BA01684F/97/EN/03.22-00
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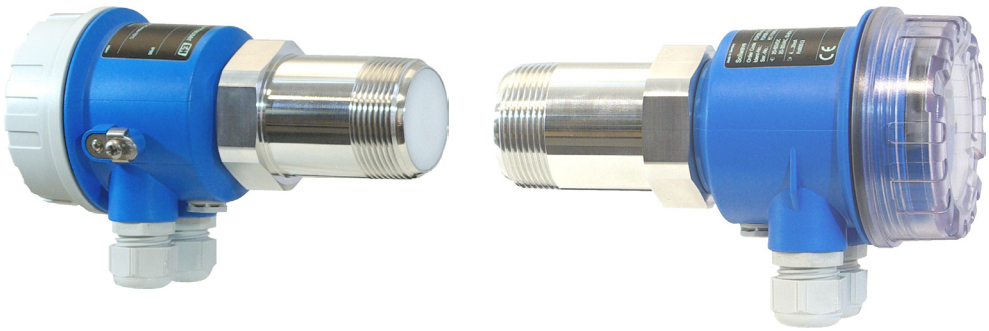
2023-12-06

Operating Instructions
Soliwave FDR56/FQR56

Microwave barrier



Endress+Hauser
People for Process Automation

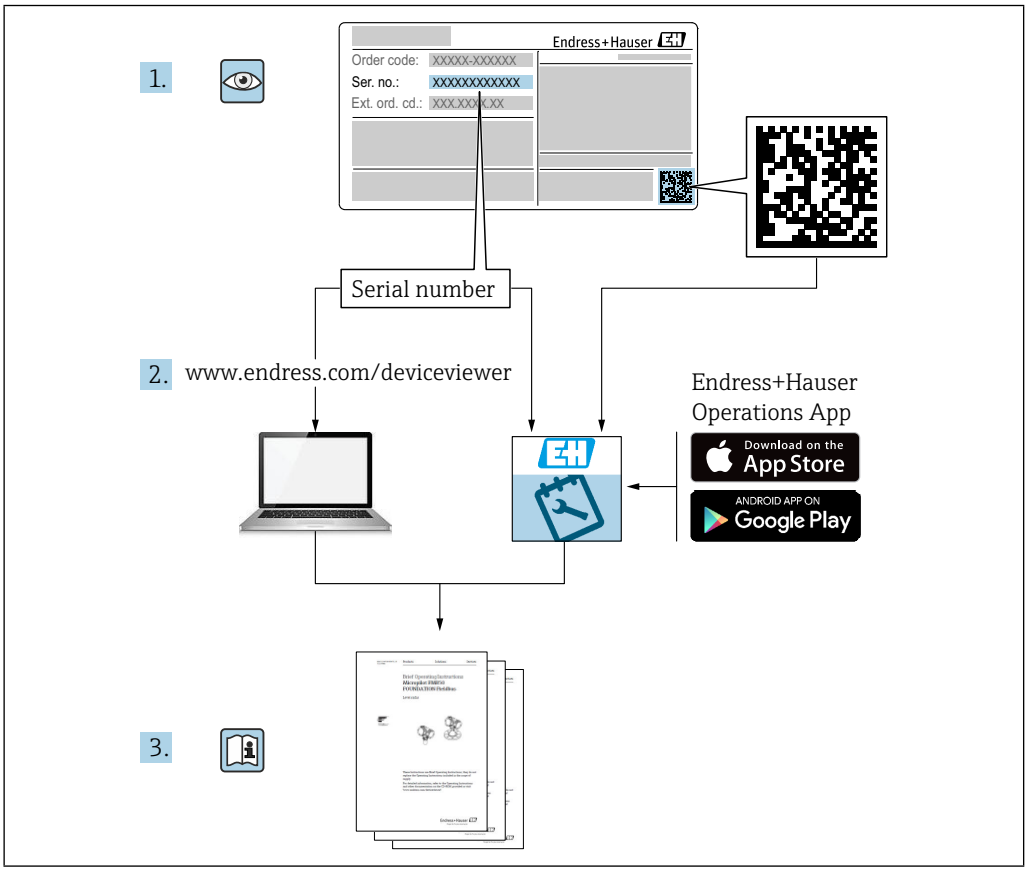

1.
Endress+Hauser
Order code: XXXXX-XXXXXX
Ser. no.: XXXXXXXXXXX
Ext. ord. cd.: XXX.XXX.XX
Serial number
2.
www.endress.com/deviceviewer
Endress+Hauser
Operations App
Download on the App Store
ANDROID APP ON Google Play
3.

Table of contents

1 About this document

1.1 Symbols

1.1.1 Safety symbols

DANGER
This symbol alerts you to a dangerous situation. Failure to avoid this situation will result in serious or fatal injury.

WARNING
This symbol alerts you to a dangerous situation. Failure to avoid this situation can result in serious or fatal injury.

CAUTION
This symbol alerts you to a dangerous situation. Failure to avoid this situation can result in minor or medium injury.

NOTICE
This symbol contains information on procedures and other facts which do not result in personal injury.

1.1.2 Electrical symbols

⏚ Protective Earth (PE)
A terminal which must be connected to ground prior to establishing any other connections.

1.1.3 Symbols for certain types of information

✓ Permitted
Procedures, processes or actions that are permitted.

✗ Forbidden
Procedures, processes or actions that are forbidden.

ℹ Tip
Indicates additional information

Reference to documentation

Reference to another section

Reference to graphic

▶ Notice or individual step to be observed

1., 2., 3. Series of steps

1.1.4 Symbols in graphics

A, B, C ... View

1, 2, 3 ... Item numbers

Hazardous area

Safe area (non-hazardous area)

1.1.5 Device-specific symbols

LED on
Indicates an illuminated LED

LED off
Indicates a non-illuminated LED

Configuration mode
Indicates the function number or value

Normal operation
Indicates only the signal strength of the limit detection

Key (+)
Indicates the key for increasing a function value

Key (-)
Indicates the key for reducing a function value

Free path
Indicates the free path between FDR and FQR

Covered path
Indicates the covered path between FDR and FQR

2 Basic safety instructions

2.1 Requirements for the personnel

The personnel must fulfill the following requirements to carry out the necessary tasks, e. g., commissioning and maintenance:
- ▸ Trained, qualified specialists must have a relevant qualification for the specific function and task
- ▸ Are authorized by the plant owner/operator
- ▸ Are familiar with federal/national regulations
- ▸ Must have read and understood the instructions in the manual and supplementary documentation
- ▸ Follow instructions and comply with conditions

2.2 Designated use

Use the microwave barrier only for point level detection and counting and control purposes. Improper use can pose hazards. Ensure that the measuring device is free of defects while it is in operation.

- Use the measuring device only for media to which the process-wetted materials have an adequate level of resistance
- Do not exceed or drop below the limit values for the measuring device
  TI00443F

Incorrect use
The manufacturer is not liable for damage caused by improper or non-designated use.

Clarification of borderline cases:
- In the case of special fluids and media used for cleaning, Endress+Hauser is glad to provide assistance in verifying the corrosion resistance of wetted materials, but does not accept any warranty or liability.

Residual risks
The electronics housing and the modules installed in it can heat up to 80 °C (176 °F) during operation due to heat input from the process as well as the power dissipation of the electronics.

Danger of burns from contact with surfaces!
▸ If necessary, ensure protection against contact to prevent burns.

2.3 Workplace safety

For work on and with the device:
▸ Wear the required protective equipment according to federal/national regulations.

2.4 Operational safety

Risk of injury!
▸ Operate the device in proper technical condition and fail-safe condition only.
▸ The operator is responsible for interference-free operation of the device.

2.4.1 Conversions to the device

Unauthorized modifications to the device are not permitted and can lead to unforeseeable dangers.
▸ If, despite this, modifications are required, consult with Endress+Hauser.

2.4.2 Repair

To ensure continued operational safety and reliability,
▸ Carry out repairs on the device only if they are expressly permitted.
▸ Observe national regulations pertaining to the repair of an electrical device.
▸ Only use original spare parts and accessories from Endress+Hauser.

2.4.3 Hazardous area

To eliminate danger to persons or the facility when the device is used in the hazardous area (e.g. explosion protection):
▸ Check the nameplate to verify whether the ordered device can be used as intended in the hazardous area.

2.5 Product safety

The devices of the microwave barrier are designed in accordance with good engineering practice to meet state-of-the-art safety requirements, has been tested, and left the factory in a condition in which it is safe to operate.

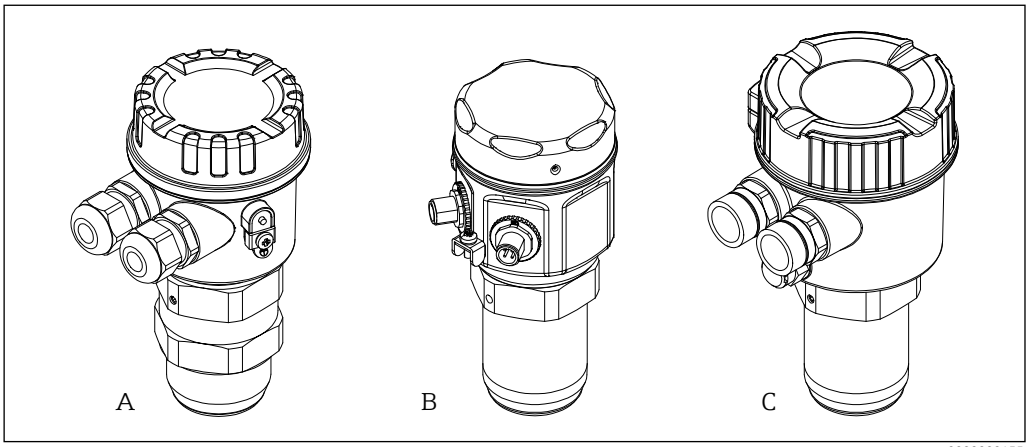
They meet general safety standards and legal requirements. They also complies with the EU directives listed in the device-specific EU Declaration of Conformity. Endress+Hauser confirms this by affixing the CE mark to the devices.

3 Product description

The Soliwave microwave barrier consists of the FQR56 transmitter and the FDR56 transceiver and is used for the non-contact point level detection of powdery to lumpy bulk solids and liquids, for the purpose of monitoring and counting piece goods as well as for the detection of build-up.

The devices of the Soliwave microwave barrier are available in different versions; the choice of devices that are used depends on the specific application, as well as factors such as the types of area for which they are approved and the electrical connection.

3.1 Product design



1 *Device variants*

Device variants	Example		
	A	B	C
Housing	F16 (Polyester)	F15 (Stainless steel)	F34 (Aluminum)
Electrical connection	Cable gland M20	Connector M12	Thread 1/2" NPT
Process connection	Thread G 1½ in accordance with ISO 228-1	Thread R 1½ in accordance with EN 10226	Thread 1½ NPT in accordance with ANSI/ ASME

Details about the available device variants can be viewed in the product configurator on the Endress+Hauser homepage www.endress.com.

4 Incoming acceptance and product identification

4.1 Incoming acceptance

Check the following during goods acceptance:
❑ Are the order codes on the delivery note and the product sticker identical?
❑ Are the goods undamaged?
❑ Do the nameplate data match the ordering information on the delivery note?
❑ If required (see nameplate): Are the Safety Instructions, e. g. XA, provided?
❑ Is the device properly secured?

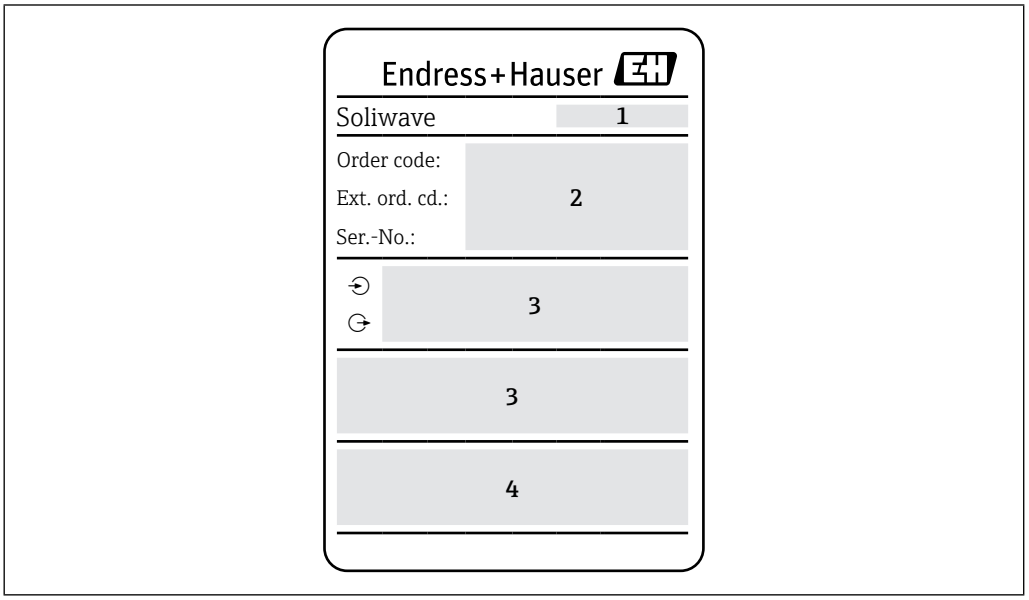
If one of these conditions is not met, please contact the manufacturer's sales office.

4.2 Product identification

The measuring device can be identified in the following ways:
- Nameplate data
- Extended order code with breakdown of the device features on the delivery note
- Enter serial number from nameplates in *W@M Device Viewer* (www.endress.com/deviceviewer): All of the information on the measuring device is displayed along with an overview of the scope of technical documentation provided

- Enter the serial number on the nameplate into the *Endress+Hauser Operations App* or use the *Endress+Hauser Operations App* to scan the 2-D matrix code (QR Code) on the nameplate

4.2.1 Nameplate



2 *Nameplate data*

1 *Manufacturer address*
2 *Order number, external order code, serial number*
3 *Technical data*
4 *Approval-specific information*

4.2.2 Manufacturer address

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

4.3 Storage and transport

4.3.1 Storage conditions

Use original packaging.

Storage temperature
→ 53

4.3.2 Transporting the device

Transport the device to the measuring point in the original packaging.

4.3.3 Disposal of packaging

The carton is environmentally compatible and 100 % recyclable in accordance with European Directive 2004/12/EC on packaging (recyclability is confirmed by means of the RESY symbol on the carton).

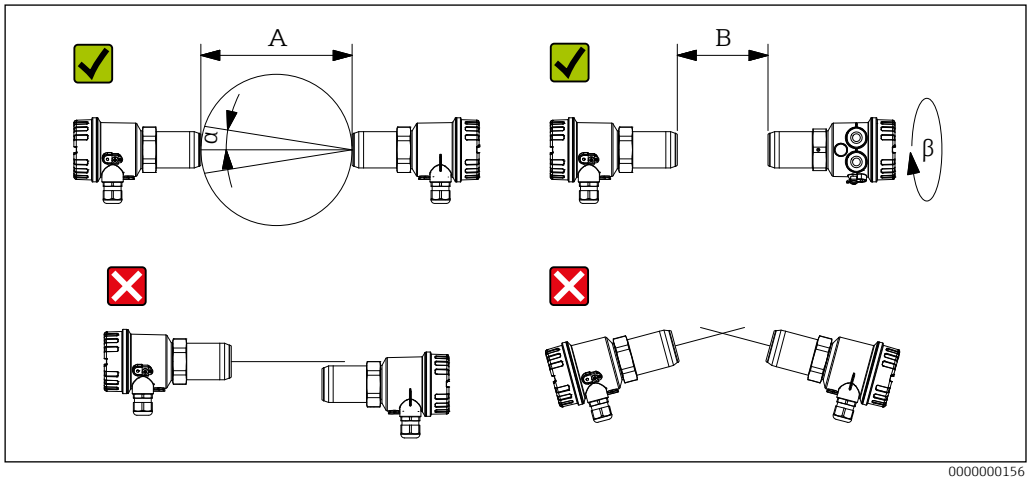
5 Mounting

5.1 Mounting conditions

Minimization of application-specific influences
▸ Vibration influence → 🖹53

5.1.1 Mounting position

The installation position is arbitrary under consideration of the following conditions:
- **Microwaves are polarized**: FDR56 and FQR56 must not be rotated against each other along their longitudinal axis (except by 180° or for detection ranges smaller than 300 mm (11.8 in)).
- Maintain a minimum distance of 30 mm (1.18 in).



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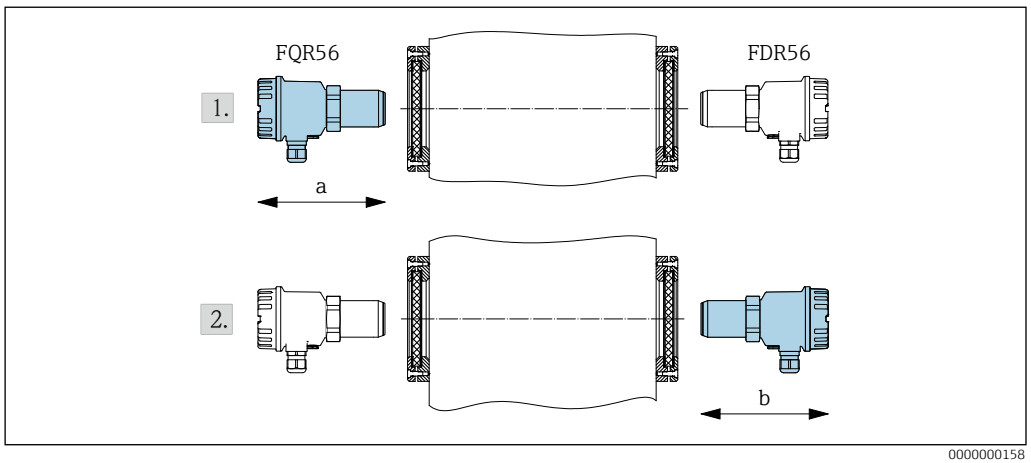
3 Mounting position

A Detection range 0.3 to 100 m (11.8 to 3937 in)
B Detection range 0.03 to 0.3 m (1.18 to 11.8 in)
α Antenna opening angle approx. 11°
β 90°

5.1.2 Optimization of the signal quality

If the microwave barrier devices are installed in front of microwave-permeable windows or plugs, it is possible to optimize the signal quality by moving FQR56 and FDR56 on their longitudinal axis **after an automatic adjustment has been performed**. → 🖹28



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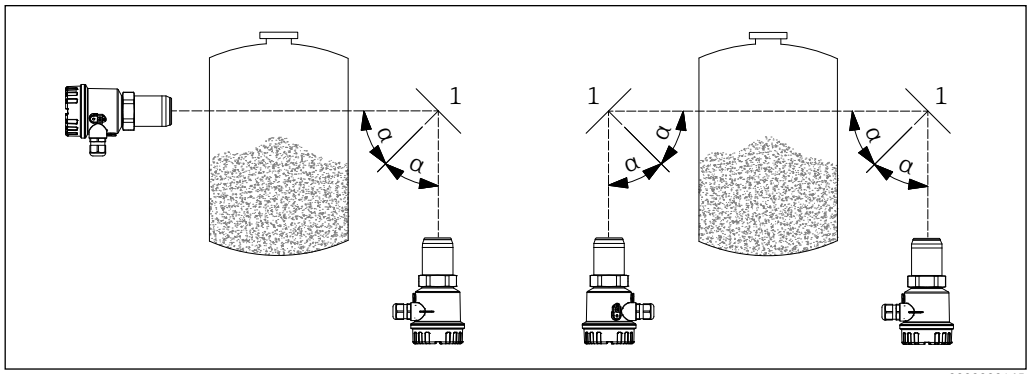
4 Optimization of the signal quality

1. Loosen device 1 (here FQR56) and move it slowly by **a** = ±10 mm (±0.4 in) until a signal maximum is reached (LED signal strength), fix device again.
   Example: →
2. Then loosen device 2 (here FDR56) and move it slowly by **b** = ±10 mm (±0.4 in) until a signal maximum is reached, fix the device again.
   Example: →

Position change performed (here horizontal shift)
▸ Perform automatic adjustment again

5.1.3 Reflector operation

Direct comparison of FQR56 and FDR56 not possible.
▸ Deflect microwave beam via plane metal mirrors (reflectors).



