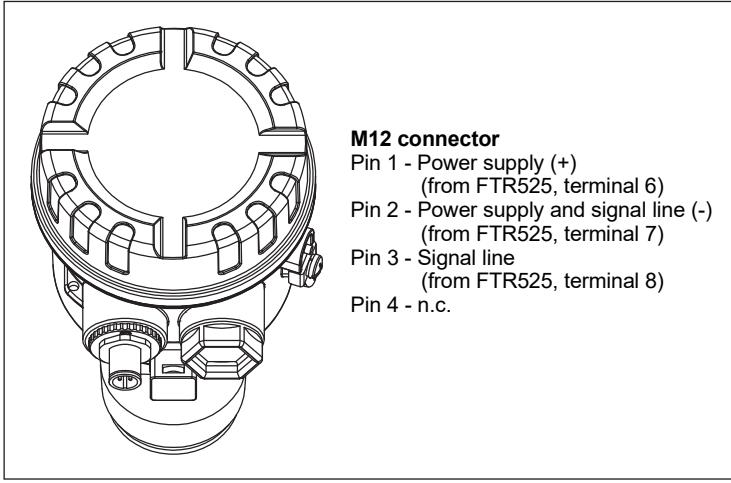
Terminals	Max. 2.5 mm ²
Cable entries	<ul style="list-style-type: none"> • Cable gland M20 x 1.5 or cable entry ½ NPT • Degree of protection: min. IP66 • Cable gland for non-hazardous areas: <ul style="list-style-type: none"> - Material: Plastic - Color: gray - Clamping range: 5 to 10 mm (EN 61444) or 7 to 10 mm (UL-514 B) • Cable gland for hazardous areas: <ul style="list-style-type: none"> - Material: Nickel-plated brass - Color: silver - Clamping range: 7 to 10.5 mm • Quantity: 1 piece per device
	<p>Notice! The cable gland is only admissible for the connection of fixed-installation lines and cables. The operator must ensure corresponding strain relief.</p>
Cable specification	<p>The connecting cables provided by the customer (cables for connecting the FQR57/FDR57 to the FTR525) must fulfil the following requirements:</p> <ul style="list-style-type: none"> • Electrical safety in accordance with applicable national regulations. • Permitted temperature range → page 45 • Normal installation cable with at least three wires • Length of each connecting cable: max. 500 m • Cable resistance: max. 12 Ω/km • Cable cross-sections: 0.2 to 2.5 mm² (24 to 12 AWG)
Device connector	<p>Device versions with an M12 circular plug-in connector E or F are connected to the FTR525 using this connector.</p>  <p>M12 connector</p> <ul style="list-style-type: none"> Pin 1 - Power supply (+) (from FTR525, terminal 6) Pin 2 - Power supply and signal line (-) (from FTR525, terminal 7) Pin 3 - Signal line (from FTR525, terminal 8) Pin 4 - n.c.

Figure 6: Connecting the device using an M12 circular plug-in connector

Notice!

- Binder series 713/63
- 4-pin
- Housing made of die-cast zinc, nickel-plated
- Suitable mating connectors and prefabricated connection cables
→ page 35

Device versions **H** and **J** with a Harting Han8D plug-in connector are connected to the FTR525 using this connector.

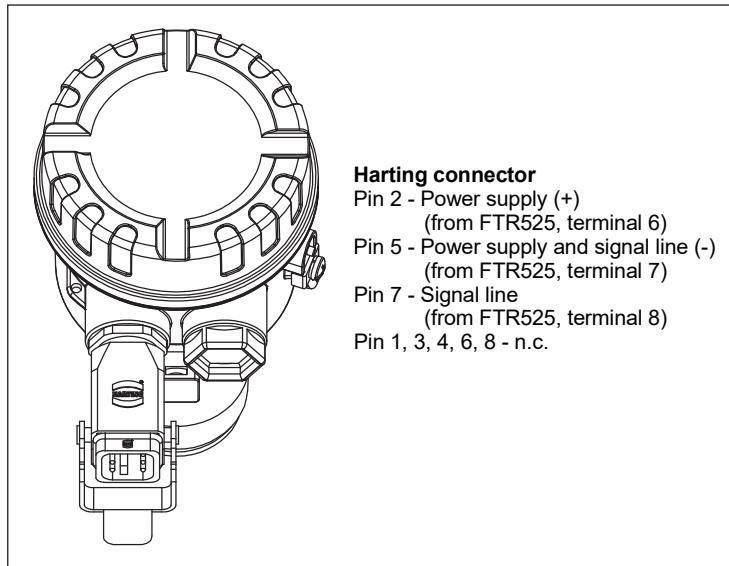


Figure 7: Connecting the device using a Harting Han8D plug-in connector

Notice!

- Connector insert Han® 8 D, 3-pin
- Harting Han® 3 A housing, die-cast zinc, powder-coated RAL 7037 (gray)
- Suitable mating connectors and prefabricated connection cables
→ page 35

Performance characteristics

Reference operating conditions	Every application is different in terms of its shape and size (such as detection area and influential reflexion edges), distance from FQR57/FDR57 to the 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 (FQR57/FDR57 are temperature-compensated internally).
Influences on level limit detection	<p>The influences of the shape and size, distances of FQR57/FDR57 from the medium and the medium properties are eliminated during a basic setup.</p> <p>The following points, however, have an influence on level limit detection:</p> <ul style="list-style-type: none"> • Moisture within the process In principle, additional moisture (for example, condensate running down the radiation window of the FQR57/FDR57) attenuates the measuring signal. To the extent that there are variable moisture levels, the microwave barrier must be adjusted under the least favourable conditions, so that the "Free path" and "Covered path" statuses can be detected reliably. • Accumulations Accumulations in front of the radiation window of the FQR57/FDR57 can also lead to attenuation of the measuring signal (potentially further amplified by additional moisture). Accumulations must therefore be avoided through structural measures or the use of special process adapters (accessories → page 35), or must be removed during regular maintenance measures (depending on the degree of influence).
	<p>Notice!</p> <ul style="list-style-type: none"> • When exchanging the FQR57/FDR57 devices, they do not have to be adapted to the application again. The application-dependent configuration is automatically transferred from the FTR525 to the devices when it is connected. • With the help of the current output from the FTR525, the progress of accumulations, fouling or similar from "unsoiled" to "soiled" can be evaluated (limit values are individually configurable).
Influences on bulk flow detection	<p>In addition to the influences on level limit detection, the following points must also be observed for the bulk flow detection:</p> <ul style="list-style-type: none"> • Distance of FDR57 from the medium The measuring signal is influenced by the distance between the FDR57 and the medium. With significantly deviating distances, the FDR57 should be installed, if possible, such that the distance is as constant as possible. If this is not possible, the microwave barrier must be adjusted under the least favourable conditions in this case too. <p>Notice! If the detection range is under 500 mm, the FQR57 and FDR57 should be installed at an angle of 90° relative to one another, to avoid possible overrangings and therefore faulty measurements (→ page 13).</p>
Vibration effects	<p>Vibration resistance – continuous load with sliding frequency in accordance with EN 60068-2-6:</p> <ul style="list-style-type: none"> • -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 (see "Performance characteristics").
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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 35
- For devices intended for use in hazardous locations, please observe the safety notes of the Operating Instructions.
→ page 34

Orientation	The orientation is essentially user defined, taking into consideration the following notes: <ul style="list-style-type: none">• As the microwaves are polarised, the FQR57 and the FDR57 must not be turned towards each other by their longitudinal axis (except by 180° or for detection distances less than 500 mm).• Avoid interference from reflections at metal parts.• An improvement in signal quality can be attained by installing the FQR57 and FDR57 so that they can be moved by ± 10 mm along their longitudinal axis.• If the detection range is under 500 mm, the FQR57 and FDR57 should be installed at an angle of 90° relative to one another, to avoid possible overrangings and therefore faulty measurements.• Between the FQR57 and the FDR57, a minimum clearance of 30 mm should be maintained.
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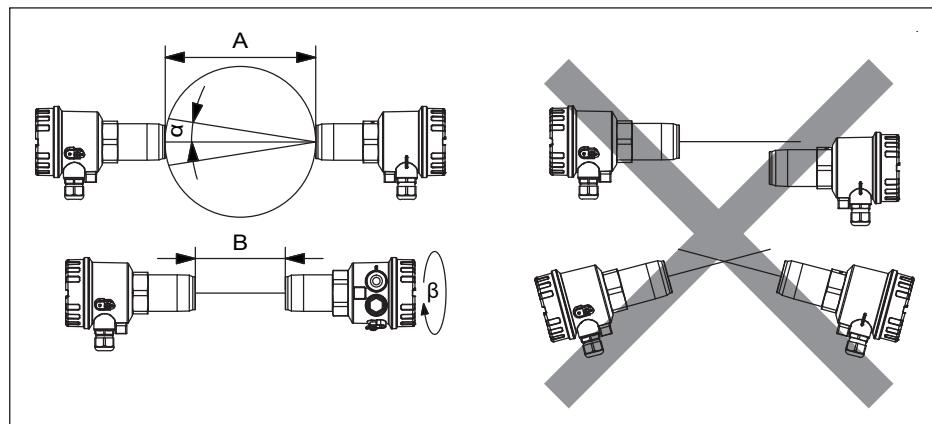


Figure 8: Orientation

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

Both the FQR57 and the FDR57 are equipped with a standard thread (R 1½ in accordance with EN 10226 or 1½" NPT in accordance with ANSI/ASME B1.20.1 or G 1½ in accordance with ISO 228-1) as the process connection. This enables easy installation in existing container couplings or nozzles. For optimal orientation after mounting the electronics housing of the devices in the process, it can be rotated as desired (by 360°).

