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2022-05-01

Operating Instructions
Soliwave FDR16/FQR16

Microwave barrier

Endress+Hauser
People for Process Automation

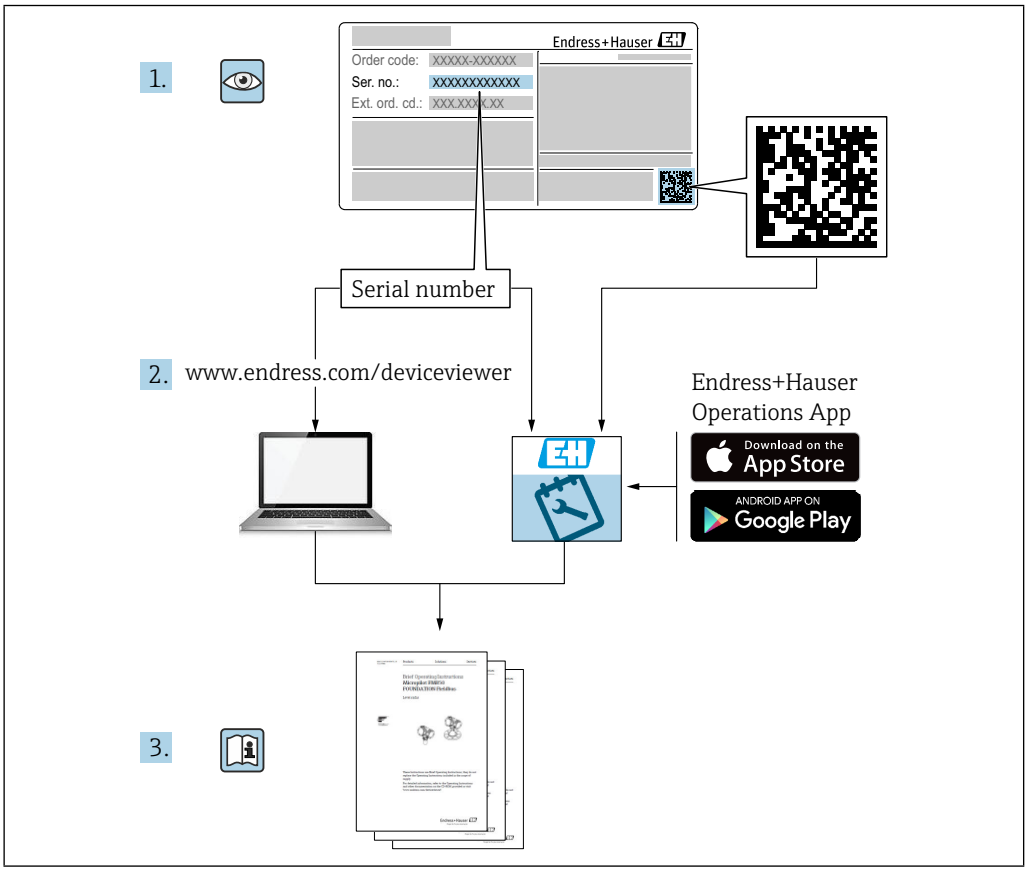

1.
Endress+Hauser
Order code: XXXXX-XXXXXX
Ser. no.: XXXXXXXXXXX
Ext. ord. cd.: XXX.XXX.XX
Serial number
2.
www.endress.com/deviceviewer
Endress+Hauser
Operations App
Download on the App Store
ANDROID APP ON Google Play
3.

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

⏚ Ground connection
Grounded clamp, which is grounded via a grounding system.

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.

Tip
Indicates additional information

Reference to documentation

Reference to another section

Reference to graphic

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 an non-illuminated LED

○ LED undefined
Indicates an undefined or arbitrary light state of the LED

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 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
  TI01564F

2.2.1 Incorrect use

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

Residual risks
Due to heat transfer from the process, the temperature of the electronics housing and the assemblies contained therein may rise to 70 °C (158 °F) during operation.

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.

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.

Repair
Repair is only possible by the manufacturer.

2.5 Product safety

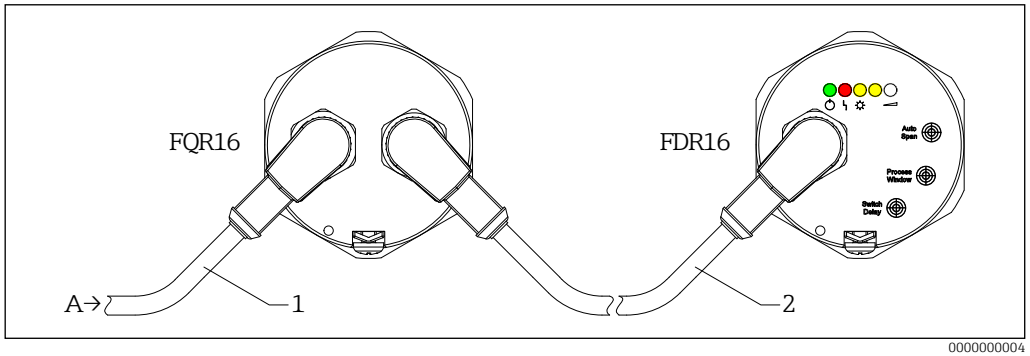
The devices of the microwave barrier are designed in accordance with good engineering practice to meet state-of-the-art safety requirements, has been tested, and left the factory in a condition in which it is safe to operate.

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

Ultra compact microwave barrier for non-contact point level detection of bulk solids and liquids as well as counting piece goods and object detection

3.1 Product design



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1 *Product design*

A Supply and signal circuit
1 Connection cable M12 socket
2 Connection cable M12 socket/plug

⚠ WARNING
Use in potentially explosive atmospheres → Observe XA!

4 Incoming acceptance and product identification

4.1 Incoming acceptance

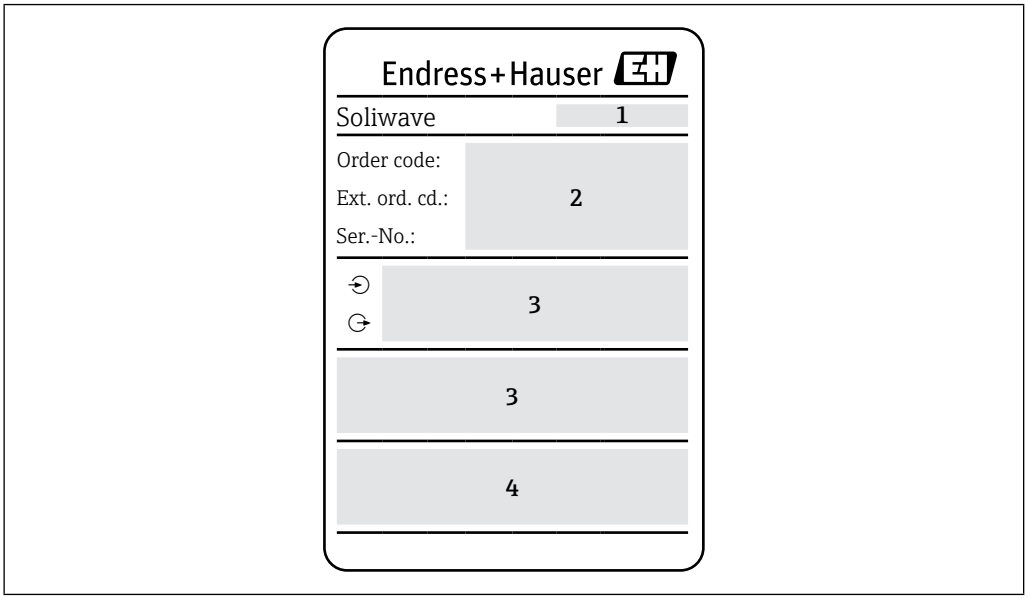
Check the following during goods acceptance:
❑ Are the order codes on the delivery note and the product sticker identical?
❑ Are the goods undamaged?
❑ Do the nameplate data match the ordering information on the delivery note?
❑ If required (see nameplate): Are the Safety Instructions, e. g. XA, provided?
❑ 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
→ 38

4.3.2 Transporting the device

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

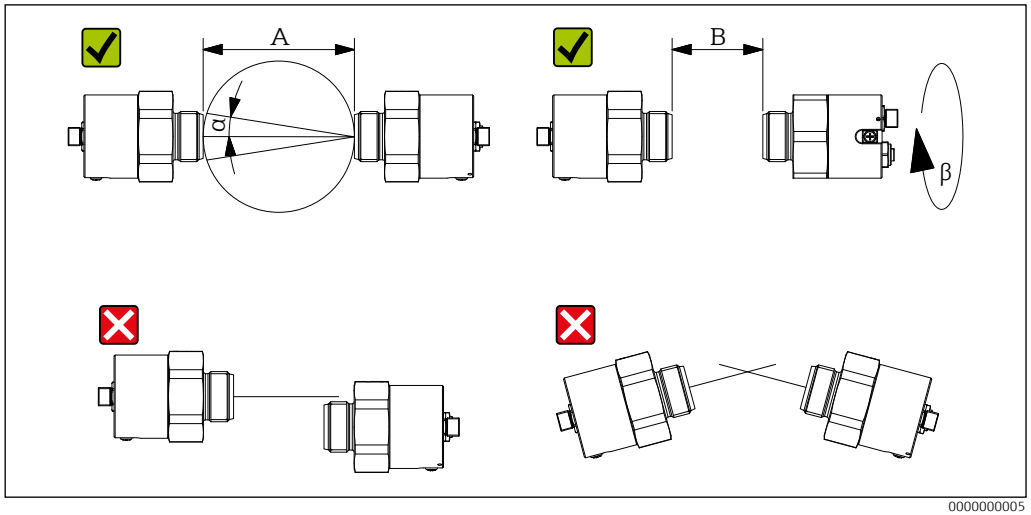
5 Mounting

5.1 Mounting conditions

Minimization of application-specific influences
▸ Vibration influence → 39

5.1.1 Mounting position

The installation position is arbitrary under consideration of the following conditions:
- **Microwaves are polarized**: Do not rotate FDR16 and FQR16 against each other around their longitudinal axis (except by 180° or for detection ranges smaller than 500 mm (19.7 in)).
- The position of the potential equalization terminal can be used to check the alignment; it must point in the same direction for both devices (or be rotated by 90° for detection ranges smaller than 500 mm (19.7 in)).