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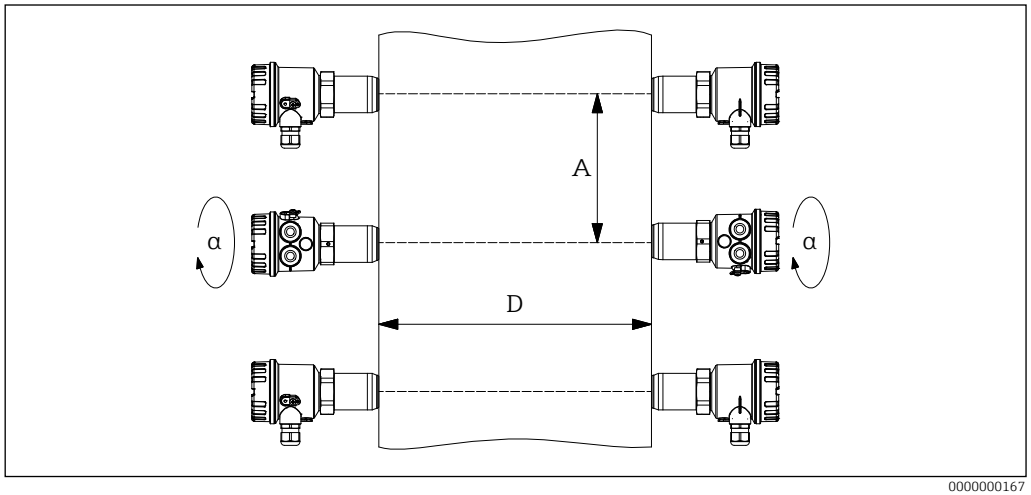
5 *Reflector operation*

1 Reflector
α Angle of entrance = angle of emission

- Arrange devices symmetrically to the reflector (entrance angle = exit angle).
- Range reduction per reflector: 10 %

5.1.4 Parallel operation

Mutual interference is to be avoided.
▸ Rotate every second microwave barrier by 90°.



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6 *Parallel operation*

A Distance between microwave barriers
D Detection range
α 90°

- Recommendation under ideal conditions: **A ≥ D/2**
- Applications with stronger reflections: Increase **A** as required

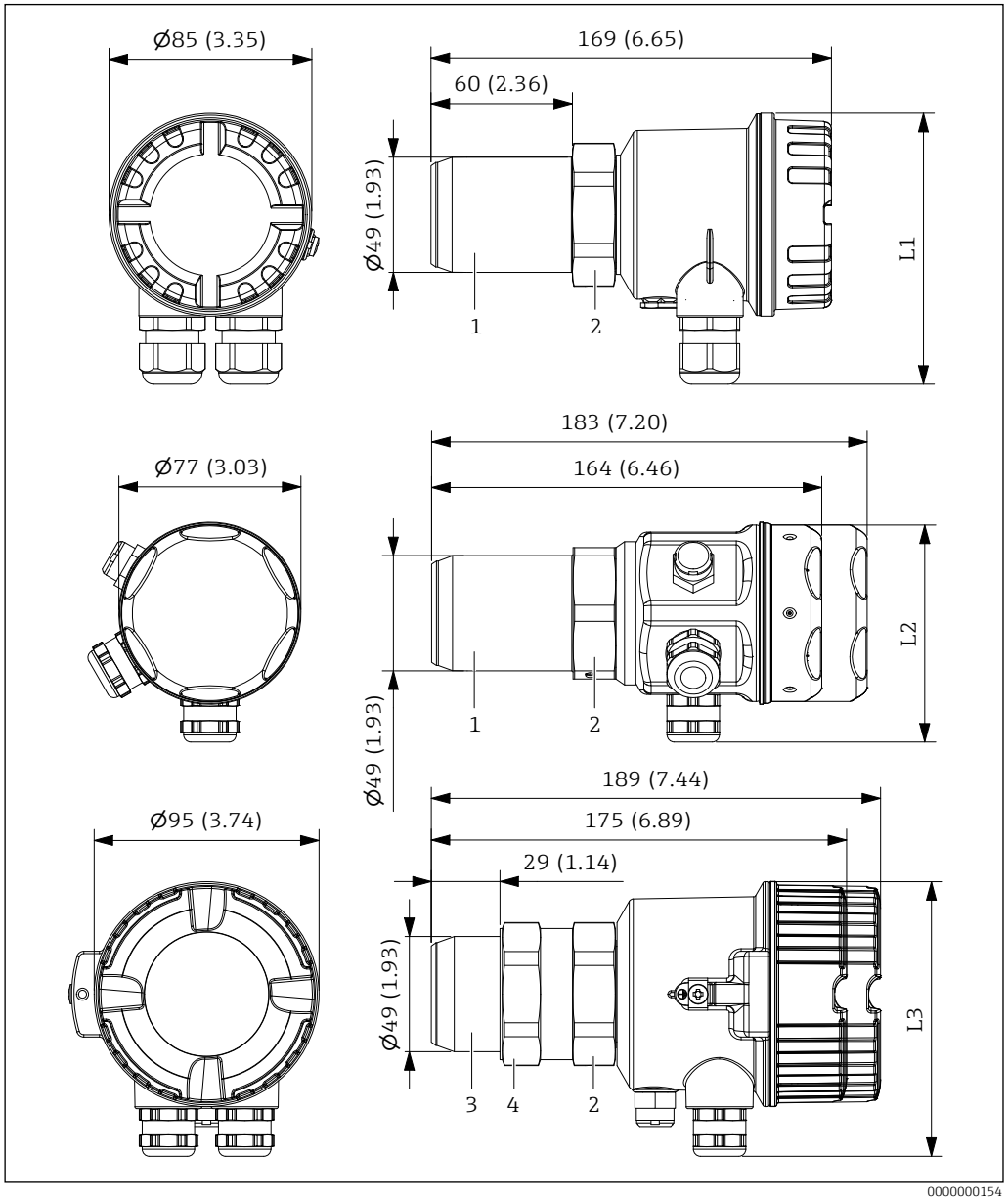
5.1.5 Mounting with accessories

Details of available accessories
→ 41

5.1.6 Operating temperature range

→ 53

5.1.7 Mounting dimensions



7 *Mounting dimensions. Unit of measurement mm (in)*

1 *Connection thread R 1½ / 1½ NPT*
2 *Hexagon SW55*
3 *Connection thread G 1½*
4 *Counternut (SW55)*

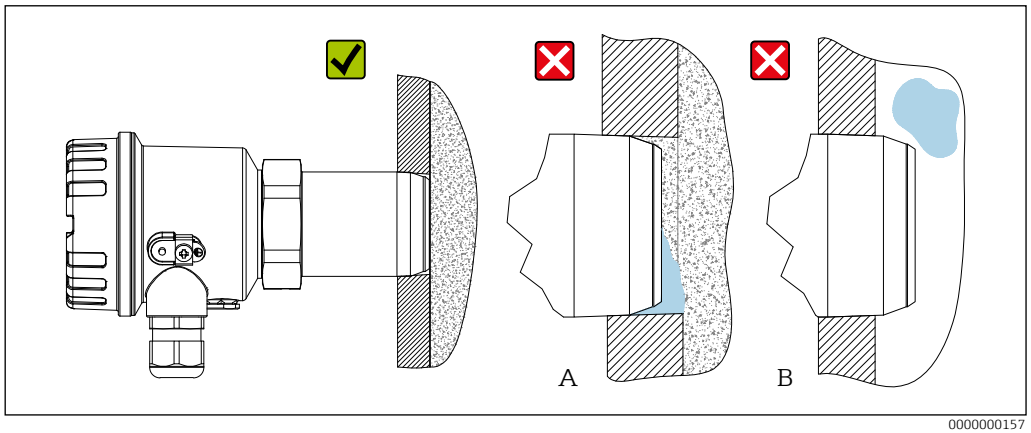
Dimensions L1 to L3, depending on the housing and electrical connection:

Housing	Electrical connection			
	Cable gland M20	Thread 1/2" NPT	Connector M12	Connector Harting HAN8D
L1 (F16)	114 (4.49)	111 (4.37)	101 (3.98)	133 (5.24)
L2 (F15)	93 (3.66)	94 (3.70)	88 (3.46)	120 (4.72)
L3 (F34)	116 (4.57)	117 (4.60)	111 (4.37)	143 (5.63)

5.2 Mounting the device

5.2.1 Mounting in contact with the process

The device is screwed directly into the process (for example in existing threads or vessel sleeves) with its process connection (standard threads R 1½ according to EN 10226, G 1½ according to ISO 228-1 or 1½ NPT according to ANSI/ASME B1.20.1).



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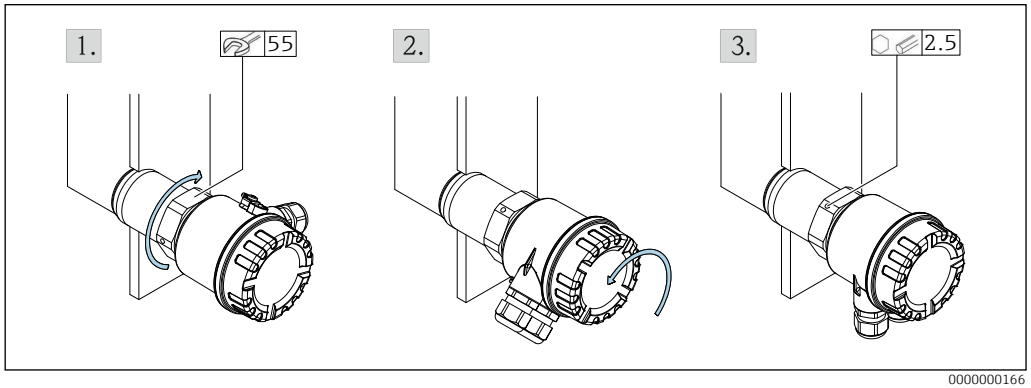
8 Direct mounting with threaded connection

- 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 device (**A**), thereby damping 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 occurring as a result of large product items falling.

Mounting with connection thread



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9 Mounting with connection thread

1. Screw in connection thread. For G 1½ thread: Tighten counternut.
2. Align the electronics housing (cable gland or plug connector of both devices must point in the same direction).
3. Fix the housing in place.

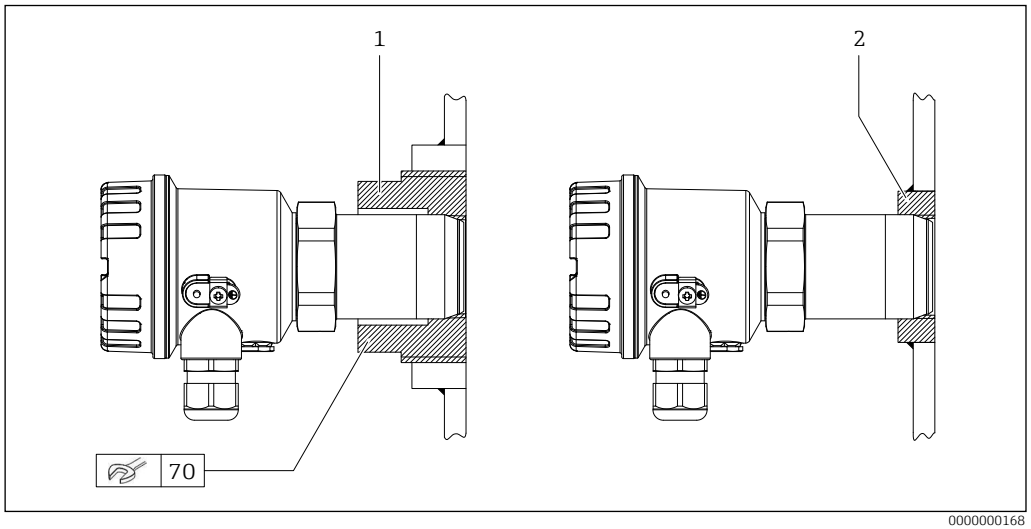
- When using the G 1½ process connection (standard thread according to ISO 228-1, hexagon SW55) with counternut, the device can be mounted flush particularly easily, as it is a cylindrical thread.
- Seal (if necessary): to be provided by the customer

Mounting with weld-in adapter FAR52-A*

▸ Weld the adapter flush with the inner wall of the container.
▸ Screw in the device flush with the inner wall. For G 1½ thread: Tighten counternut.

Mounting with screw-in adapter FAR52-B*

▸ Screw in the adapter flush with the inner wall of the container.
▸ Screw in the device as far as it will go.



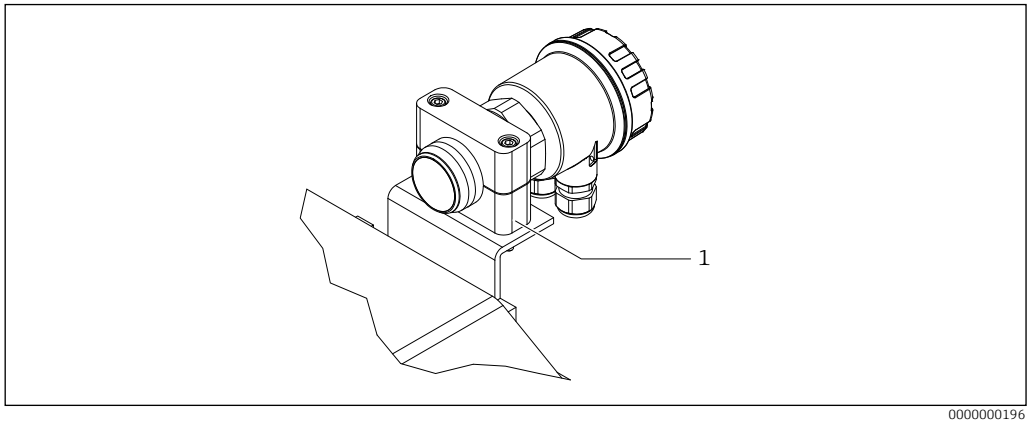
10 Weld-in or screw-in adapter FAR52. Unit of measurement mm (in)

*1 Screw-in adapter FAR52-B**
*2 Weld-in adapter FAR52-A**

- Suitable weld-in and screw-in adapters of type FAR52 → 42
- Observe the installation instructions in the associated Technical Information.
- Seal (if necessary): to be provided by the customer

Mounting for open processes

▸ Mount the device with a mounting bracket, for example, on existing plant components.



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11 Mounting bracket

1 Mounting bracket

- For open processes, the mounting is arbitrary.
- Suitable mounting brackets → 42

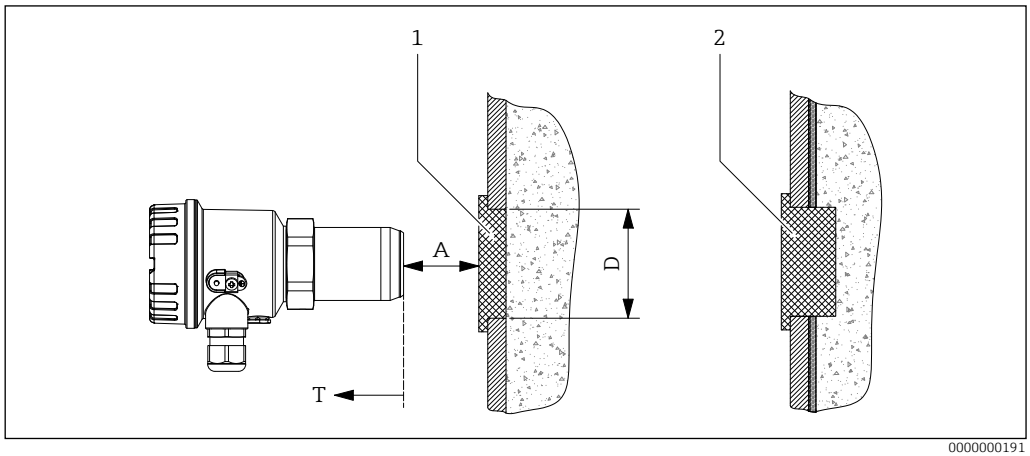
5.2.2 Mounting without contact with the process

For a microwave-impermeable process wall (for example, metal vessel wall), mounting is done in front of microwave-permeable windows such as plastic plugs, ceramic disks, or sight glass fittings.

Mounting in front of microwave-permeable plugs of type FAR54

▸ Mount plug. → TI01371F

▸ Mount the device in a suitable manner before the plug, for example with mounting bracket on existing plant components.



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12 Mounting in front of microwave-impermeable process wall

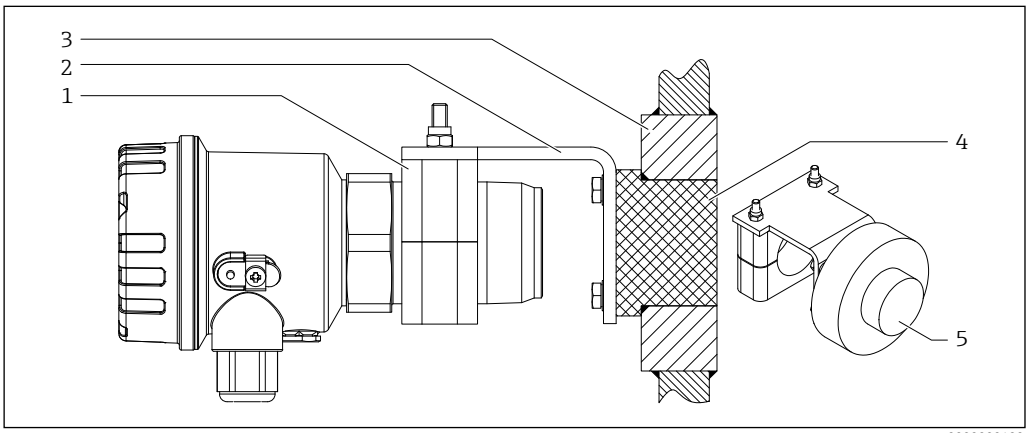
1 Microwave-permeable plug

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

- Observe maximum temperature **T** at the device connection. → 53
- Risk of condensate formation on the inner process wall → plug **2**
- **A** minimize → minimize signal attenuation
- Observe the installation instructions in the associated Technical Information.
- Suitable plug of type FAR54 → 46

Mounting with weld-in adapter with mounting arm

▸ Weld the adapter flush with the inner wall of the container.
▸ Screw the mounting arm to the weld-in adapter using the plug.
▸ Mount the device on the mounting arm using the enclosed mounting bracket.