Installation

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

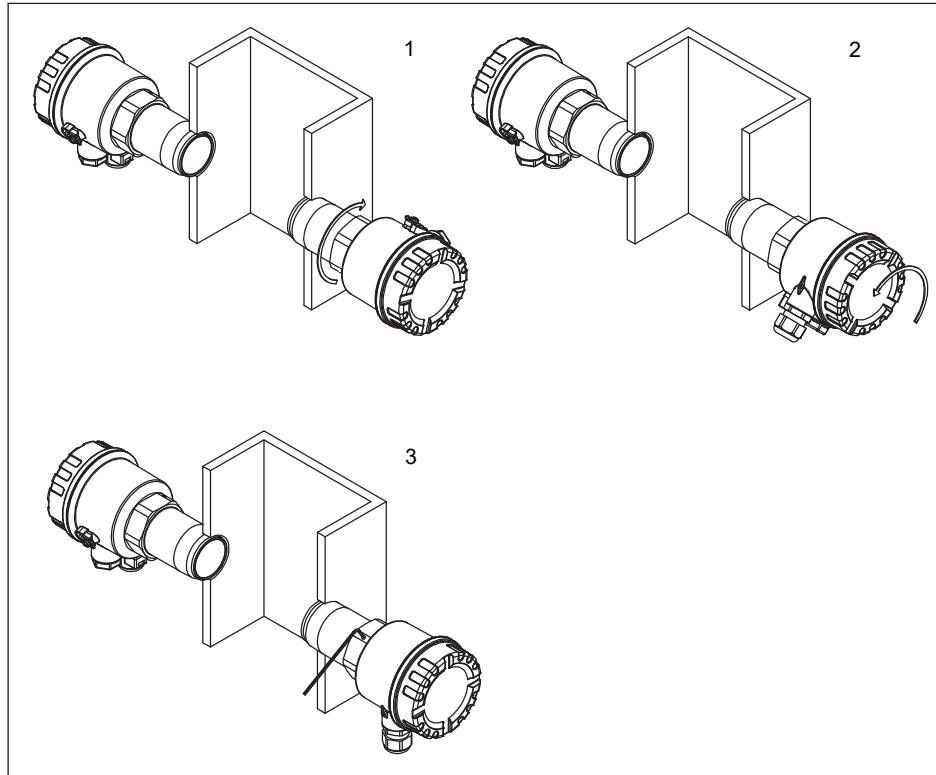


Figure 9: Installation with self-sealing connection thread

1. Turn self-sealing connection thread R 1½ or 1½ NPT into the process (SW55 hexagon).
2. Align FQR57 and FDR57 with each other (the fronts of both devices must be opposite each other on one axis).
3. Secure the housing (2 mm hex socket).

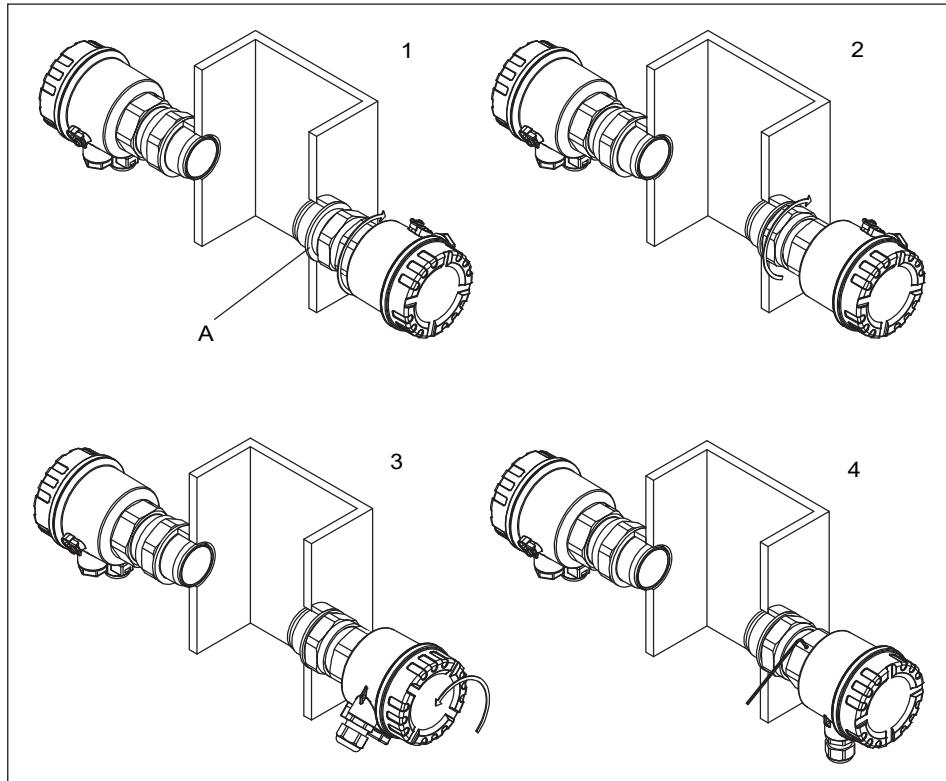
Installation with non-self-sealing connection thread (G 1½)

Figure 10: Installation with non-self-sealing connection thread

A Supplied gasket

1. Screw non-self-sealing connection thread G 1½ with the enclosed process seal into the process (SW55 hexagon).
2. Tighten the counter nut of the thread (also SW55 hexagon).
3. Align FQR57 and FDR57 with each other (the fronts of both devices must be opposite each other on one axis).
4. Secure the housing (2 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 FQR57/FDR57 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.

Using reflectors

If FQR57 and FDR57 cannot be positioned directly opposite each other for structural reasons, the microwave can be deflected via flat metal mirrors (reflectors).

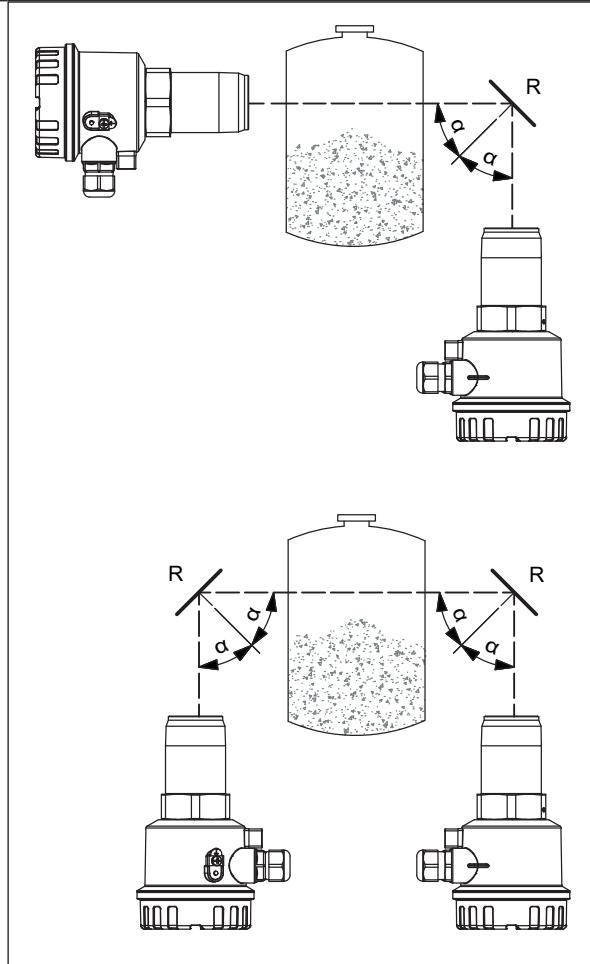


Figure 11: Using reflectors

1 Reflector

α Angle of entrance = angle of emission

Notice!

- Please note that the FQR57 and FDR57 must be positioned symmetrically with respect to the reflector (angle of entrance = angle of emission), as otherwise the FDR57 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 FTR525.

Notice!

- Use the channels in order, i.e. 1, 2, ..., 5, 1, ...
- Details on the FTR525 settings
→ page 34

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 37

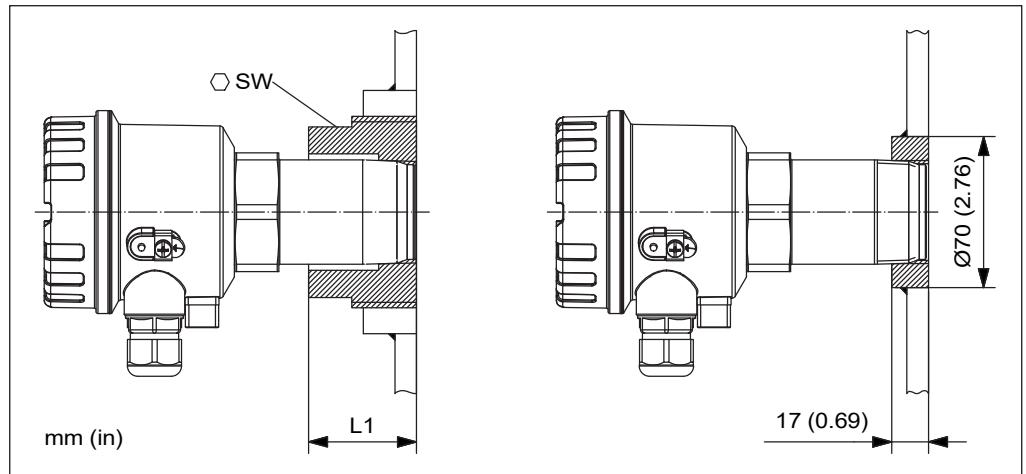


Figure 12: FAR52 weld-in or screw-in adapter

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.