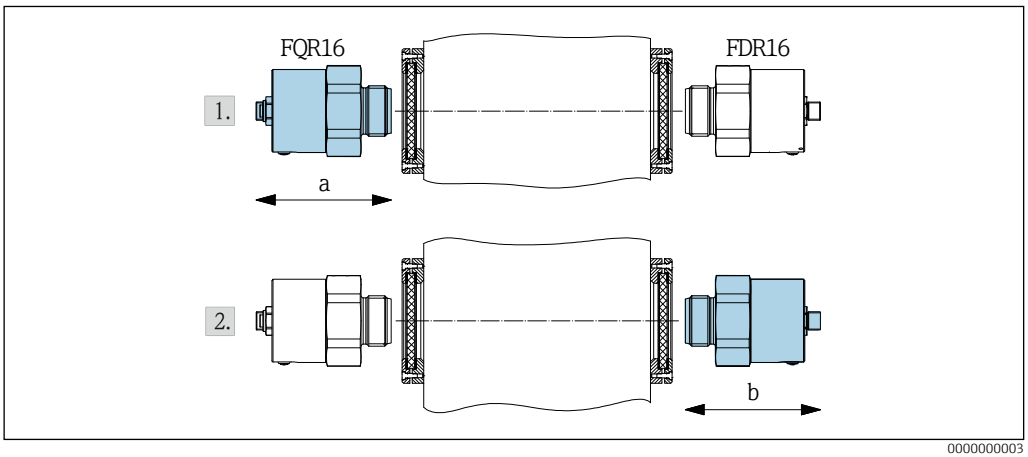


3 *Mounting position*

A Detection range 0.5 to 20 m (19.7 to 787.4 in)
B Detection range 0.12 to 0.5 m (4.7 to 19.7 in)
α Antenna opening angle approx. 12°
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 FQR16 and FDR16 on their longitudinal axis **after an automatic adjustment has been performed**. → 23



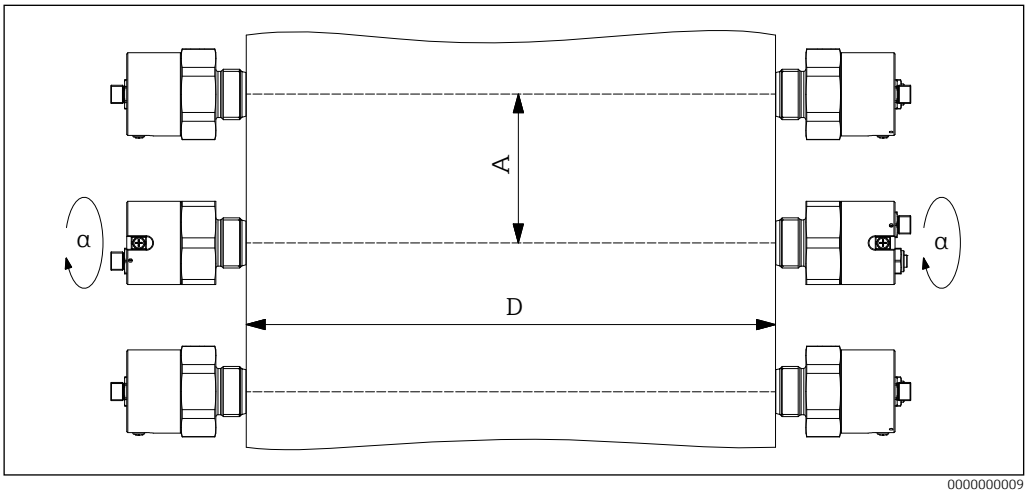
4 *Optimization of the signal quality*

1. Loosen device 1 (here FQR16) and move it slowly by **a** = ±10 mm (±0.4 in) until a signal maximum is reached (max. flashing or permanently illuminated LED signal strength, fix device again. → 22
2. Then loosen device 2 (here FDR16) and move it slowly by **b** = ±10 mm (±0.4 in) until a signal maximum is reached, fix the device again.

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

5.1.3 Parallel operation

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



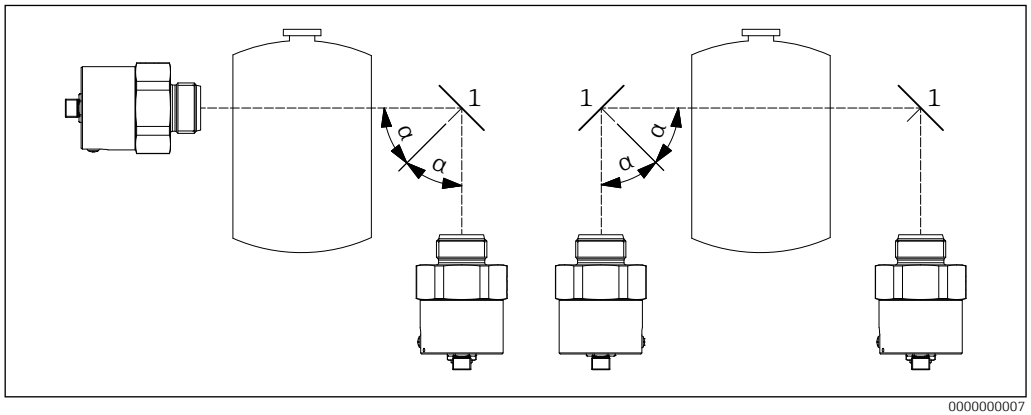
5 *Parallel operation*

A Distance between microwave barriers
D Detection range
α 90°

- Recommendation under ideal conditions: **A ≥ D/2**
- Applications with stronger reflections: **A** increase additionally

5.1.4 Reflector operation

Direct comparison of FQR16 and FDR16 not possible.
Deflect microwave beam via plane metal mirrors (reflectors).



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6 *Reflector operation*

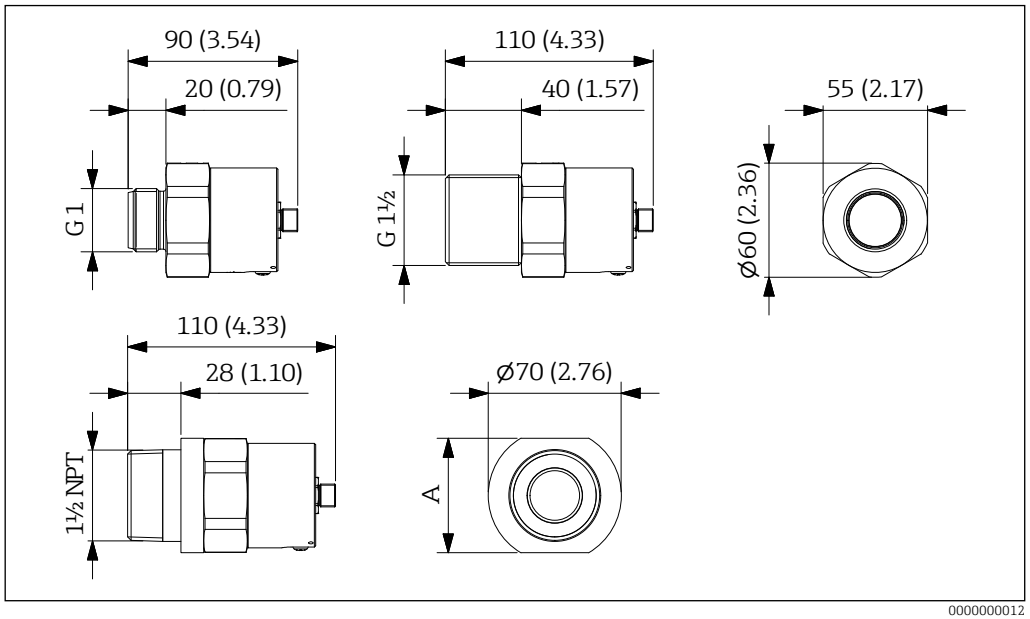
1 Reflector
α Angle of entrance = angle of emission

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

5.1.5 Operating temperature range

→ 38

5.1.6 Mounting dimensions



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

A 2⅜" (60.325 mm / 2.375 in)

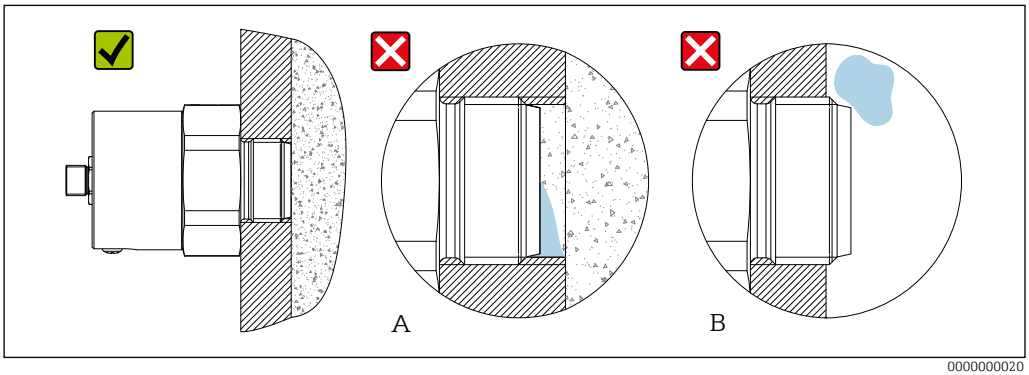
5.2 Mounting the device

5.2.1 Mounting in contact with the process

The FDR16/FQR16 is screwed directly into the process (for example existing threads or vessel sleeves) with its process connection (standard threads G 1 and G 1½ according to ISO 228-1 or 1½ NPT according to ANSI/ASME B1.20.1).

Direct mounting with threaded connection

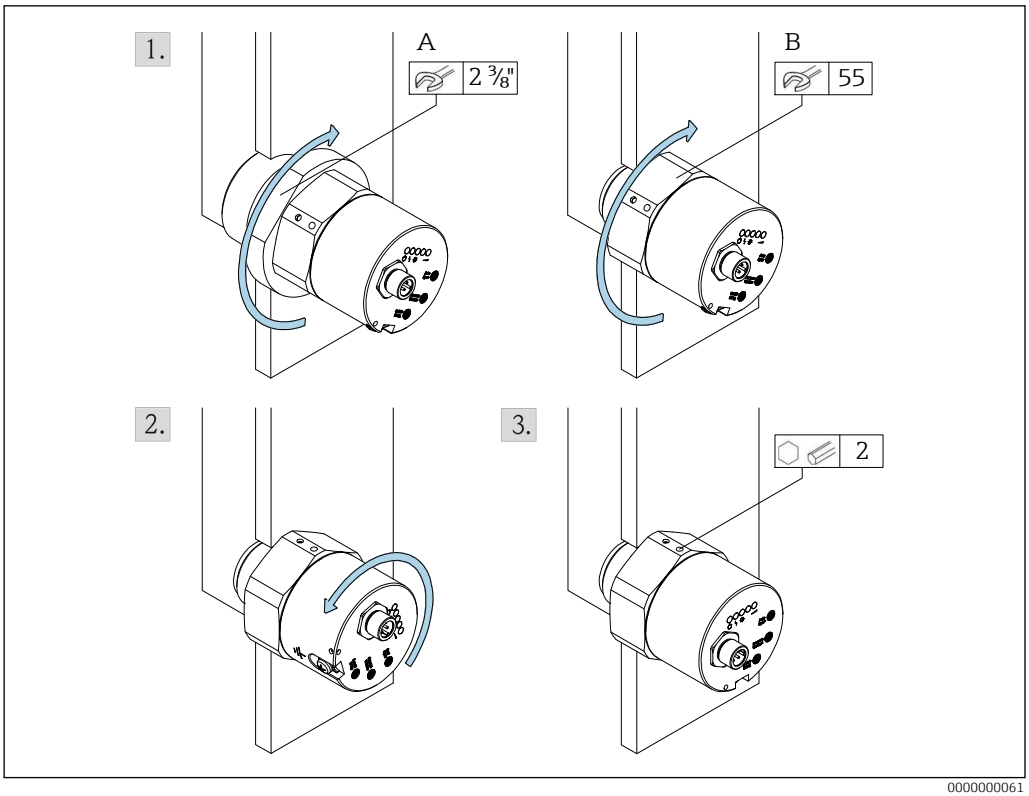
The simplest mounting method is by screwing into the process wall. To do this, a corresponding internal thread (G 1, G 1½ or 1½ NPT) must be available in the process.