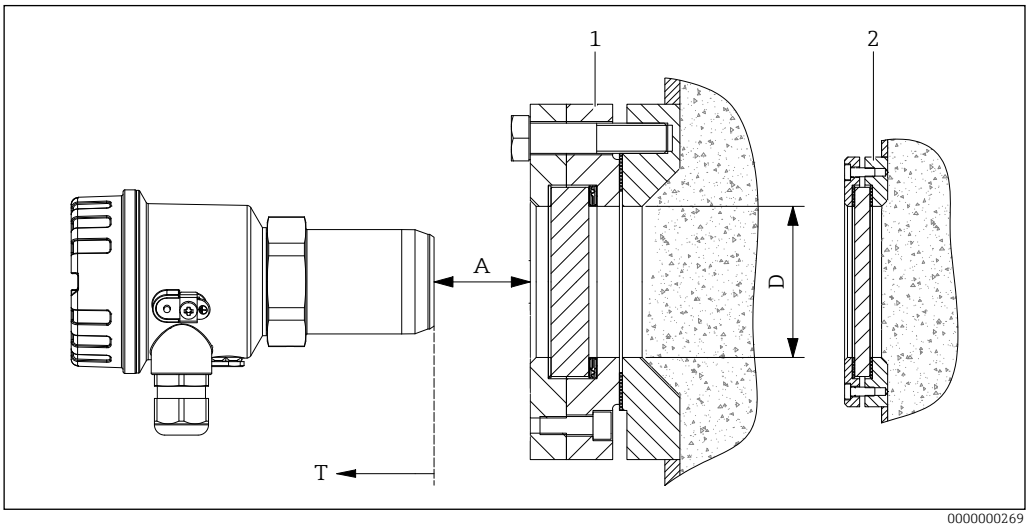
13 *Weld-in adapter with mounting arm. Unit of measurement mm (in)*

1 *Mounting bracket (aluminum or plastic)*
2 *Mounting arm*
3 *Weld-in adapter*
4 *Plug (flush-mounted with weld-in adapter)*
5 *Plug (protruding into the process, in case of condensation on the inside wall of the container)*

Suitable weld-in adapter with mounting arm
→ 43

Mounting in front of microwave permeable sight glass fitting

▸ Weld the sight glass fitting flush with the inner wall of the container.
▸ Mount the device in a suitable manner in front of the sight glass fitting, for example with a mounting bracket on existing plant components.

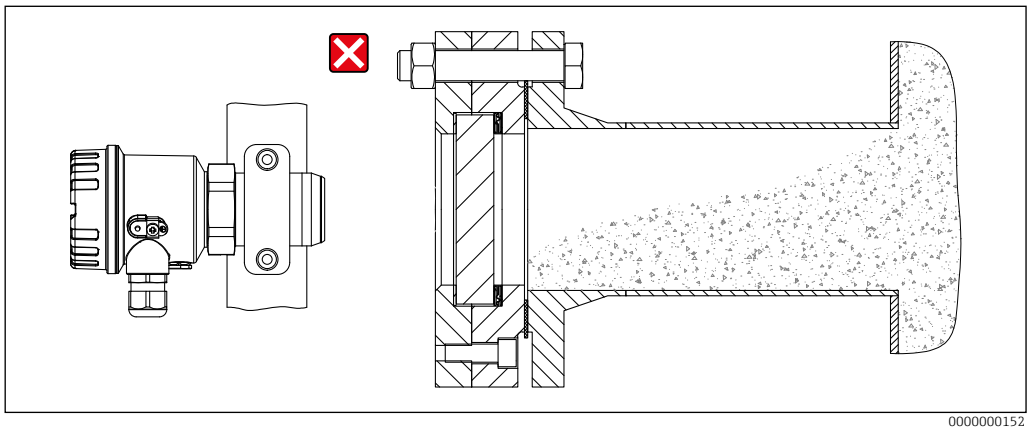


14 *Sight glass fitting*

1 *Sight glass fitting for processes up to 10 bar (145 psi)*
2 *Sight glass fitting for unpressurized processes*

- Observe maximum temperature **T** at the device connection. → 53
- **A** minimize → minimize signal attenuation
- Suitable sight glass fittings and sight glass plates → 46

Avoid material accumulation in front of the sight glass (risk of incorrect measurements).



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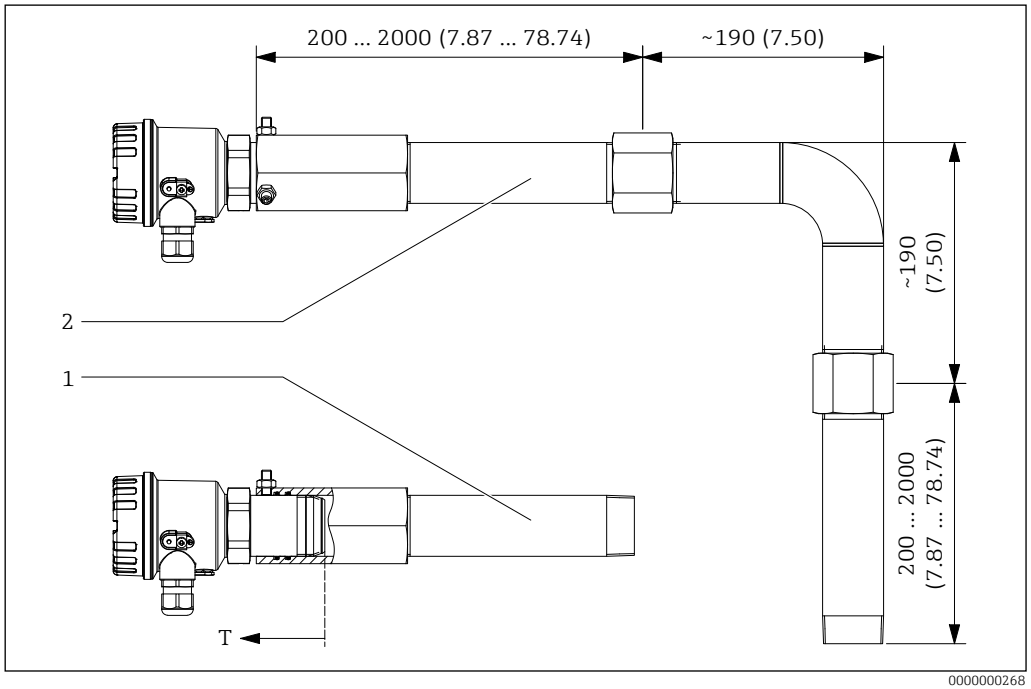
15 Impermissible mounting with the risk of material accumulation

Mounting with waveguide type FAR55

- ▸ Mount waveguide. → TI01372F
- ▸ Insert the devices into the socket, align them and fix them in place with the three enclosed M8 hexagon socket screws (SW4) and locknuts (SW13).



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16 Wave guide FAR55. Unit of measurement mm (in)

*1 Straight version FAR55-A**
*2 Angulated version FAR55-B**

- Suitable waveguide type FAR55 → 📄50
- Observe the installation instructions in the associated Technical Information.
- Observe maximum temperature **T** at the device connection. → 📄53
- Seal (if necessary): to be provided by the customer

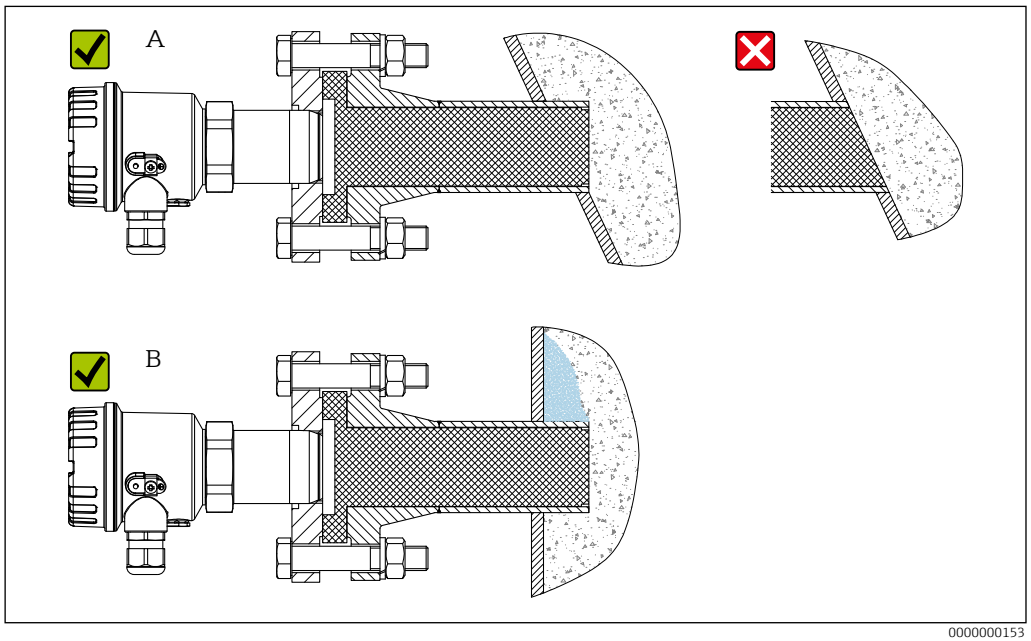
Mounting with mounting flange and plug → 🖼18

- ▸ Insert a suitable plug into the existing process connection piece.
- ▸ Mount suitable mounting flange.
- ▸ Screw the device into the mounting flange. For G 1½ thread: Tighten counternut.

- Suitable mounting flanges → 44
- Suitable plug of type FAR54 → TI01371F
- Gasket and mounting screws: to be provided by customer

Mounting on process nozzle

- Mounting of process nozzle with inclined process wall (**A**)
- Mounting in case of risk of material accumulation on inner process wall (**B**)

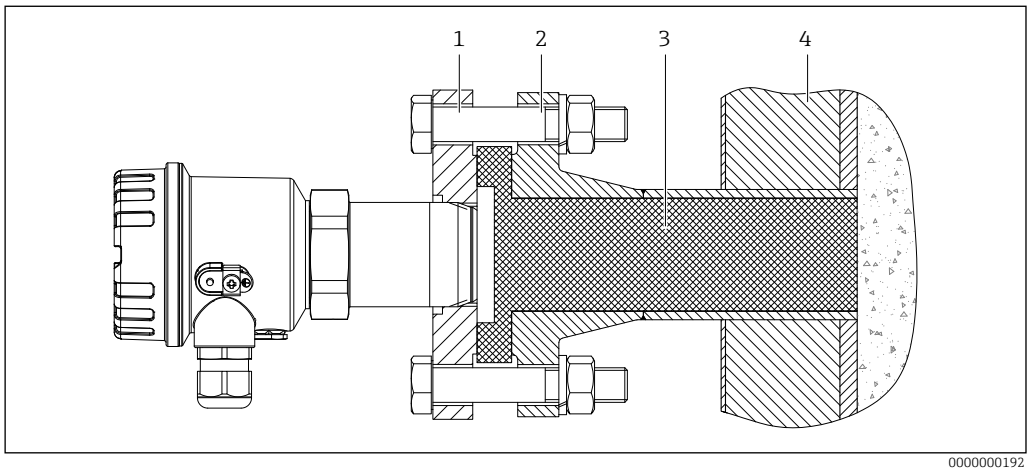


17 *Mounting on process nozzle*

If there is a risk of condensation forming between the device and the plug: Use of process connection type FAR50 with integrated venting element → 49

Mounting with weld-in socket type FAR50

▸ Mount weld-in socket. → TI01362F
▸ Screw the device into the mounting flange. For G 1½ thread: Tighten counternut.



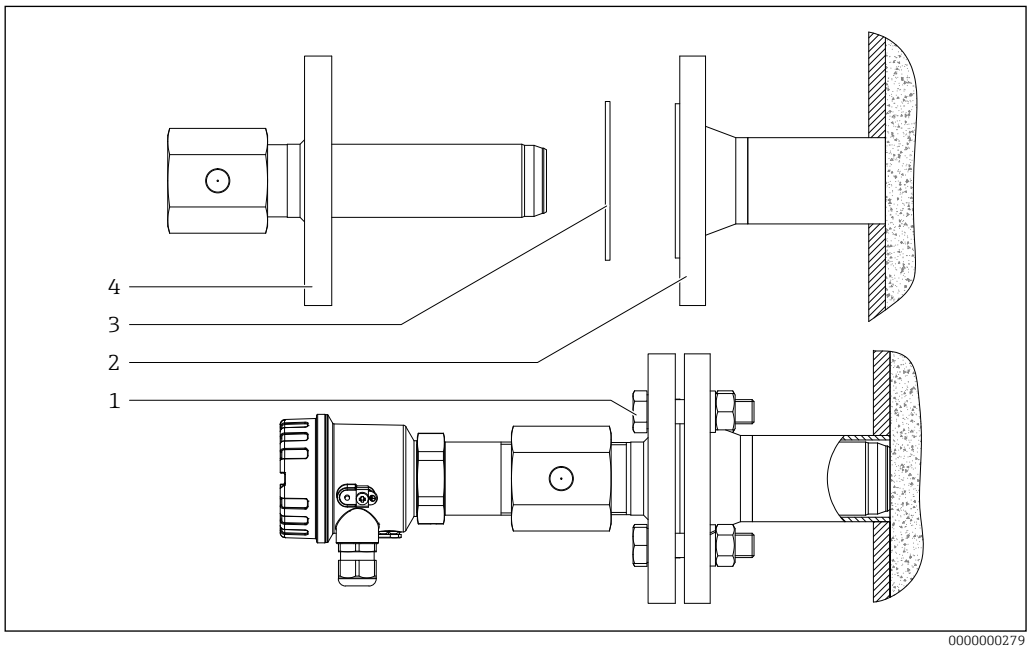
18 *Weld-in nozzle FAR50*

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

- Observe maximum temperature **T** at the device connection. → 53
- Observe the installation instructions in the associated Technical Information.
- Suitable weld-in nozzles of type FAR50 → 49
- Seal (if necessary): to be provided by the customer

Mounting with insertion adapter type FAR51

▸ Mount plug-in adapter in existing process connection piece. → TI01368F
▸ Screw the device into the plug-in adapter. For G 1½ thread: Tighten counternut.



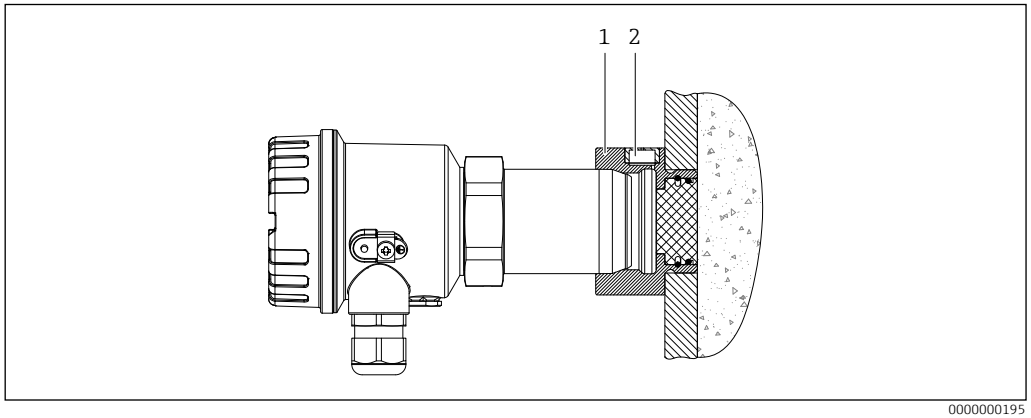
19 *Insertion adapter FAR51*

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

- Observe maximum temperature **T** at the device connection. → 53
- Observe the installation instructions in the associated Technical Information.
- Suitable plug-in adapter type FAR51 → 48
- Seal (if necessary): to be provided by the customer

Mounting with high pressure adapter

▸ Screw the high-pressure adapter into the existing process connection thread.
▸ Screw the device into the adapter connection thread.



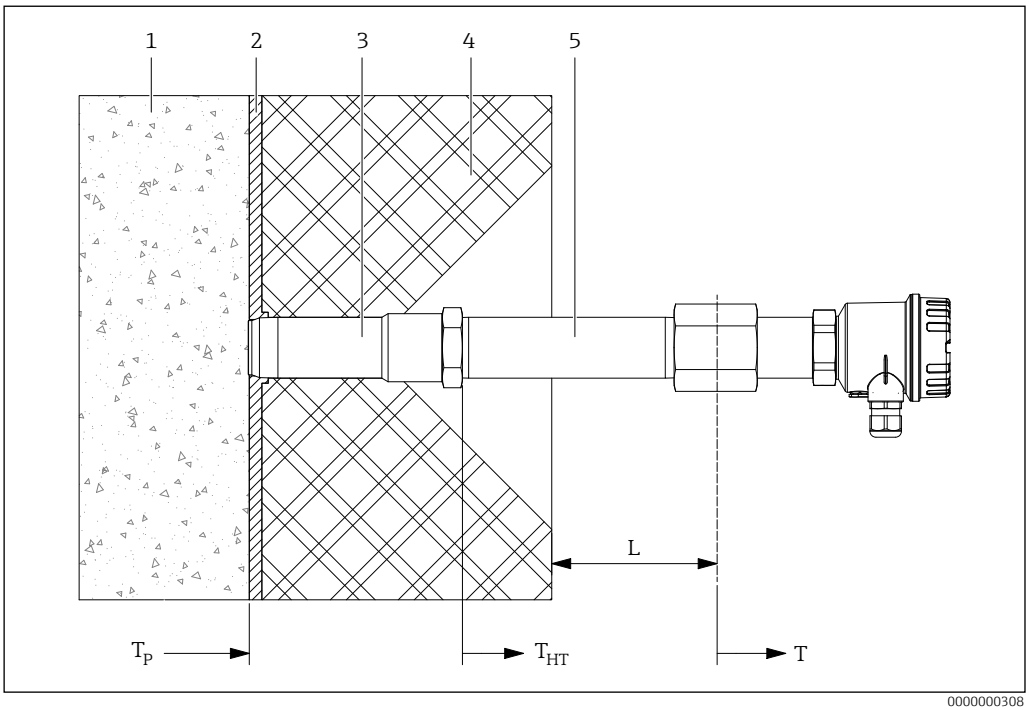
20 *High pressure adapter*

1 *High pressure adapter*
2 *Integrated venting element*

- Suitable high pressure adapter → 45
- Seal: to be provided by the customer

Mounting with high temperature adapter and extensions

▸ Mount high temperature adapter.
▸ If required: Mount extension(s).
▸ Screw the device into the connection thread. For G 1½ thread: Tighten counternut.