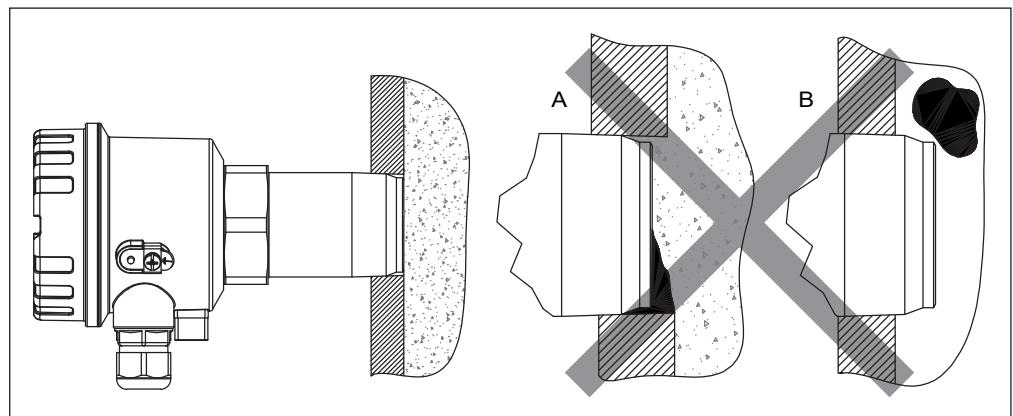


Figure 13: Direct mounting with threaded connection

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.

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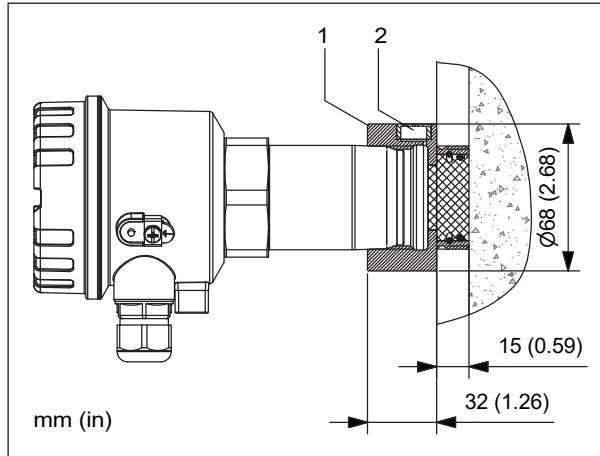


Figure 14: Mounting with high pressure adapter

Notice!

The maximum temperature at the FDR57/FQR57 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 (virgin, unfilled) such as polytetrafluoroethylene (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.

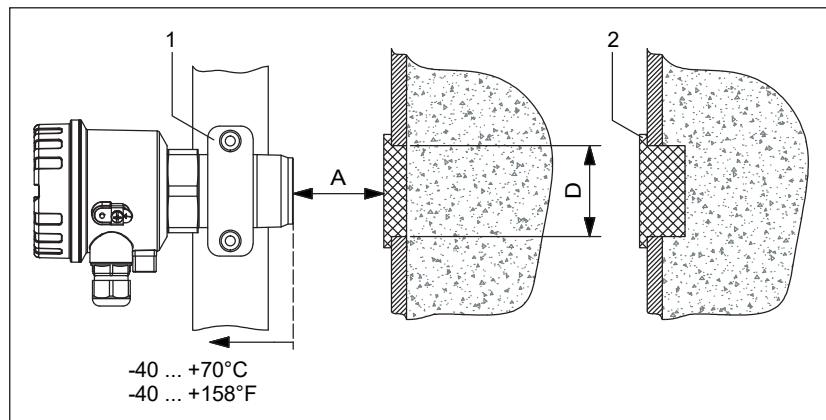


Figure 15: Bracket mounting in front of a microwave-impermeable process wall

1 Bracket

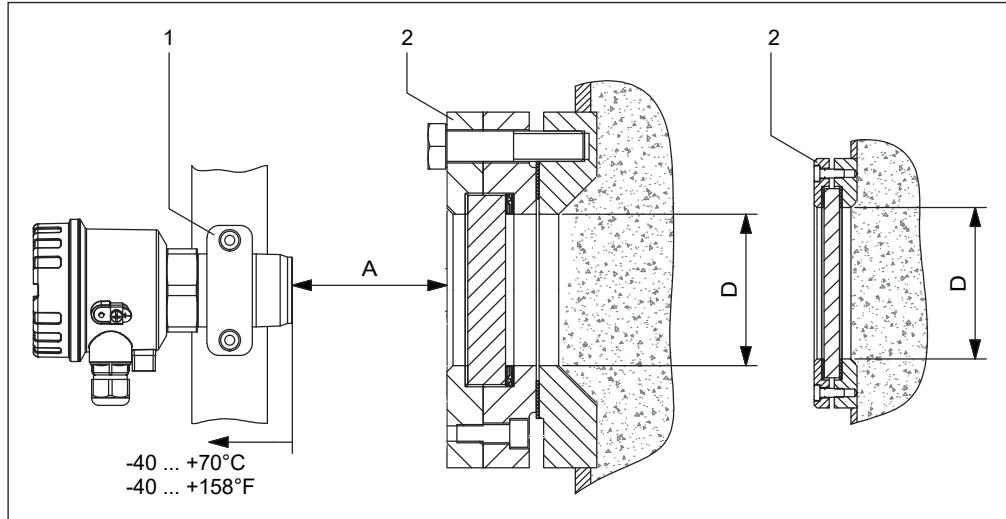
2 Microwave-permeable plug on formation of condensate on the inner wall

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 FDR57/FQR57 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.
- Suitable plugs made of PTFE or aluminum oxide ceramic of type FAR54 are available as accessories in different lengths and diameters.
- Accessories → page 35

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.



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).
- For optimal alignment of the microwave barrier, it should be possible to move the FQR57 transmitter and FDR57 transceiver by ± 10 mm along their longitudinal axes.

Sight glass fittings should in principle only be installed at places where no material can collect on the process side. Mounting on a connecting nozzle, for example, could result in the inability to detect a free path.

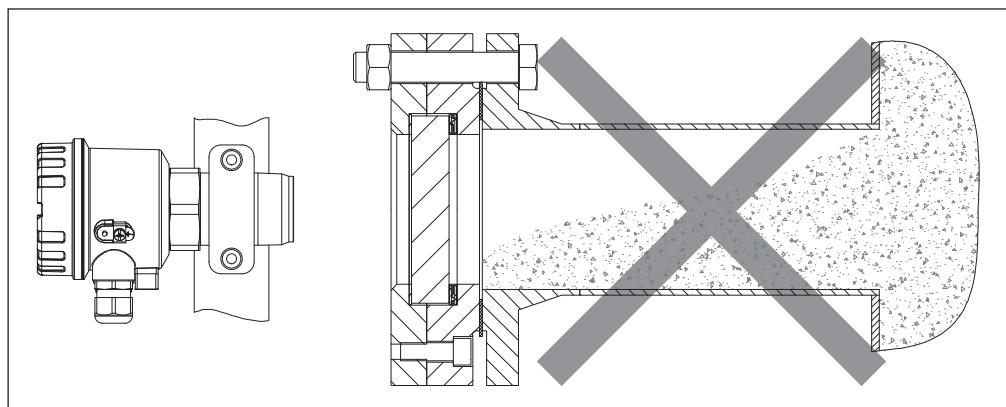


Figure 17: Impermissible mounting with the risk of material collection

Notice!

- Suitable mounting brackets made of plastic or aluminum are available as accessories.
- Suitable sight glass fittings made of stainless steel with borosilicate glass are available as accessories.
- Accessories → page 35

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.

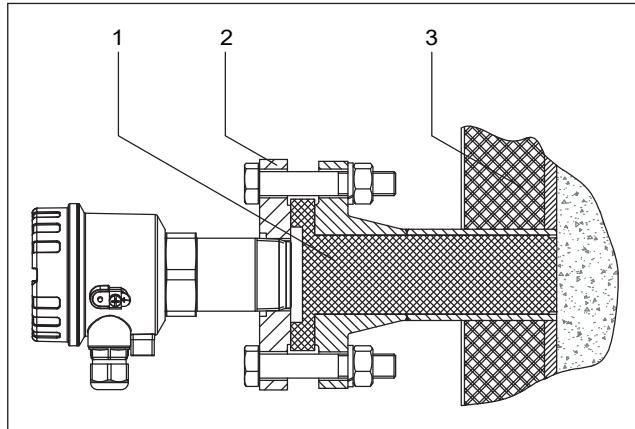


Figure 18: Mounting on available process nozzles

- 1 *Plug*
- 2 *Mounting flange*
- 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.
- Accessories → page 35

Notice!

- 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.

