

# Technical Information

## Soliwave FDR56/FQR56

### Microwave barrier



## Compact microwave barrier for non-contact limit detection for bulk solids

### Application

The Soliwave 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.

Suitable as level limit switch for all kinds of bulk solids and liquids, for counting piece goods (such as bags or boxes) and analysing of build-up, fouling etc.

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.

### Device properties

- Detection range up to 100 m
- 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
- With a wide range of available accessories adaptable to various applications
- For use in hazardous areas (dust)

### Your benefits

- Compact devices:
  - 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.
- Measuring principle almost independent of process conditions
- 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)
- Mechanical robustness
  - No wear
  - Process-wetted ceramic sensor diaphragm (optional)
  - Long service life
  - Maintenance-free
- Analogue 4-20 mA current output for analysis of build-up, fouling etc.
- Adjustable sensitivity
- Compliant with ATEX, CSA and IECEx

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## Document information

### Display conventions





#### Safety symbols

Symbol	Meaning
<b>NOTICE</b>	<b>NOTICE!</b> This symbol contains information on procedures and other facts which do not result in personal injury.

#### Electrical symbols

Symbol	Meaning
	Direct current
	Alternating current
	Direct current and alternating current
	<b>Protective Earth (PE)</b> A terminal which must be connected to ground prior to establishing any other connections.









#### Symbols for certain types of information

Symbol	Meaning
	<b>Tip</b> Indicates additional information.
	Reference to documentation
	Reference to page
	Reference to graphic

#### Symbols in graphics

Symbol	Meaning
1, 2, 3 ...	Item numbers
1., 2., 3. ...	Series of steps

#### Device-specific symbols

Symbol	Meaning
	<b>LED on</b> Indicates an illuminated LED
	<b>LED off</b> Indicates a non-illuminated LED
	<b>Configuration mode</b> Indicates the function number or value
	<b>Normal operation</b> Indicates only the signal strength of the limit detection
	<b>Key (+)</b> Indicates the key for increasing a function value
	<b>Key (-)</b> Indicates the key for reducing a function value
	<b>Free path</b> Indicates a free path of the limit detection
	<b>Covered path</b> Indicates a covered path of the limit detection

## 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.

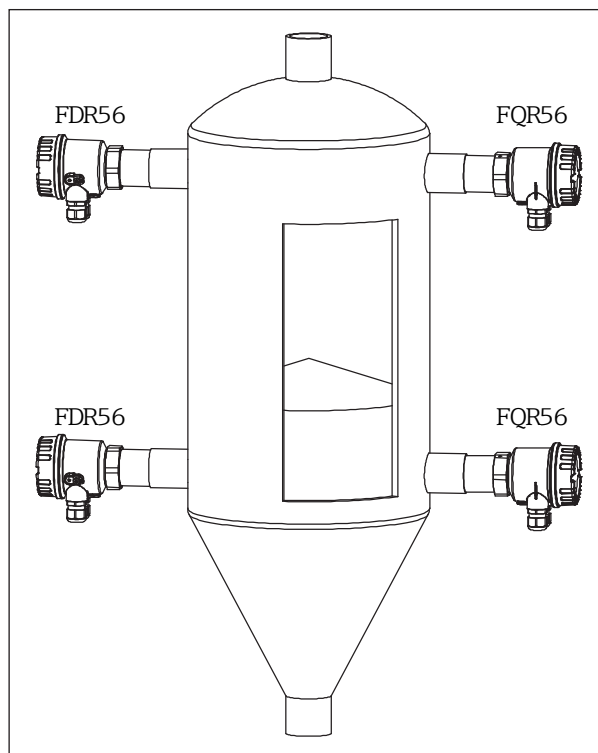
The complete measuring system for limit detection consists of an FQR56 transmitter and a FDR56 transceiver.

### 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 is lower.
- 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 Nivotester 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 Nivotester FTR525.

### Example: min/max limit detection of a vessel

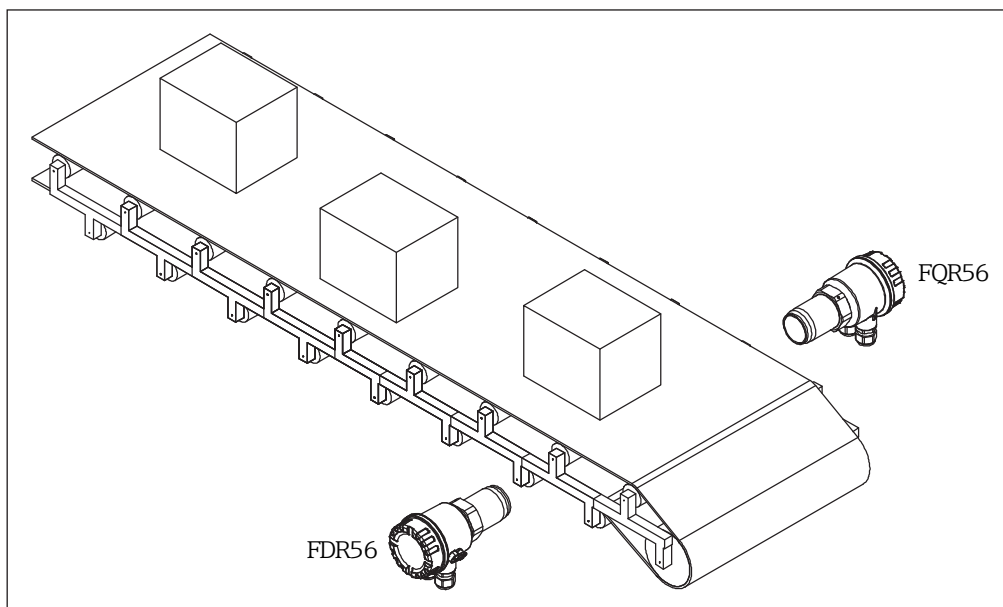
With the help of two microwave barriers, the overshoot of the upper (e.g. product overflow) and the undercut of the lower limit value (e.g. dry running of the discharge screw conveyor) can be detected safely.



1 Example of min/max limit detection

**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).

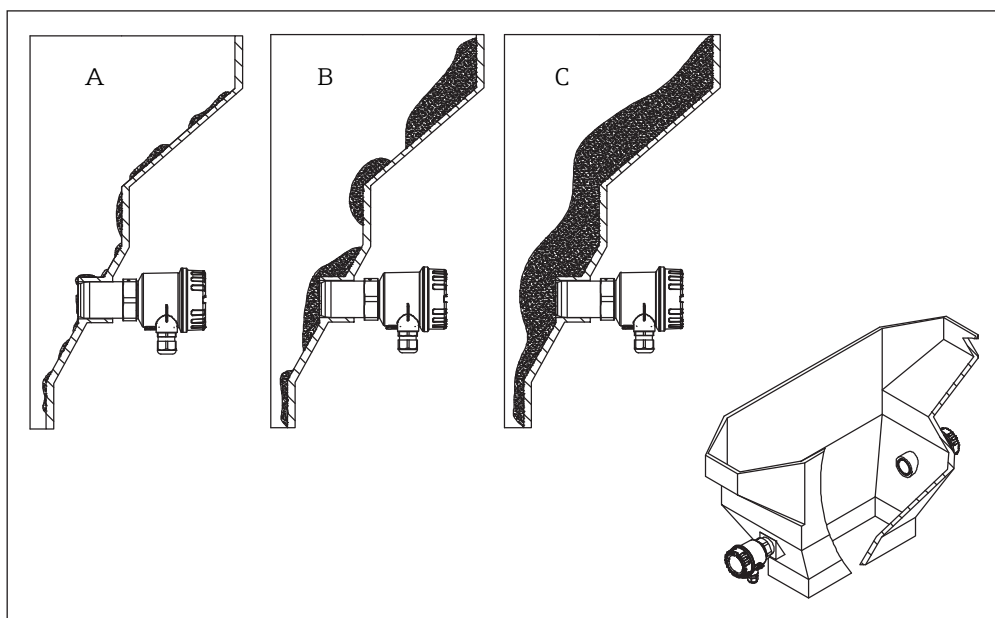


2 Example of counting piece goods

**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.



3 Example build-up detection in an electrostatic filter

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

**NOTICE**


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 (→  36).

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**Safety**

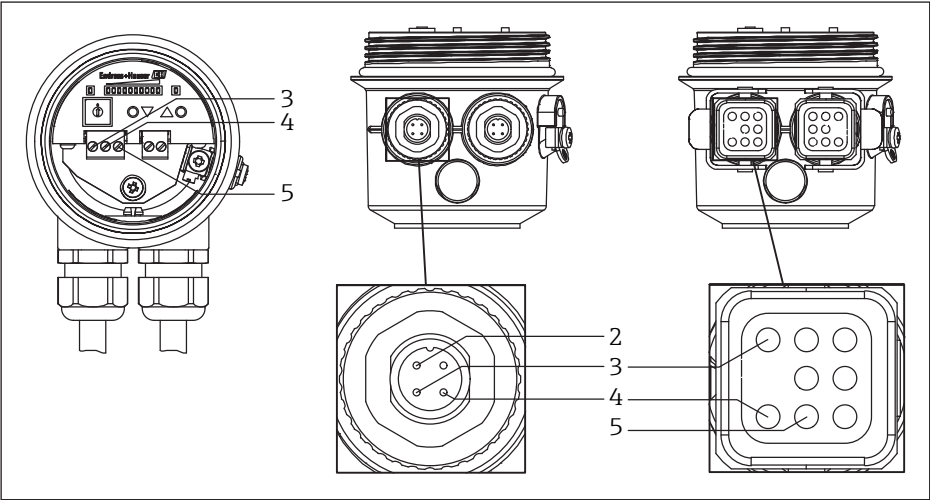
We shall only grant a guarantee if the device is installed and operated in accordance with the Operating Instructions. Safety measures in accordance with the user's safety standard, which provide additional protection for the device and its signal transfer, are to be implemented by the user.

## Input

<b>Measured variable</b>	Strength of the electromagnetic wave received by the FQR56 transmitter
<b>Measuring range (detection range)</b>	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.
<b>Operating frequency</b>	24.15 GHz $\pm$ 80 MHz
<b>Transmitting power</b>	<p>The radiated power by the FQR56 is maximum 100 mW e.i.r.p. (equivalent isotrope radiation performance).</p> <ul style="list-style-type: none"> <li>■ Power density directly in front of the device: Approx. 1 mW/cm<sup>2</sup></li> <li>■ Power density at a distance of 1 m: Approx. 0.3 <math>\mu</math>W/cm<sup>2</sup></li> </ul> <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>
<b>Switching frequency</b>	max. 2 Hz
<b>Antenna opening angle (3 dB)</b>	approx. $\pm$ 9 °
<b>Switching frequency FDR56</b>	max. 4 Hz (Output $\rightarrow$ 8)

## Output

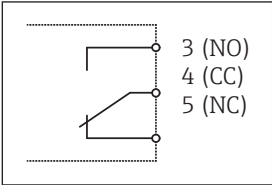
Terminal and onnector assignment



4 Output: Terminal and connector assignment (connector 2)

Relay

- Potential-free change-over contact
- Switching capacity:
  - ~ 250 V / 4 A (Harting connector type HAN8D max. 50 V)
  - = 125 V / 0.4 A or 30 V / 4 A
- Switching frequency: max. 4 Hz



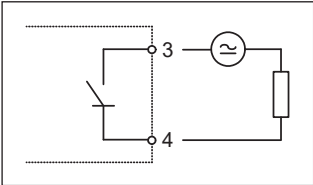
Electrical connection	Relay		
Connection terminals	Terminal 3 (NO)	Terminal 4 (CC)	Terminal 5 (NC)
M12 connector (Binder series 713/763)	Connector 2		
	Terminal 2 (NO)	Terminal 3 (CC)	Terminal 4 (NC)
Harting connector type HAN8D	Connector 2		
	Terminal 3 (NO)	Terminal 4 (CC)	Terminal 5 (NC)

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 V / 0.4 A
  - = 40 V / 0.4 A
- Switching frequency: max. 2 Hz

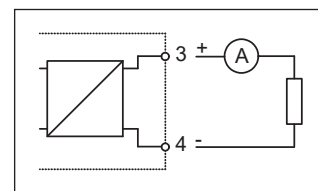


Electrical connection	Solid-state relay
Connection terminals	Terminal 3 – 4
M12 connector (Binder series 713/763)	Connector 2, contact 3 – 4
Harting connector type HAN8D	Connector 2, contact 3 – 4