21 *High temperature adapter with extension*

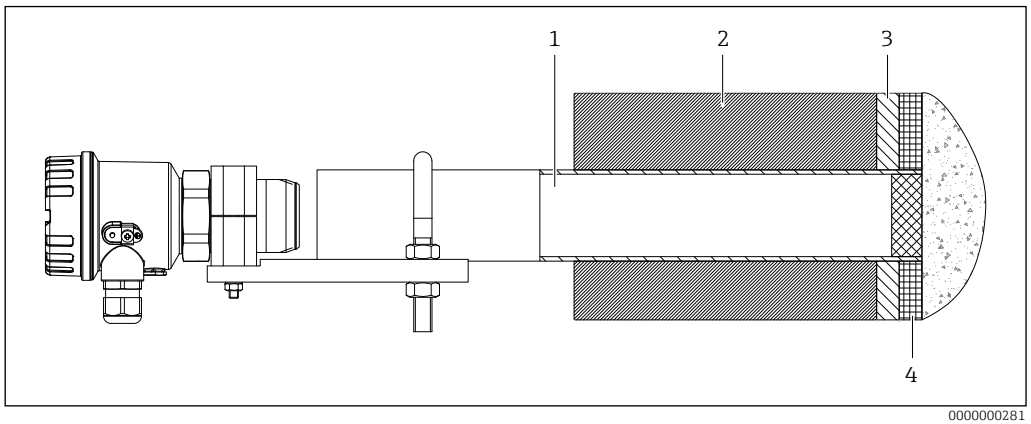
1 *Process*
2 *Wall*
3 *High temperature adapter*
4 *Insulation*
5 *Length extensions (optional)*

Observe the following temperatures:
- Temperature $\mathbf{T_P} \leq +450$ °C (+842 °F) at the process connection of the high-temperature adapter
- Temperature $\mathbf{T} \leq +70$ °C (+158 °F) at the device connection
- Temperature $\mathbf{T_{HT}} \leq +160$ °C (+320 °F) on the internal thread of the high-temperature adapter when using the extension, otherwise $\mathbf{T_{HT}} \leq \mathbf{T}$

- **L** must be selected depending on the process and ambient temperatures.
- Suitable high temperature adapter and extension → 50

Mounting with spacer tube (wave guide) type FAR53

▸ Mount spacer tube. → TI01370F
▸ Mount the device to the mounting plate using the enclosed mounting bracket.



22 *Mounting with spacer tube (wave guide)*

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

- Suitable spacer tubes of type FAR53 → 📄49
- Observe the installation instructions in the associated Technical Information.
- Observe maximum temperature **T** at the device connection. → 📄53
- Seal (if necessary): to be provided by the customer

5.3 Post-installation check

❑ Is the device undamaged (visual inspection)?

❑ Does the device conform to the measuring point specifications?

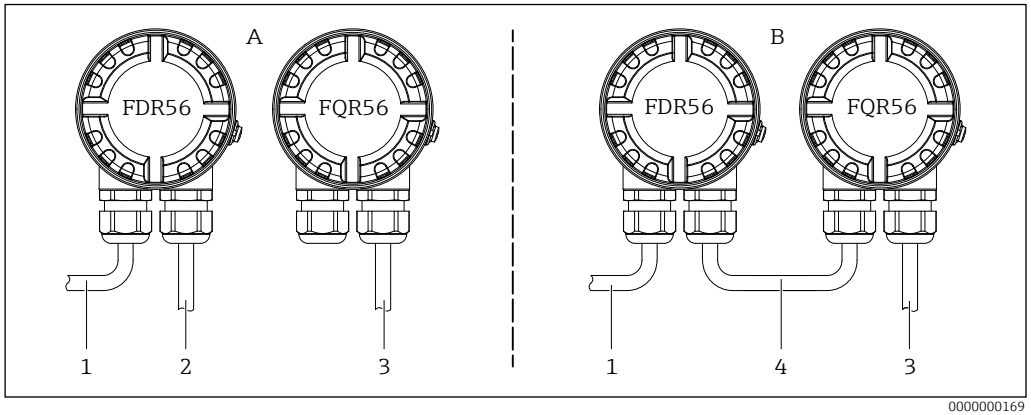
For example:
- Process temperature
- Process pressure
- Ambient temperature

❑ Are the measuring point number and labeling correct (visual inspection)?

❑ Is the device adequately protected against precipitation and direct sunlight?

❑ Is the device properly secured?

6 Electrical connection



23 Product design

A Independent wiring of FDR and FQR
B Ring wiring FDR via the FQR
1 Connection signal circuit
2 Connection of supply circuit FDR
3 Connection of supply circuit FQR
4 Connection of supply circuit for ring wiring

For a device for the hazardous area:
Observe the instructions in the Ex documentation (XA).

6.1 Connection requirements

The following points must be observed before connecting the device:
- The voltage supply must match the voltage specified on the nameplate.
- Switch off the supply voltage before connecting the device.
- When using the public powers supply, install an easy accessible power switch in the proximity of the instrument. Mark the power switch as a disconnector for the instrument (EN/IEC 61010).
- The cable glands and connectors are permitted for connecting fixed cables and lines only. The operator must ensure adequate strain relief.

- The device is to be attached so that the cable gland is protected from mechanical damage (degree of mechanical hazard "low" – impact energy: 4 joules).
- Seal unused entry glands with approved sealing plugs that correspond to the type of protection. The plastic transport sealing plug does not meet this requirement and must therefore be replaced during installation.

6.1.1 Required tool

For the terminals:
0.6 x 3.5 mm

For the sensing weight:
25 mm (AF) (plastic) or 22 mm (AF) (metal)

6.1.2 Connecting cable requirements

The connecting cables provided by the customer must meet the following requirements:
- Permissible temperature range → 53
- Protection → 53
- Normal installation cable sufficient
- Cable cross-sections: 0.2 to 2.5 mm² (24 to 12 AWG)

Cable gland
- Clamping range:
  - 5 to 10 mm (0.2 to 0.39 in) acc. to EN 50262 or 7 to 10 mm (0.28 to 0.39 in) acc. to UL-514 B (Cable gland made of plastic)
  - 7 to 10.5 mm (0.28 to 0.41 in) (Cable gland made of metal)
- Tightening torque
  - Max. 6 Nm (Cable gland made of plastic)
  - Max. 10 Nm (Cable gland made of metal)

For the optionally supplied mating M12 connectors, the following requirements apply:
- Clamping range of the cable: 6 to 8 mm (0.24 to 0.31 in)
- Cable cross-sections: Max. 0.75 mm² (18 AWG)

Suitable connection cable
→ 📄41 and order structure option "accessory enclosed"

6.2 Connect potential equalization

The potential equalization for the device must be integrated into the existing potential equalization on site.

Requirements:
- The potential equalization must be connected to the external ground terminal on the device.
- For optimum electromagnetic compatibility, keep the potential equalization line as short as possible.
- The recommended cable cross-section is 2.5 mm².
- The potential equalization of the FDR56/FQR56 must be included in the local potential equalization.

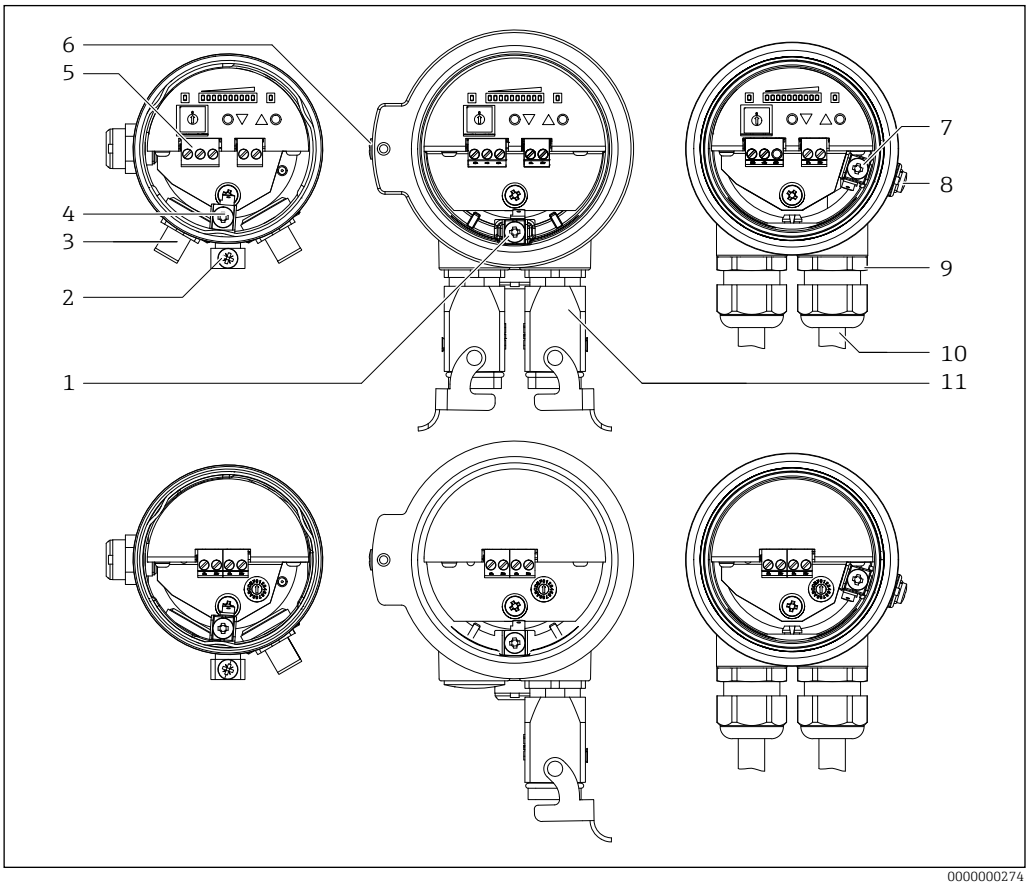
6.3 Connecting the device

The electrical connection is realized by internal terminals or external connectors.

1. Insert cable into cable gland.
   - For plastic cable gland: Tighten cap nut until the rubber seal is touched all around and then tighten cap nut with by ½ turn.
   - For metal cable gland: Tighten the cap nut (torque of up to 10 Nm).
2. Connect the protective ground.
3. Connect the power supply and signal output.

For connection via plug connector:

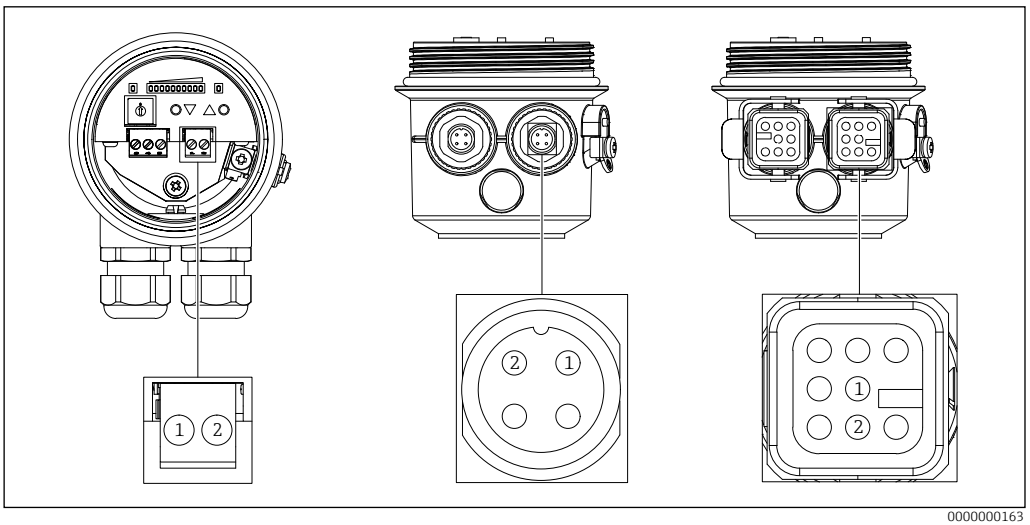
1. Connect the protective ground.
2. Connect the connectors and fix them.



24 Electrical connection

1 Connecting potential matching (inside) F34 housing
2 Connecting potential matching (outside) F15 housing
3 M12 connector
4 Connecting potential matching (inside) F15 housing
5 Terminals
6 Connecting potential matching (outside) F34 housing
7 Connecting potential matching (inside) F16 housing
8 Connecting potential matching (outside) F16 housing
9 Cable gland
10 Connecting cable
11 Harting connector

6.3.1 Supply circuit connection



25 Supply circuit connection (Connector 1)

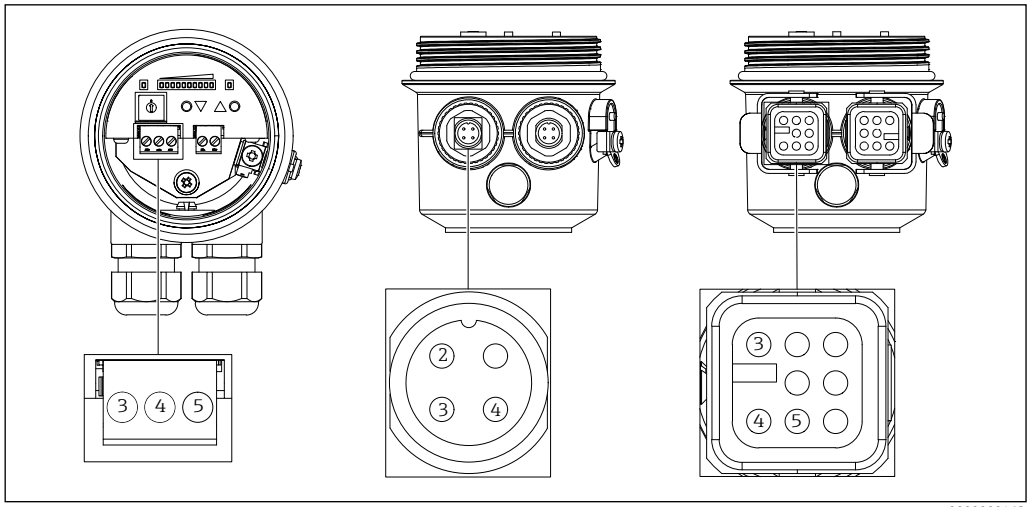
Connect the power supply according to the device version:
→ 53

Electrical connection	Supply voltage
Connection terminals	Terminals 1 - 2
M12 connector Binder series 713/763	Connector 1, contact 1 - 2
Harting connector type HAN8D	Connector 1, contact 1 - 2

NOTICE

- The polarity of the supply voltage can be set as required.
- Provide overcurrent protection device (max. 10 A) for the supply voltage.
- In accordance with IEC/EN61010 a suitable circuit breaker must be provided for the measuring device.
- The electrical connection with connector is only available for the power supply with 20 to 60 V DC or 20 to 30 V AC, 50/60 Hz (ordering option "E").

6.3.2 Connection signal circuit



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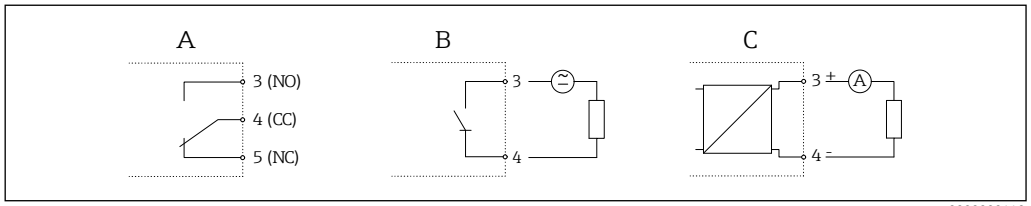
26 Connection signal circuit (Connector 2)



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27 Signal circuits

A Relay output
B Current output
C Solid-state relay

Relay output

→ 52

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

NOTICE

- The contact material of the relay is also suitable for switching small signal circuits, if no inductive loads or higher currents have been switched previously.
- If the switching frequency is high, the solid-state relay should be selected.
- When using the Harting connector type HAN8D the maximum switching voltage is 120 V DC or 50 V AC.

Solid-state relay
→ 52

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

NOTICE

The polarity of the solid-state relay can be set as required.

Current output
→ 52

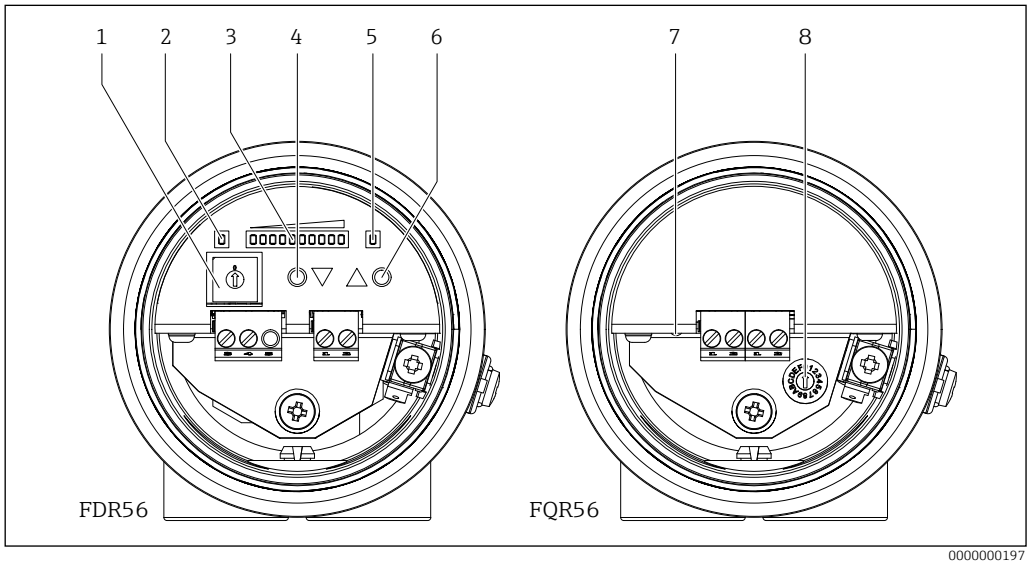
Electrical connection	Current output
Connection terminals	Terminals 3 (+) - 4 (-)
M12 connector Binder series 713/763	Connector 2, contact 3 (+) - 4 (-)
Harting connector type HAN8D	Connector 2, contact 3 (+) - 4 (-)

6.4 Post-connection check

❑ Is the device or cable undamaged (visual inspection)?
❑ Do the cables used comply with the requirements?
❑ Do the mounted cables have adequate strain relief?
❑ Are the connectors firmly tightened?
❑ Does the supply voltage match the specifications on the nameplate?
❑ No reverse polarity, is terminal assignment correct?
❑ If supply voltage is present, is the green LED lit?

