



Level



Pressure



Flow



Temperature



Liquid
Analysis



Registration



Systems
Components



Services

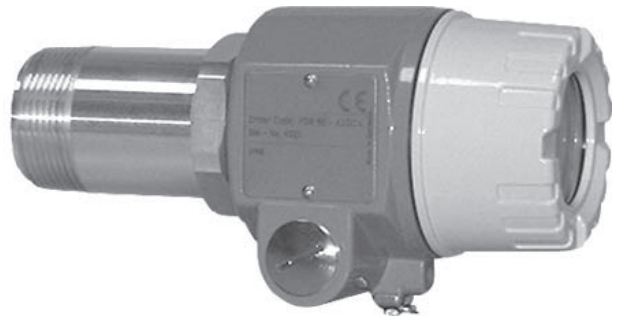
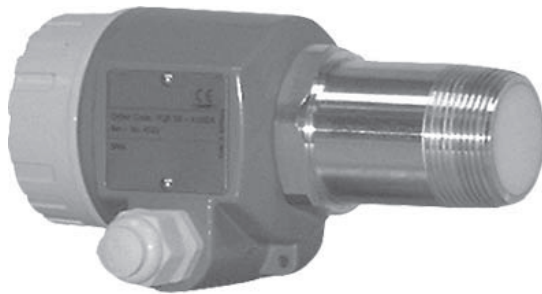


Solutions

Technical Information

Soliwave M FQR50 / FDR50

Microwave barrier



Area of application

The microwave barrier uses a contact free procedure for detection. It can be installed in containers, conduits, shafts or on free fall shafts. It is possible to take a measurement through non-metallic container materials from the outside.

Suitable as level limit switch for controlling and counting all types of bulk solids.

Typical bulk solids are:

- wood chips, wood dust or flour
- plaster, cement, ash
- paper or cardboard shred
- gravel, sand
- dried powders in general
- bags, boxes

Advantages at a glance

- Option of flush front, contact free assembly
- Mechanically robust
 - no wear and tear
 - long serviceable life
 - maintenance free
- Indication of the signal strength on the receiver
- Adjustable sensitivity
- Easy assembly using R 1½ - or 1½ NPT - thread
- Conforms to ATEX II 1/2 D, ATEX II 1/2 G and IECEx Zone 0/1