**Current**

- Current output 4 ... 20 mA
- Active
- Max. load: 600  $\Omega$

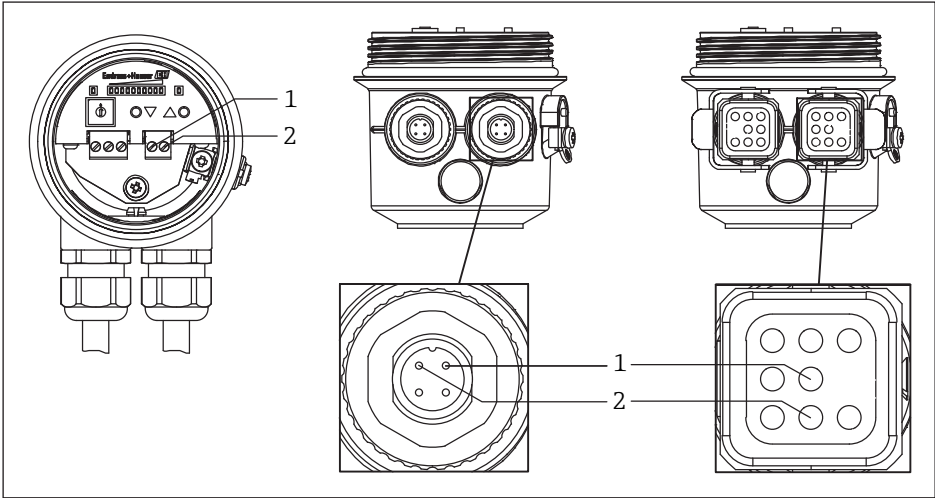


Electrical connection	Current output
Connection terminals	Terminal 3 (+) – 4 (-)
M12 connector (Binder series 713/763)	Connector 2, contact 3 (+) – 4 (-)
Harting connector type HAN8D	Connector 2, contact 3 (+) – 4 (-)

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

## Power supply

### Terminal and connector assignment



5 Power supply: Terminal and connector assignment (connector 1)

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 (→ 10) is used to connect the FDR56/FQR56 to the power supply.

### Supply voltage

- ~ 85 to 253 V, 50/60 Hz
- = 20 to 60 V or ~ 20 to 30 V, 50/60 Hz

### NOTICE


- The polarity of the supply voltage can be set as required.
- When using the public powers supply, install an easy accessible power switch in the proximity of the instrument. Mark the power switch as a disconnecter 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 V or ~ 20 ... 30 V, 50/60 Hz.

### Power consumption

- FQR56:
  - max. 7 VA (~ 85 ... 253 V, 50/60 Hz)
  - max. 1 W (= 20 ... 60 V) or 1.5 VA (~ 20 ... 30 V, 50/60 Hz)
- FDR56:
  - max. 9 VA (~ 85 ... 253 V, 50/60 Hz)
  - max. 2.4 W (= 20 ... 60 V) or 4 VA (~ 20 ... 30 V, 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<sup>2</sup>.
  - Potential equalization of the FDR56/FQR56 should be incorporated in the local potential equalization.

 For devices intended for use in hazardous locations, please observe the guidelines in the Ex documentation (XA).

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<b>Terminals</b>	Max. 1.5 mm <sup>2</sup>
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- |                      |   |
|----------------------|---|
| <b>Cable entries</b> | <ul style="list-style-type: none"><li>■ Cable gland M20 x 1.5 or cable entry ½ NPT</li><li>■ Degree of protection: Min. IP66</li><li>■ Cable gland in non-hazardous areas:<ul style="list-style-type: none"><li>- Material: Plastic</li><li>- Color: Gray</li><li>- Clamping range: 5 to 10 mm (EN 61444) or 7-10 mm (UL-514 B)</li></ul></li><li>■ Cable gland in hazardous areas:<ul style="list-style-type: none"><li>- Material: Nickel-plated brass</li><li>- Color: Silver</li><li>- Clamping range: 7 to 10.5 mm</li></ul></li><li>■ Quantity: 2 pieces per device</li></ul> |
|----------------------|---|

**NOTICE**

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

- 
- |                         |   |
|-------------------------|---|
| <b>Device connector</b> | <ul style="list-style-type: none"><li>■ M12 connector (Binder series 713/763)</li><li>■ Harting connector type HAN8D</li></ul><br><div style="display: flex; align-items: flex-start;"><div style="margin-right: 10px;"></div><div><ul style="list-style-type: none"><li>■ Suitable mating connectors are available as an order variant.</li><li>■ Suitable mating connectors and prefabricated connection cables are available as accessories (→ 32).</li></ul></div></div> |
|-------------------------|---|
- 

- |                            |  |
|----------------------------|--|
| <b>Cable specification</b> | <ul style="list-style-type: none"><li>■ Normal instrument cable is sufficient</li><li>■ Conductor cross-section: max. 1.5 mm<sup>2</sup></li></ul> |
|----------------------------|--|

## Performance characteristics

<b>Reference operating conditions</b>	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 Soliwave microwave barrier.
<b>Influence of ambient temperature</b>	The ambient temperature has no direct influence on the measuring system (devices are temperature-compensated internally).
<b>Vibration effects</b>	<p>Vibration resistance – continuous load with sliding frequency in accordance with EN 60068-2-6:</p> <ul style="list-style-type: none"><li>■ -40 to +80 °C (-40 to +176 °F)</li><li>■ Excitation: Sine</li><li>■ Frequency range: 10 to 55 Hz</li><li>■ Amplitude: 0.75 mm</li><li>■ Throughput speed: 1 octave per minute</li><li>■ Test axes: Three directions (X, Y, Z)</li><li>■ Number of frequency cycles: 20 per axis</li><li>■ Test duration: Approx. 1 h 38 min per axis</li><li>■ Test temperature: Room temperature</li></ul>

## Installation

### Mounting location

The mounting location must be selected such that application-specific influences are minimized (→ 12).

#### NOTICE

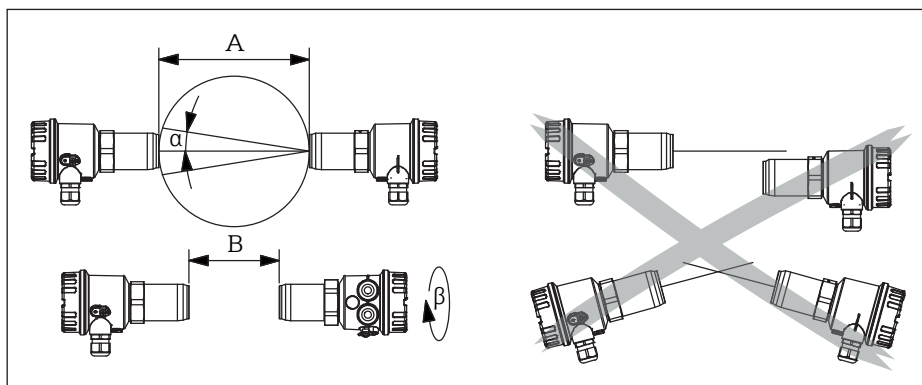
- In case of vibrating mounting locations it is recommended to use devices with encapsulated electronics (see ordering structure "Accessory mounted").
- Interfering reflections on metal parts must be avoided.
- Depending on the installation locations, different process adapters are available as accessories (→ 36).



For devices intended for use in hazardous locations, please observe the guidelines in the Ex documentation (XA).

### 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) =  $9^\circ$ ).



6 Orientation

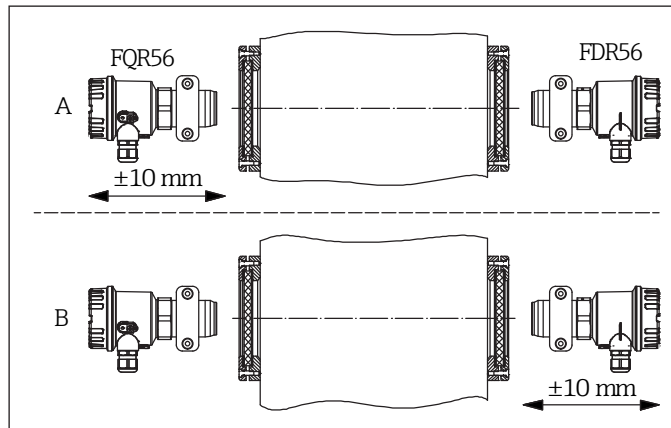
- A Detection range 0.3 ... 100 m  
 B Detection range 0.03 ... 0.3 m  
 α Angle of radiation approx.  $9^\circ$   
 β  $90^\circ$

### 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  $180^\circ$  relative to one another or  $90^\circ$  if the detection range is under 500 mm, see below).
- 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  $90^\circ$  relative to one another to avoid possible overrangings.

### Improvement of signal quality when mounting in front of windows

When installed in front of microwave permeable windows, the signal quality can be improved by moving the FQR56 transmitter and FDR56 transceiver along their longitudinal axis.



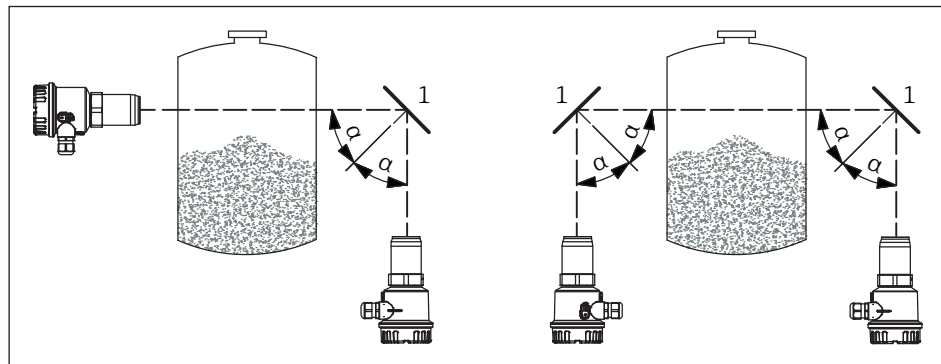
■ 7 Improvement of signal quality

### 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).



■ 8 Using reflectors

1 Reflector

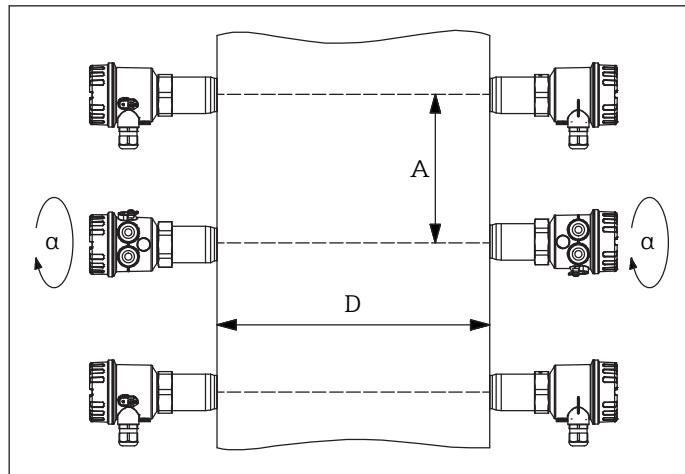
$\alpha$  Angle of entrance = angle of emission

### 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, it can happen that several microwave barriers are operated in parallel at one location (e.g. for detecting multiple level limits in a pipe). To prevent mutual interference, five different channels (operating frequencies) can be selected on the FQR56 transmitter. In addition, it is recommended to mount every second microwave barrier rotated by  $90^\circ$ .