8 *Mounting with connection thread*

- 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



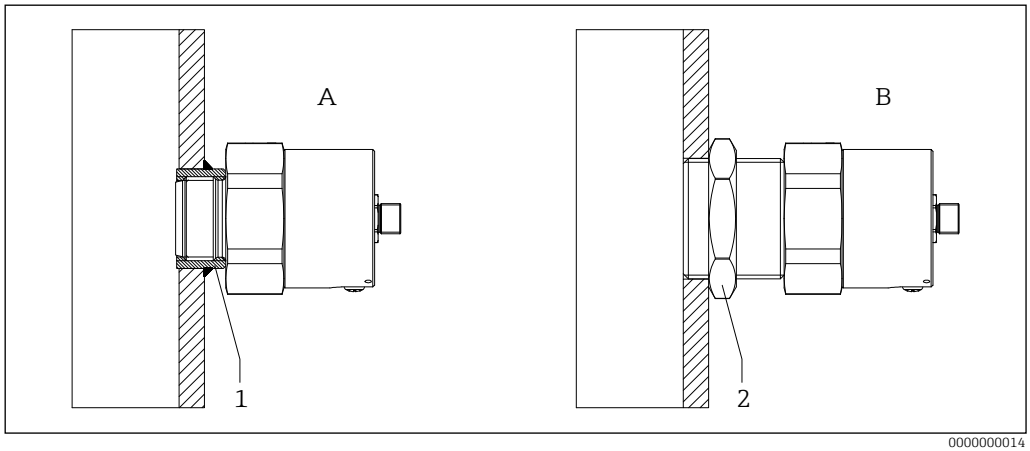
9 *Mounting with connection thread*

A *1½ NPT*
B *G 1 / G 1½*

1. Screw in conical (**A**) or cylindrical (**B**) connection thread.
2. Align the housing of the electronics (potential equalization terminal of both devices must point in the same direction).
3. Fix the housing in place.

Seal: to be provided by the customer

Mounting alternatives



10 Mounting alternatives

1 Welding sleeve G 1
2 Counternut G 1½

When using the G 1½ process connection (standard thread according to ISO 228-1, hexagon SW55) and using the optional counternut, the device can be mounted flush particularly easily, as it is a cylindrical thread. → 29

Mounting with welding sleeve G 1 (A)

▸ Screw in the device as far as it will go.

Mounting in existing thread G 1½ (B)

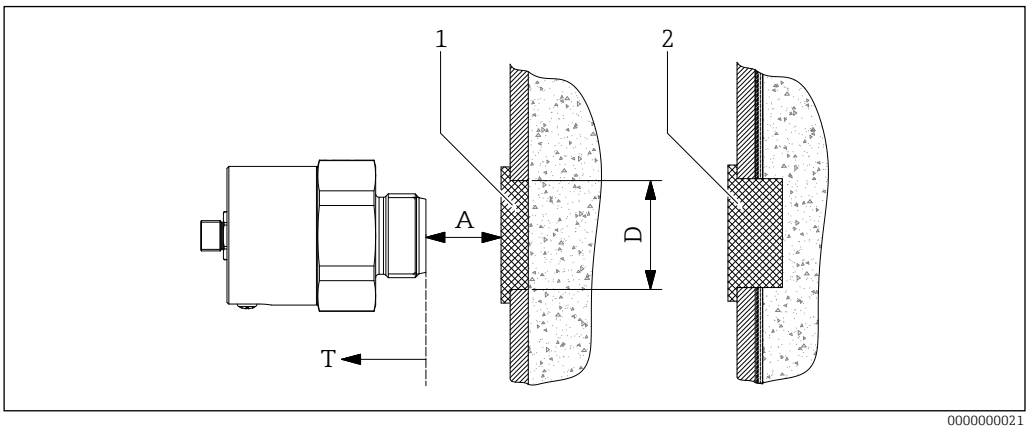
▸ Screw in the device flush with the inner wall and lock it with a G 1½ counternut.

- Seal: to be provided by the customer
- Suitable welding sleeve and counternut
  → 29 and order structure option "accessory enclosed"

5.2.2 Mounting without contact with the process

Mounting in front of microwave-permeable plugs

- Observe maximum temperature **T** → 38
- Risk of condensate formation on the inner process wall → plug **2**
- **A** minimize → minimize signal attenuation
- Suitable plug of type FAR54 → 33

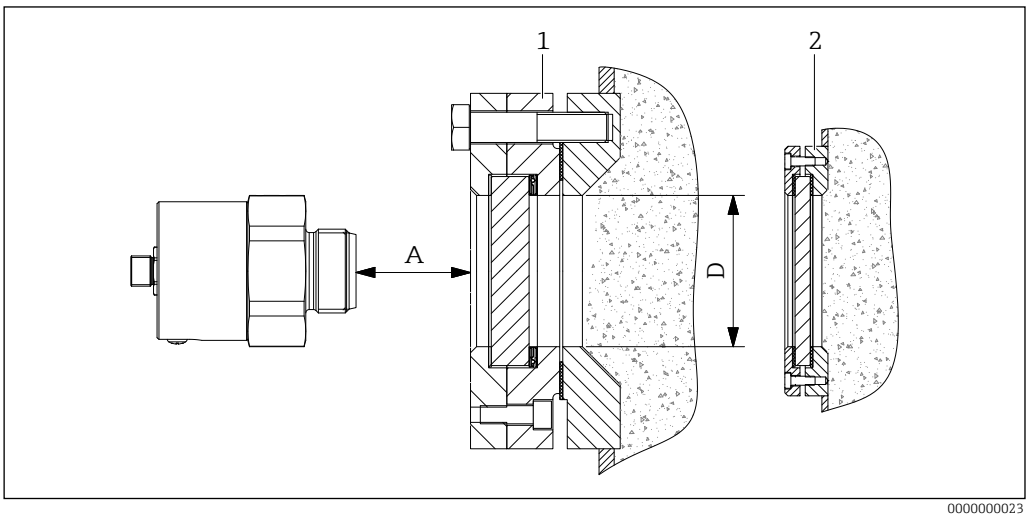


11 *Mounting in front of microwave-impermeable process wall*

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

Mounting in front of microwave permeable sight glass fitting

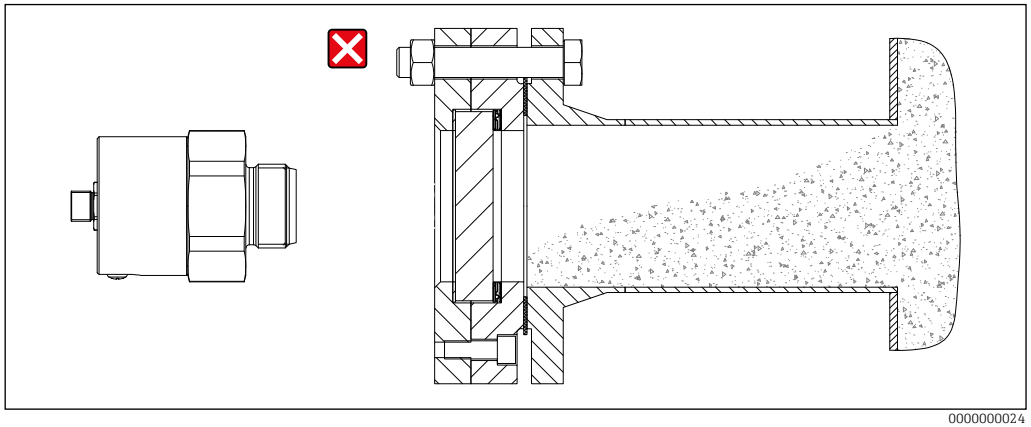
- Observe maximum temperature → 38
- Suitable sight glass fittings → 33



12 *Mounting in front of microwave permeable sight glass fitting*

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

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



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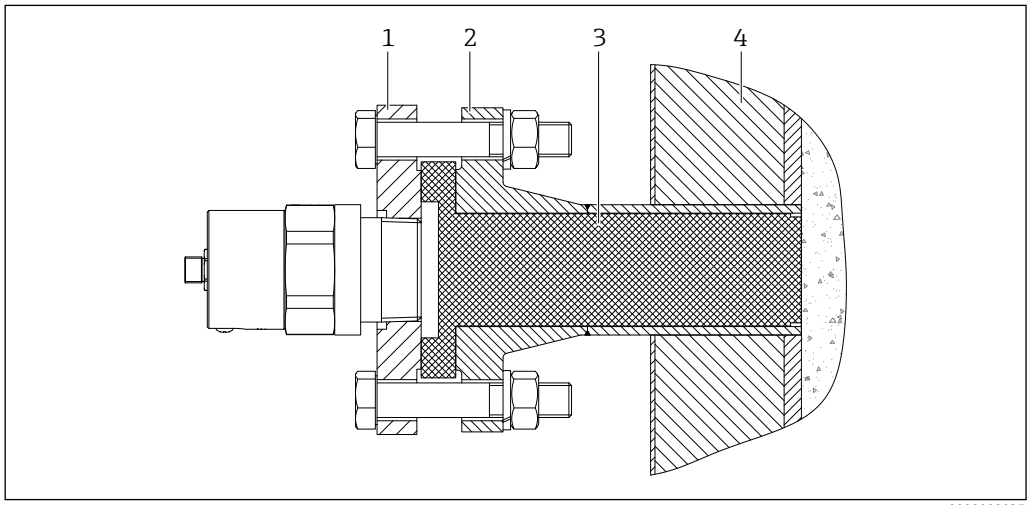
13 Impermissible mounting with the risk of material accumulation

Mounting on process nozzle



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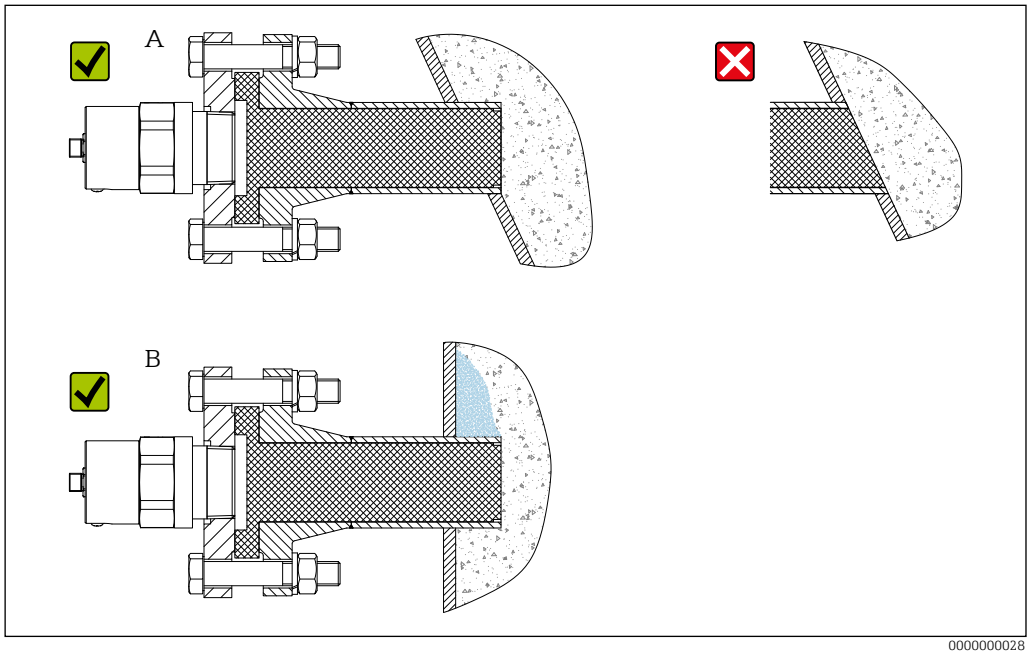
14 Mounting on process nozzle