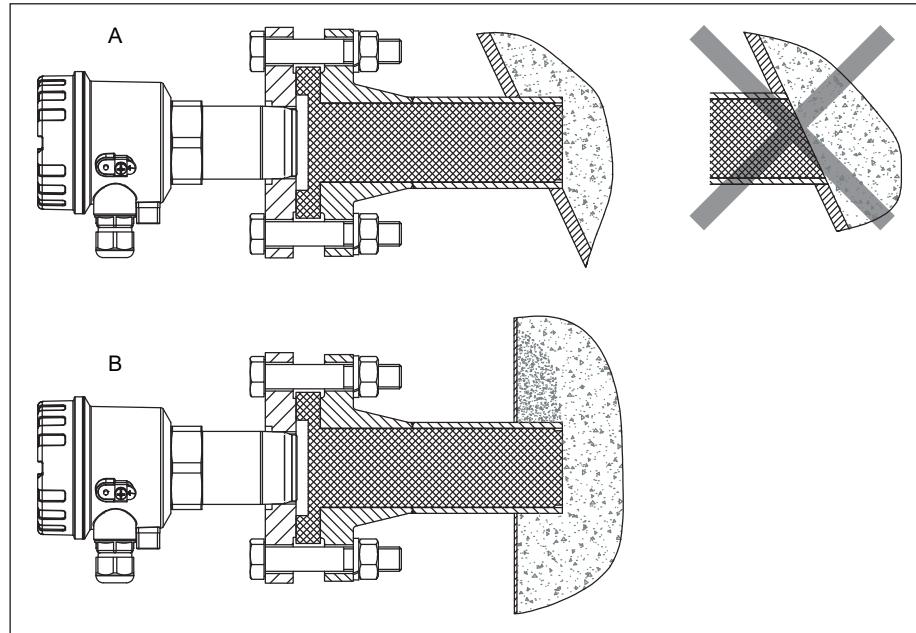


Figure 19: Mounting with the risk of accumulations

Notice!

- When there is a risk of condensate forming between the process connection of the FDR57/ FQR57 and the plug, we recommend using the process nozzle type FAR50, 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.
- Accessories → page 42

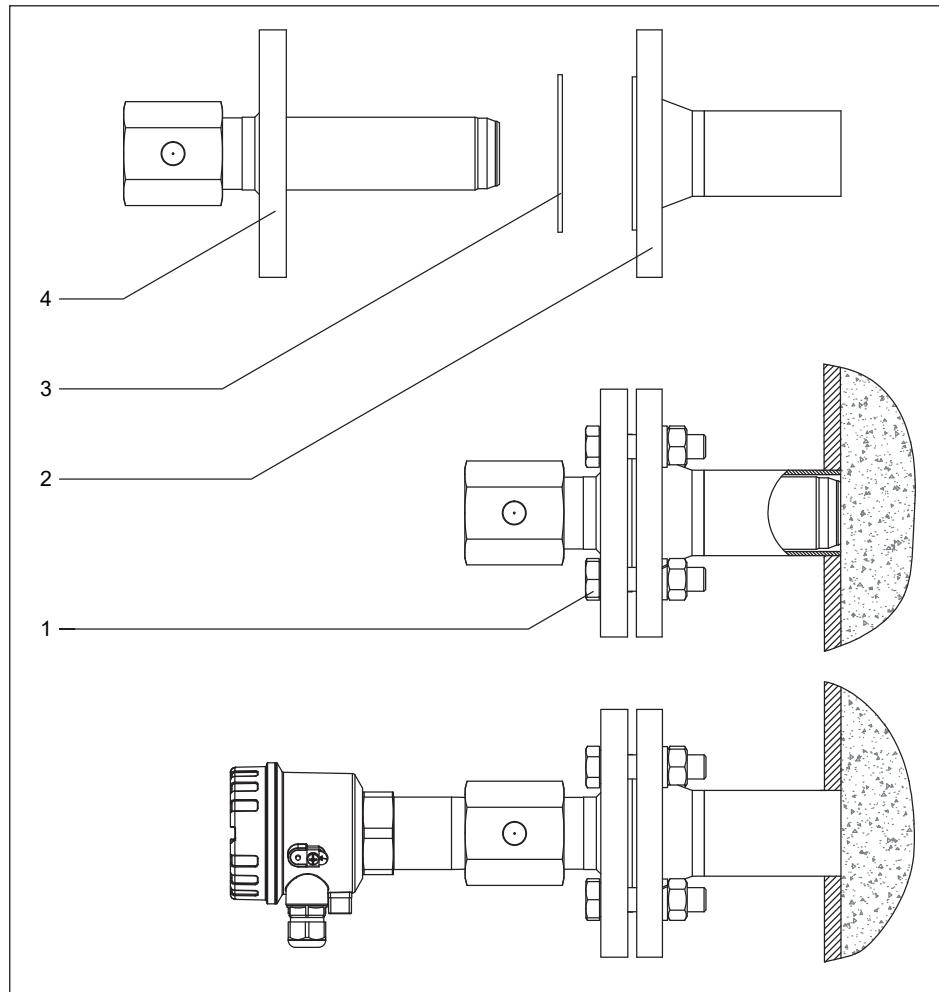


Figure 20: Mounting with FAR51 insertion adapter

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

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 microwave barrier FQR57/FDR57 from the high process temperatures of +70 to +450°C (+158 to +842°F). 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).

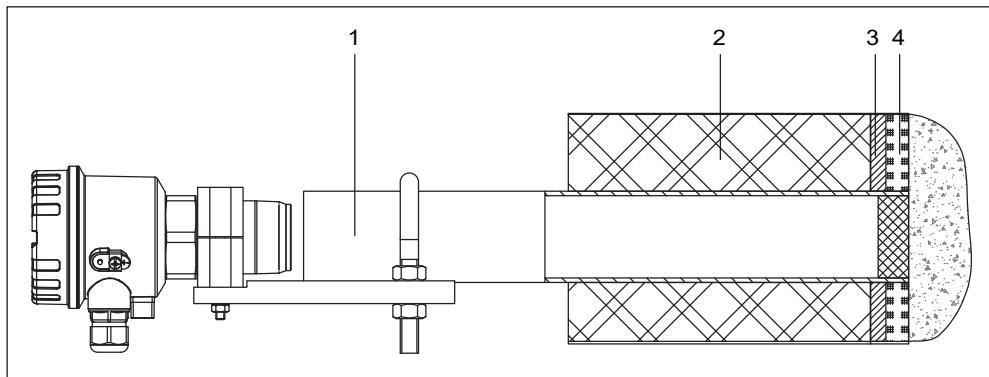


Figure 21: Mounting with spacer tube

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

Notice!

- Suitable spacer tubes of type FAR53, made of steel or stainless steel, are available as accessories in different versions (→ page 43).
- The mounting of devices with mounting brackets (connection with mounting plate) and pipe clamps (connection of mounting plate with spacer tube) allows for movement by ± 10 mm and thus for optimal alignment of the microwave barrier.
- When there is a risk of condensate forming in the spacer tube, we recommend using process nozzle type FAR50 (→ page 42), which is equipped with a mounting flange with a pressure equalization element.

For structural or space reasons, it may be necessary to mount the FQR57/FDR57 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.

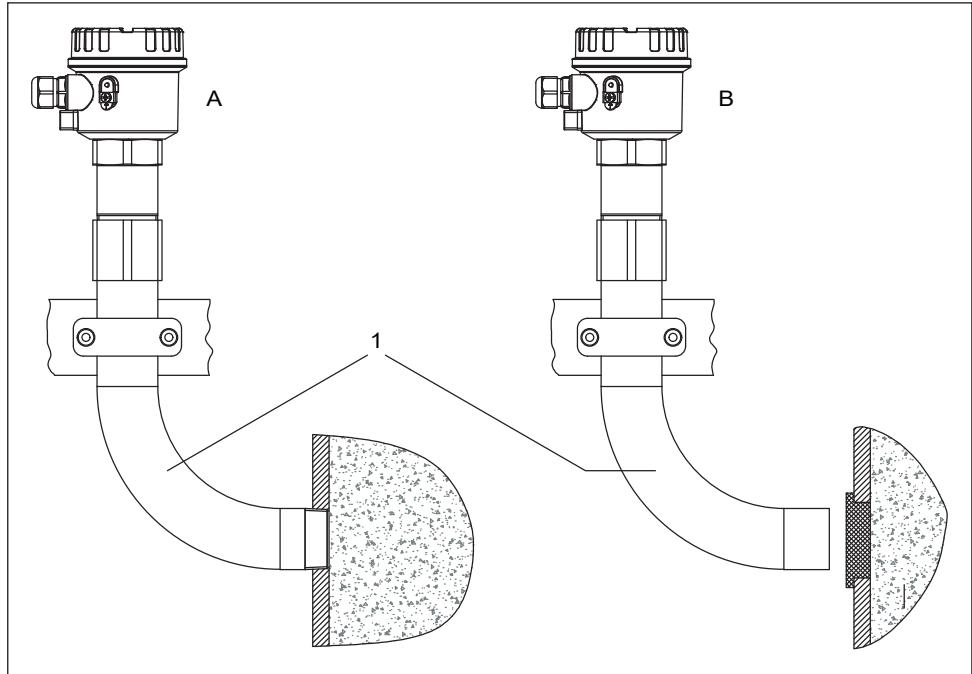


Figure 22: Mounting with wave guide

- 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 (→ page 43) in different versions.

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.