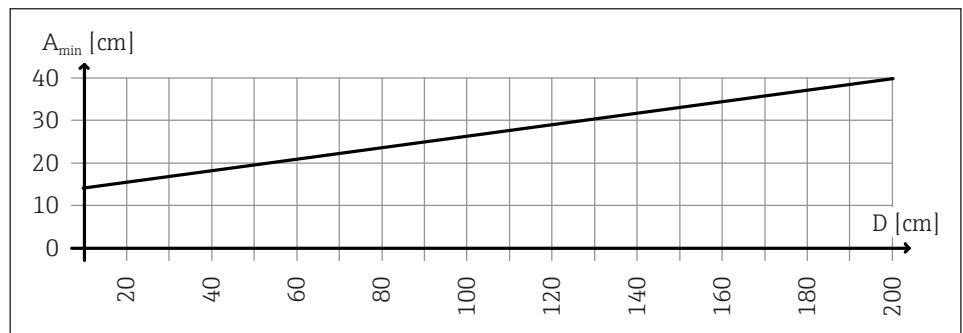
9 Parallel mode

$A$  Distance between microwave barriers

$D$  Detection distance

$\alpha$   $90^\circ$

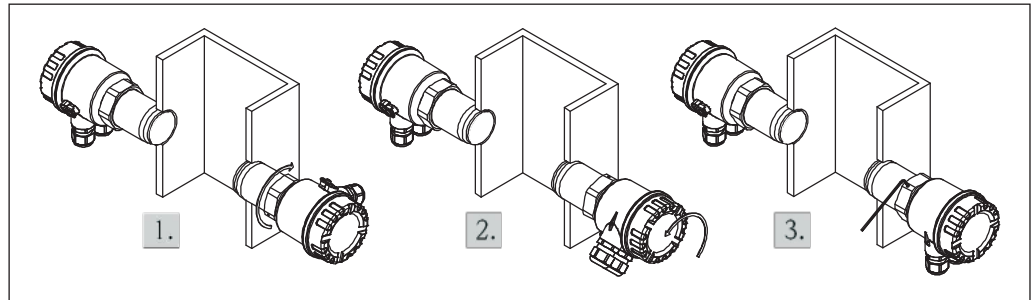
When using different channels (operating frequencies) and operation as shown in the example for parallel operation, the following dependency of the detection distance  $D$  to the distance  $A$  of the individual microwave barriers applies.



10 Dependency of detection distance to the distance of the microwave barriers

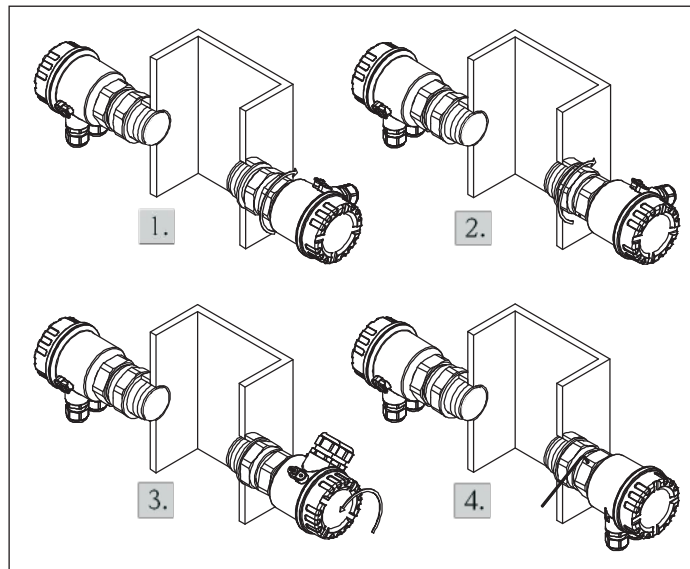
**NOTICE**

- 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 → 31

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

11 Installation with self-sealing connection thread

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

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

12 Installation with non-self-sealing connection thread

1. Slide the enclosed process seal over the process connection and screw the non-self-sealing connection thread G 1½ into the existing screw-in thread (SW55 hexagon).
2. Tighten the counter nut of the connection thread (also SW55 hexagon).
3. Align electronic housing.
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 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.

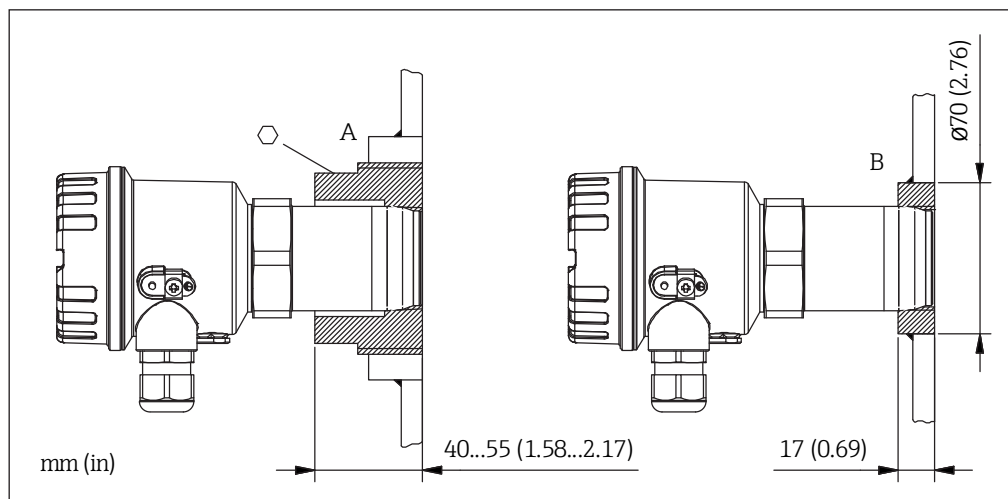


**Direct mounting with threaded connection**

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.



- 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 → 36

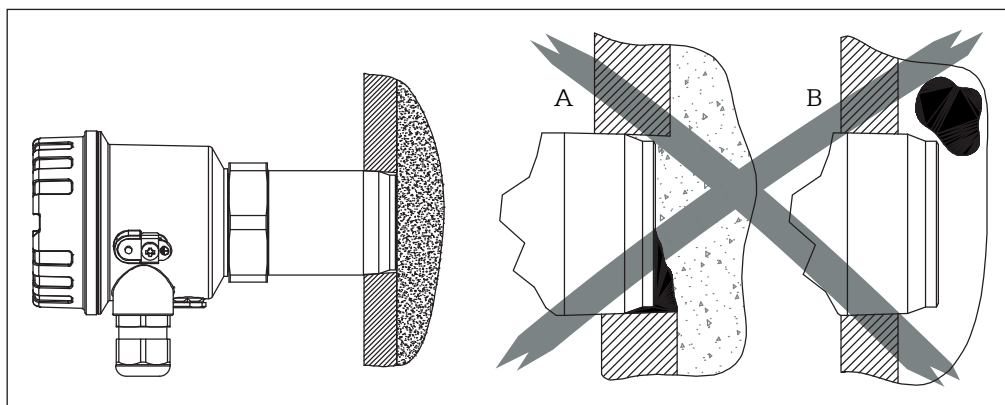


13 FAR52 weld-in or screw-in adapter

A Screw-in adapter

B Weld-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.



14 Direct mounting with threaded connection

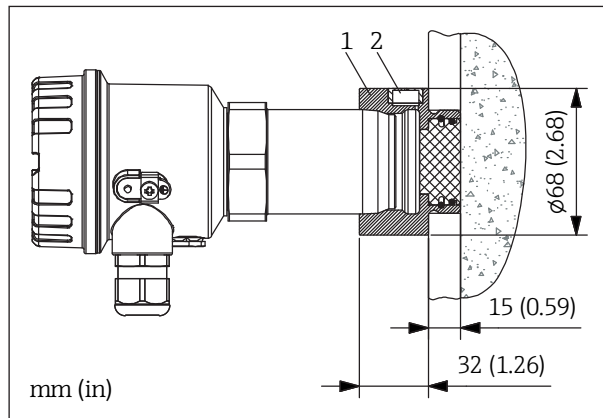
**NOTICE**

- 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 according to ISO 228-1, hexagon SW55) with integrated counter nut, the devices can be flush mounted especially easily, as a parallel thread is used.

For applications with a high process pressure up to 2 MPa (20 bar) absolute, we recommend the following high pressure adapter (accessories → 36).



15 Mounting with high pressure adapter

- 1 High pressure adapter
- 2 Integrated venting element

### NOTICE

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

### Mounting in front of microwave-impermeable process wall

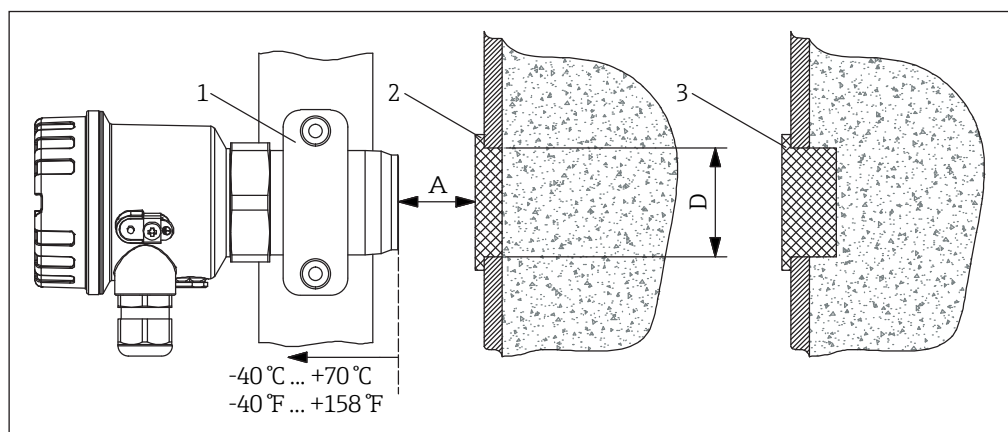
If, due to the process conditions (such as high temperatures, high pressures or hazardous nature of the material), no direct installation in the microwave-impermeable process wall is possible, the microwave barrier can emit its signal through an additionally installed plug.

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 %, uncolored)
- Borosilicate glass (uncolored)

### NOTICE

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



16 Bracket mounting in front of a microwave-permeable process wall

- 1 Mounting bracket
- 2 Microwave-permeable plug
- 3 Microwave-permeable plug on formation of condensate on the inner wall

**NOTICE**

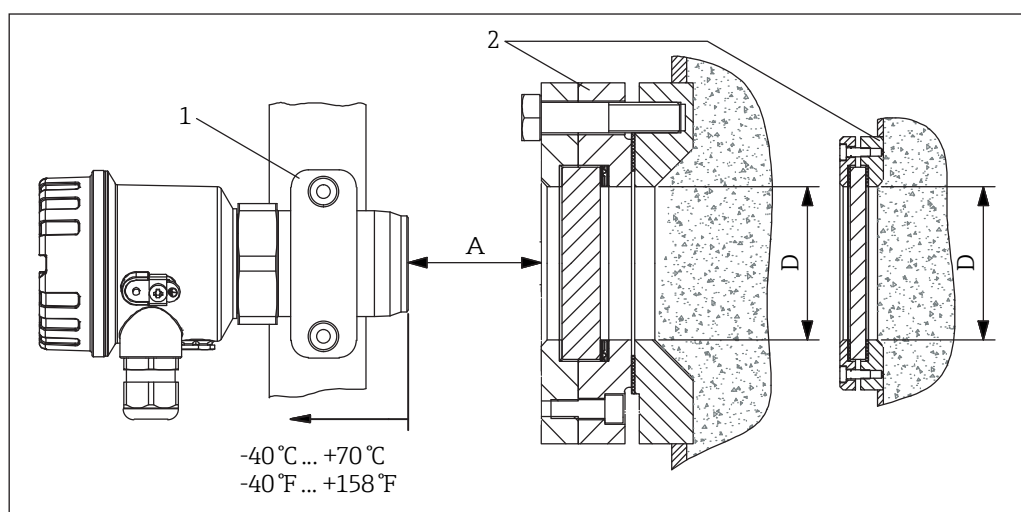
- With bracket mounting in front of a microwave-permeable plug and the risk of the formation of condensate on the inner wall of the container, we recommend a plug protruding into the process (3).
- The maximum temperature at the FDR56/FQR56 must be observed.
- Distance **A** is based on the clear opening 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 → 36

### 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 uncolored borosilicate glass.



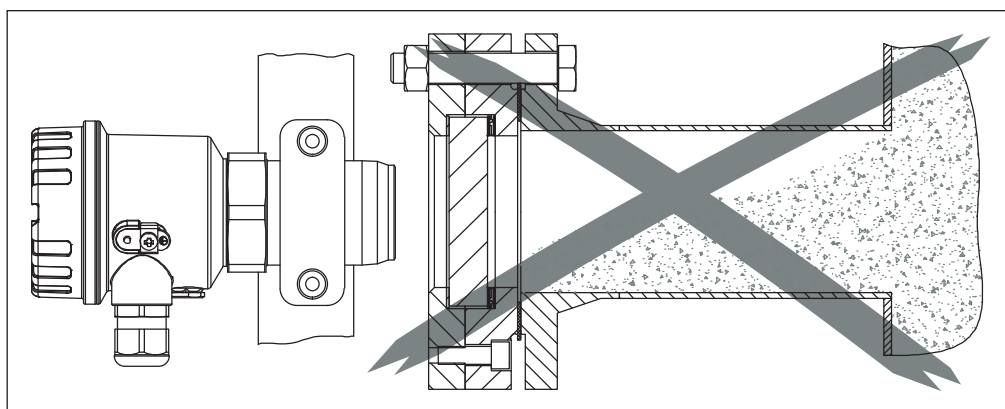
17 Bracket mounting in front of microwave-permeable sight glass fitting

- 1 Mounting bracket  
2 Sight glass fitting

**NOTICE**

Distance **A** is based on the clear opening **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. Mounting on a connecting nozzle, for example, could result in the inability to detect a free path.