1 Mounting flange
2 Process nozzle
3 Plug
4 Process insulation

- Suitable mounting flanges → 31
- Suitable plugs → 33
- Suitable process nozzle of type FAR50 → 36

In case of risk of buildup

▸ Avoid mounting types that favor this process



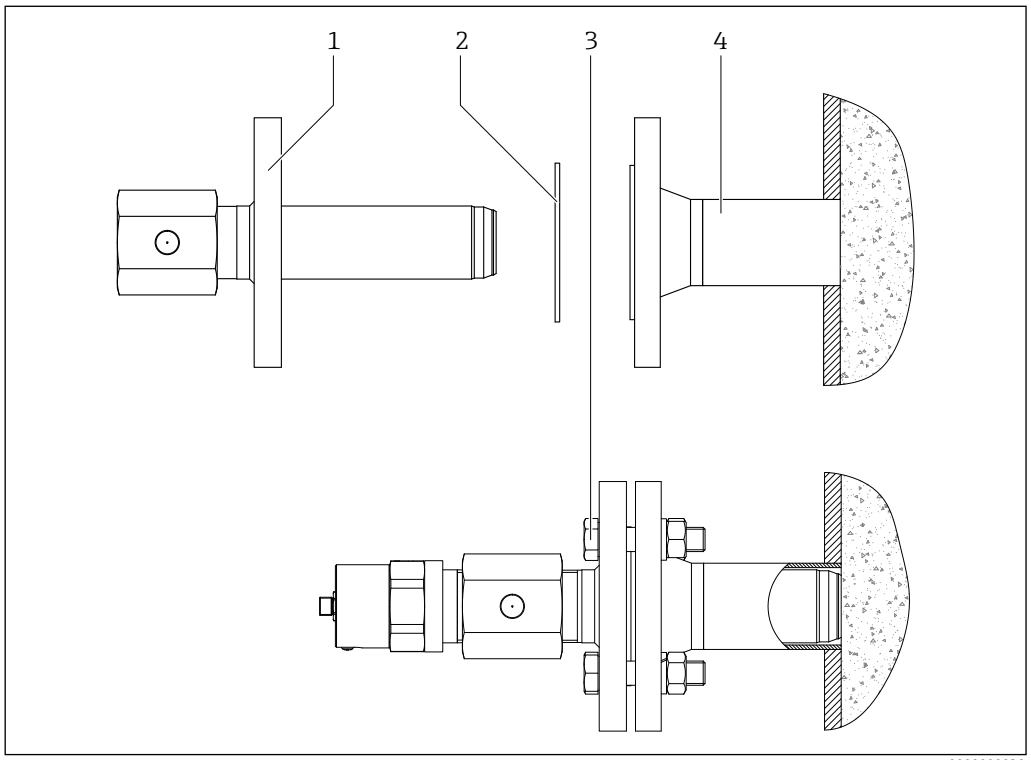
15 *Mounting with risk of buildup*

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

If there is a risk of condensation forming between the device and the plug

▸ Use of process connection type FAR50 with integrated venting element
→ 📄36

Mounting on process nozzle



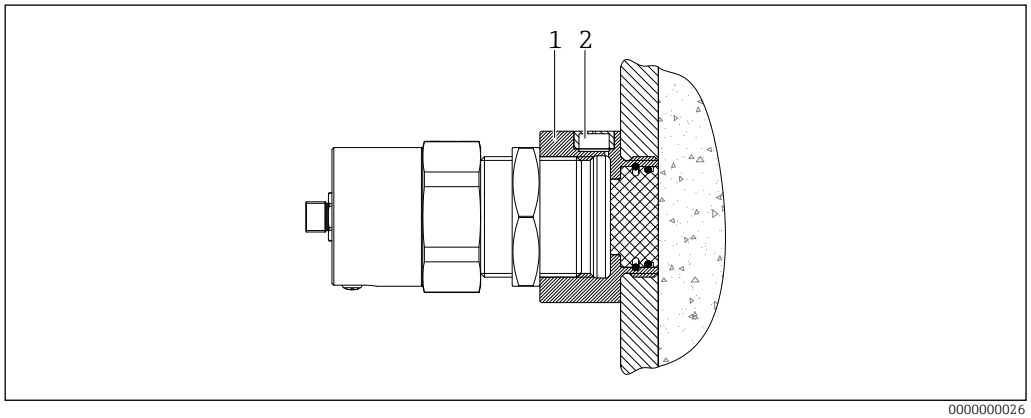
16 *Mounting with insertion adapter FAR51*

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

Suitable insertion adapter of type FAR51 → 35

Mounting with high pressure adapter

▸ Applications with process pressure up to 21 bar (305 psi)



17 *Mounting with high pressure adapter*

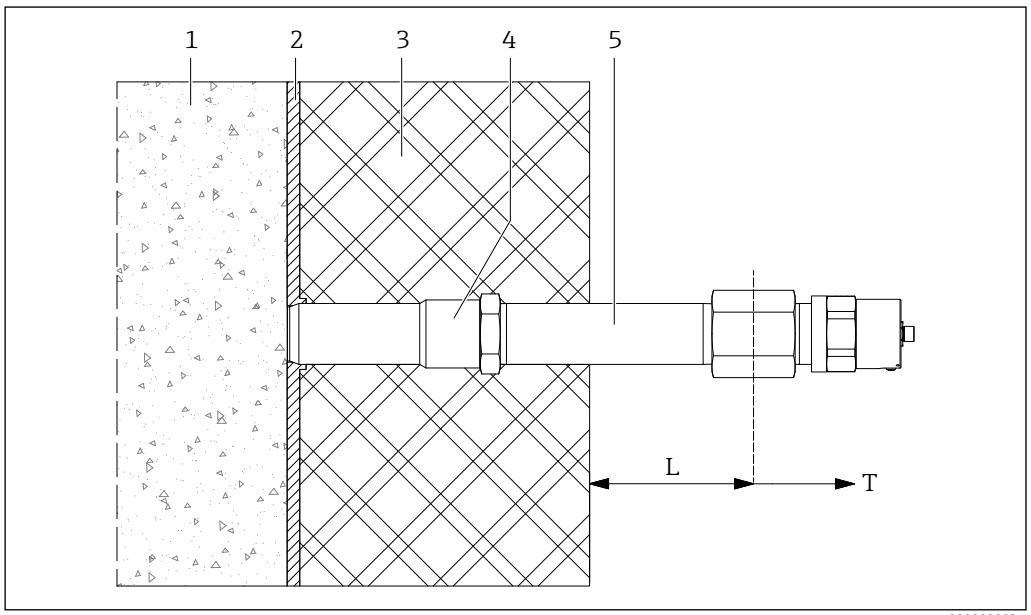
1 *High pressure adapter*
2 *Integrated venting element*

Suitable high pressure adapter → 32

Mounting with high temperature adapter and extensions

▸ Applications with process temperature +60 to +450 °C (+140 to +842 °F)

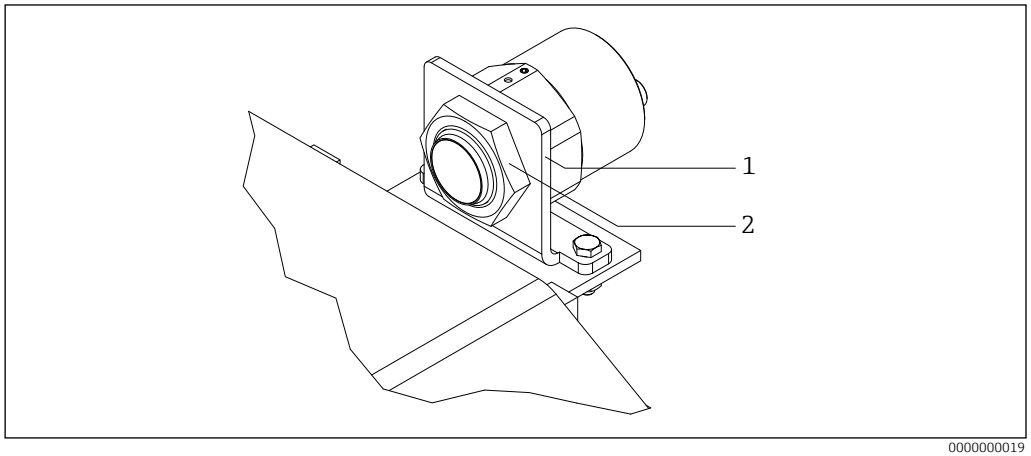
- Process pressure 0.8 to 5.1 bar (12 to 74 psi) absolute
- Observe maximum temperature **T** → 📄38
  ▸ Exceeding leads to destruction!
- **L** must be selected depending on the process and ambient temperatures.
- Suitable high temperature adapter and extension → 📄37



18 *Mounting with high temperature adapter and extensions*

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

Mounting for open processes



19 *Mounting for open processes*

1 *Mounting bracket*
2 *Counternut*

Suitable mounting bracket an counternut → 📄29

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

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

6.1 Connection requirements

6.1.1 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 mm^2.
- The potential equalization of the FDR16/FQR16 must be included in the local potential equalization.

6.1.2 Connecting cable requirements

The connections cables with M12A connector must be fulfil the following requirements:
- Permissible temperature range → 38
- Protection → 39
- Connection cable FQR16 max. 2.5 Ω/core
- Connecting cable FDR16 with FQR16 max. 5 Ω/core
- Total capacity < 100 nF

Suitable connection cable
→ 27 and order structure option "accessory enclosed"

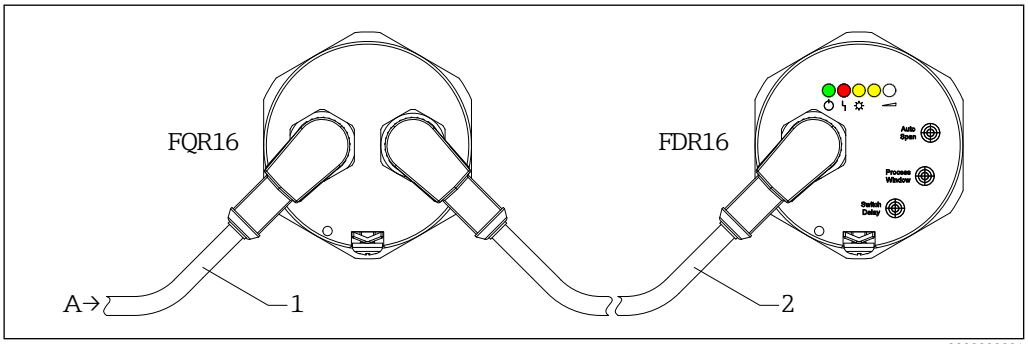
6.2 Output signal

Safety-related circuit
MIN or MAX point level: The electric switch opens when the point level is reached, in case of malfunctions or power failure.