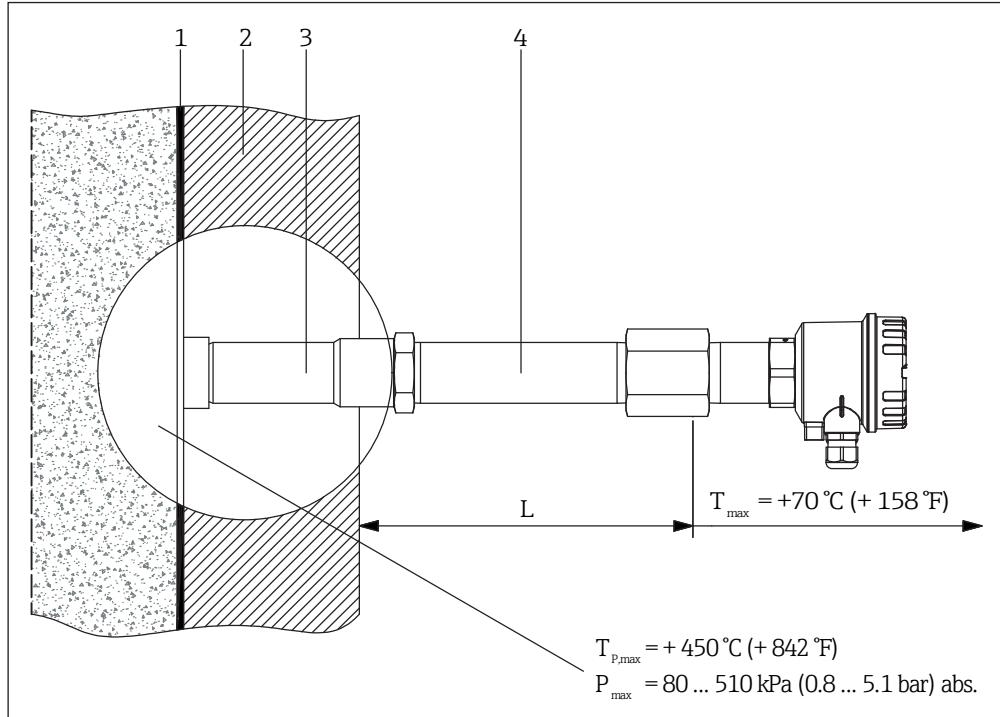


Figure 23: Mounting with high temperature adapter and length extensions

- 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 FDR57/FQR57 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 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)
- IP20 (with open housing)

Vibration resistance see vibration effects → page 12

Electromagnetic compatibility (EMC)

- Interference emission to EN 61326, Electrical Equipment Class B
- Interference immunity to EN 61326, Appendix A (Industrial)
- Normal installation cable is sufficient for the wiring.

Process

Process temperature	<ul style="list-style-type: none">Without optional process adapter: -40 to +70°C (-40 to +158°F)With optional high temperature adapter: -40 to +450°C (-40 to +842°F)Note deviating temperature ranges with the accessories offered!
Process pressure range	<ul style="list-style-type: none">50 to 680 kPa (0.5 to 6.8 bar) absolute, only to be observed with device installed directly in the process80 to 510 kPa (0.8 to 5.1 bar) absolute, with use of the optional high temperature adapter50 to 2000 kPa (0.5 to 20 bar) absolute, with use of the optional high pressure adapterNote deviating pressure ranges with the accessories offered.
Vibration	see vibration effects → page 12

Mechanical construction

Dimensions

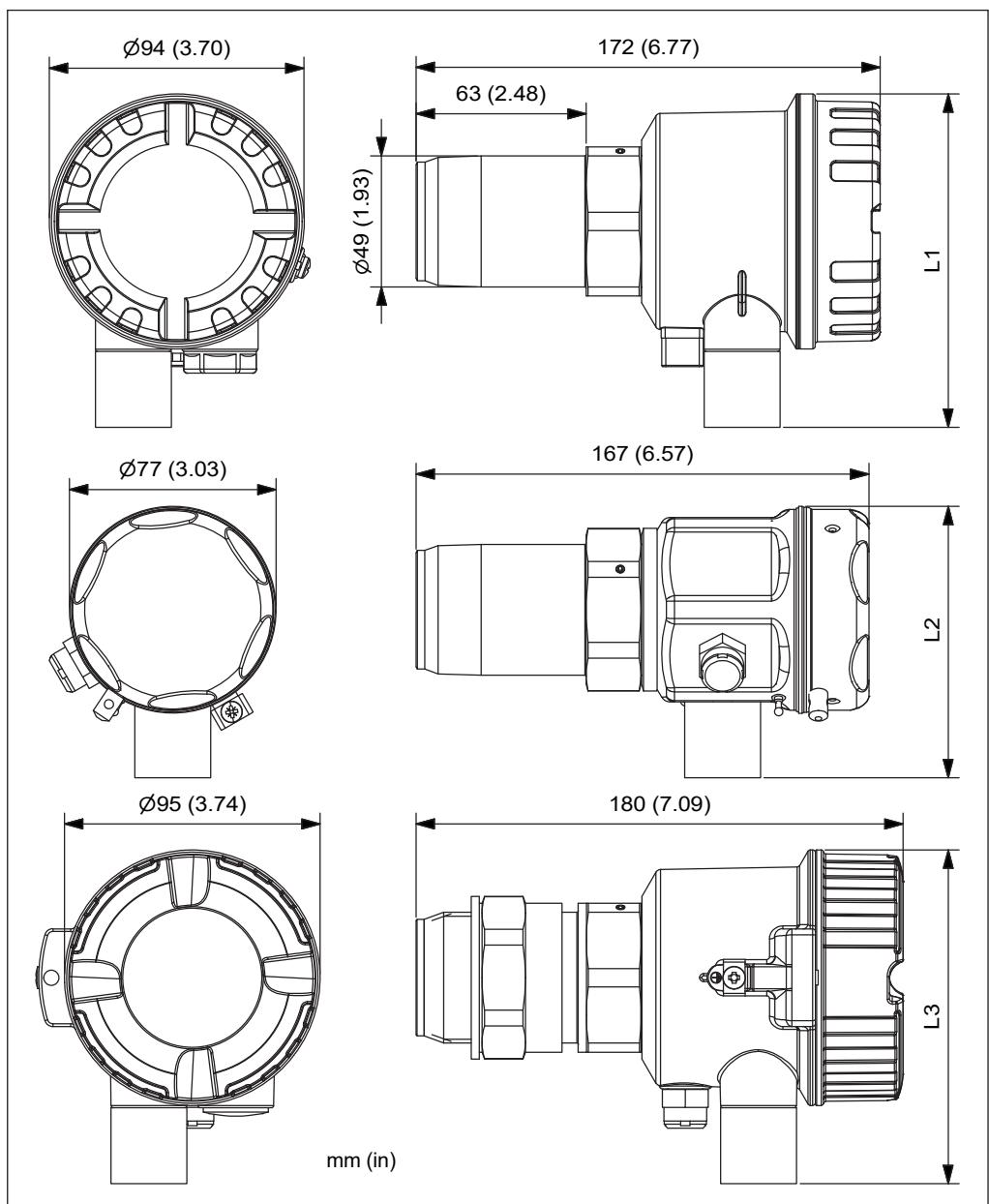


Figure 24: Dimensions

Dimensions L1 to L3 (all dimensions in mm (in)), depending on the housing and electrical connection:

Housing	Electrical connection			
	M20 gland	1/2 NPT thread	M12 connector	Harting connector
Plastic, dimension L1	123 (4.84)	121 (4.76)	111 (4.37)	143 (5.63)
Stainless steel, dimension L2	93 (3.66)	94 (3.70)	88 (3.46)	120 (4.72)
Aluminium, dimension L3	116 (4.57)	117 (4.60)	111 (4.37)	143 (5.63)

Weight	1.1 to 1.7 kg (2.43 to 3.75 lbs), depending on the selected housing and process connection
Materials	<ul style="list-style-type: none">• Stainless steel 316Ti (1.4571):<ul style="list-style-type: none">- Process connection- Pressure equalization element (housing made of stainless steel and aluminum)• Stainless steel 316L (1.4435):<ul style="list-style-type: none">- Housing- Adapter ½ NPT (housing made of stainless steel and aluminum)• Aluminum:<ul style="list-style-type: none">- Housing• Plastic:<ul style="list-style-type: none">- Housing- M20 cable gland, adapter ½ NPT and pressure equalization element (housing made of plastic)• Die-cast zinc:<ul style="list-style-type: none">- M12 connector, nickel-plated- Harting connector, powder-coated• Brass, nickel-plated:<ul style="list-style-type: none">- M20 cable gland (housing made of stainless steel and aluminum)
Process connections	Connection thread: <ul style="list-style-type: none">• R 1½ in accordance with EN 10226• 1½ NPT in accordance with ANSI/ASME• G 1½ in accordance with ISO 228-1

Operability

Operation and configuration is carried out entirely via the FTR525 process transmitter with control unit.

When the housings of the FQR57 transmitter and the FDR57 transceiver are open, a green LED is visible, which indicates a connected power supply (provided by the FTR525).