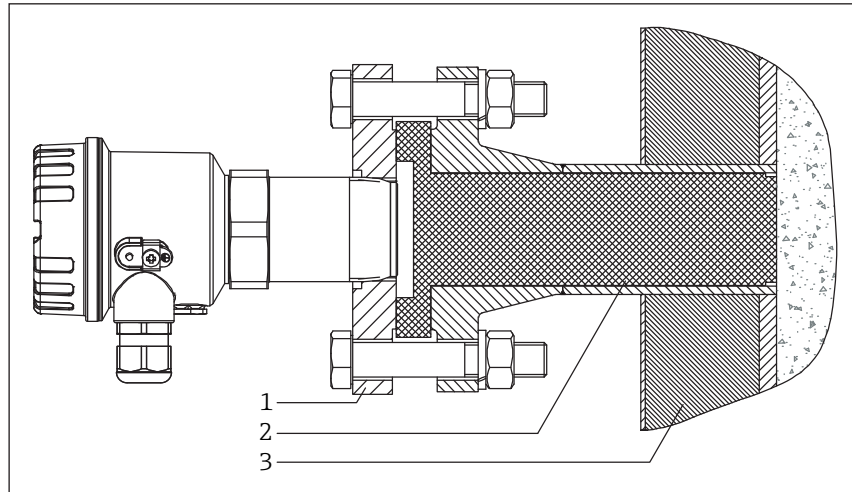


18 Impermissible mounting with the risk of material collection

**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 FDR56/FQR56 devices can be carried out during ongoing operation, which significantly simplifies the service process.



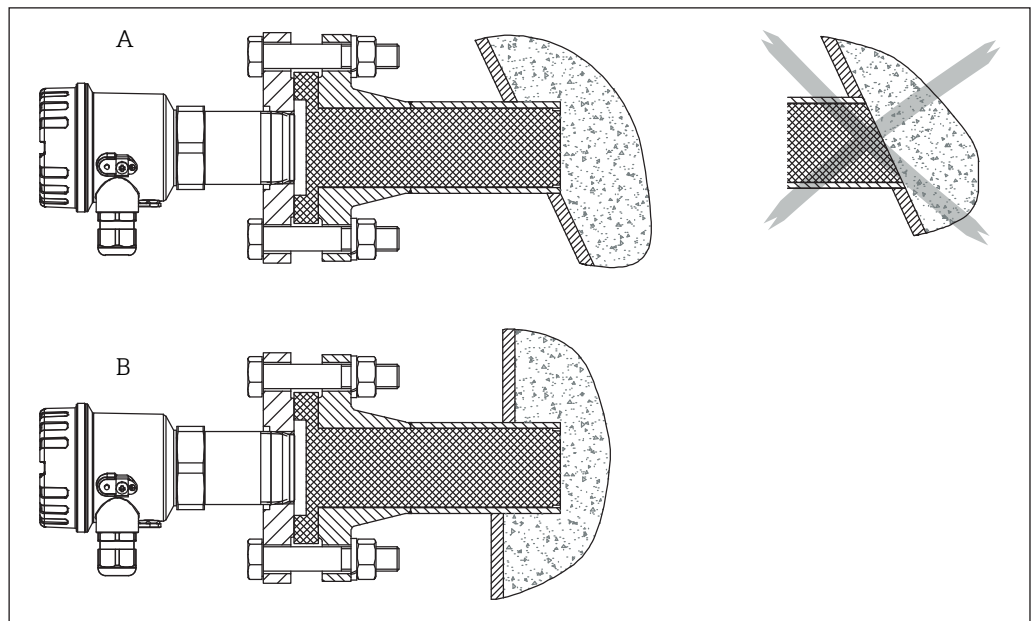
19 Mounting on available process nozzles

- 1 Mounting flange
- 2 Plug
- 3 Process insulation



- Suitable mounting flanges with corresponding connection threads made of stainless steel and plugs made of PTFE or aluminum oxide ceramic 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 → 36

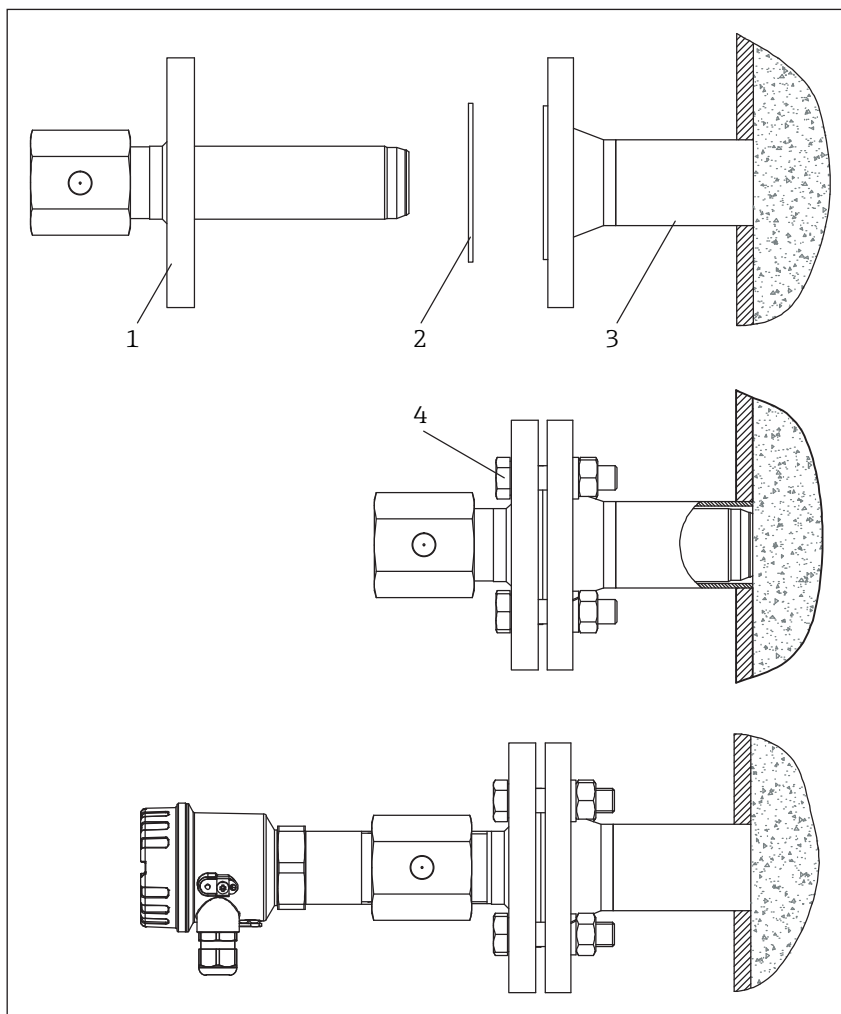
If there is the risk of build-up, avoid installations that favour this condition.



20 Mounting with the risk of accumulations

**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.
- 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 (→ 36), which is equipped with a mounting flange with a pressure equalization element.



21 Mounting with FAR51 insertion adapter

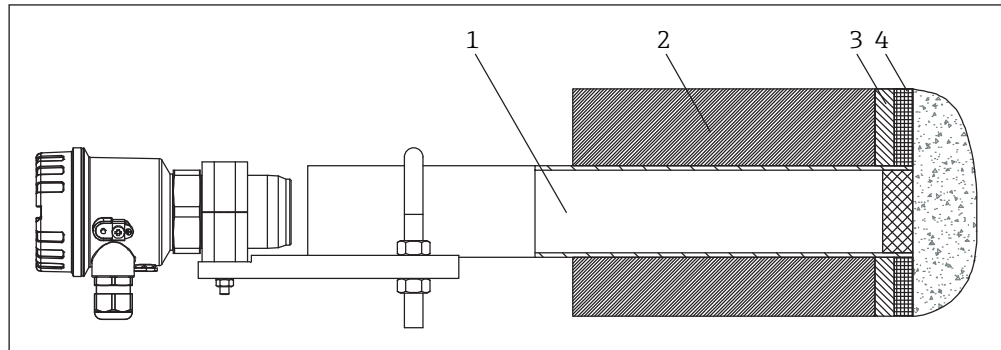
- 1 Insertion adapter
- 2 Customer-supplied gasket
- 3 Process nozzle
- 4 Customer-supplied installation material

**i** 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 (→ 36).

### 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 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).

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.



22 Mounting with spacer tube

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

 Suitable spacer tubes of type FAR53, made of steel or stainless steel, are available as accessories in different versions (→ 36).

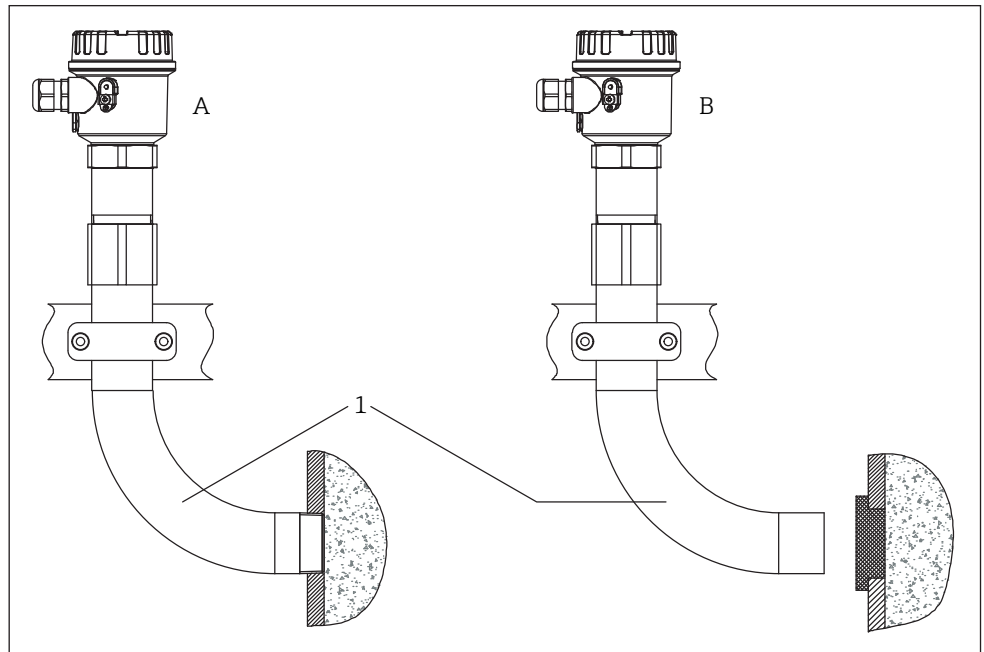
### NOTICE

When there is a risk of condensate forming in the spacer tube, we recommend using process nozzle type FAR50 (→ 36), which is equipped with a mounting flange with a pressure equalization element.

In case of barely accessible measuring points or cramped confines, it may be necessary to mount the FDR56/FQR56 at an angle to the planned installation site. 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.