- Maximum point level detection (MAX): e.g. for overfill protection
  The microwave barrier keeps the electrical switch closed as long as the beam path is **free**.
- Minimum point level detection (MIN): e.g. for no-load protection
  The microwave barrier keeps the electrical switch closed as long as the beam path is **covered**.

Function test
With a two-channel evaluation, a function monitoring of the microwave barrier can be realized in addition to the point level detection.
When both outputs are connected, the MIN and MAX outputs assume opposite states (antivalence) in fault-free operation. In the event of a fault or a line break, both outputs drop out.

6.3 Connecting the device

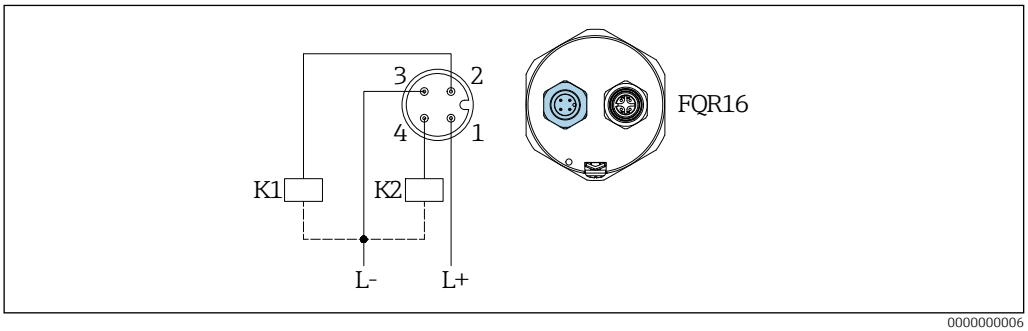


20 *Measuring system*

A Supply and signal circuit
1 Connection cable M12 socket
2 Connection cable M12 socket/plug

Power supply, Output signal
→ 38

6.3.1 Pin assignment



21 *Pin assignment for supply voltage and output circuit*

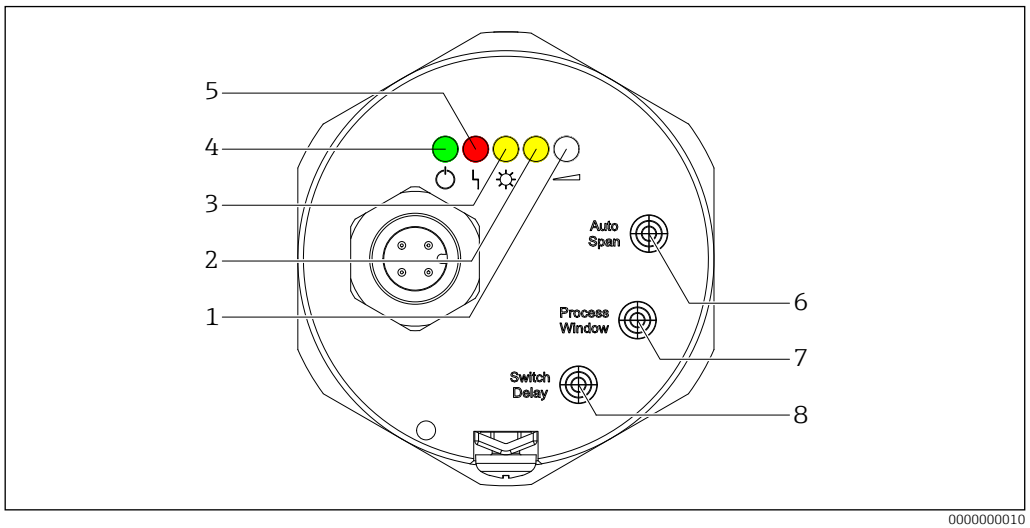
Kx External load

The devices are internally equipped with a fine-wire fuse 500 mA (slow-blow) according to IEC 60127-2, this cannot be changed by the user in the event of a fault.

6.4 Post-connection check

❑ Is the device or cable undamaged?
❑ 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



22 *Display and operating elements of the FDR16*

1 *Signal strength (LED white)*
2 *Only for parameterization: LED yellow*
3 *Sensor state (LED yellow)*
4 *Operation (LED green)*
5 *Error/warning (LED red)*
6 *Parameterization point automatic adjustment*
7 *Parameterization point process window*
8 *Parameterization point switch delay*

7.1 Light signals (LEDs)

Display	Meaning
	**Operation** LED lights up: Device is ready for operation (supply voltage is applied) LED flashes: Device is in parameterization mode → 23
	**Error/Warning** LED lights up: Error/device failure (unrecoverable error) LED flashes: Warning/maintenance required (recoverable error)
	**Sensor state** LED off: Free path LED on: Covered path
	For parameterization only
	**Signal strength** The signal strength is indicated by a white LED, the light state (off, 2 to 15 Hz or permanently lit) is proportional to the strength of the signal.

7.2 Output signal

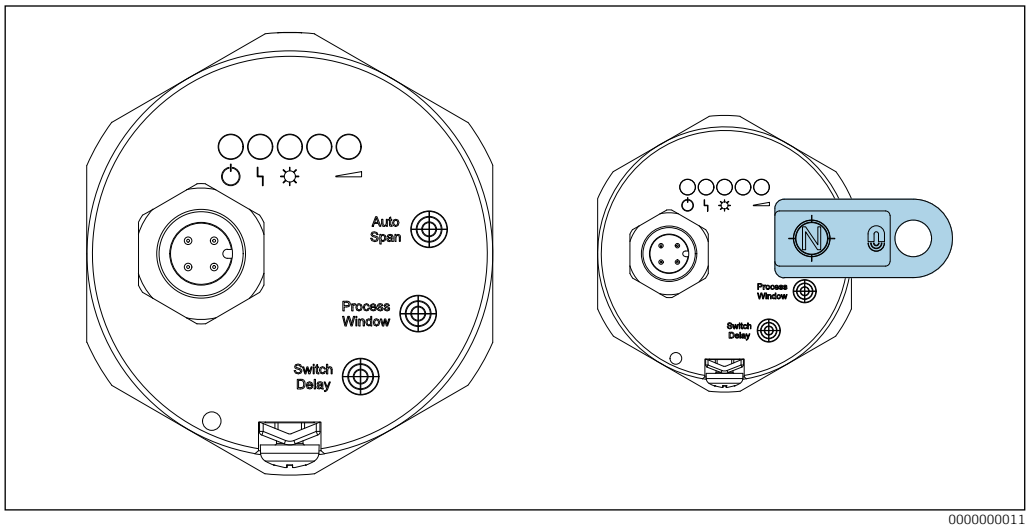
7.2.1 Point level detection

Point level	Signal strength (LED white)	Sensor state	Switching output	
			MAX safety	MIN safety
	LED on or flashing fast (approx. 9 to 15 Hz)	●	1 2	1 4
	LED off or flashing slowly (approx. 2 to 8 Hz)		1 2	1 4

7.2.2 Error case

Point level	Sensor state	Error/Warning	Switching output	
	●	**Warning**  LED flashing	1 2	1 4
			1 2	1 4
	●	**Error**  LED lights up permanently	1 2	1 4

7.3 On-site operation



23 On-site operation

Operation via operating magnet → 29
To operate, place the operating magnet (north pole visible as shown) on the marked areas of the FDR16. The operating magnet is included in the scope of delivery of the FDR16. It can be optionally cancelled or ordered as an accessory.

7.4 Parameterization

Setting options only available with activated parameterization mode (7.4.2 ... 7.4.5)

7.4.1 Activation parameterization mode

1. Power supply off: Operating magnet on "**Auto Span**", "**Process Window**" or "**Switch Delay**"
2. Power supply on: Initialization → green LED (operation) flashes slowly
3. Remove operating magnet → parameterization mode (green LED continues to flash slowly)

- The device continues to operate normally in the background depending on the current settings, so that, for example, exceeding the point level leads to a switchover of the signal output.
- 10 minutes no action → parameterization mode is terminated (device switches to normal operation)
- The parameterization mode can also be terminated by a voltage reset.

7.4.2 Automatic adjustment

- Automatic adjustment of the process-dependent detection range.
- To be performed once during commissioning **with free path**

Perform automatic adjustment

1. Operating magnet on "**Auto Span**" → green LED flashes quickly
2. Remove the operating magnet within 10 seconds:
   → green LED lights up for 2 s
   → automatic adjustment successfully performed

- Automatic adjustment not feasible (for example, with covered path) → warning
- After an automatic adjustment, the white LED (signal strength) lights up permanently if the signal strength is sufficiently high and there is a free path.
- When the path is covered, the yellow LED (sensor status) indicates the covered path, and the white LED is off or flashing at a low frequency. If this is not the case, the process window must then be adjusted.

7.4.3 Set process window

- If the point level cannot be reliably detected after an automatic adjustment because the medium to be detected does not dampen sufficiently, the process window must reduced step by step.
- An enlargement of the process window is also possible. This is useful if, for example, material is conveyed through the detection range of the microwave barrier due to the process, which leads to attenuation of the microwave.

Customize process window

1. Operating magnet on "**Process Window**":
   → green LED flashes quickly
   → display (5 s) current process window
2. Continue to stop operating magnet → every 5 s change to next process window
3. Remove operating magnet → last displayed process window selected

Display	Meaning
	**100 %** (for very good damping media)
	**70 %** (for good damping media)
	**50 %** (factory setting)
	**30 %** (for smaller damping media)
	**15 %** (for small damping media)

7.4.4 Set switching delay

A switching delay is helpful, for example, if the signal strength fluctuates strongly, so that the outputs only switch when the switching point is exceeded or undershot for a correspondingly long time.

Set switching delay

1. Operating magnet on "**Switch Delay**":
   → green LED flashes quickly
   → display (5 s) current switching delay
2. Continue to stop operating magnet → every 5 s change to next switching delay
3. Remove operating magnet → last displayed switching delay selected

Display	Meaning
	Switching delay off (factory setting)
	500 ms
	1 s
	5 s
	10 s

7.4.5 Reset to factory settings

In case of unknown settings or use in a new application, it is recommended to reset the FDR16 to its factory settings beforehand.

Factory settings:
- Process window 50 %
- Switching delay off

Perform factory reset

1. Operating magnet on "**Auto Span**" → green LED flashes quickly
2. Continue to stop operating magnet (min. 20 s):
   → after 10 s, red LED flashes slowly (warning of resetting)
   → after another 10 s red LED flashes quickly
3. Remove operating magnet → parameter reset to factory setting (7.4.2 … 7.4.4)

7.5 Function test

- Function test only possible with parameterization mode deactivated! → 23
- If the operating magnet is held ≥ 30 s against the marking, the red LED flashes and the device automatically returns to the current switching state.

Perform function test

1. Operating magnet on "**Auto Span**", "**Process Window**" or "**Switch Delay**" (min. 2 s)
   → all LEDs light up briefly
   → current switching state is inverted
   → function test is performed
2. Remove operating magnet → change to normal operation

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 → 19
- "Post-connection check" checklist" → 21

8.2 Powering up the measuring device

The microwave barrier is ready for operation a maximum of 3 s after the supply voltage is applied.
Initial setup → 7.4.2 … 7.4.5

9 Diagnostics and troubleshooting

Error	Possible cause	Remedy
Device does not respond	Supply voltage does not match the specification on the nameplate	Apply correct voltage
	Supply voltage has the wrong polarity	Reverse the polarity of the supply voltage
No communication between FDR16 and FQR16 (FDR16 green LED off)	Connecting cable not connected	Connect connecting cable
	Connection cable has no contact	Check connecting cable
Signal outputs do not switch	Microwave barrier not parameterized	Parameterize FDR16 (if necessary, reset to factory settings beforehand).
	FDR16 and/or FQR16 defective	Inspection and repair if necessary

10 Maintenance

No special maintenance work is required.