Certificates and approvals

CE mark	<p>The FQR57/FDR57 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.</p> <p>By applying the CE mark, Kirchgaesser confirms that the device has passed the necessary tests.</p>
Ex approval	<p>The measuring device is certified for use in hazardous areas and the safety instructions of the Operating Instructions are to be observed.</p> <p>→ page 34</p> <p>Notice! Certificates → page 45</p>
Telecommunications	<ul style="list-style-type: none">• 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	<ul style="list-style-type: none">• 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• EN 60079-0 Hazardous areas – part 0: Equipment – general requirements• EN 60079-11 Potentially explosive atmosphere – part 11: Device protection through intrinsic safety “i”

Ordering information

Order code	10	Approval:
	AA	Non-hazardous area
	BA	ATEX II 1G Ex ia IIC T4 Ga / ATEX II 1D Ex ia IIIC T135°C Da
	BB	ATEX II 1/2G Ex ia IIC T4 Ga/Gb / ATEX II 1/2D Ex ia IIIC T135°C Da/Db
	IA	IECEx Ex ia IIC T4 Ga / IECEx Ex ia IIIC T135°C Da
	IB	IECEx Ex ia IIC T4 Ga/Gb / IECEx Ex ia IIIC T135°C Da/Db
	99	Special version, to be specified
	20	Housing:
	A	Polyester, IP66
	B	Stainless steel, IP66
	D	Aluminium, IP66
	9	Special version, to be specified
	30	Electrical connection:
	A	Cable gland M20
	D	Thread 1/2 NPT
	E	M12 connector Binder series 713/763
	F	M12 connector Binder series 713/763 + corresponding mating connector
	H	Harting connector type HAN8D
	J	Harting connector type HAN8D + corresponding mating connector
	Y	Special version, to be specified
	40	Process connection:
	GG2	Thread ISO 228 G 1 1/2, 316Ti
	VE2	Thread ANSI 1 1/2 NPT, 316Ti
	XF2	Thread EN 10226 R 1 1/2, 316Ti
	YYY	Special version, to be specified
	50	Window transmission:
	1	PTFE
	3	Ceramic
	9	Special version, to be specified
FDR57 -		
FQR57 -		

Extended order code

The following order code is optional:

60							Test, report, declaration: *1
							JA Inspection certificate EN10204-3.1, wetted metallic parts
							KH Final inspection report
70							Accessory enclosed: *1
							R9 Special accessory, to be specified
80							Tag: *1
							Z1 Stainless steel
							Z2 Paper
							Z3 Additionally provided
FDR57 -							
FQR57 -							

*1 Multiple selection possible

Comments regarding the product structure

For devices with certification option **BA** und **IA**, the following restrictions apply:

- **Housing (20)**: only **(B)**
- **Electrical connection (30)**: only **(A)** and **(D)**
- **Transmission window (50)**: only **(1)**

For devices with certification option **BB** und **IB**, the following restrictions apply:

- **Housing (20)**: only **(B)** and **(D)**
- **Transmission windows (50)**: only **(1)**

Documentation

The following documents can be downloaded from www.kirchgaesser.com:

- Operating Instructions FDR57/FQR57 (**ba064000a1**)
- Operating Instructions FTR525 (**ba064300en**)
- Catalogue extract FTR525 (**ka064300en**)
- EU-Type Examination Certificate BVS 18 ATEX E 024 X (**bp064000a1**)
- IECEx Certificate of Conformity IECEx BVS 18.0042X (**ec064000en**)

Scope of delivery

The scope of delivery includes the FQR57 or FDR57 in a box with operating instructions included. Depending on the order code, the scope may be extended to include a matching mating connector (electrical connections).

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 can 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.

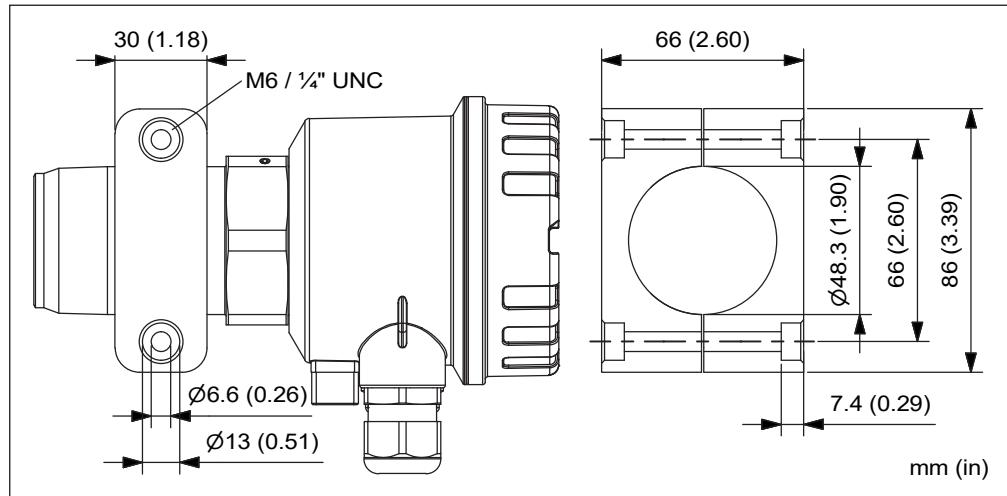


Figure 25: Mounting bracket dimensions

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)

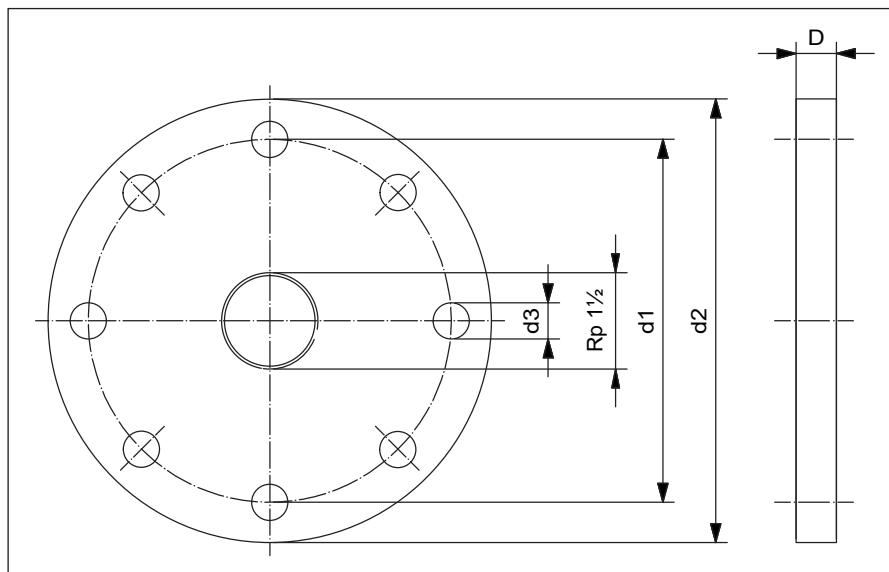


Figure 26: Dimensions of mounting flange (connection dimensions in accordance with EN 1092-1)

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)

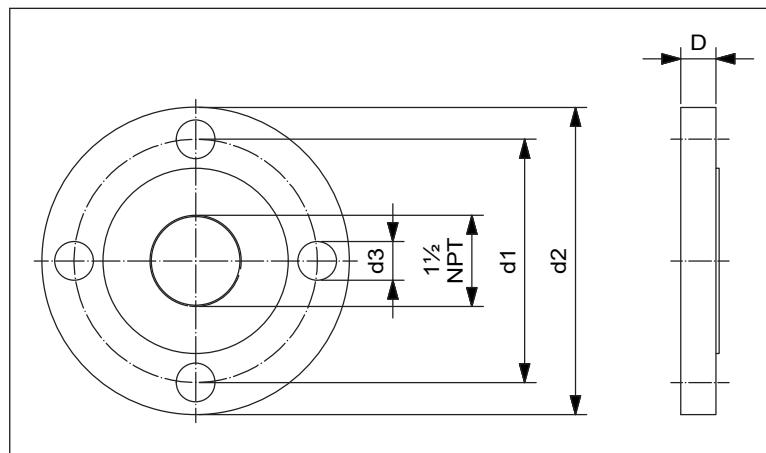


Figure 27: Dimensions of mounting flange (connection dimension in accordance with ANSI/ASME B16.5)

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)

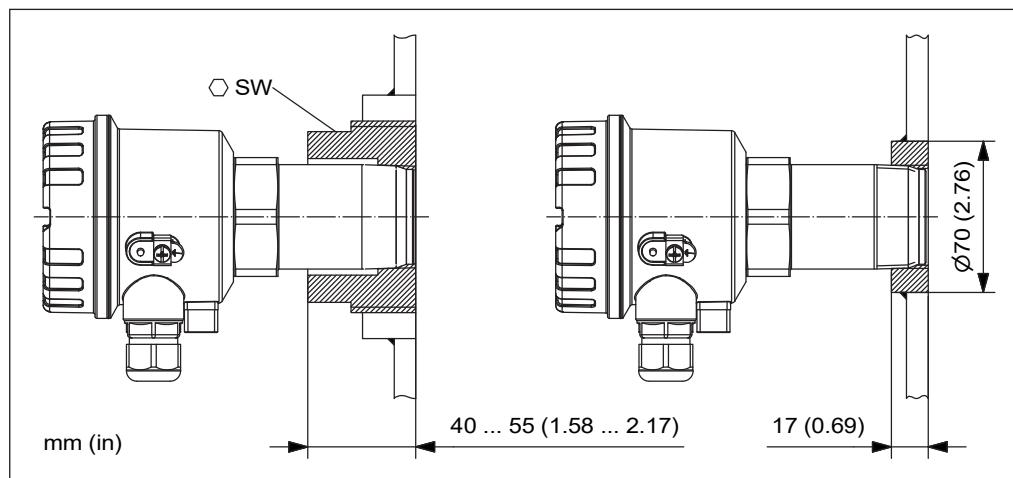


Figure 28: Dimensions of weld-in or screw-in adapter FAR52

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 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)