#### 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.



23 Mounting with wave guide

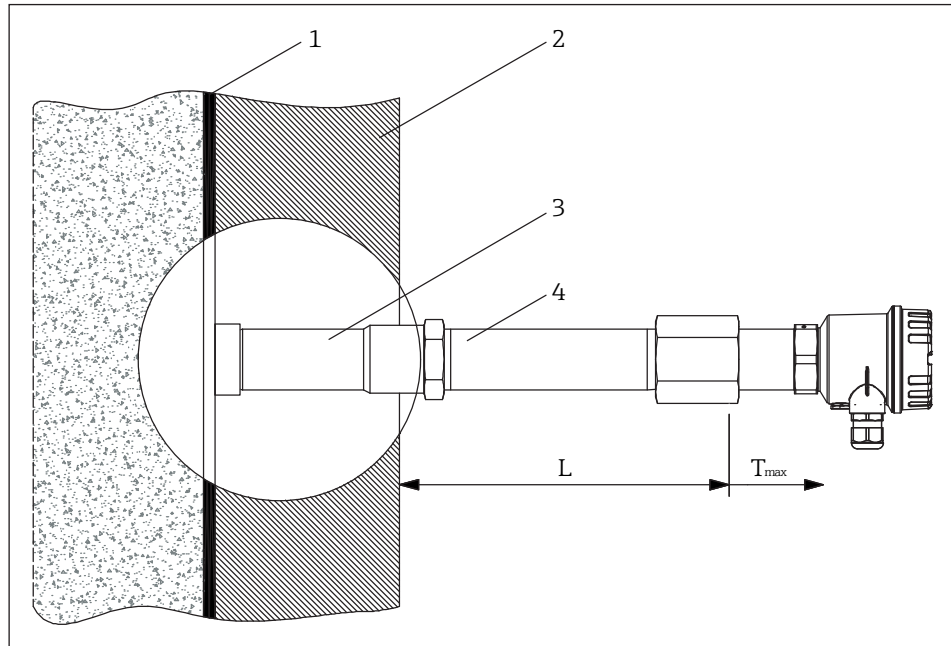
- A Mounting directly in the process with connection thread  
 B Mounting in front of the process plug without connection thread  
 1 Wave guide



Suitable stainless steel wave guides of type FAR55 are available as accessories in different versions (→ 36).

### 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.



24 Mounting with high temperature adapter and length extensions

- 1 Wall
- 2 Insulation
- 3 High temperature adapter
- 4 Extension (optional)



### NOTICE

The maximum temperature **T<sub>max</sub>** 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.

**i** Suitable high temperature adapters and length extensions made of stainless steel are available as accessories (→ 36).



## Environment

<b>Operating temperature range</b>	<p>-40 to +70 °C (-40 to +158 °F)</p> <p>For outdoor operation in strong sunlight:</p> <ul style="list-style-type: none"><li>▪ Mount the device in the shade</li><li>▪ Avoid direct sunlight, particularly in warmer climatic regions</li><li>▪ Use a protective cover, which can be ordered as an accessory (→  46)</li></ul>
<b>Storage temperature</b>	<p>-40 to +80 °C (-40 to +176 °F)</p>
<b>Degree of protection</b>	<ul style="list-style-type: none"><li>▪ IP 66 (with closed housing)</li><li>▪ IP 20 (with open housing)</li></ul>
<b>Vibration resistance</b>	<p>see vibration influence (→  12)</p>
<b>Electromagnetic compatibility (EMC)</b>	<ul style="list-style-type: none"><li>▪ Interference emission to EN 61326, Electrical Equipment Class B</li><li>▪ Interference immunity to EN 61326, Appendix A (Industrial)</li><li>▪ Normal installation cable is sufficient for the wiring.</li></ul>

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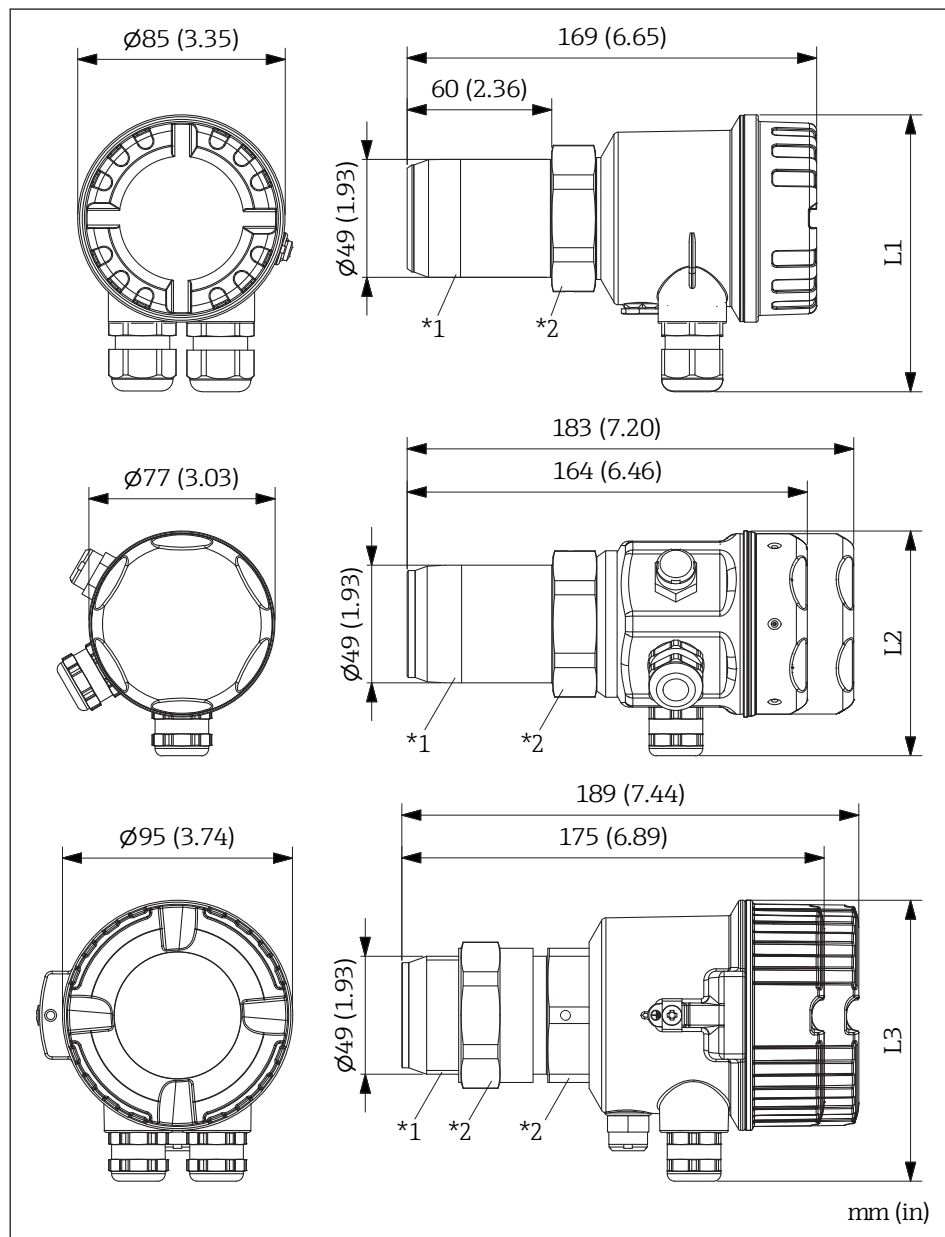
## Process

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<b>Process temperature range</b>	<ul style="list-style-type: none"><li>■ Without optional process adapter: -40 to +70 °C (-40 to +158 °F)</li><li>■ With optional high temperature adapter (→ 36): -40 to +450 °C (-40 to +842 °F)</li><li>■ Note deviating temperature ranges with the accessories offered!</li></ul>
<b>Process pressure range</b>	<ul style="list-style-type: none"><li>■ 50 to 680 kPa (0.5 to 6.8 bar) absolute, only to be observed with FDR56/FQR56 installed directly in the process</li><li>■ 80 to 510 kPa (0.8 to 5.1 bar) absolute, with use of the optional high temperature adapter</li><li>■ 50 to 2000 kPa (0.5 to 20 bar) absolute, with use of the optional high pressure adapter</li><li>■ Note deviating pressure ranges with the accessories offered.</li></ul>
<b>Vibration</b>	see vibration influence (→ 12)

## Mechanical construction

### Dimensions



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



On device variants with connector and extended ordering option "Electronics, encapsulated" the weight increases by 0.2 kg (0.44 lbs).

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**Materials**

- Stainless steel 316Ti (1.4571):
  - Process connection
  - Pressure equalization element (F15/F34 housing)
- Stainless steel 316L (1.4435):
  - F15 housing
  - Adapter ½ NPT (F15/F34 housing)
- Aluminum:
  - F34 housing
- Plastic:
  - F16 housing
  - M20 cable gland, adapter ½ NPT and pressure equalization element (F16 housing)
- Die-cast zinc:
  - M12 connector, nickel-plated
  - Harting connector, powder-coated
- Brass, nickel-plated:
  - M20 cable gland (F15/F34 housing)

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**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, also 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
  - Switch-on and switch-off delay, can be selected separately
- LED field strength indicator as an adjustment and positioning aid

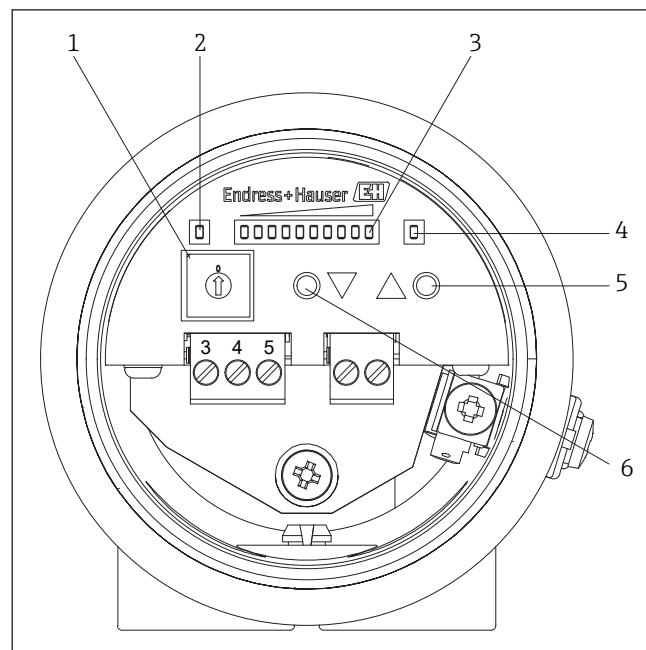
On the transmitter FQR56 there are no settings required, with the exception of those for parallel mode (→ 31) using multiple microwave barriers.

### Operating concept

#### Transceiver 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. 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 adjustment to the process conditions only needs to be performed during initial installation. Later alterations can be performed and saved at any time.



26 Display and operating elements of the FDR56







- 1 Function selection switch
- 2 Ready LED (green)
- 3 Bar graph display
- 4 Switch output LED (yellow)
- 5 Operating button (+)
- 6 Operating button (-)

#### 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 (function 6 = standard setting, LED off: relay in rest position, solid-state relay high-impedance).

Signal output

The following overview exemplarily shows the behavior of the possible signal outputs with regard to the display of the signal strength during overshoot or undercut (function 6 = standard setting) 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

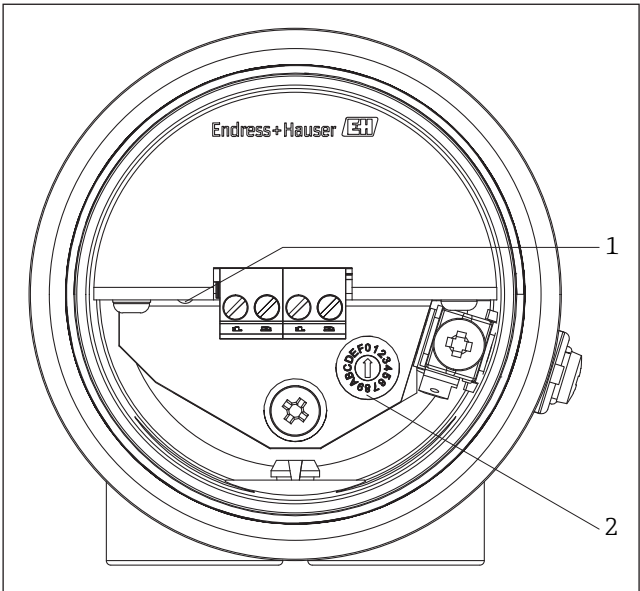
27 Behaviour of the signal output

NOTICE

The value of the current output corresponds to the signal strength (1 LED  $\cong$  1.6 mA).

Transmitter FQR56

To prevent intermodulation interference from microwave barriers operated close to each other, different channels (operating frequencies) for parallel operation ( $\rightarrow$  15) can be configured with the rotary coding switch on the FQR56 transmitter.



28 Display and operating elements of the FQR56

- 1 Ready LED (green)
- 2 Rotating switch parallel mode

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 "Parameterisation 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 calibration with free path)

→ Using the (6) ▼ key, the sensitivity can be reduced.

→ ▼ → ▼ ...

→ Using the (5) ▲ key, the sensitivity can be increased.

→ ▲ → ▲ ...


















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.