10.1 Cleaning

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

11 Repair

No repair is provided for this device.

11.1 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

11.2 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

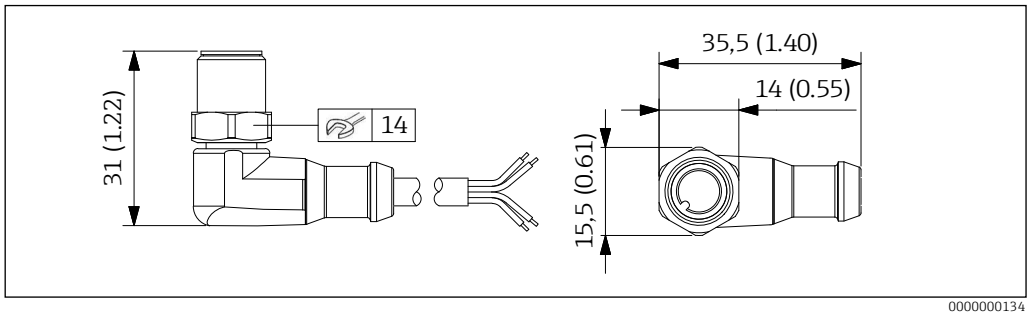
The accessories can be optionally ordered together with the device or separately.
→ Ordering structure "Accessories enclosed" option

12.1 Device specific accessories

12.1.1 Prefabricated cables

Connection cable with M12 right-angle plug (⚠)
- Number of poles/cross section: 4 x 0.34 mm²
- A-coded
- Operating temperature range: -25 to +90 °C (-13 to +194 °F)
- Materials
  - TPU (housing)
  - FKM (seal)
  - PUR (cable)
- Degree of protection: IP69
- Order number:
  - 71530954 (5 m (196.85 in))
  - 71530958 (10 m (393.70 in))
  - 71530962 (20 m (787.40 in))

Connection cable with M12 right-angle plug (Ex/⚠)
- Number of poles/cross section: 4 x 0.34 mm²
- A-coded
- Operating temperature range: -20 to +60 °C (-4 to +140 °F)
- Materials
  - TPU (housing)
  - FKM (seal)
  - PUR (cable)
- Degree of protection: IP67 (Ex) / IP69 (⚠)
- Order number:
  - 71530974 (5 m (196.85 in))
  - 71530975 (10 m (393.70 in))

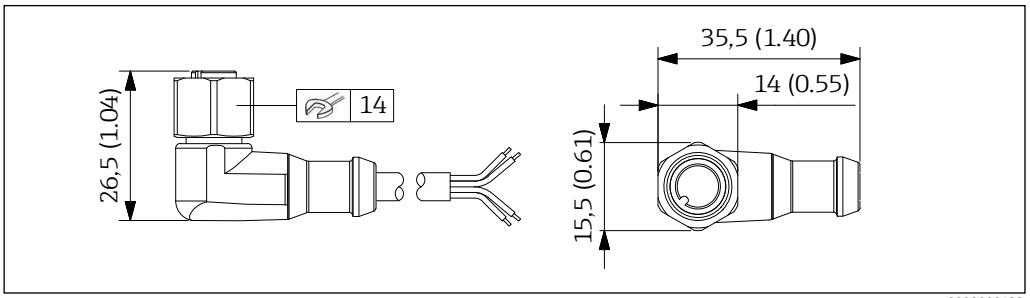


24 Connection cable with M12 right-angle plug. Unit of measurement mm (in)

Connection cable with M12 right-angle socket (⚠)
- Number of poles/cross section: 4 x 0.34 mm²
- A-coded
- Operating temperature range: -25 to +90 °C (-13 to +194 °F)
- Materials
  - TPU (housing)
  - FKM (seal)
  - PUR (cable)
- Degree of protection: IP69

- Order number:
  - 71530949 (5 m (196.85 in))
  - 71530950 (10 m (393.70 in))
  - 71530953 (20 m (787.40 in))

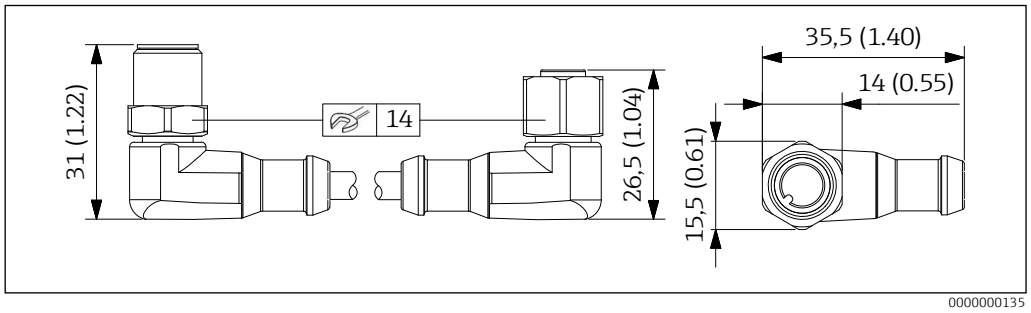
Connection cable with M12 right-angle socket (⚠/⚠)
- Number of poles/cross section: 4 x 0.34 mm²
- A-coded
- Operating temperature range: -20 to +60 °C (-4 to +140 °F)
- Materials
  - TPU (housing)
  - FKM (seal)
  - PUR (cable)
- Degree of protection: IP67 (⚠) / IP69 (⚠)
- Order number:
  - 71530971 (5 m (196.85 in))
  - 71530973 (10 m (393.70 in))



25 *Connection cable with M12 right-angle socket. Unit of measurement mm (in)*

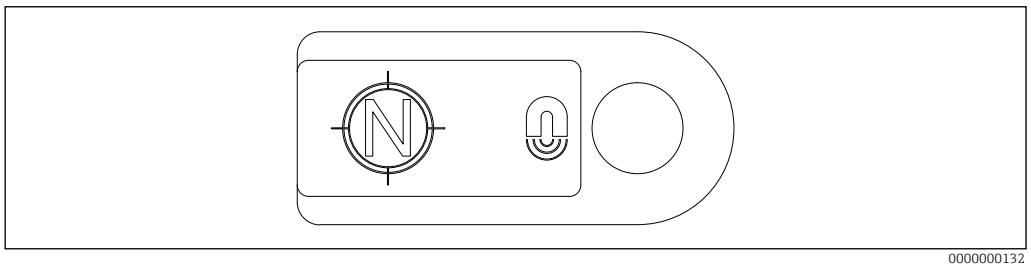
Connecting cable with M12 right-angle plug and M12 right-angle socket (⚠)
- Number of poles/cross section: 4 x 0.34 mm²
- A-coded
- Operating temperature range: -25 to +90 °C (-13 to +194 °F)
- Materials
  - TPU (housing)
  - FKM (seal)
  - PUR (cable)
- Degree of protection: IP69
- Order number:
  - 71530943 (5 m (196.85 in))
  - 71530944 (10 m (393.70 in))
  - 71530947 (20 m (787.40 in))

Connecting cable with M12 right-angle plug and M12 right-angle socket (⚠/⚠)
- Number of poles/cross section: 4 x 0.34 mm²
- A-coded
- Operating temperature range: -20 to +60 °C (-4 to +140 °F)
- Materials
  - TPU (housing)
  - FKM (seal)
  - PUR (cable)
- Degree of protection: IP67 (⚠) / IP69 (⚠)
- Order number:
  - 71530969 (5 m (196.85 in))
  - 71530970 (10 m (393.70 in))



26 Connecting cable with M12 right-angle plug and M12 right-angle socket. Unit of measurement mm (in)

12.1.2 Operating magnet

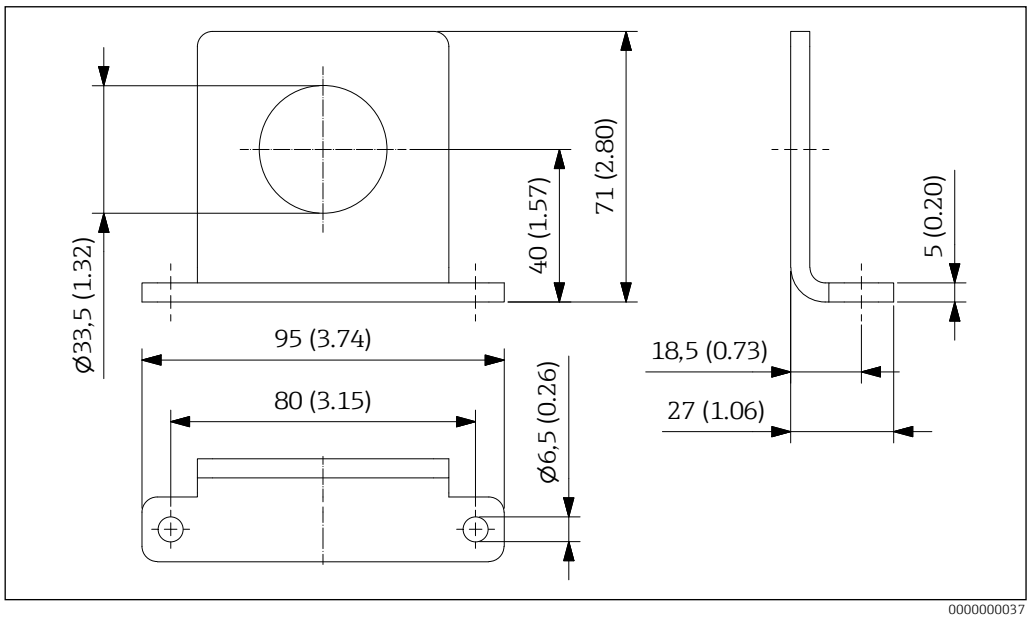


27 Operating magnet

Order number: 71535426

12.2 Mounting bracket

- G 1, ISO 228-1
- Material: 304 (1.4301)
- Weight: 0.22 kg (0.49 lb)
- Mounting screws (2 x M6): to be provided by customer
- Order number: 71530850



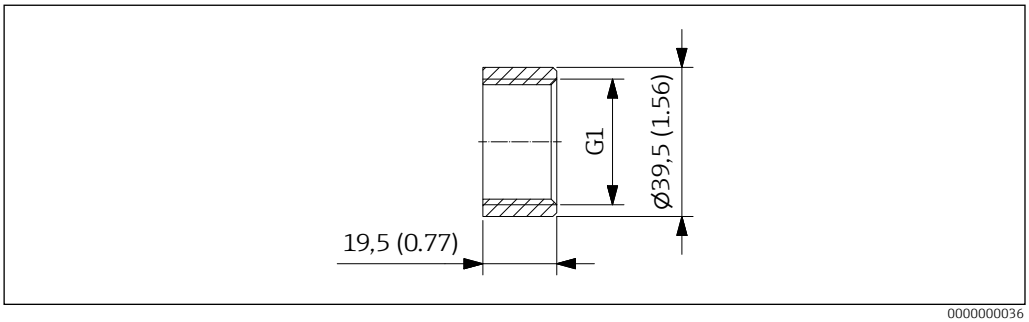
28 Dimensions mounting bracket. Unit of measurement mm (in)