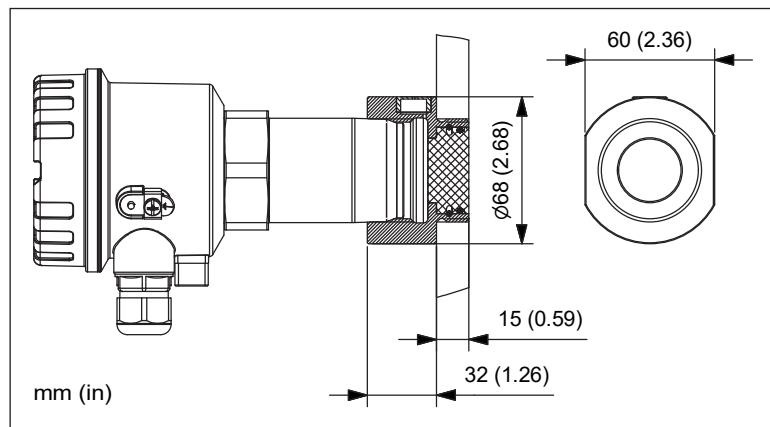


Figure 29: Dimension of the high pressure adapter

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)

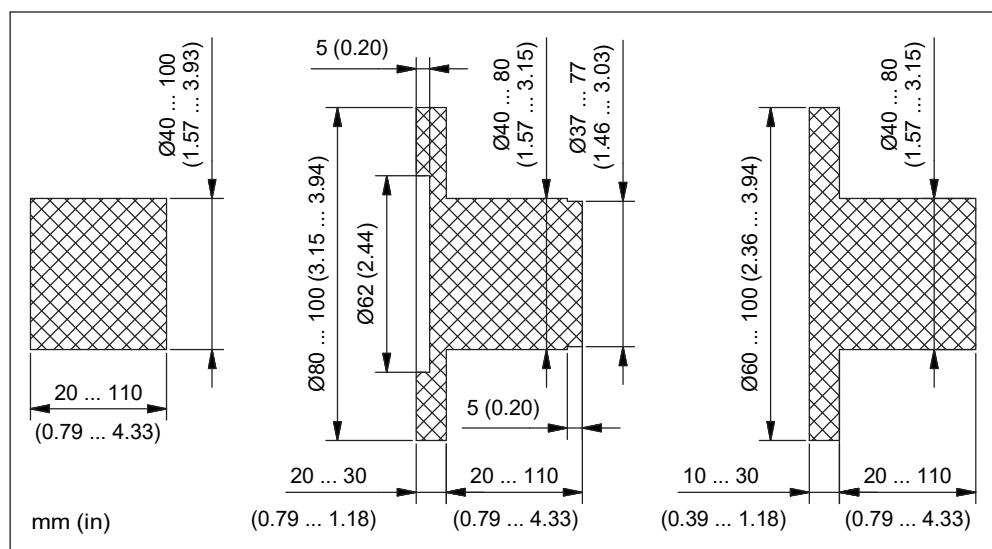


Figure 30: Dimensions of FAR54 plugs

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.

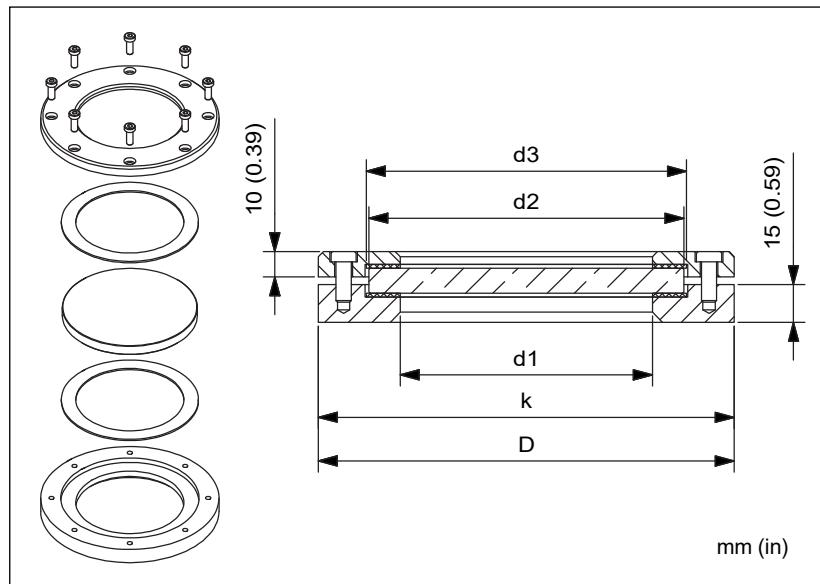


Figure 31: Dimensions of sight glass fitting for welding on/in for unpressurized processes

DN	d1 mm (in)	d2 mm (in)	d3 mm (in)	D mm (in)	k 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.

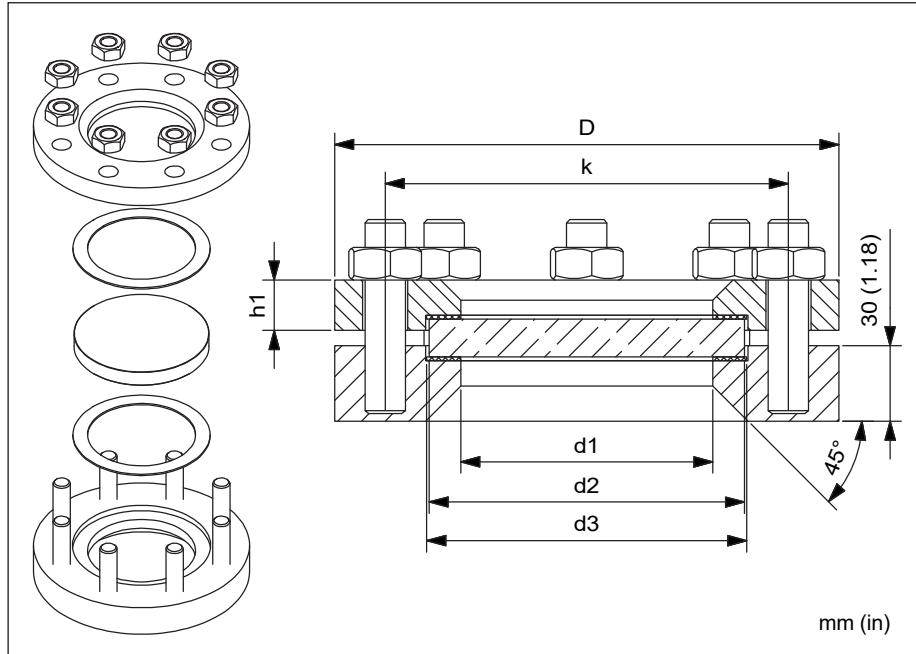


Figure 32: Dimensions of sight glass fitting for welding on/in for processes up to 1 MPa

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).

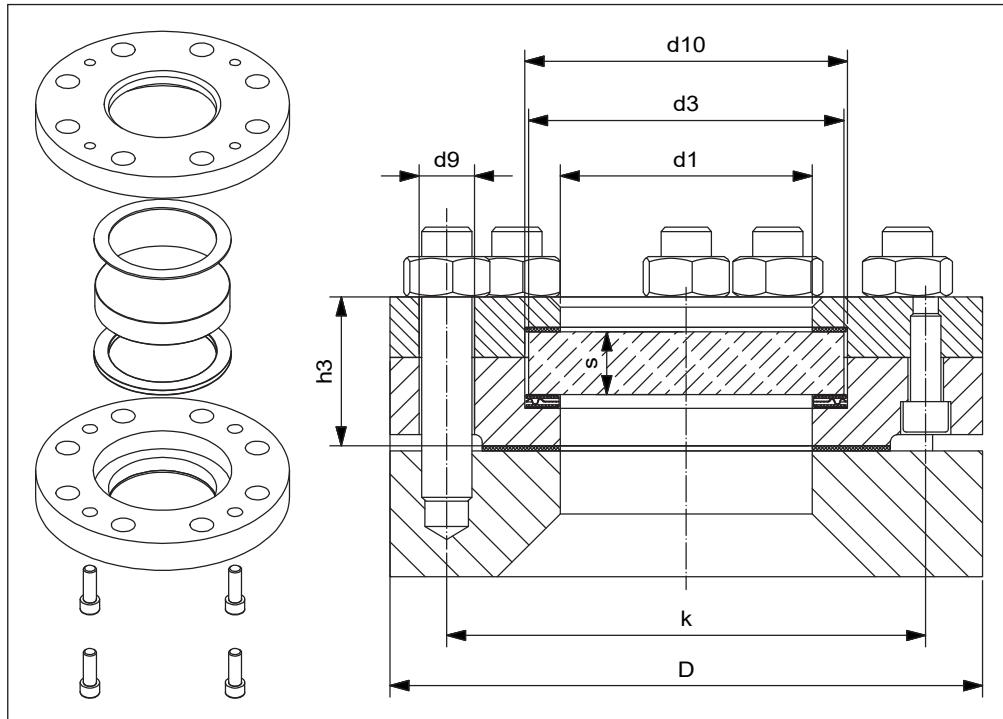


Figure 33: Dimensions of sight glass fitting for bolting on for processes up to 2.5 MPa

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)