## Parameterisation functions

Function/meaning	Value range
1 = Automatic adjustment of the sensitivity with free radiation path	—
2 = Automatic adjustment of the sensitivity with covered radiation path	—
3 = Manual adjustment of the sensitivity (upper limit, 10% increment/LED)	Upper limit from function 1: minimum ... maximum
4 = Manual adjustment of the sensitivity (lower limit, 10% increment/LED)	Lower limit from function 1: minimum ... maximum
5 = Hysteresis setting	 ...
6 = Selection of the limit signal function (Min./Max. safety, relay output only)	Relay switches when microwave barrier is free Relay switches when microwave barrier is covered






Function/meaning	Value range
7 =  Switching delay setting (switch-on delay)	 off (no delay)  100 ms
8 =  Switching delay setting (switch-off delay)	... (200/300/500 ms, 1/2/3/5/10 s)  20 s
9 =  Enable simulation mode	 Covered path ...  Free path
A =  Attenuation setting	 off (no attenuation)  100 ms ... (200/300/500 ms, 1/2/3/5/10 s)  20 s
B =  C =  D =  E = 	without function
F =  Reset to factory settings	

**NOTICE**

Further information on settings and parameter configuration can be found in the Operating Instructions (→ 47).

**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 corresponds to the position 0 in these settings.



## Certificates and approvals

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### CE mark

The Soliwave 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, Endress+Hauser confirms that the device has passed the necessary tests.

### Ex approval

The microwave barrier is certified for use in hazardous areas and the safety instructions to be observed are provided in the separate "Safety Instructions" (XA) document. This is also referenced on the nameplate.



The separate Ex documentation (XA) with all relevant data regarding explosion protection can be obtained from your Endress+Hauser sales center or as a download from [www.endress.com](http://www.endress.com).

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### 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

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### Other standards and guidelines

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

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## Ordering information

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Detailed ordering information is available from the following sources:

- In the product configurator on the Endress+Hauser website: [www.endress.com](http://www.endress.com) → Select your country → Products → Select measurement technologies, software or components → Select product (selection lists: Measuring methods, product family, etc.) → Device support (right column): Configure the selected product → The product configurator opens for the selected product.
- From your Endress+Hauser sales center: [www.addresses.endress.com](http://www.addresses.endress.com)



### Product Configurator – the tool for individual product configuration

- Up-to-the-minute configuration data
- Depending on the device: Direct input of measuring point-specific information such as measuring range or operating language
- Automatic verification of exclusion criteria
- Automatic creation of the order code and its breakdown in PDF or Excel output format

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### Scope of delivery

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






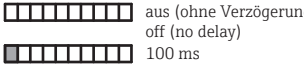



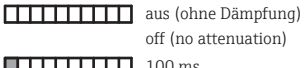

## User-specific settings

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

**Endress+Hauser** 






Bestellcode / Order code:	FDR56-
Gerätenummer / Device No.:	

Funktion, Bedeutung / Function, meaning	Wertebereich / Range of values	Einstellung / Setting
5 =  Einstellung der Hysterese / Hysteresis setting		<input type="text"/>
6 =  Grenzsignalfunktion (Min./Max. Sicher- heit, nur Relaisausgang) / Limit signal function (min./max. safety, relay output only)	 Relais schaltet bei freier Mikrowellenschanke / Relay switches when microwave barrier is free Relais schaltet bei bedeckter Mikrowellenschanke / Relay switches when microwave barrier is covered	<input type="text"/>
7 =  Einstellung der Schaltverzögerung (Einschaltverzögerung) / Switching delay setting (switch-on delay)	 aus (ohne Verzögerung) / off (no delay) 100 ms	<input type="text"/>
8 =  Einstellung der Schaltverzögerung (Ausschaltverzögerung) / Switching delay setting (switch-off delay)	... (200/300/500 ms, 1/2/3/5/10 s)  20 s	<input type="text"/>
A =  Einstellung der Dämpfung / Attenuation setting	 aus (ohne Dämpfung) / off (no attenuation) 100 ms ... (200/300/500 ms, 1/2/3/5/10 s)  20 s	<input type="text"/>

## Beispiel / Example:

- Hysterese / Hysteresis = 1
- Relais schaltet bei freier Mikrowellenschanke / Relay switches when microwave barrier is free
- Anzugverzögerung / Response delay = aus / off
- Abfallverzögerung / Drop-out delay = 300 ms
- Dämpfung / Attenuation = 1 s

Bestellcode / Order code:	FQR56-
Gerätenummer / Device No.:	

Kanal / Channel	1	2	3	4	5
Schalterstellung Kanalwahl für Parallelbetrieb / Switch setting channel for parallel operation mode	 <input type="checkbox"/>	 <input type="checkbox"/>	 <input type="checkbox"/>	 <input type="checkbox"/>	 <input type="checkbox"/>

ad060016ms; Rev. 1.2



The blank form can be used for documentation of the FDR56 and FQR56 device settings.

## Accessories

Various accessories are available for the device, and can be ordered with the device or at a later stage from Endress+Hauser. Detailed information on the order code in question is available from your local Endress+Hauser sales center or on the product page of the Endress+Hauser website: [www.endress.com](http://www.endress.com).

### Mating connectors

For the device variants with connectors the following mating connectors can be used:

- Order No.:  
71381872, M12 series 713/763, 4-pole  
71381882, Harting HAN8D



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

### Prefabricated connection cables

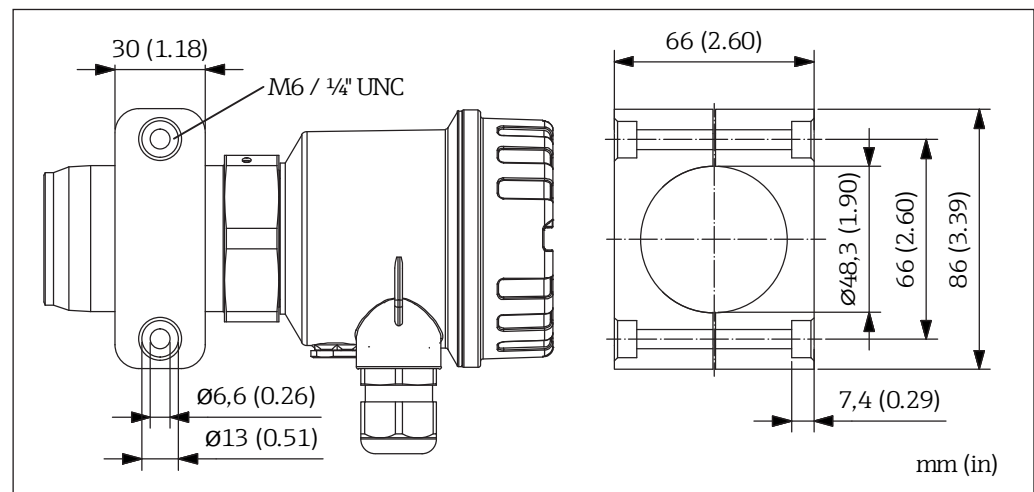
For the device variants with connectors the following prefabricated connection cables can be used:

- Order No.:  
71381853, M12 series 713/763, 4 x 0.34 mm<sup>2</sup>, PUR, length 2 m (6.45 ft)  
71381870, M12 series 713/763, 4 x 0.34 mm<sup>2</sup>, PUR, length 5 m (16.40 ft)  
71381877, Harting HAN8D, 4 x 0.75 mm<sup>2</sup>, PUR, length 2 m (6.45 ft)  
71381879, Harting HAN8D, 4 x 0.75 mm<sup>2</sup>, 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.:  
52017501, aluminum  
52017502, 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.

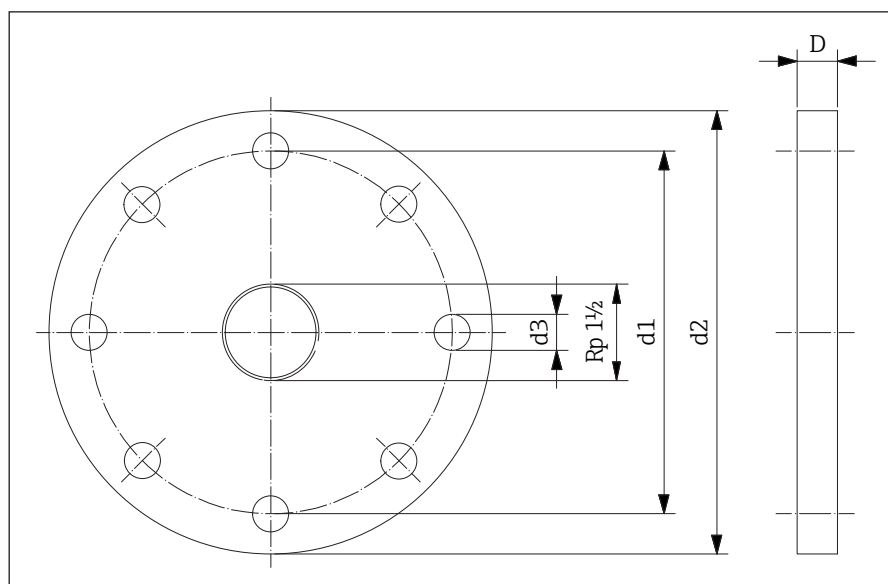


29 Mounting bracket dimensions

### 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.:
  - 71006348, DN40 PN40, Rp 1½ internal thread
  - 71108383, DN40 PN40, Rp 1½ internal thread, inspection certificate in accordance with EN 10204-3.1
  - 71381884, DN40 PN40, G 1½ internal thread
  - 71381885, DN40 PN40, G 1½ internal thread, inspection certificate in accordance with EN 10204-3.1
  - 71006350, DN50 PN16, Rp 1½ internal thread
  - 71108388, DN50 PN16, Rp 1½ internal thread, inspection certificate in accordance with EN 10204-3.1
  - 71381887, DN50 PN16, G 1½ internal thread
  - 71381888, DN50 PN16, G 1½ internal thread, inspection certificate in accordance with EN 10204-3.1
  - 71006352, DN100 PN16, Rp 1½ internal thread
  - 71108390, DN100 PN16, Rp 1½ internal thread, inspection certificate in accordance with EN 10204-3.1
  - 71381890, DN100 PN16, G 1½ internal thread
  - 71381891, DN100 PN16, G 1½ internal thread, inspection certificate in accordance with EN 10204-3.1
- Material: 316Ti stainless steel (1.4571)
- Weight: DN40 approx. 2.3 kg (5.07 lbs) to DN100 approx. 5.8 kg (12.79 lbs)



30 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/PN40	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.:

71006349, 1½" 150 lbs, 1½ NPT internal thread

71108387, 1½" 150 lbs, 1½ NPT internal thread, inspection certificate in accordance with EN 10204-3.1

71006351, 2" 150 lbs, 1½ NPT internal thread

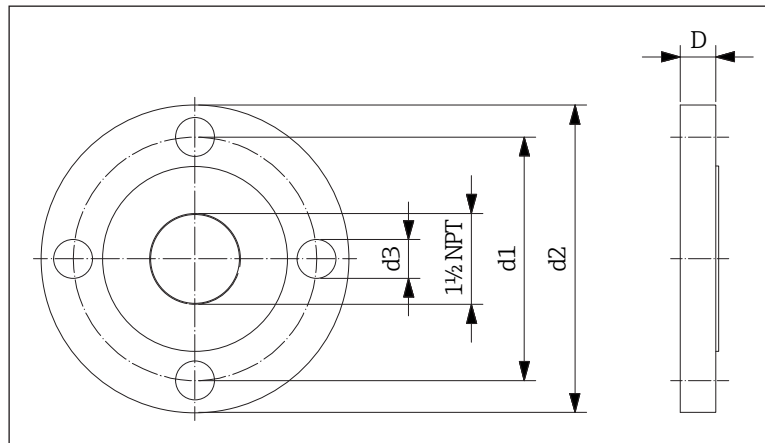
71108389, 2" 150 lbs, 1½ NPT internal thread, inspection certificate in accordance with EN 10204-3.1

71006353, 4" 150 lbs, 1½ NPT internal thread

71108391, 4" 150 lbs, 1½ NPT internal thread, inspection certificate in accordance with EN 10204-3.1

■ Material: 316Ti stainless steel (1.4571)

■ Weight: 1½" approx. 1.5 kg (3.31 lbs) to 4" approx. 6.8 kg (15.0 lbs)