12.3 Counternut

- Material: 316 (1.4401)
- Weight:
  - G1: 0.04 kg (0.09 lb)
  - G 1½: 0.07 kg (0.15 lb)
- Order number:
  - 71530854 (G 1, SW40)
  - 71530857 (G 1½, SW55)

12.4 Welding sleeve

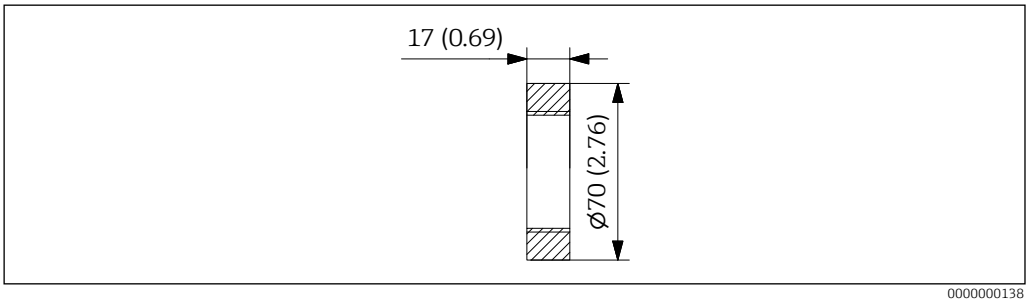
- G 1 (ISO 228-1), half length according to EN 10241
- Material: 316Ti (1.4571)
- Weight: 0.07 kg (0.15 lb)
- Order number:
  - 71530862
  - 71530941 (with inspection certificate EN 10204 - 3.1 material)



29 Dimensions welding sleeve. Unit of measurement mm (in)

12.5 Weld-in adapter

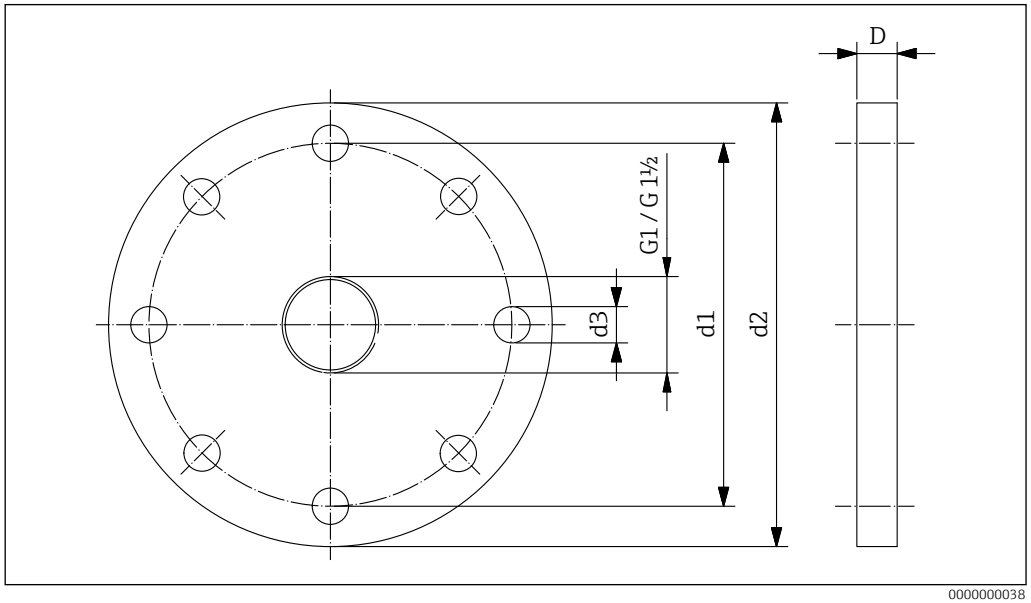
- Type FAR52 (→ TI01369F), internal thread G 1½
- Material: 316Ti (1.4571), steel P235GH (1.0345)
- Weight: 0.3 kg (0.66 lb)



30 Dimensions weld-in adapter FAR52. Unit of measurement mm (in)

12.6 Mounting flange

- 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:
  - 71530977 (DN40 PN40, G 1)
  - 71530992 (DN40 PN40, G 1, with inspection certificate EN 10204 - 3.1 material)
  - 71381884 (DN40 PN16, G 1½)
  - 71381885 (DN40 PN16, G 1½, with inspection certificate EN 10204 - 3.1 material)
  - 71531009 (DN50 PN16, G 1)
  - 71531011 (DN50 PN16, G 1, 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)
  - 71531014 (DN100 PN16, G 1)
  - 71531024 (DN100 PN16, G 1, 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)

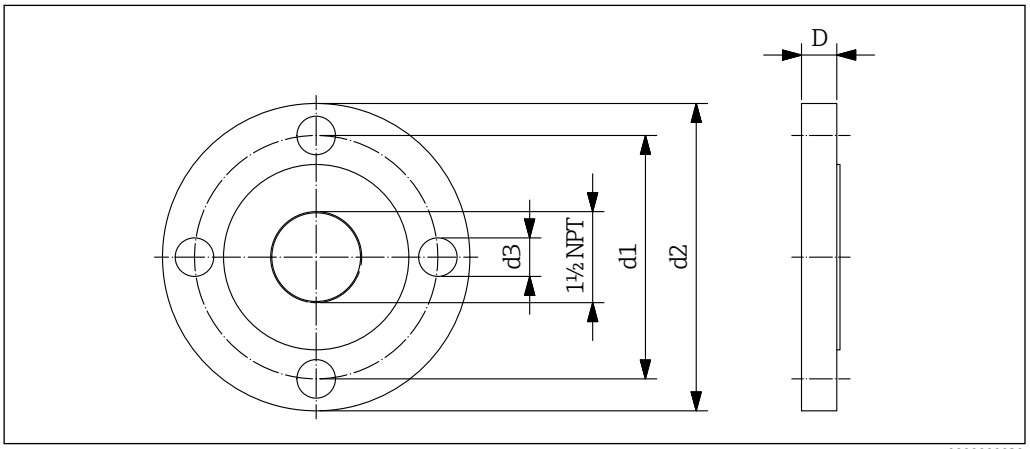


31 Dimensions mounting flange Connection dimensions according to DIN EN 1092-1

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 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)

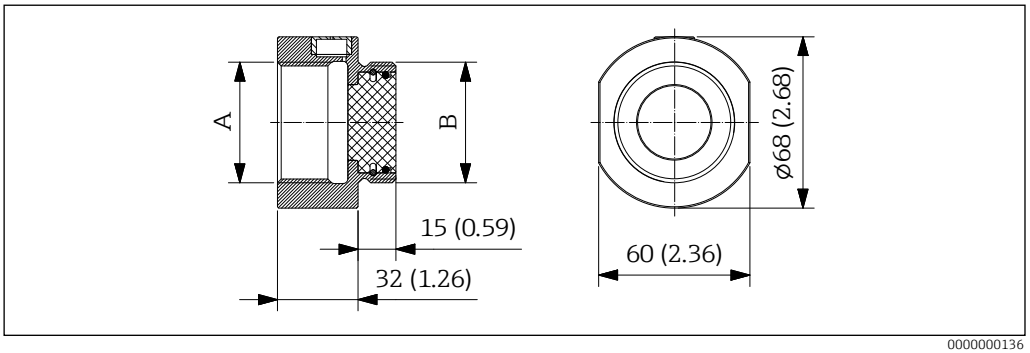


32 *Dimensions mounting flange (Connection dimensions according to ANSI/ASME B16.5)*

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

12.7 High pressure adapter

- Process pressure: 21 bar (305 psi) absolute
- 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 (A+B), ISO 228-1)
  - 71381898 (G 1½ (A+B), ISO 228-1, with inspection certificate EN 10204 - 3.1 material)
  - 71381899 (G 1½ (B), ISO 228-1, 1½ NPT (A), ANSI/ASME)
  - 71381904 (G 1½ (B), ISO 228-1, 1½ NPT (A), ANSI/ASME, with inspection certificate EN 10204 - 3.1 material)

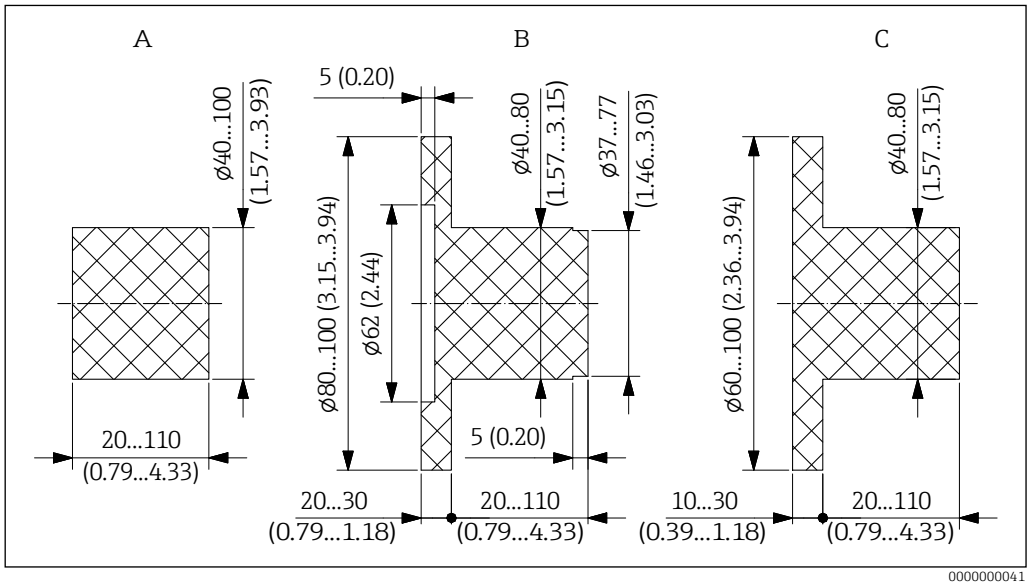


33 *Dimensions high pressure adapter. Unit of measurement mm (in)*

A Device connection thread
B Process connection thread

12.8 Plug

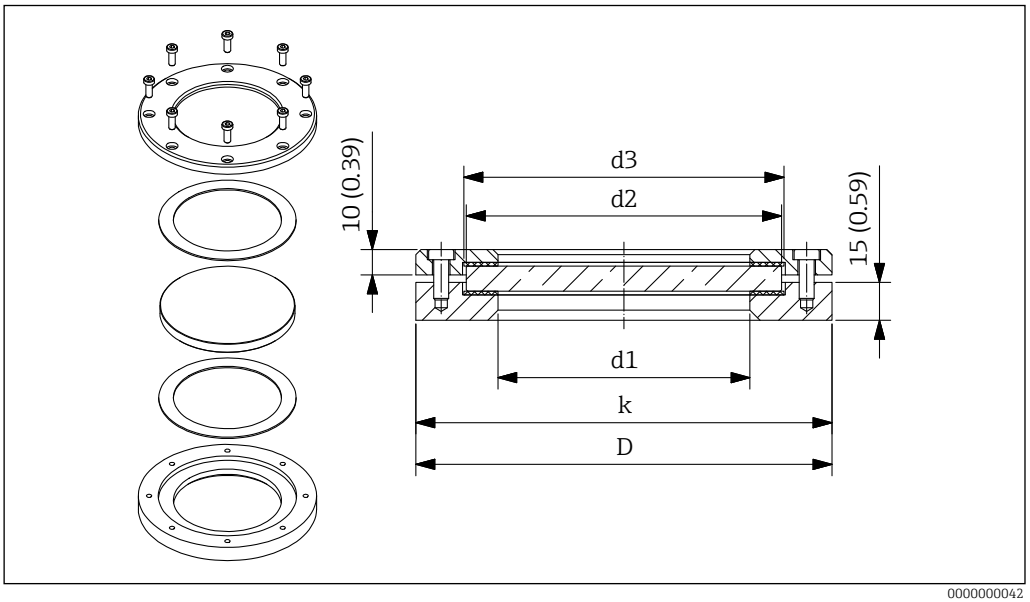
- Type FAR54 (→ TI01371F)
- Material: PTFE, aluminum oxide ceramics
- Process temperature: -40 to +800 °C (-40 to +1472 °F)
- Weight: Depending on version (max. 3.2 kg (7.05 lb))