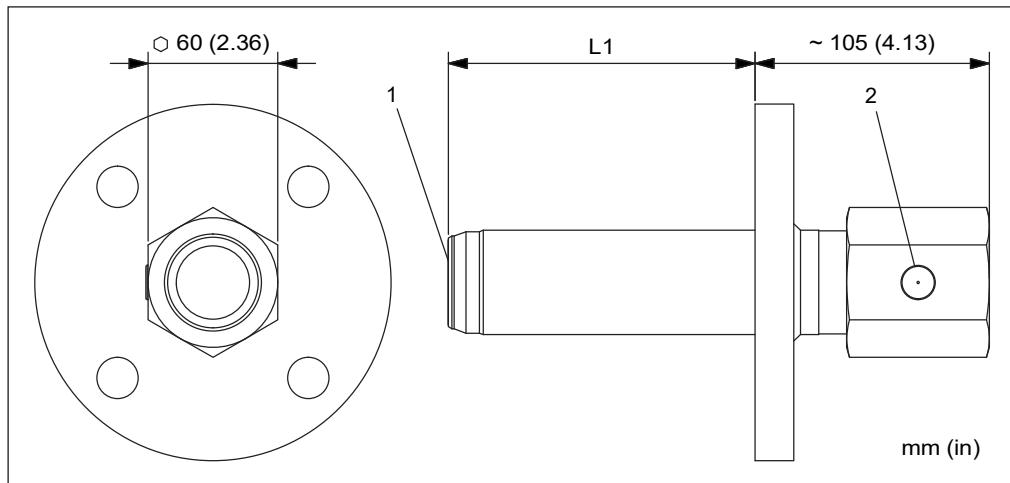


Figure 34: Dimensions of plug-in adapters

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)

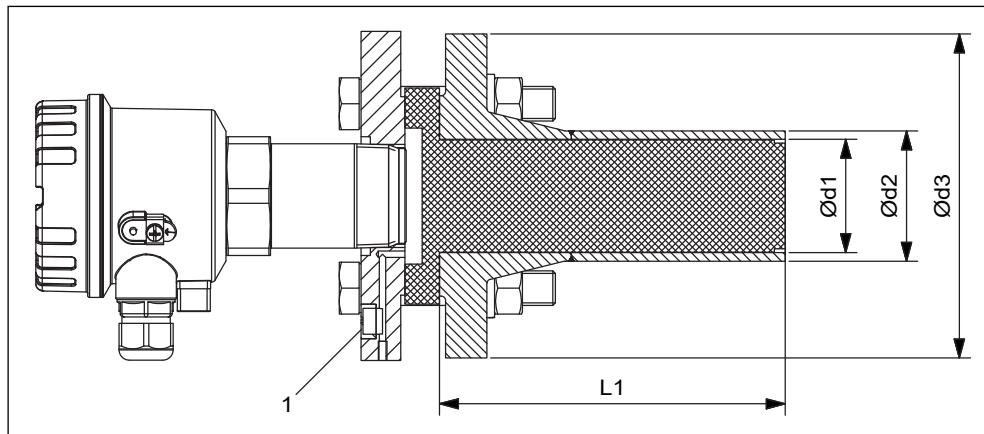


Figure 35: Dimensions of weld-in nozzles

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)

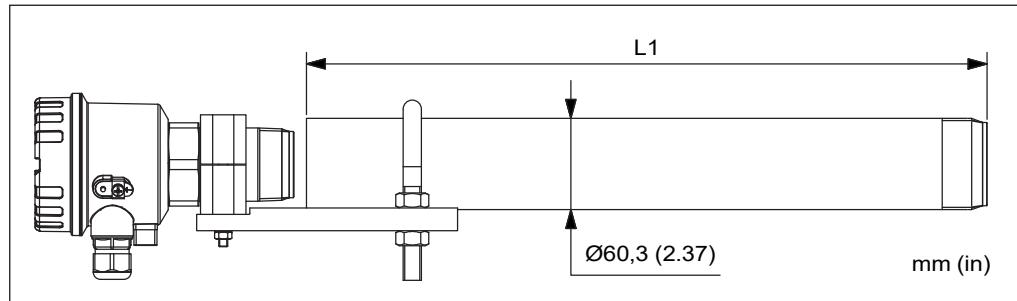


Figure 36: Dimensions of spacer tube (wave guide)

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)

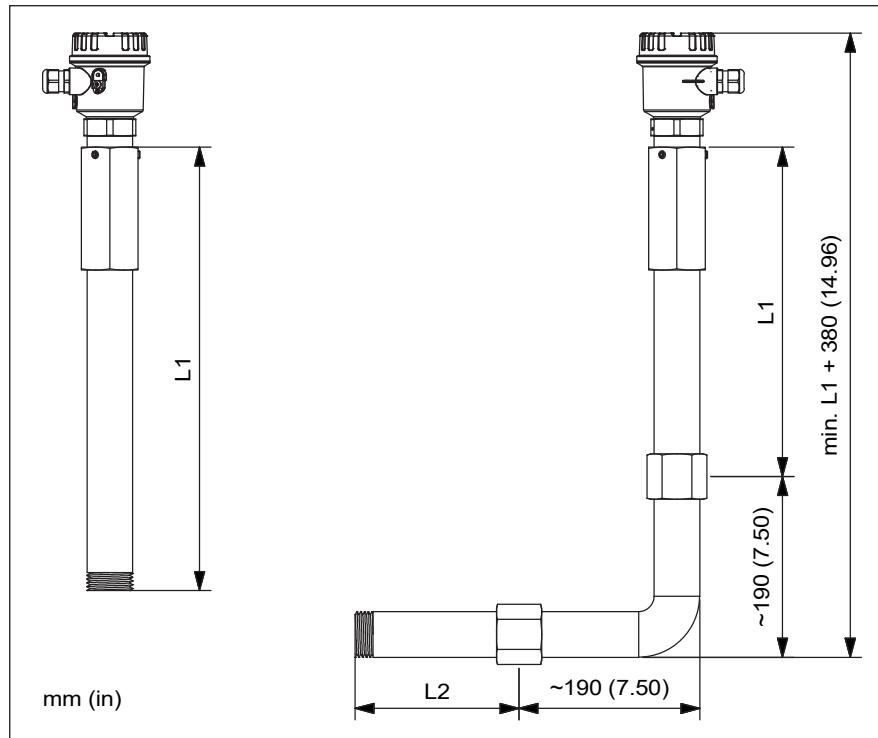


Figure 37: Dimensions of wave guide

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 :

- 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)

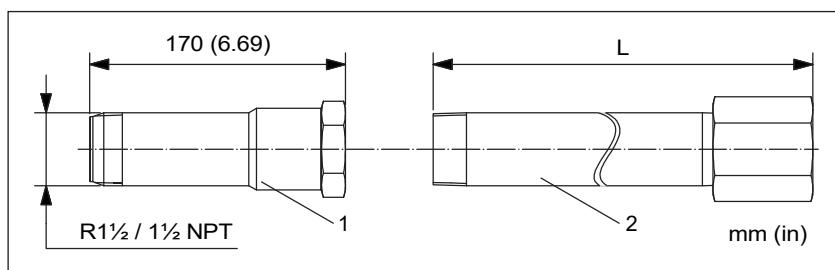


Figure 38: Dimensions of high temperature adapter and extensions

1 High temperature adapter
2 Extension

Technical data

Ambient conditions	<ul style="list-style-type: none">• Ambient temperature: -40 to +70°C (-40 to +158°F)• Ambient pressure: 80 to 110 kPa (0.8 to 1.1 bar) absolute
Degree of protection	<ul style="list-style-type: none">• IP66 (with closed housing)• IP20 (with open housing)
Process conditions	<ul style="list-style-type: none">• Process temperature: -40 to +70°C (-40 to +158°F)• Process pressure: 50 to 680 kPa (0.5 to 6.8 bar) absolute
	<p>Notice! Using the optional accessories (→ page 35) the process conditions can be expanded:</p> <ul style="list-style-type: none">• High temperature adapter: -40 to +450°C (-40 to +842°F)• High pressure adapter: 50 to 2000 kPa (0.5 to 20 bar) absolute
Certifications	<p>EU-Type Examination Certificate</p> <ul style="list-style-type: none">• Regulation: Directive 2014/34/EU (ATEX)• Standards: EN 60079-0, EN 60079-11, EN 60079-26• Designation of explosion protection:<ul style="list-style-type: none">- ATEX II 1G Ex ia IIC T4 Ga and ATEX II 1D Ex ia IIIC T135°C Da (Device types FQR57-BA* and FDR57-BA*)- ATEX II 1/2G Ex ia IIC T4 Ga/Gb and ATEX II 1/2D Ex ia IIIC T135°C Da/Db (Device types FQR57-BB* and FDR57-BB*)• Certificate number: BVS 18 ATEX E 024 X <p>IECEx Certificate of Conformity</p> <ul style="list-style-type: none">• Regulation: IEC Certification Schema for Explosive Atmospheres• Standards: IEC 60079-0, IEC 60079-11, IEC 60079-26• Designation of explosion protection:<ul style="list-style-type: none">- IECEx Ex ia IIC T4 Ga and IECEx Ex ia IIIC T135°C Da (Device types FQR57-IA* and FDR57-IA*)- IECEx Ex ia IIC T4 Ga/Gb and IECEx Ex ia IIIC T135°C Da/Db (Device types FQR57-IB* and FDR57-IB*)• Certificate number: IECEx BVS 18.0042X

Subject to change!

For your notes!



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