7 Operation options

7.1 Overview



28 *Display and operating elements*

1 *Function selection switch*
2 *Ready for operation LED (green) (FDR56)*
3 *Display*
- *Normal operation: Signal strength*
- *Configuration mode: Function number and function value*
4 *Operating button ▼ (decrease or toggle)*
5 *Switch output LED (yellow), only relay*
6 *Operating button ▲ (increase or toggle)*
7 *Ready for operation LED (green) (FQR56)*
8 *Switch for adjusting the operating frequency*

7.1.1 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 think, the adjustment of the sensitivity is carried out for clear and unambiguous limit detection.

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.

NOTICE

- The device is in operating mode in encoding switch position "0" only. All other positions are for parameter configuration.
- In parameterization mode, the microwave barrier continues to operate in the background, and changed settings are taken into account directly.
- After completing the settings, set the encoding switch back to the initial position "0" (= operation).

7.1.2 Transmitter FQR56

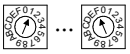
In the event of interference from nearby microwave barriers in the 24 GHz ISM band, it is possible to slightly adjust the operating frequency of the microwave barrier on the FQR56 transmitter.

NOTICE

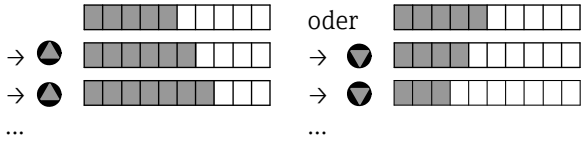
When operating several microwave barriers installed close to each other, the Soliwave FDR57/FQR57 device combination with the FTR525 Nivotester should be selected; with this, independent parallel operation is possible.

7.2 On-site operation

7.2.1 Operation of the FDR56

1. Select any function (Overview → 35)
   → Encoding switch 1 to F
   
   → The display shows the selected function 1 to F for two seconds.
   
2. Setting the selected function
   → The two operating buttons can be used to increase/decrease the value or to switch the selection.

   Example: Function 3 (manual adjustment on free path)

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 parameter configuration function and changed if necessary.
4. After the parameterization has been completed (i.e. after the microwave barrier has been adapted to the respective medium), the encoding switch must be returned to the "0" position and the FDR56 is now ready for operation.

7.2.2 Operation of the FQR56

1. Selection of the switch position 0 to 4 (slightly different operating frequency in each case)
   → 
2. Select the next switch position if the interference is still present.

The switch positions 5 to F have no function, the operating frequency in these positions corresponds to switch position 0.

7.3 Parameterization

The microwave barrier can be adjusted on the FDR56. The setup can be made on free or covered path. Therefore there are functions for automatic and manual setup available.

For most applications the automatic setup is sufficient.

7.3.1 Adjustment with free or minimum covered path (function 1)

This automatic setup function can be used if the path is free or minimum covered.

1. Set encoding switch to Position 1
   → Display of the function number

   → After 2 seconds: Display of the current signal strength, example:
   

2. Simultaneously press the operation buttons on the device with free or minimum covered path
   → Automatic adjustment is carried out
   → Display of the signal strength after adjustment, example:

3. Move the encoding switch to the initial position 0
   → Display of the current signal strength

Optional:
Additional manual adjustment with maximum covered path (function 4)

For most applications the automatic setup is sufficient. The manual setup can be used to adapt the microwave barrier individually to the application or medium.

If after an automatic setup on free path (function 1) the medium can not be detected safely (switching point of the limit detection is not undercut on maximum covered path), the sensitivity must be reduced with this manual setup function 4.

1. Move the encoding switch to position 4
   → Display of the function number

   → After 2 seconds: Display of the current signal strength, example:

2. Press the operation buttons on the device to achieve an increase or reduction of the signal strength display with maximum covered path
   → Display of the signal strength with maximum covered path (all 10 LEDs are not lit)

3. Move the encoding switch to the initial position 0
   → Display of the current signal strength

NOTICE

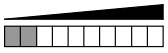
- The Soliwave microwave barrier is adjusted, if with maximum covered path a) on devices with switching output the switching point (LED 5) is undercut safely or b) on devices with current output all 10 LEDs are not lit.
- A repeated automatic adjustment (function 1 or function 2) resets any adjustment carried out earlier.

7.3.2 Adjustment with maximum covered path (function 2)

This automatic setup function can be used if the path is maximum covered.

1. Move the encoding switch to position 2
   → Display of the function number

   → After 2 seconds: Display of the current signal strength, example:



2. Simultaneously press the operation buttons on the device with maximum covered path
   → Automatic adjustment is carried out
   → Display of the signal strength after adjustment

3. Move the encoding switch to the initial position 0
   → Display of the current signal strength

Optional:
Additional manual adjustment with free or minimum covered path (function 3)

For most applications the automatic setup is sufficient. The manual setup can be used to adapt the microwave barrier individually to the application or medium.

If after an automatic setup with covered path (function 2) the condition "free path" can not be detected safely (switching point of the limit detection is not exceeded with free or minimum covered path), the sensitivity must be increased with this manual setup function 3.

1. Move the encoding switch to position 3
   → Display of the function number

   → After 2 seconds: Display of the current signal strength, example:

2. Press the opartion buttons on the device to achieve an increase or reduction of the signal strength display with free or minimum covered
   → Display of the signal strength with free or minimum covered path (all 10 LEDs illuminate)

3. Move the encoding switch to the initial position 0
   → Display of the current signal strength

NOTICE

- The Soliwave microwave barrier is adjusted, if with free or minimum covered path a) on devices with switching output the switching point (LED 5) is exceeded safely or b) on devices with current output a minimum of 6 LEDs are lit (ideally all 10 LEDs are lit).
- A repeated automatic adjustment (function 1 or function 2) resets any adjustment carried out earlier.

7.3.3 Advanced settings

The following settings are optional and not required in most cases; it may make sense to use them only for special adaptations to the application and/or to the downstream analysis (process control system):

- Hysteresis (function 5): Adjusting of a switching hysteresis (only for signal output relay or solid-state relay, → 30)
- Limit signal function (function 6): Adjusting of the switching characteristics (only for signal output relay or solid-state relay, → 31)
- Switching delay (Function 7 and function 8): Adjusting of a switch-on and/or switch-off delay (only for signal output relay or solid-state relay, → 32)
- Damping (Function A): Averaging of the detected signal strength (→ 33)

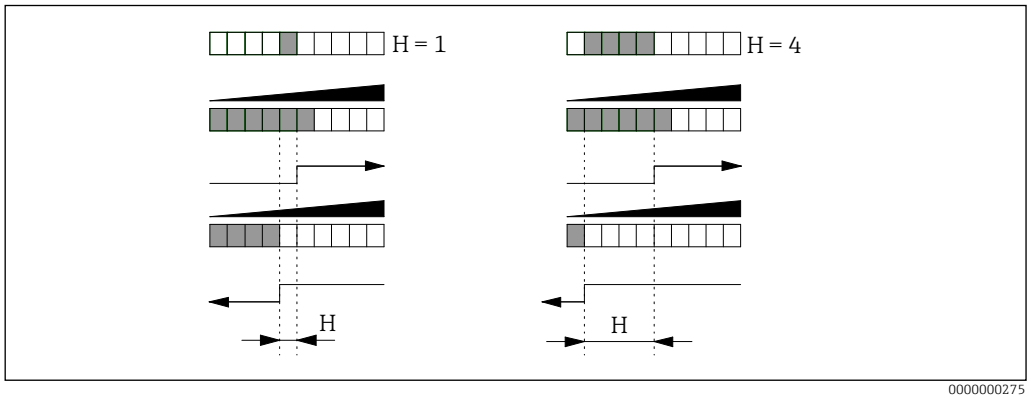
NOTICE

Overview of the factory defaults
→ 35

Hysteresis (Function 5)

A hysteresis from 1 to 4 LEDs can be programmed for the switch output (change-over contact with relay, normally open contact with solid-state relay, of no significance for current output).

- The fixed switch point with increasing signal strength is at the transition from LED 5 to LED 6.
- For decreasing signal strength, the switch point can be configured between the transition from LED 5 to LED 4 (minimum hysteresis of an LED) and maximum between LED 2 to LED 1 (maximum hysteresis of four LEDs).



29 *Adjustment of the switching hysteresis*

H Hysteresis

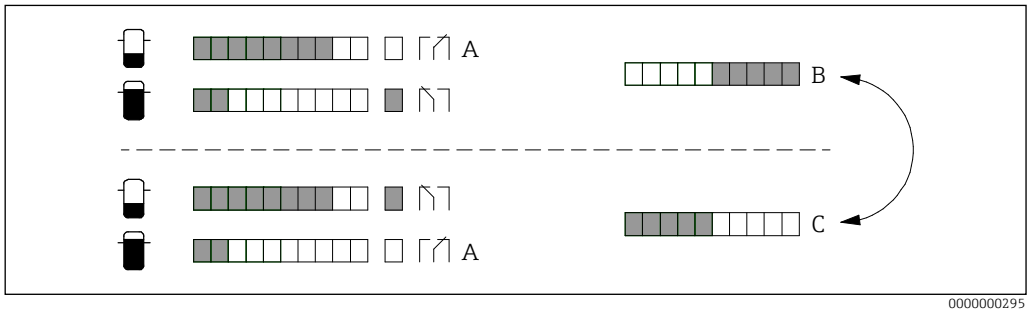
1. Move the encoding switch to position 5
   → Display of the function number
   → After 2 seconds: Display of the configured hysteresis, example:
2. Press the operation buttons on the device in order to configure the hysteresis in the range from 1 to 4 LEDs
   → Display of the changed hysteresis, example hysteresis increased from 3 LEDs to 4 LEDs:
3. Move the encoding switch to the initial position 0
   → Display of the current signal strength

NOTICE

- A larger hysteresis can also be used to prevent the output from continuously switching with a fluctuating signal strength. If, for example, the signal strength continuously fluctuates between the third and eighth LED, the factory default hysteresis of an LED would lead to the switch output continuously switching when the fourth LED is undershot.
- This setting has no significance for the current output.

Limit signal function (function 6)

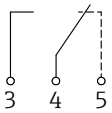
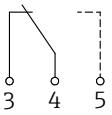
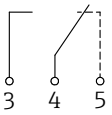
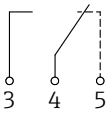
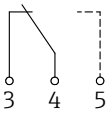
For devices with a relay and solid-state relay, the limit signal function determines the switching behavior upon exceeding and undershooting the limit value (upper limit value LED 5, lower limit determined by hysteresis).



30 *Adjustment of limit signal function*

A Rest position (supply voltage missing)
B Minimum safety
C Maximum safety (default setting)

1. Move the encoding switch to position 6
   → Display of the function number
   
   → After 2 seconds: Display of the configured limit signal function, example:
   
2. Press the button on the device in order to change between the two possible limit signal functions
   → Display of the changed limit signal function, example:
   
3. Move the encoding switch to the initial position 0
   → Display of the current signal strength

Output	Rest position	Setting	Exceeding of switch point (LED 5)	Undershooting hysteresis (function 5)
Relay (Contact 3-4-5) or **solid-state relay** (Contact 3-4)				
				

NOTICE

- These settings are for adapting the switching function to the downstream analysis (process control system).
- This setting has no significance for the current output.

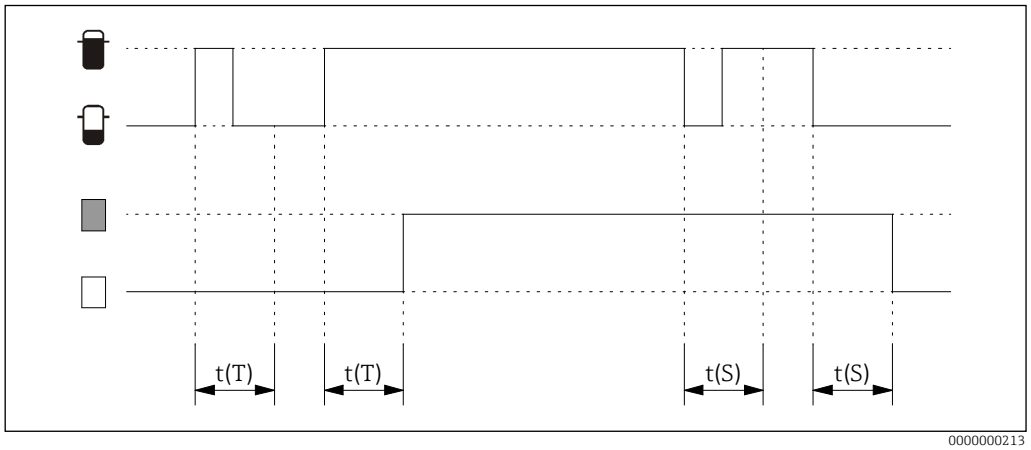
Switching delay (function 7 and function 8)

An additional switch-on and/or switch-off delay can be configured for the switch output. This can be used, for example, to stabilize the switch output when the signal strength fluctuates greatly, so that the relay does not switch until the switch point has been exceeded or undershot for a corresponding time.

As long as the times, in which a maximum limit is exceeded, are smaller than the switch-off delays, the switch output remains in the "uncovered state" (function 6 = standard setting).

NOTICE

For the following illustration, function 6 = standard setting.



31 Adjustment of switching delays

t(S) Switch-on delay (function 7)
t(T) Switch-off delay (function 8)

Setting	Delay t(S), t(T)	Setting	Delay t(S), t(T)
	Without		2 s
	100 ms		3 s
	200 ms		5 s
	300 ms		10 s
	500 ms		20 s
	1 s		

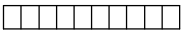
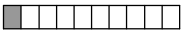
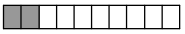
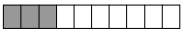
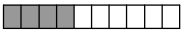
1. Move the encoding switch to position 7 (switch-on delay t(S)) or position 8 (switch-off delay t(T))
   → Display of the function number, switch-off delay example
   
   → After 2 seconds: Display of the configured delay time, example switch-off delay = off:
   
2. Press the button on the device to configure the delay time
   → Display of the changed delay time, example switch-off delay = 300 ms:
   
3. Move the encoding switch to the initial position 0
   → Display of the current signal strength

NOTICE

- The delays impact only the switch outputs (relay and solid-state relay); they have no significance for the current output.
- If the process conditions are unstable, the signal strength can be calmed with a parameterizable damping (function A).

Damping (function A)

For unstable process conditions, the display of the signal strength can be stabilized by a configurable damping; averaging of the output signal takes place here over the set time.

Setting	Damping	Setting	Damping
	Without		2 s
	100 ms		3 s
	200 ms		5 s
	300 ms		10 s
	500 ms		20 s
	1 s		

1. Move the encoding switch to position A
   → Display of the function number
   
   → After 2 seconds: Display of the configured damping, example damping = 200 ms:
   
2. Press the button on the device to configure the damping
   → Display of the changed damping, example damping increased to 500 ms
   
3. Move the encoding switch to the initial position 0
   → Display of the current signal strength

NOTICE

- The set time not only damps the signal strength display, but also impacts the switch output (for example, a delayed switching) and the current output (rises/falls with a delay).
- If only the switch output is to be stabilized, it is advisable to configure a switch-on and/or off delay. → 30
- The switch-on and/or off delay and damping can be combined, which causes the detection to be significantly slower.

Reset to factory settings (function F)

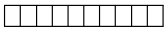
This function can be used to reset the FDR56 to its factory settings as follows:

1. Move the encoding switch to position F
   → Display of the function number
   
   → All LEDs go out after 2 seconds.
2. Press both buttons on the device to set it to the factory defaults
   → All LEDs illuminate as confirmation.
3. Move the encoding switch to the initial position 0
   → Display of the current signal strength

Simulation

The FDR56 gives you the ability to simulate a signal and thereby an output variable, independent of the process, for example, in order to configure a downstream PLC or a data logger.

The simulation is carried out as follows (function 6 = standard setting):

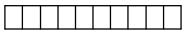
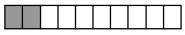
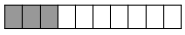
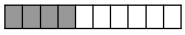
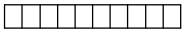
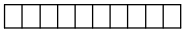
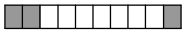
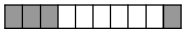
1. Move the encoding switch to position 9
   → Display of the function number
   
   → After 2 seconds: Display of the simulated signal strength, example: signal strength = 0 LEDs, switch output: not switched, current output: 4 mA
   

2. Press the button on the device to configure the desired signal strength
   → Display of the changed simulated signal strength, example: signal strength = 8 LEDs, switch output: switched, current output: 16.8 mA
   
3. Move the encoding switch to the initial position 0
   → Display of the current signal strength

NOTICE

The simulation ends as soon as the encoding switch is no longer at position 9.

7.4 Overview device functions

Function		Description	Factory settings
0		Display of the signal strength	–
1		Automatic adjustment with free path	–
2		Automatic adjustment with covered path	–
3		Manual adjustment with free path	–
4		Manual adjustment with covered path	–
5		Hysteresis	
6		Limit signal function	
7		Switch-on delay	
8		Switch-off delay	
9		Simulation	–
A		Damping	
B		Without fuction	–
C		Without fuction	–
D		Without fuction	–
E		Without fuction	–
F		Reset to factory settings	–

8 Commissioning

8.1 Function check

Before commissioning the measuring point, check whether the post-installation and post-connection checks have been performed.

- "Post-installation check" checklist → 21
- "Post-connection check" checklist" → 26

8.2 Powering up the measuring device

The microwave barrier will be switched on by an applied power supply on FQR56 transmitter and FDR56 transceiver.

The microwave barrier is ready for operation a maximum of 3 s after the supply voltage is applied.

The green LED glows on both devices when power supply is applied.

8.3 Configuring the device

The microwave barrier can be adjusted on the FDR56.
- Initial setup → 28
- Advanced settings → 30

9 Diagnostics and troubleshooting

9.1 General troubleshooting

Before commissioning the measuring point, check whether the post-installation and post-connection checks have been performed.
- "Post-installation check" checklist → 21
- "Post-connection check" checklist" → 26

9.2 Overview of the diagnostic functions

Error	Possible cause	Remedy
Yellow LED off with uncovered path	No power or power too low (green LED does not light up)	Check power supply
	Transmitter FQR56 defective	Replace transmitter
	Path of rays covered (for example window dirty)	Check path of rays and clean if necessary
	Wrong installation	Check installation → 10
	Wrong settings	Check settings → 28
Yellow LED on with covered path	Transceiver FDR56 defective	Replace transceiver
	Attenuation of the product too low	Adjust sensitivity → 30
	Wrong settings	Check settings → 28
Strong fluctuation of signal strength	Turbulent application, reflections and so on	Increase signal damping → 30

9.3 Resettting the device

To reset the FDR56 transceiver, proceed as follows:
- De-energise the device or disconnect the connector; all settings are retained
- Reset to factory settings → 30

10 Maintenance

No special maintenance work is required.

10.1 Maintenance recommendation

If medium is building up, it is recommended that the beam path is checked regularly and cleaned if necessary:
- PTFE or ceramic disk at the process connection
- Sight glass fitting or configurable accessories with PTFE or ceramic disk
- Materials the customer uses in the process that allow microwaves to pass through

10.2 Cleaning

The device must be cleaned if necessary (for example, removal of product caking), but do not damage the transmission window.