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

12.9 Sight glass fitting

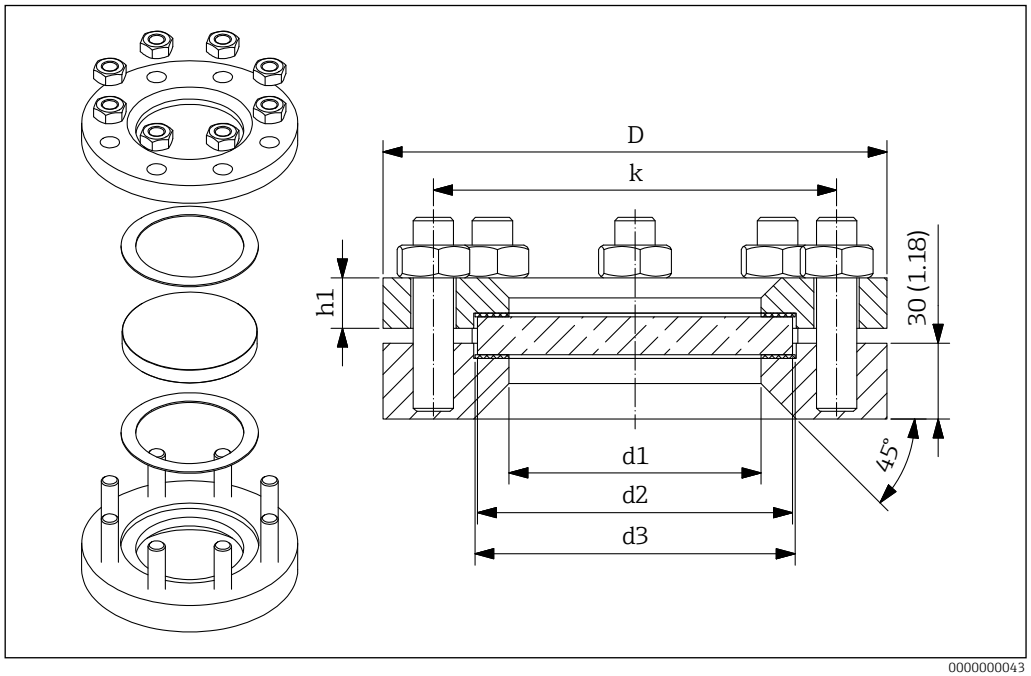
- Unpressurized, weld-on or weld-in type
- Material: 316Ti (1.4571), seal silicone (max. +200 °C/+392 °F)
- Weight: DN50 approx. 2.4 kg (5.29 lb) to DN100 approx. 4.1 kg (9.04 lb)
- Mounting screws enclosed
- Order number:
  - 71026443 (DN50)
  - 71026444 (DN80)
  - 71026445 (DN100)
- Sight glass disc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



35 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)

- 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)

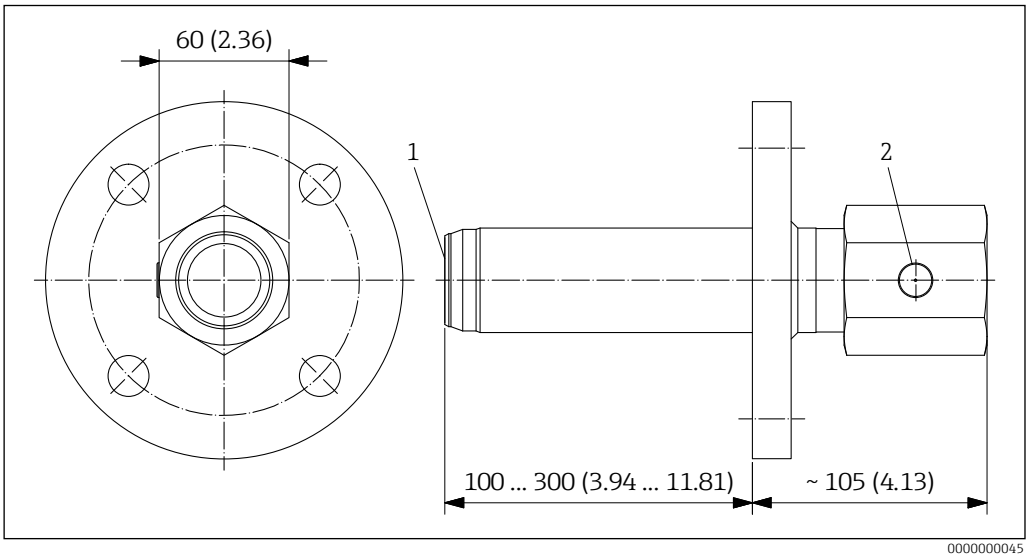


36 Dimensions sight glass fitting for processes up to 10 bar (145 psi). Unit of measurement mm (in)

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)

12.10 Insertion adapter

- 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 1½ NPT, G 1½
- Optionally with PTFE or aluminum oxide ceramics
- Process temperature: -40 to +450 °C (-40 to +842 °F)
- Process pressure: 0.8 to 5.1 bar (12 to 74 psi) absolute
- Material: 316Ti (1.4571)
- Weight: 5 to 10 kg (11 to 22 lb)

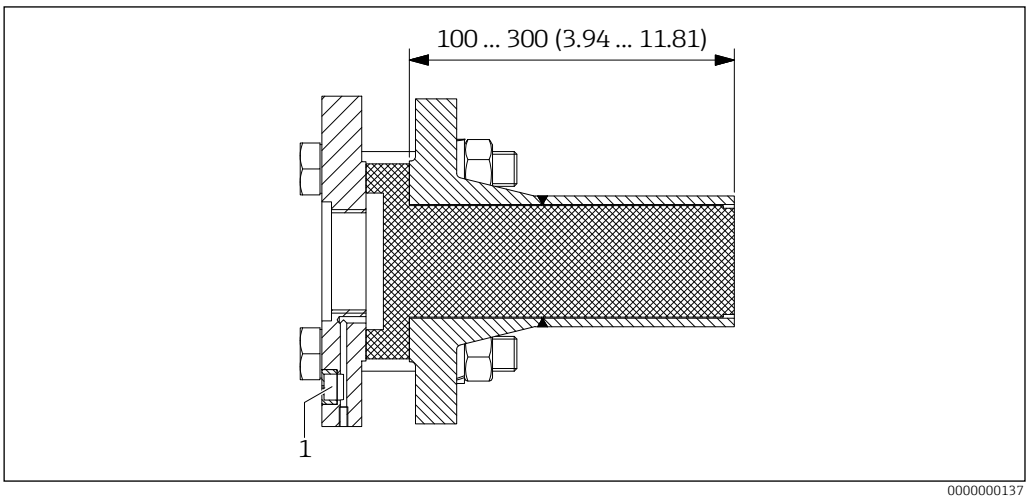


37 *Dimensions insertion adapter. Unit of measurement mm (in)*

1 Disc with seal, optional
2 Integrated venting element

12.11 Weld-in nozzle

- 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 1½ NPT, G 1½
- Process temperature: max. -40 to +200 °C (-40 to +392 °F)
- Material: Stainless steel 316Ti (1.4571)
- Weight: approx. 6 to 7 kg (13 to 15.5 lb)
- Mounting screws enclosed

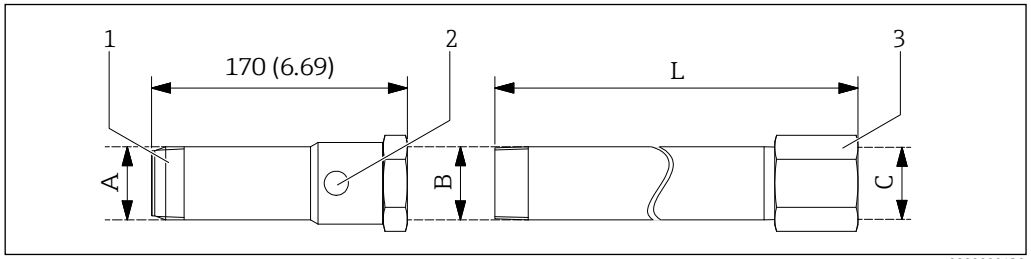


38 *Dimensions weld-in nozzle. Unit of measurement mm (in)*

1 Integrated venting element

12.12 High temperature adapter

- Process temperature: +450 °C (+842 °F), 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 (A), G 1½ (B))
  - 71478114 ((R 1½ (A), G 1½ (B), with inspection certificate EN 10204 - 3.1 material)
  - 71113449 (1½ NPT (A+B))
  - 71478115 (1½ NPT (A+B), with inspection certificate EN 10204 - 3.1 material)



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

1 High temperature adapter (connection thread A, internal thread B)
2 Integrated venting element
3 Extension (connecting thread B, female thread C)

- 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 (B), G 1½ (C), L = 225 mm)
  - 71113451 (R 1½ (B), G 1½ (C), L = 325 mm)
  - 71113452 (R 1½ (B), G 1½ (C), L = 525 mm)
  - 71113453 (1½ NPT (A+B), L = 225 mm)
  - 71113454 (1½ NPT (A+B), L = 325 mm)
  - 71113455 (1½ NPT (A+B), L = 525 mm)

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

13.1.3 Operating frequency

24.15 to 24.25 GHz

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. ± 12°

13.2 Output

13.2.1 Output signal

Switching output

- 3-wire DC-PNP (positive voltage signal at the switching output of the electronics)
- 2 DC-PNP outputs, antivalent switched
- Max. 200 mA per output, short-circuit proof
- Switching delay parameterizable (off, 500 ms to 10 s)

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

- U = 18 to 30 V DC
- In accordance with IEC/EN61010 a suitable circuit breaker must be provided for the measuring device.
- Voltage source: Non-hazardous contact voltage or Class 2 circuit (North America).

13.3.2 Power consumption

P ≤ 2.4 W

13.3.3 Current consumption

I ≤ 120 mA (without load)

13.3.4 Load

Max. 200 mA

13.4 Environment

13.4.1 Ambient temperature

-20 to +60 °C (-4 to +140 °F)

13.4.2 Storage temperature

See ambient temperature

13.4.3 Degree of protection

- : IP69
- : IP67

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

- -20 to +60 °C (-4 to +140 °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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