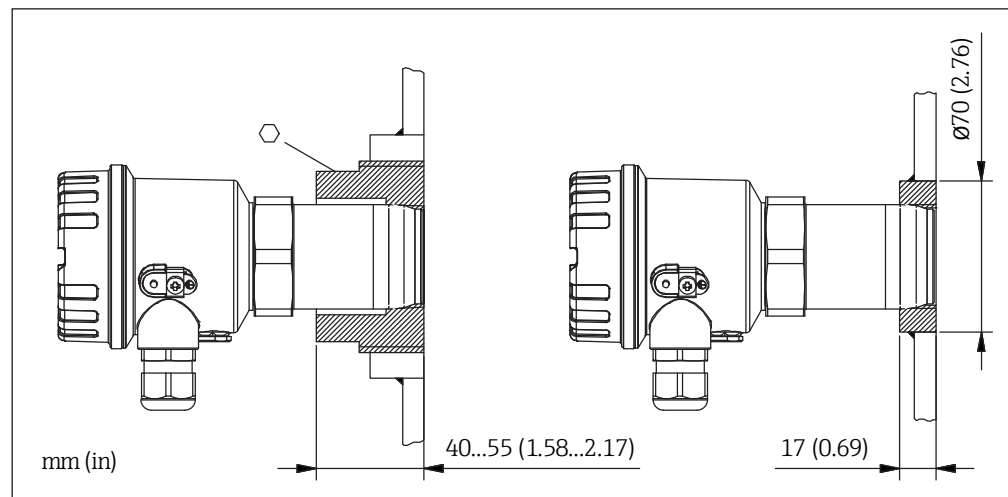
31 Dimensions of mounting flange (connection dimension in accordance with ANSI/ASME B16.5)

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 (→ TI01369F/97/EN):

- 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: 316Ti stainless steel (1.4571) and P235GH steel (1.0345)
- Weight: FAR52-AAAA1A approx. 0.3 kg (0.66 lbs) to FAR52-BVL22B approx. 1.8 kg (4 lbs)

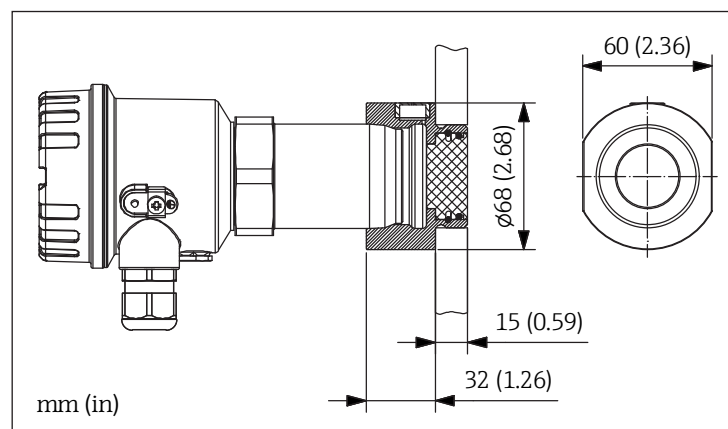


32 Dimensions of weld-in or screw-in adapter FAR52

### High pressure adapter

For mounting with microwave-impermeable process wall and high process pressure up to 2 MPa (20 bar) absolute, the following high pressure adapters (→ 17) can be used:

- Order No.:
  - 71381894, Process and device connecting thread G 1½ in accordance with ISO 228-1
  - 71381898, Process and device connecting thread G 1½ in accordance with ISO 228-1, inspection certificate in accordance with EN 10204-3.1
  - 71381899, Process connecting thread G 1½ in accordance with ISO 228-1, device connecting thread 1½ NPT in accordance with ANSI/ASME
  - 71381904, Process connecting thread G 1½ in accordance with ISO 228-1, device connecting thread 1½ NPT in accordance with ANSI/ASME, inspection certificate in accordance with EN 10204-3.1
- Material: 316Ti stainless steel, PTFE window transmission
- Weight: Approx. 0.8 kg (1.76 lbs)

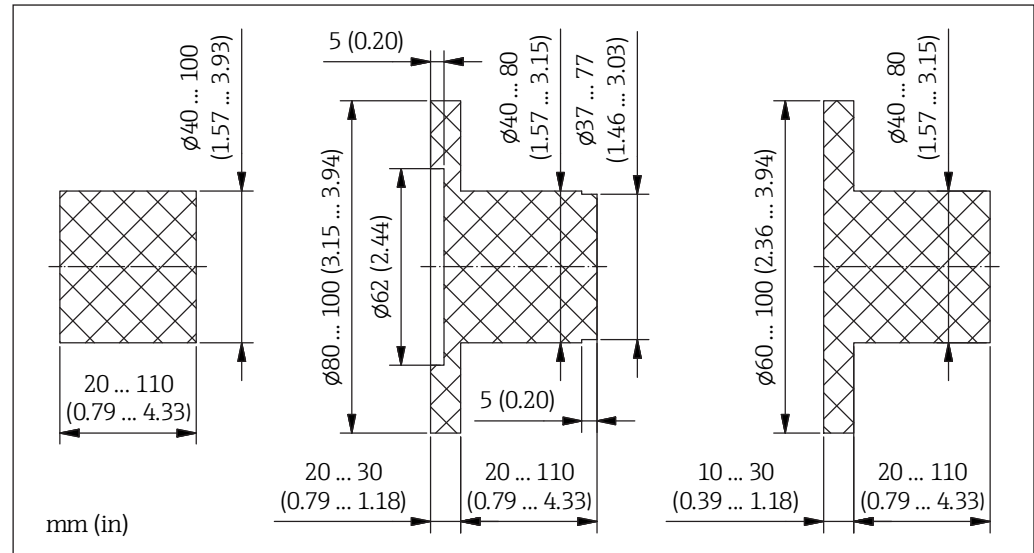


33 Dimension of the high pressure adapter

### Plug

For mounting with microwave-impermeable process walls, plugs of type FAR54 can be used  
(→  TIO1371F/97/EN):

- Material: PTFE and aluminum 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)

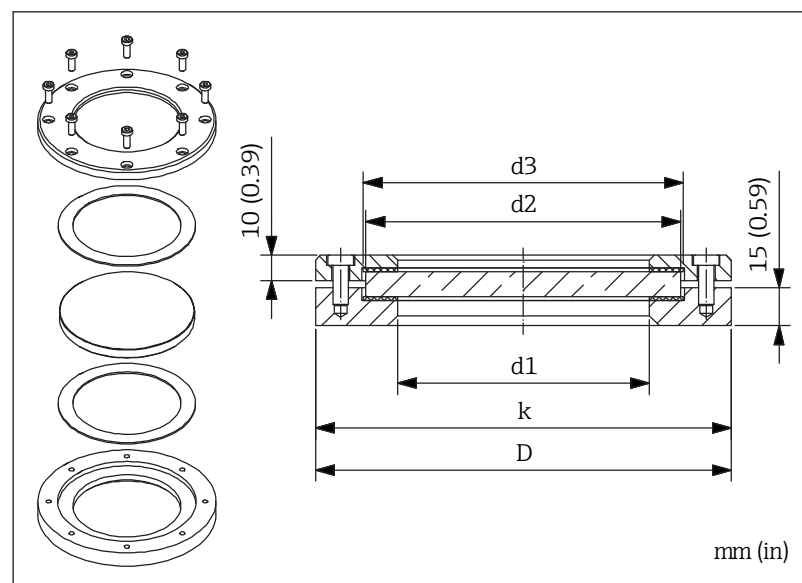



 34 Dimensions of FAR54 plugs

### 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.:  
71026443, DN50  
71026444, DN80  
71026445, DN100
- Material: 316Ti stainless steel, 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.



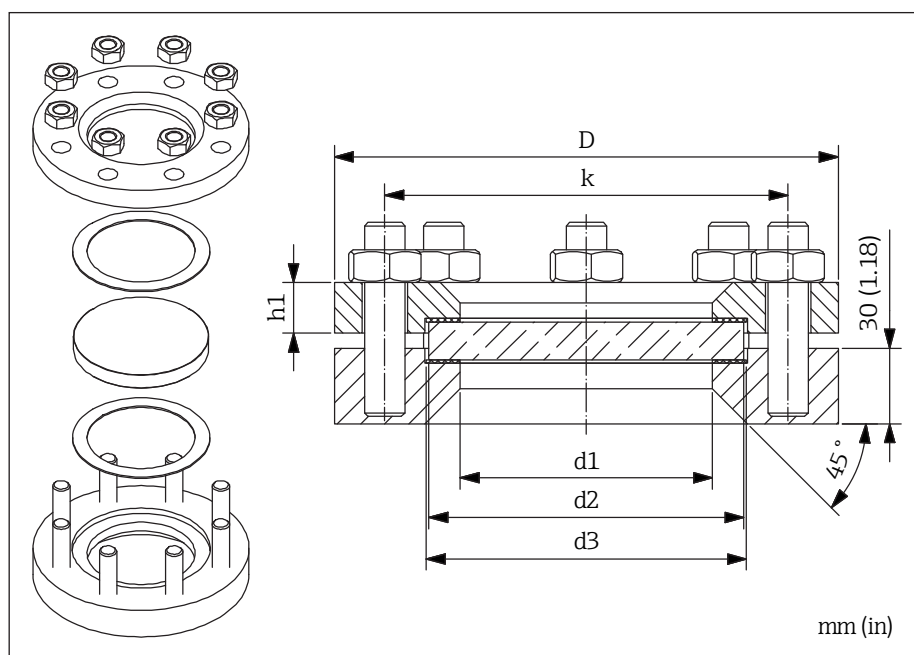
 35 Dimensions of sight glass fitting for welding on/in for unpressurized processes



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.:  
71026446, DN50  
71026447, DN80  
71026448, DN100
- Material: 316Ti stainless steel, silicon seal (max. +200 °C/+392 °F)
- Weight: DN50 approx. 6.7 kg (14.77 lbs) to DN100 approx. 13.0 kg (28.66 lbs)
- The delivery includes the inspection glass fitting, incl. seals and mounting screws.

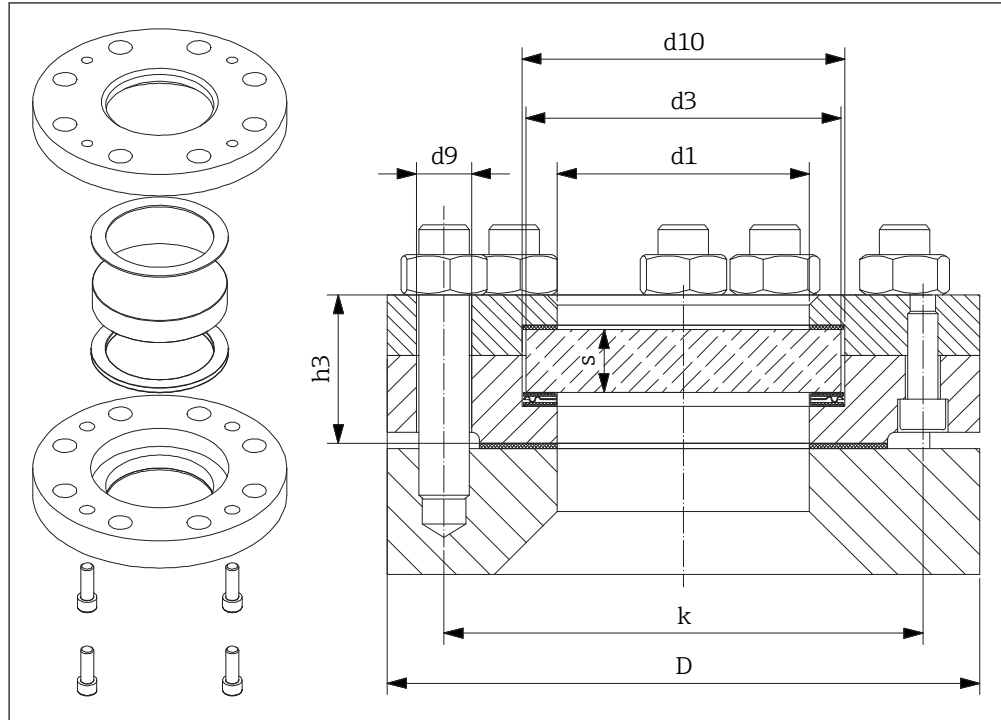


36 Dimensions of sight glass fitting for welding on/in for processes up to 1 MPa

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.:  
71026449, DN50  
71026450, DN80  
71026451, DN100
- Material: 316Ti stainless steel, PTFE seal and C4400 (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).