11 Repair

11.1 General notes

Repair and modification concept
The Endress+Hauser repair and modification concept provides for the following:
- The measuring devices have a modular design.
- Spare parts are grouped into logical kits and are accompanied by Installation Instructions.

- Repairs are carried out by Endress+Hauser Service or by appropriately trained customers.
- Certified devices can only be converted to a variant with different certification by the Endress+Hauser Service team or at the factory.

Notes concerning repair and modification
Observe the following when repairing or modifying a measuring device:
- Use original Endress+Hauser spare parts only.
- Carry out the repair according to the Installation Instructions.
- Observe the applicable standards, national regulations, Ex documentation (XA) and certificates.
- Document every repair and modification and enter the details in the W@M life cycle management database.

11.2 Spare parts

General notes:
- Please refer to the instruction leaflet supplied or these Operating Instructions for installation instructions.
- Each spare part is identified by an order number. When changing parts, please make sure that only a suitable spare part is installed.
- Other spare part numbers apply for special versions (TSP) of devices, please contact Endress+Hauser if you want to order a spare part for your special version.

⚠ WARNING
- If incorrect spare parts are installed in Ex-certified devices, the device is no longer compliant with Ex specifications and can no longer be operated in the hazardous area.
- If the wrong supply voltage is selected, this can destroy spare parts immediately.

11.3 Replacing the electronics or a device

After replacing the electronics or a device (FDR56), a new adjustment is required, since the settings are saved in the electronic insert.

NOTICE

- If the settings can still be read out before the replacement, they should be noted and re-entered after the replacement. A basic adjustment must then be carried out.
- The electronics of device variants with connector and extended ordering option "electronics encapsulated" can only be replaced by the manufacturer.

Details about the available device variants can be viewed in the product configurator on the Endress+Hauser homepage www.endress.com.

11.4 Spare parts

Electronic inserts are available for all device variants. Information on the required electronics such as approval, supply voltage and signal output can be found on the nameplate.

NOTICE

- All spare parts for the device, including the order code, are listed and can be ordered at the Internet site www.endress.com (W@M Device Viewer). If available, the corresponding Installation Instructions can also be downloaded there.
- Each electronic insert is identified by an order number; only the matching electronics should be used for replacement.

⚠ WARNING

- If incorrect spare parts are installed in Ex-certified devices, the device is no longer compliant with Ex specifications and can no longer be operated in the hazardous area.
- If the wrong supply voltage is selected, this can destroy spare parts immediately.
- Selection of an incorrect signal output can lead to the downstream machine getting damaged.

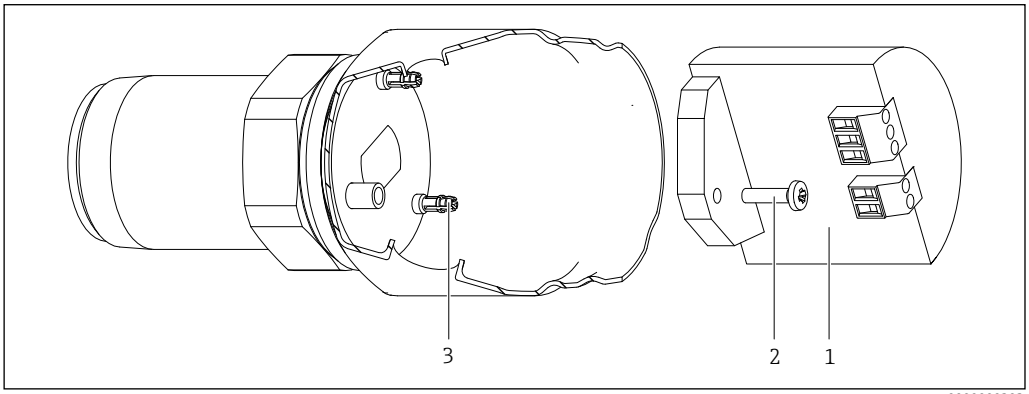
11.4.1 Available electronics

Order number	Device type	Approval
▪ 71125423 ▪ 71324253 ▪ 71324267 ▪ 71125424 ▪ 71324258 ▪ 71324268 ▪ 71125425 ▪ 71324271 ▪ 71125426 ▪ 71324274 ▪ 71125427 ▪ 71324276 ▪ 71125428 ▪ 71324277	FDR56-AA1A****, F15/F16 (datecode up to 04.2016) FDR56-AA1A****, F15/F16 (datecode from 05.2016) FDR56-AA1A****, F34 FDR56-AA1E****, F15/F16 (datecode up to 04.2016) FDR56-AA1E****, F15/F16 (datecode from 05.2016) FDR56-AA1E****, F34 FDR56-AA2A****, F15/F16 FDR56-AA2A****, F34 FDR56-AA2E****, F15/F16 FDR56-AA2E****, F34 FDR56-AA3A****, F15/F16 FDR56-AA3A****, F34 FDR56-AA3E****, F15/F16 FDR56-AA3E****, F34	Without
▪ 71125417 ▪ 71324242 ▪ 71125418 ▪ 71324243	FQR56-AAA****, F15/F16 FQR56-AAA****, F34 FQR56-AAE****, F15/F16 FQR56-AAE****, F34	
▪ 71258315 ▪ 71258316 ▪ 71258317 ▪ 71258318 ▪ 71258319 ▪ 7125832	FDR56-CA1A****, F15/F16 FDR56-CA1E****, F15/F16 FDR56-CA2A****, F15/F16 FDR56-CA2E****, F15/F16 FDR56-CA3A****, F15/F16 FDR56-CA3E****, F15/F16	CSA
▪ 71258291 ▪ 71258311	FQR56-CAA****, F15/F16 FQR56-CAE****, F15/F16	

Order number	Device type	Approval
▪ 71324253 ▪ 71324267 ▪ 71324258 ▪ 71324268 ▪ 71125425 ▪ 71324271 ▪ 71125426 ▪ 71324274 ▪ 71125427 ▪ 71324276 ▪ 71125428 ▪ 71324277	FDR56-GR1A****, F15/F16 FDR56-GR1A****, F34 FDR56-GR1E****, F15/F16 FDR56-GR1E****, F34 FDR56-GR2A****, F15/F16 FDR56-GR2A****, F34 FDR56-GR2E****, F15/F16 FDR56-GR2E****, F34 FDR56-GR3A****, F15/F16 FDR56-GR3A****, F34 FDR56-GR3E****, F15/F16 FDR56-GR3E****, F34	EAC
▪ 71125417 ▪ 71324242 ▪ 71125418 ▪ 71324243	FQR56-GRA****, F15/F16 FQR56-GRA****, F34 FQR56-GRE****, F15/F16 FQR56-GRE****, F34	
▪ 71324253 ▪ 71324267 ▪ 71324258 ▪ 71324268 ▪ 71125425 ▪ 71324271 ▪ 71125426 ▪ 71324274 ▪ 71125427 ▪ 71324276 ▪ 71125428 ▪ 71324277	FDR56-UR1A****, F15/F16 FDR56-UR1A****, F34 FDR56-UR1E****, F15/F16 FDR56-UR1E****, F34 FDR56-UR2A****, F15/F16 FDR56-UR2A****, F34 FDR56-UR2E****, F15/F16 FDR56-UR2E****, F34 FDR56-UR3A****, F15/F16 FDR56-UR3A****, F34 FDR56-UR3E****, F15/F16 FDR56-UR3E****, F34	UKCA
▪ 71125417 ▪ 71324242 ▪ 71125418 ▪ 71324243	FQR56-URA****, F15/F16 FQR56-URA****, F34 FQR56-URE****, F15/F16 FQR56-URE****, F34	
▪ 71125429 ▪ 71324279 ▪ 71324300 ▪ 71125430 ▪ 71324280 ▪ 71324301 ▪ 71125431 ▪ 71324324 ▪ 71125432 ▪ 71324325 ▪ 71125433 ▪ 71324327 ▪ 71125434 ▪ 71324329	FDR56-BA1A****, F15 (datecode up to 04.2016) FDR56-BA1A****, F15 (datecode from 05.2016) FDR56-BA1A****, F34 FDR56-BA1E****, F15 (datecode up to 04.2016) FDR56-BA1E****, F15 (datecode from 05.2016) FDR56-BA1E****, F34 FDR56-BA2A****, F15 FDR56-BA2A****, F34 FDR56-BA2E****, F15 FDR56-BA2E****, F34 FDR56-BA3A****, F15 FDR56-BA3A****, F34 FDR56-BA3E****, F15 FDR56-BA3E****, F34	ATEX
▪ 71125419 ▪ 71324246 ▪ 71125420 ▪ 71324247	FQR56-BAA****, F15 FQR56-BAA****, F34 FQR56-BAE****, F15 FQR56-BAE****, F34	
▪ 71258322 ▪ 71258324 ▪ 71258325 ▪ 71258327 ▪ 71258329 ▪ 71258330	FDR56-CB1A****, F15 FDR56-CB1E****, F15 FDR56-CB2A****, F15 FDR56-CB2E****, F15 FDR56-CB3A****, F15 FDR56-CB3E****, F15	CSA
▪ 71258313 ▪ 71258314	FQR56-CBA****, F15 FQR56-CBE****, F15	

Order number	Device type	Approval
▪ 71125436 ▪ 71324380 ▪ 71324382 ▪ 71125437 ▪ 71324381 ▪ 71324383 ▪ 71125438 ▪ 71324387 ▪ 71125439 ▪ 71324388 ▪ 71125440 ▪ 71324389 ▪ 71125441 ▪ 71324390	FDR56-IA1A****, F15 (datecode up to 04.2016) FDR56-IA1A****, F15 (datecode from 05.2016) FDR56-IA1A****, F34 FDR56-IA1E****, F15 (datecode up to 04.2016) FDR56-IA1E****, F15 (datecode from 05.2016) FDR56-IA1E****, F34 FDR56-IA2A****, F15 FDR56-IA2A****, F34 FDR56-IA2E****, F15 FDR56-IA2E****, F34 FDR56-IA3A****, F15 FDR56-IA3A****, F34 FDR56-IA3E****, F15 FDR56-IA3E****, F34	EX IECEx
▪ 71125421 ▪ 71324250 ▪ 71125422 ▪ 71324252	FQR56-IAA****, F15 FQR56-IAA****, F34 FQR56-IAE****, F15 FQR56-IAE****, F34	

11.4.2 Replacing the electronics



32 *Replacing the electronics*

1 *Electronics*
2 *Screw*
3 *Spacers*

The electronics are mounted on two self-clamping spacers and secured with a screw:

1. Loosen the screw.
   PH2
2. Detach the electronic insert by pulling it from the two spacers and take it out of the device vertically.
3. Insert the new electronic insert straight into the housing, push it onto the spacers to snap it in and fasten it with the screw (1 to 2 Nm).

11.5 Return

The measuring device must be returned if the wrong device has been ordered or delivered. As an ISO-certified company and also due to legal regulations, Endress+Hauser is obliged to follow certain procedures when handling any returned products that have been in contact with medium. To ensure safe, swift and professional device returns, please refer to the procedure and conditions for returning devices provided on the Endress+Hauser website at
http://www.endress.com/support/return-material

11.6 Disposal

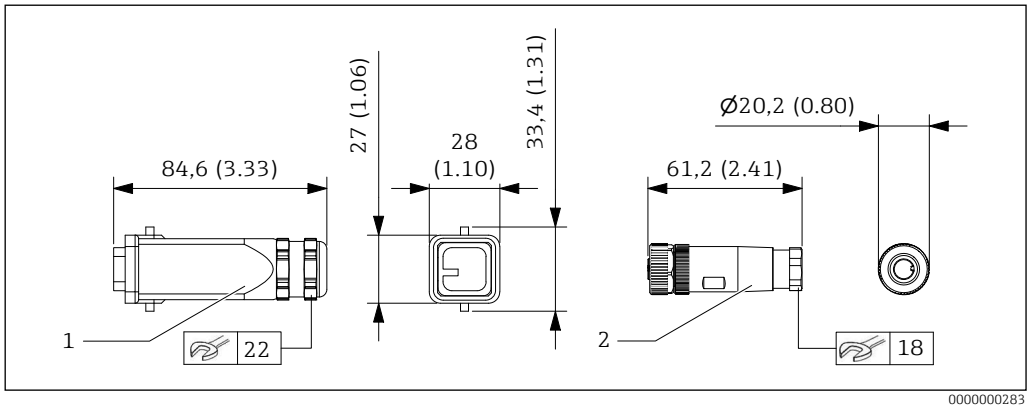
If required by the Directive 2012/19/EU on waste electrical and electronic equipment (WEEE), our products are marked with the depicted symbol in order to minimize the disposal of WEEE as unsorted municipal waste.

Such products may not be disposed of as unsorted municipal waste and can be returned to Endress+Hauser for disposal at conditions stipulated in our General Terms and Conditions or as individually agreed.

12 Accessories

The accessories can be optionally ordered together with the device or separately.
→ Ordering structure "Accessories enclosed" option

12.1 Mating connectors

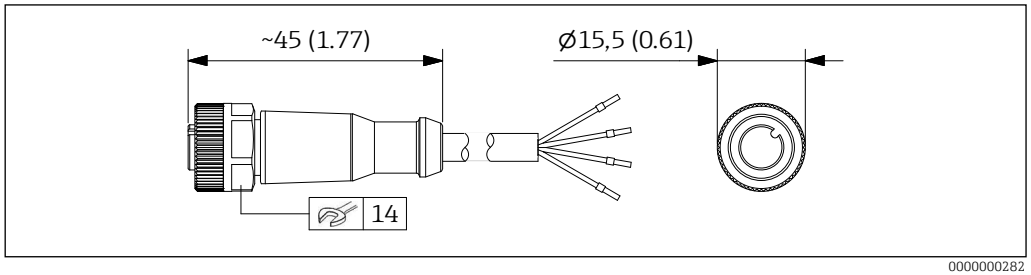


33 *Mating connectors. Unit of measurement mm (in)*

1 Harting cable socket
2 M12 cable socket

Order number:
- 71381872 (M12, A-coded, 4-pole, max. 0.75 mm²)
- 71381882 (Harting HAN8D, 0.14 to 2.5 mm²)

12.2 Pre-fabricated connection cables

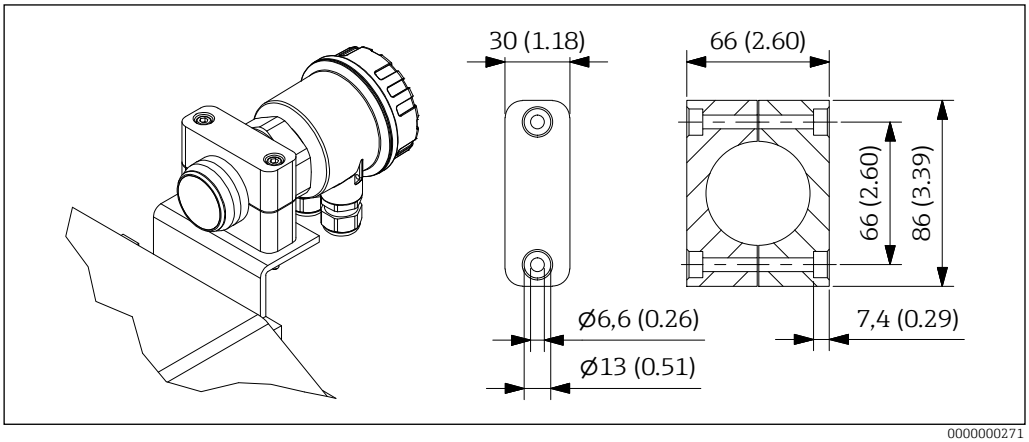


34 *Connection cable with M12 plug. Unit of measurement mm (in)*

- M12 connector, A-coded
- Number of poles/cross section: 4 x 0.34 mm²
- Operating temperature range: -25 to +90 °C (-13 to +194 °F)

- Materials:
  - TPU (housing)
  - FKM (seal)
  - PUR (cable)
- Protection: IP65, IP67, IP68, IP69K
- Order number:
  - 71381853 (2 m (78.74 in))
  - 71381870 (5 m (196.85 in))

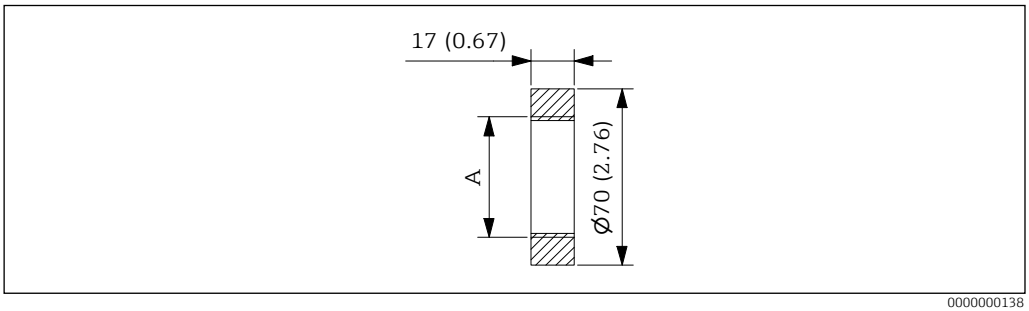
12.3 Mounting bracket



35 Dimensions mounting bracket. Unit of measurement mm (in)

- Material: Plastic or aluminum
- Operating temperature:
  - Plastic: -20 to +70 °C (-4 to +158 °F)
  - Aluminum: -40 to +70 °C (-40 to +158 °F)
- Weight: max. 0.22 kg (0.49 lb)
- Mounting screws (2 x M6): to be provided by customer
- Order number:
  - 52017501 (Aluminum)
  - 52017502 (Plastic)

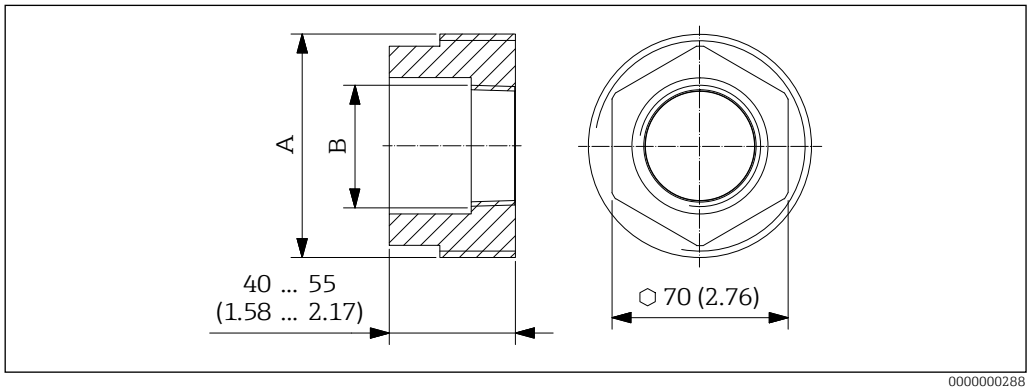
12.4 Weld-in adapter



36 Dimensions FAR52-A. Unit of measurement mm (in)

- Type FAR52-A → TI01369F
- Weld-in adapter with internal thread (A) Rp 1½, 1½ NPT and G 1½
- Material: 316Ti (1.4571), steel P235GH (1.0345)
- Weight: FAR52-AAAA1A approx. 0.3 kg (0.66 lb)

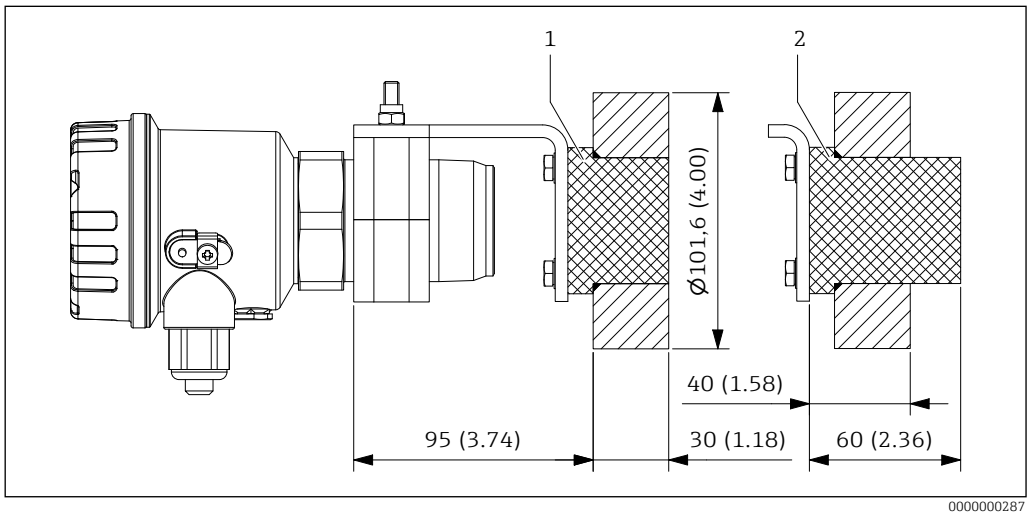
12.5 Screw-in adapter



37 *Dimensions FAR52-B. Unit of measurement mm (in)*

- Type FAR52-B → TI01369F
- 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 (1.4571), steel P235GH (1.0345)
- Weight: FAR52-BVL22B approx. 1.8 kg (4 lb)

12.6 Weld-in adapter with mounting arm

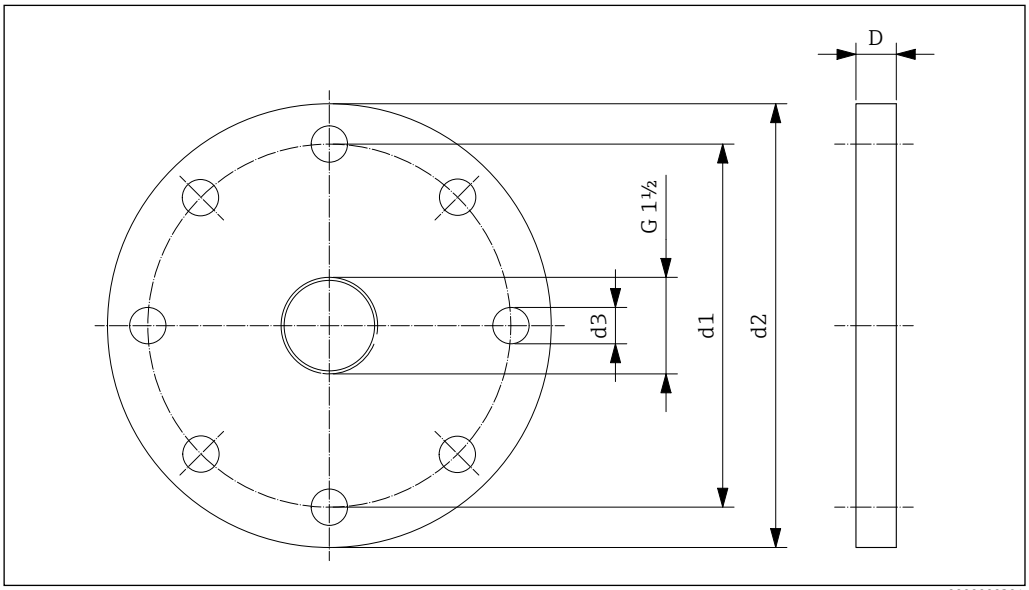


38 *Dimensions weld-in adapter. Unit of measurement mm (in)*

1 Type SALS/SPPS
2 Type SAL/SPP

- Material:
  - Mounting arm: Stainless steel 304 (1.4301)
  - Mounting bracket: Plastic or aluminum
  - Weld-in adapter: Stainless steel 304 (1.4301)
  - Plug: Plastic PE-UHMW
- Operating temperature:
  - Mounting bracket aluminum: -40 to +70 °C (-40 to +158 °F)
  - Mounting bracket Plastic: -20 to +70 °C (-4 to +158 °F)
- Weight: approx. 2.6 kg (5.73 lb)
- Mounting screws enclosed
- Order number:
  - 71516954 Type SPPS (Mounting bracket plastic, short plug)
  - 71516947 Type SPP (Mounting bracket plastic, long plug)
  - 71516952 Type SALS (Mounting bracket aluminum, short plug)
  - 71516949 Type SAL (Mounting bracket aluminum, long plug)

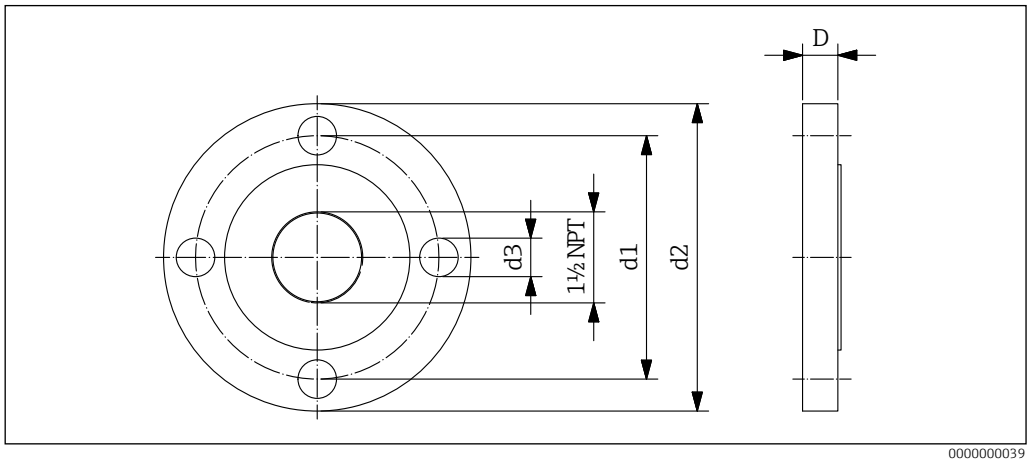
12.7 Mounting flange



39 *Dimensions mounting flange (Connection dimensions according to DIN 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

- Connection dimensions according to DIN EN 1092-1
- Material: 316Ti (1.4571)
- Weight: DN40 approx. 2.3 kg (5.07 lb) to DN100 approx. 5.8 kg (12.79 lb)
- Mounting screws and gasket: to be provided by customer
- Order number:
  - 71006348 (DN40 PN40, Rp 1½)
  - 71108383 (DN40 PN40, Rp 1½), with inspection certificate EN 10204 - 3.1 material
  - 71381884 (DN40 PN40, G 1½)
  - 71381885 (DN40 PN40, G 1½), with inspection certificate EN 10204 - 3.1 material
  - 71006350 (DN50 PN16, Rp 1½)
  - 71108388 (DN50 PN16, Rp 1½), with inspection certificate EN 10204 - 3.1 material
  - 71381887 (DN50 PN16, G 1½)
  - 71381888 (DN50 PN16, G 1½), with inspection certificate EN 10204 - 3.1 material
  - 71006352 (DN100 PN16, Rp 1½)
  - 71108390 (DN100 PN16, Rp 1½), with inspection certificate EN 10204 - 3.1 material
  - 71381890 (DN100 PN16, G 1½)
  - 71381891 (DN100 PN16, G 1½), with inspection certificate EN 10204 - 3.1 material

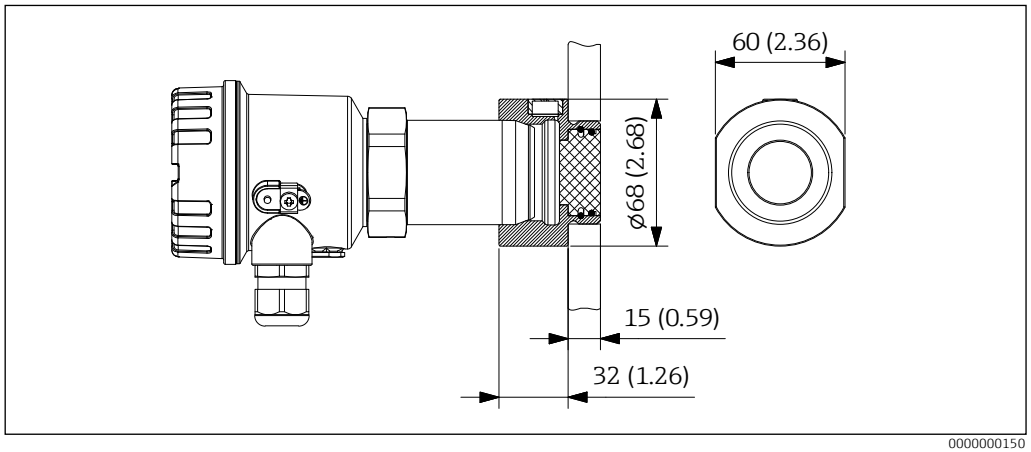


40 Dimensions mounting flange (Connection dimensions according to ANSI/ASME B16.5)

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

- Connection dimensions according to ANSI/ASME B16.5
- Material: 316Ti (1.4571)
- Weight: 1½" approx. 1.5 kg (3.31 lb) to 4" approx. 6.8 kg (15.0 lb)
- Mounting screws and gasket: to be provided by customer
- Order number:
  - 71006349 (1½" 150 lbs, 1½ NPT)
  - 71108387 (1½" 150 lbs, 1½ NPT), with inspection certificate EN 10204 - 3.1 material
  - 71006351 (2" 150 lbs, 1½ NPT)
  - 71108389 (2" 150 lbs, 1½ NPT), with inspection certificate EN 10204 - 3.1 material
  - 71006353 (4" 150 lbs, 1½ NPT)
  - 71108391 (4" 150 lbs, 1½ NPT), with inspection certificate EN 10204 - 3.1 material

12.8 High pressure adapter

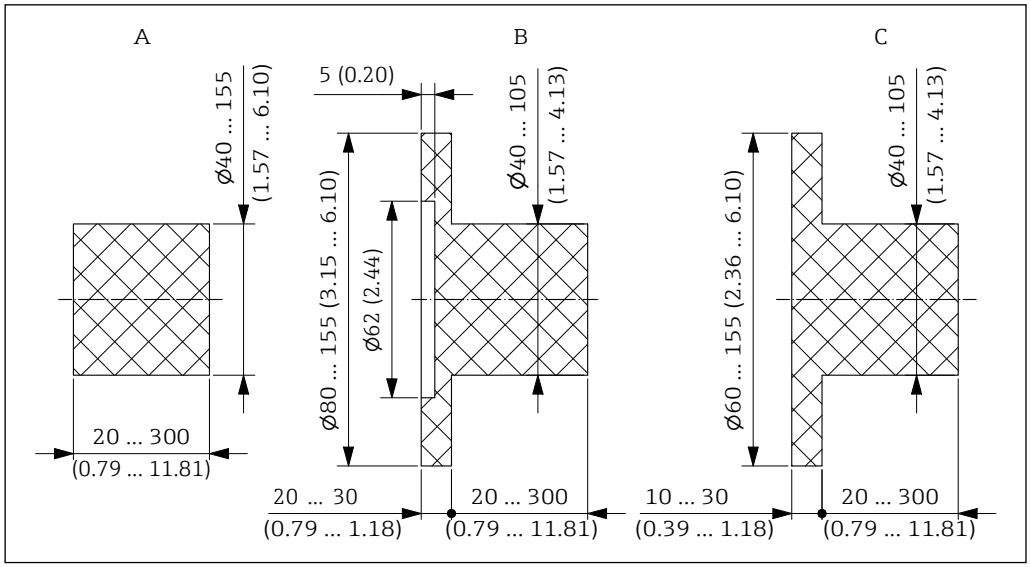


41 Dimensions high pressure adapter. Unit of measurement mm (in)

- Process pressure: 0.5 to 21 bar (7 to 305 psi) absolute
- Process temperature: -40 to +70 °C (-40 to +158 °F)
- Material: 316Ti (1.4571), PTFE (window transmission)
- Weight: approx. 0.8 kg (1.76 lb)
- Seal: to be provided by the customer

- Order number:
  - 71381894 (G 1½ (Device connection thread + Process connection thread), ISO 228-1)
  - 71381898 (G 1½ (Device connection thread + Process connection thread), ISO 228-1, with inspection certificate EN 10204 - 3.1 material)
  - 71381899 (G 1½ (Process connection thread), ISO 228-1, 1½ NPT (Device connection thread), ANSI/ASME)
  - 71381904 (G 1½ (Process connection thread), ISO 228-1, 1½ NPT (Device connection thread), ANSI/ASME, with inspection certificate EN 10204 - 3.1 material)

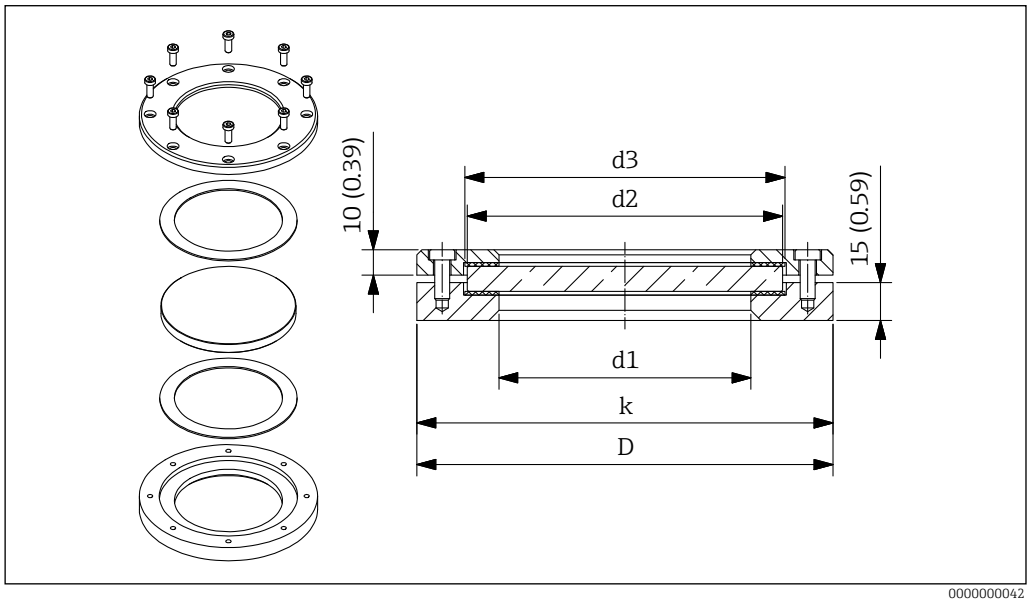
12.9 Plug



42 *Dimensions plug FAR54. Unit of measurement mm (in)*

- Type FAR54 → TI01371F
- Material: PTFE, aluminum oxide ceramics
- Process temperature: -40 to +800 °C (-40 to +1472 °F)
- Weight: Depending on version (max. 12 kg (26.5 lb))

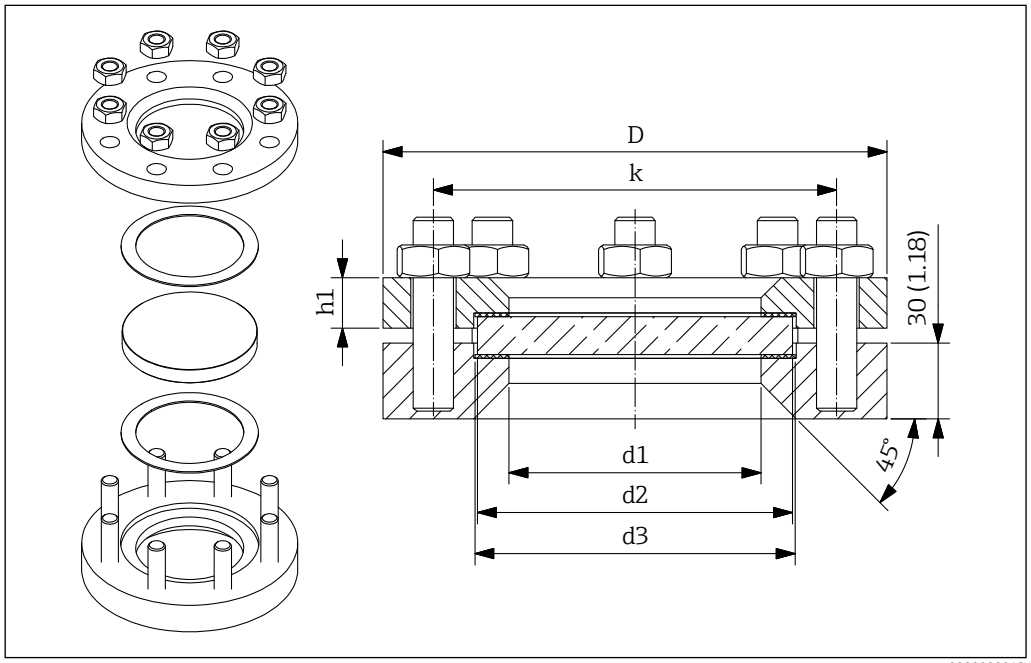
12.10 Sight glass fitting



43 *Dimensions sight glass fitting for unpressurized processes. Unit of measurement mm (in)*

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)

- Unpressurized, weld-on or weld-in type
- Material: 316Ti (1.4571), seal silicone (max. +200 °C/+392 °F)
- Weight: DN50 approx. 2.4 kg (5.29 lb) to DN100 approx. 4.1 kg (9.04 lb)
- Mounting screws enclosed
- Order number:
  - 71026443 (DN50)
  - 71026444 (DN80)
  - 71026445 (DN100)
- Sight glass disc (spare part)
  - 71209118 (DN50)
  - 71209116 (DN80)
  - 71209115 (DN100)