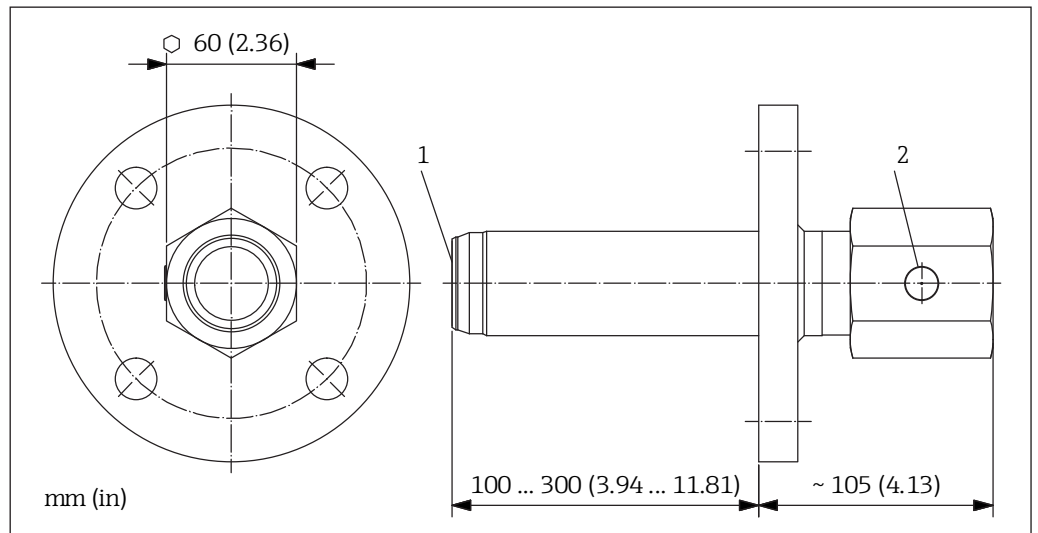
37 Dimensions of sight glass fitting for bolting on for processes up to 2.5 MPa

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 (→ TI01368F/97/EN):

- 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)



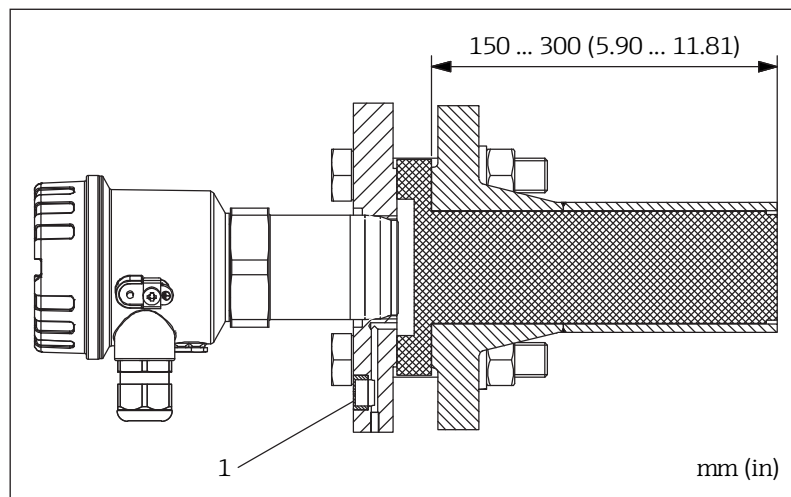
38 Dimensions of plug-in adapters

- 1 Sealed disc, optional  
2 Venting element

### Weld-in nozzles

For nozzle mounting, weld-in nozzles of type FAR50 can be used (→ TI01362F/97/EN):

- 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)



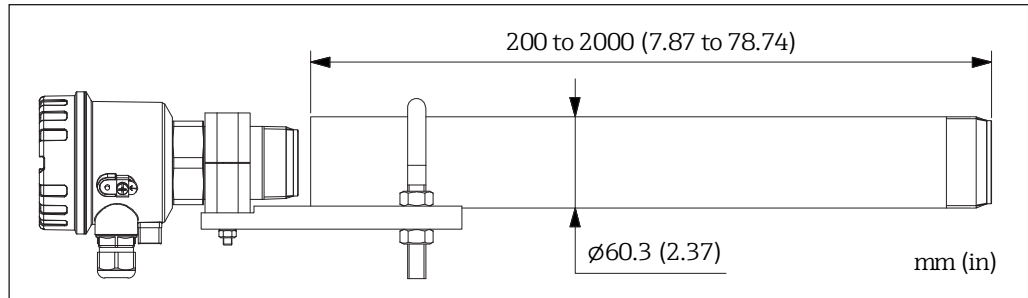
39 Dimensions of weld-in nozzles

- 1 Venting element

### Spacer tube (wave guide)

For mounting in open processes or processes with an internal lining, such as clay, spacer tubes of type FAR53 can be used (→ TI01370F/97/EN):

- Process connection: With or without thread R 2, 2 NPT and G 2
- Pipe lengths: 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)

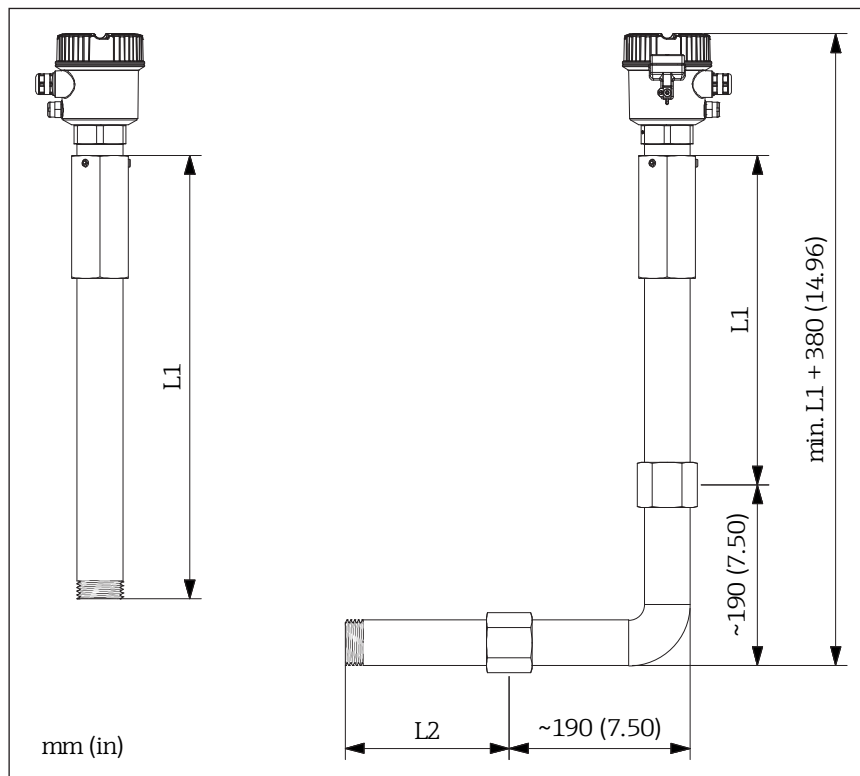


40 Dimensions of spacer tube (wave guide)

### Wave guide

For mounting in structurally restricted installation positions, wave guides of type FAR55 can be used (→ TI01372F/97/EN).

- 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)

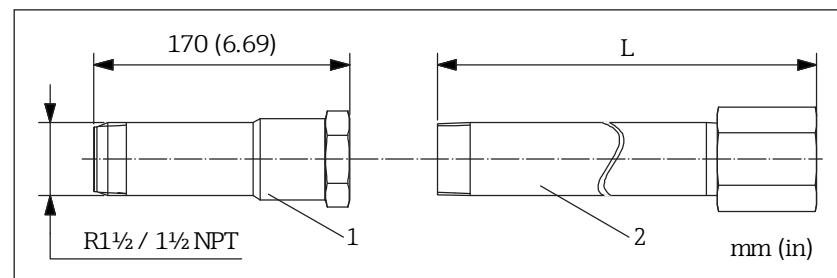


41 Dimensions of wave guide

**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 (→ 36):

- Order No. (high temperature adapter with flush-mounted ceramic disc and pressure equalization element):
  - 71113441, thread R 1½/Rp 1½ (also suitable for devices with thread ISO 228 G 1½)
  - 71478114, thread R 1½/Rp 1½ (also suitable for devices with thread ISO 228 G 1½), inspection certificate in accordance with EN 10204-3.1
  - 71113449, thread 1½ NPT
  - 71478115, thread 1½ NPT, inspection certificate in accordance with EN 10204-3.1
- Order No. (extension):
  - 71113450, thread R 1½/Rp 1½, L = 225 mm (also suitable for devices with thread ISO 228 G 1½)
  - 71113451, thread R 1½/Rp 1½, L = 325 mm (also suitable for devices with thread ISO 228 G 1½)
  - 71113452, thread R 1½/Rp 1½, L = 525 mm (also suitable for devices with thread ISO 228 G 1½)
  - 71113453, thread 1½ NPT, L = 225 mm
  - 71113454, thread 1½ NPT, L = 325 mm
  - 71113455, thread 1½ NPT, L = 525 mm
- Material: 316Ti stainless steel (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)



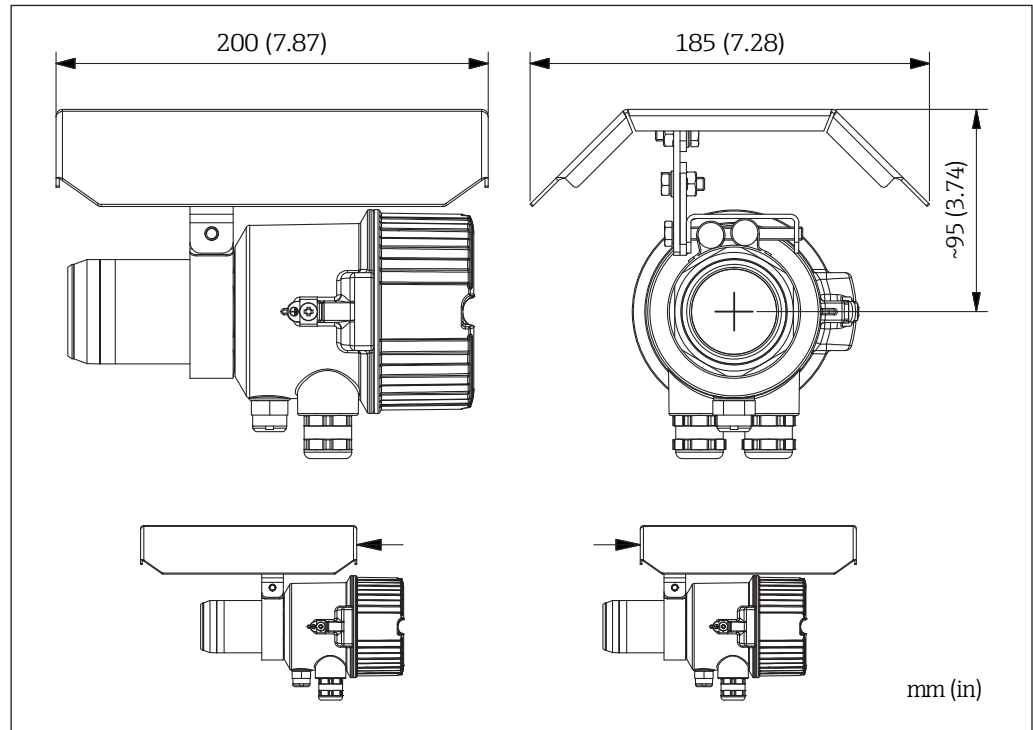
42 Dimensions of high temperature adapter and extensions

- 1 High temperature adapter
- 2 Length extension

**Weather protective cover**

For outdoor installation in strong sunlight, the following weather protection cover can be used:

- Order No.: 71454446
- Material: Stainless steel 316L (1.4404)
- Weight: approx. 0.8 kg (1.76 lbs)



43 Dimensions weather protective cover

## Supplementary documentation

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For an overview of the scope of the associated technical documentation, see the W@M Device Viewer: enter serial number from nameplate ([www.endress.com/deviceviewer](http://www.endress.com/deviceviewer))

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**Standard documentation**

Operating instructions for Soliwave FDR56/FQR56  
Documentation code: BA01684F/97/EN

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**Supplementary device-  
dependent documentation**

Safety instructions ATEX  
Documentation code: XA00509F/97/A3

Safety instructions CSA  
Documentation code: XA01244F/97/EN

Safety instructions IECEx  
Documentation code: XA00543F/97/EN

[www.addresses.endress.com](http://www.addresses.endress.com)

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