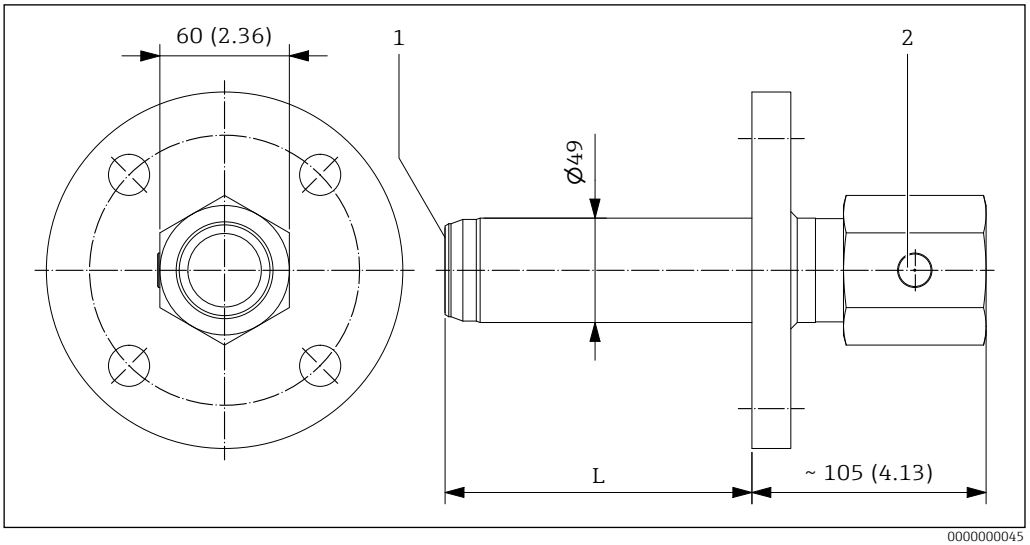
44 *Dimensions sight glass fitting for processes up to 10 bar (145 psi). Unit of measurement mm (in)*

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)

- Process pressure: 10 bar (145 psi) absolute, weld-on or weld-in type
- Material: 316Ti (1.4571), seal KLINGERSIL® C-4400 (max. +200 °C/+392 °F)
- Weight: DN50 approx. 6.7 kg (14.77 lb) to DN100 approx. 13.0 kg (28.66 lb)
- Mounting screws enclosed
- Order number:
  - 71026446 (DN50)
  - 71026447 (DN80)
  - 71026448 (DN100)

Sight glass disc (spare part)
- 71209114 (DN50)
- 71209111 (DN80)
- 71209107 (DN100)

12.11 Insertion adapter

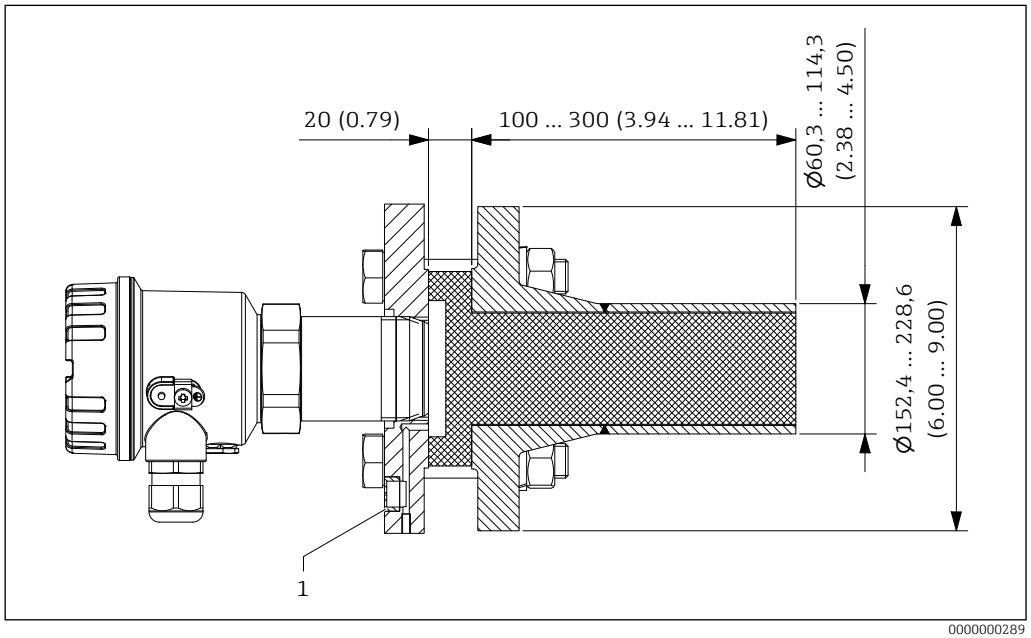


45 *Dimensions insertion adapter. Unit of measurement mm (in)*

1 Disc with seal, optional
2 Integrated venting element

- Type FAR51 → TI01368F
- Process nozzle
  - DN50 to DN100, PN16, Form A
  - NPS 2" to 4" 150 lbs, RF
- Nozzle length: 100 to 300 mm (3.94 to 11.81 in)
- Connection thread R 1½, 1½ NPT and G 1½
- Optionally with PTFE or aluminum oxide ceramics
- Process temperature: -40 to +450 °C (-40 to +842 °F)
- Process pressure: 0.8 to 1.1 bar (12 to 16 psi) absolute
- Material: 316Ti (1.4571)
- Weight: 5 to 10 kg (11 to 22 lb)

12.12 Weld-in nozzle

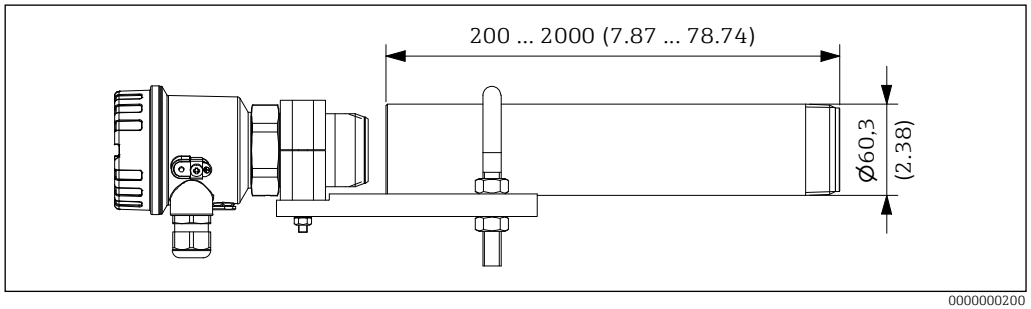


46 *Dimensions weld-in nozzle. Unit of measurement mm (in)*

1 Integrated venting element

- Type FAR50 → TI01362F
- Process nozzle:
  - DN50 to DN100, PN16, Form A
  - NPS 2" to 4" 150 lbs, RF
- Nozzle length: 100 to 300 mm (3.94 to 11.81 in)
- Connection thread R 1½, 1½ NPT and G 1½
- Process temperature: -40 to +200 °C (-40 to +392 °F)
- Process pressure: 0.8 to 1.1 bar (12 to 16 psi) absolute
- Material:
  - Nozzle: Stainless steel 316Ti (1.4571) or steel P235GH (1.0345)
  - Counter flange: Stainless steel 316Ti (1.4571) or steel P250GH (1.0460)
  - Plug: PTFE
- Weight: approx. 6 to 7 kg (13 to 15.5 lb)
- Mounting screws enclosed

12.13 Spacer tube (wave guide)

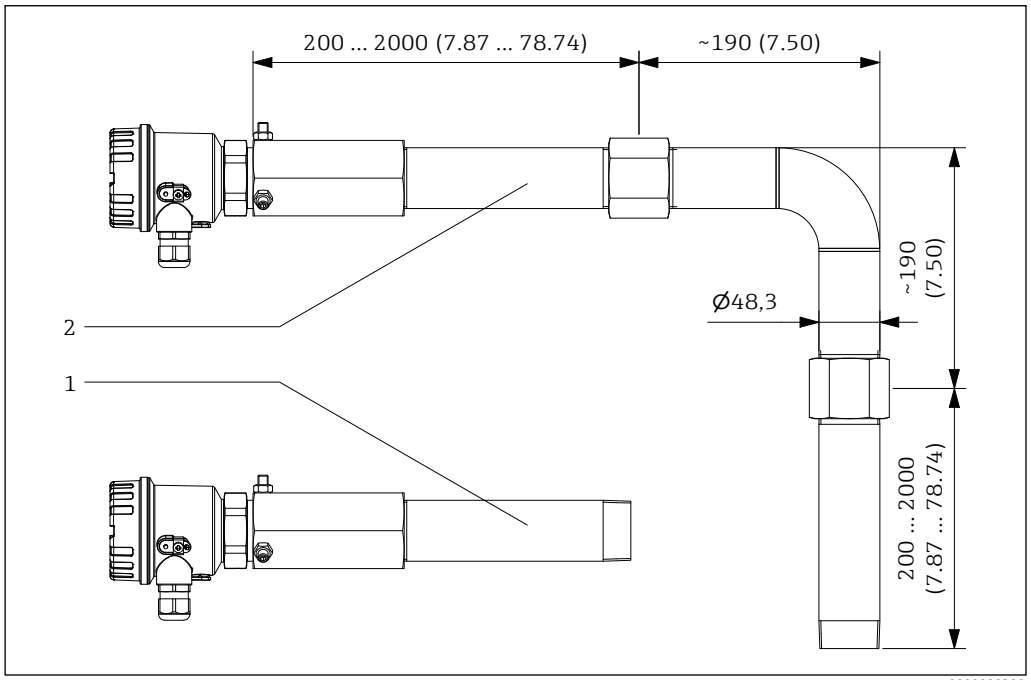


47 *Dimensions spacer tube. Unit of measurement mm (in)*

- Type FAR53 → TI01370F
- Process connection: With or without thread R 2, 2 NPT and G 2
- With optional aluminum oxide ceramic disc
- Process temperature: -40 to +450 °C (-40 to +842 °F)
- Process pressure: 0.8 to 1.1 bar (12 to 16 psi) absolute
- Material: Stainless steel 316Ti (1.4571) or steel P235GH (1.0345)

- Weight: 200 mm approx. 5.3 kg (11.7 lbs) to 2000 mm approx. 22.2 kg (48.9 lbs)

12.14 Wave guide

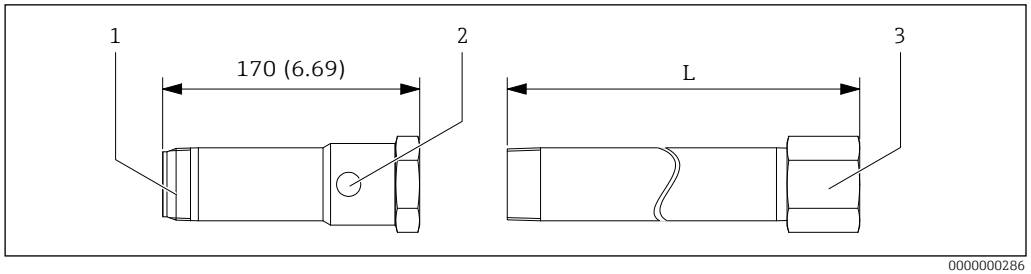


48 *Dimensions wave guide. Unit of measurement mm (in)*

1 Straight version
2 Angulated version

- Type FAR55 → TI01372F
- Process connection: With or without thread R 1½ and 1½ NPT
- Lengths: L1 = 200 to 1500 mm (7.87 to 59.06 in), L2 = 200 to 2000 mm (7.87 to 78.74 in)
- Device connection: Receptacle, suitable for thread R 1½, 1½ NPT and G 1½
- Material: Stainless steel 316Ti (1.4571)
- Weight: FAR55-AAAACGAA2* approx. 2.0 kg (4.41 lbs) to FAR55-BAAADGDL2* approx. 17.8 kg (39.24 lbs)

12.15 High temperature adapter with extension



49 *Dimensions high temperature adapter with extension. Unit of measurement mm (in)*

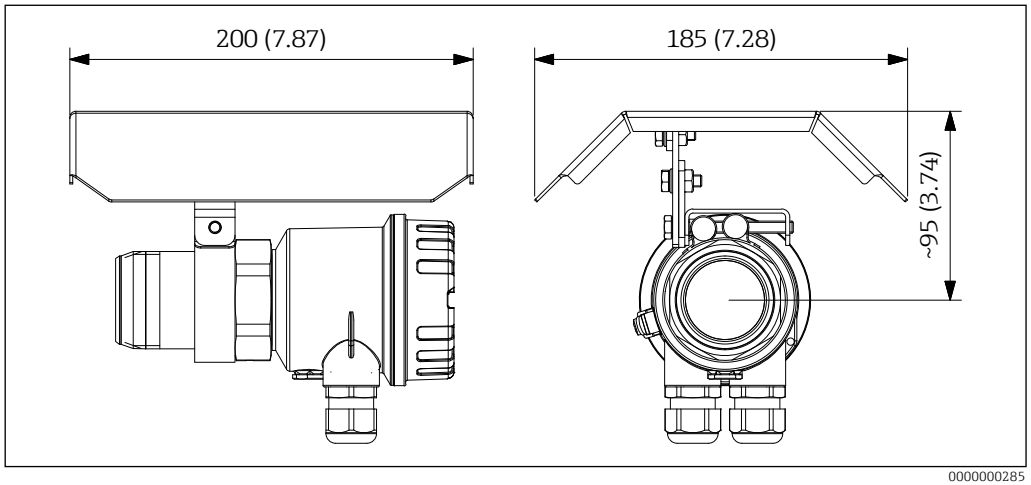
1 High temperature adapter
2 Integrated venting element
3 Extension for high temperature adapter

High temperature adapter
- Process temperature: -20 to +450 °C (-4 to +842 °F)
- Process pressure: 0.8 to 5.1 bar (12 to 74 psi) absolute
- SW55
- Material: 316Ti (1.4571), aluminum oxide ceramics (front-flush disc)

- Weight: approx. 1.4 kg (3.09 lb)
- Seal: to be provided by the customer
- Order number:
  - 71113441 (R 1½ (connection thread), G 1½ (internal thread))
  - 71478114 ((R 1½ (connection thread), G 1½ (internal thread), with inspection certificate EN 10204 - 3.1 material)
  - 71113449 (1½ NPT (internal and external thread))
  - 71478115 (1½ NPT (internal and external thread), with inspection certificate EN 10204 - 3.1 material)

Extension
- Extension for high temperature adapter, SW55
- Material: 316Ti (1.4571)
- Weight: 225 mm (8.86 in) approx. 1.1 kg (2.43 lb) to 525 mm (20.67 in) approx. 2.2 kg (4.85 lb)
- Seal: to be provided by the customer
- Order number:
  - 71113450 (R 1½ (connection thread), G 1½ (internal thread), L = 225 mm (8.86 in))
  - 71113451 (R 1½ (connection thread), G 1½ (internal thread), L = 325 mm (12.80 in))
  - 71113452 (R 1½ (connection thread), G 1½ (internal thread), L = 525 mm (20.67 in))
  - 71113453 (1½ NPT (internal and external thread), L = 225 mm (8.86 in))
  - 71113454 (1½ NPT (internal and external thread), L = 325 mm (12.80 in))
  - 71113455 (1½ NPT (internal and external thread), L = 525 mm (20.67 in))

12.16 Weather protection cover



50 Dimensions weather protective cover. Unit of measurement mm (in)

- For outdoor installation in strong sunlight, the following weather protection cover can be used.
- Material: Stainless steel 316L (1.4404)
- Weight: approx. 0.8 kg (1.76 lb)
- Mounting screws enclosed

13 Technical data

13.1 Input

13.1.1 Measured variable

Absorption of the radiated electromagnetic waves

13.1.2 Measuring range (Detection range)

Max. 100 m (depending on the process walls to be penetrated)

13.1.3 Operating frequency

24 GHz ISM

13.1.4 Transmitting power

- The radiated power is maximum 100 mW e.i.r.p. (equivalent isotrope radiation performance).
- 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

13.1.5 Antenna opening angle (3 dB)

Approx. ± 11°

13.2 Output

13.2.1 Output signal

Relay
- Switching capacity 250 V AC / 4 A, 125 V DC / 0.4 A or 30 V DC / 4 A
- Switching delay parameterizable (off, 500 ms to 10 s)
- Switching hysteresis adjustable
- Switching frequency max. 4 Hz

Solid-state relay
- Switching capacity 30 V AC / 0.4 A or 40 V DC / 0.4 A
- Switching delay parameterizable (off, 500 ms to 10 s)
- Switching hysteresis adjustable
- Switching frequency max. 4 Hz

Current output
- Current 4-20 mA, active
- Load max. 600 Ω

13.2.2 Ex connection data

See safety instructions (XA): All data relating to explosion protection are provided in separate Ex documentation and are available from the Downloads Area of the Endress+Hauser-website. The Ex documentation is supplied as standard with all Ex devices.

13.3 Power supply

13.3.1 Supply voltage

- 85 to 253 V AC, 50/60 Hz
- 20 to 60 V DC or 20 to 30 V AC, 50/60 Hz

- The polarity of the supply voltage can be set as required.
- Power supply for electrical connection with M12 connector: 20 to 60 V DC / 20 to 30 V AC, 50/60 Hz.

13.3.2 Power consumption

- FQR56:
  - 7 VA (85 to 253 V AC, 50/60 Hz)
  - 1 W (20 to 60 V DC) / 1.5 VA (20 to 30 V AC, 50/60 Hz)
- FDR56:
  - 9 VA (85 to 253 V AC, 50/60 Hz)
  - 2.4 W (20 to 60 V DC) / 4 VA (20 to 30 V AC, 50/60 Hz)

13.4 Environment

13.4.1 Ambient temperature

-40 to +70 °C (-40 to +158 °F)

13.4.2 Storage temperature

See ambient temperature

13.4.3 Degree of protection

- With closed housing: IP66
- With open housing: IP20

13.4.4 Vibration resistance

- Vibration according to EN 60068-2-6
- Excitation: Sine
- Frequency range: 5 to 500 Hz
- Amplitude: 5 to 15 Hz (5.5 mm) peak / 15 to 500 Hz 5 g
- Passing speed: 1 octave per minute
- Test directions: 3 directions (X, Y, Z)
- Test duration: approx. 140 minutes per direction (approx. 70 minutes per temperature/ direction)
- Test temperature: -40 to +70 °C

13.4.5 Shock resistance

- Shock according to EN 60068-2-27
- Excitation: half sine
- Shock duration: 18 ms
- Amplitude: 30 g
- Number of shocks: 3 per direction and temperature
- Test directions: 6 directions (±X, ±Y, ±Z)
- Test temperature: -40 to +70 °C

13.4.6 Electromagnetic compatibility

- Interference emission to EN 61326, Electrical Equipment Class B
- Interference immunity to EN 61326, Appendix A (Industrial)

13.5 Process

13.5.1 Process temperature

- -40 to +70 °C (-40 to +158 °F)
- -20 to +450 °C (-4 to +842 °F) with optional high temperature adapter
- Observe deviating temperature ranges for the accessories offered!

13.5.2 Process pressure

- 0.5 to 6.8 bar (7 to 99 psi) absolute, only to be observed for direct process mounting
- 0.8 to 5.1 bar (12 to 74 psi) absolute, when using the optional high temperature adapter
- 0.5 to 21 bar (7 to 305 psi) absolute, when using the optional high pressure adapter
- Observe deviating pressure ranges for the accessories offered!

13.6 Additional technical data

Latest technical information: Endress+Hauser website: www.endress.com → Downloads.

www.addresses.endress.com

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