Table of contents

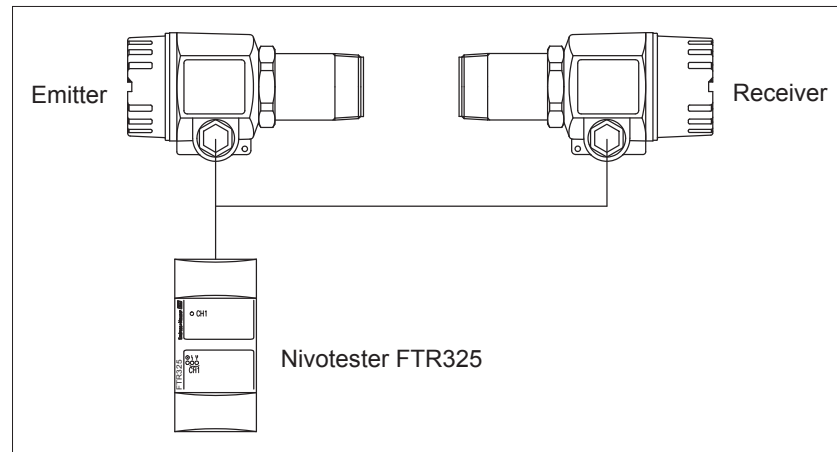
Function and system design	3	Mechanical construction	16
Measuring principle	3	Design, dimensions F18-housing (aluminium)	16
Measuring system	3	Weight	16
Equipment combinations	3	Materials	16
Input	4	Process connection	16
Measuring range (range of detection)	4	Design, dimensions (stainless steel housing)	17
Operating frequency	4	Weight	17
Transmitter power	4	Material	17
Output	4	Process connection	17
Output signal	4	Human interface	18
Switching frequency FDR50	4	Display and operating elements (Receiver)	18
Power supply	5	Calibration with covered path (switching point reached)	19
Electrical connection	5	Calibration with free path (switching point not reached)	19
Ring wiring	5	Configuration of the hysteresis	19
Star wiring	5	Calibration in applications with very low attenuation	19
Cable entry	5	Display and operating elements (emitter)	19
Cable gland	6	Certificates and approvals	20
Wire specification	6	CE approval	20
Operating conditions	7	Ex approval	20
Installation instructions	7	Radio certification	20
Notes to orientation	7	Other standards and guidelines	20
Minimum distance from emitter to receiver	7	Ordering information	21
Installation using reflectors	7	Ordering information Receiver FDR50 / Emitter FQR50	21
Parallel operation	8	Comments regarding the product structure	21
Relation between detection and minimum distance	9	Safety instructions	22
Direct installation with threaded connection	10	Zone classification	22
Bracket installation in front of microwave-permeable window	11	General safety instructions for electrical equipment for hazardous areas	22
Bracket installation in front of microwave-permeable window with danger of condensation on the container's inner wall	11	Specific safety instructions	22
Bracket installation in front of microwave-permeable sight glass fitting	11	Accessories	23
Angle installation on container	12	Mounting bracket	23
Flange mounting using screw-in flange	12	Adapter flange	23
Flange mounting using screw-in flange for oblique conical containers	12	Installation flanges, material: 316Ti (stainless steel)	24
Flange mounting using screw-in flange with danger of build-up ..	13	Sight glass fitting	25
Installation with pipe as wave guide	13	HT adapter and extension	27
High-temperature application	14	Documentation	27
Environment	15	Operating instructions (KA)	27
Ambient temperature	15	Technical informations	27
Storage temperature	15	Safety instructions	27
Degree of protection	15		
Electromagnetic compatibility (EMC)	15		
Process	15		
Process temperature range	15		
Process pressure	15		

Function and system design

Measuring principle

The FQR50 emitter puts out the microwave signal via an integrated horn antenna. The FDR50 receiver directly opposite detects this signal and forwards a switching signal to the FTR325 evaluator. Alarm and control devices may be connected to these relay outputs.

The range of the path is influenced by the different types of materials. The absorption of the microwaves here depends on the electric characteristics of the attenuating material. Materials with the capacity to conduct electricity, for example metals, reflect the waves and other materials with lower conductivity only weaken them or are even penetrated. The attenuation of the microwaves is reduced as the dielectric constant of the material to be emitted through becomes lower.



Measuring system

The complete measuring system for limit detection consists of:

- an emitter FQR50,
- a receiver FDR50 and
- an evaluator Nivotester FTR325

Optical or acoustic signalers, contactors, relays, solenoids etc. may be connected to the Nivotester.

Equipment combinations

The emitter and receiver unit FQR50/FDR50-C* (ATEX II 1/2G Ex ia IIC T4 and ATEX II 1/2D Ex iaD 20/21 IP66 T98°C resp.) may only be combined with the Nivotester FTR325-B* (ATEX II (1)G [Ex ia] IIC and ATEX II (1)D [Ex iaD] resp.).

The emitter and receiver unit FQR50/FDR50-D* (IECEx Zone 0/1 Ex ia IIC T4 and IECEx Ex iaD 20/21 IP66 T98°C resp.) may only be combined with the Nivotester FTR325-D* (IECEx [Zone 0] [Ex ia] IIC and IECEx [Ex iaD] resp.).

Note:

The devices FQR50/FDR50-A* (non hazardous area) and FQR50/FDR50-B* (ATEX II 1/2D IP66 T102°C) of the microwave barrier Soliwave M are no longer available, they have been replaced by the Soliwave FQR56/FDR56-AA* (non hazardous area) and FQR56/FDR56-BA* (ATEX II 1/2D Ex ta/tb IIIC T102°C Da/Db IP66). Please refer to the Technical Information TI00443F/97/EN for details about the new microwave barrier Soliwave.

The following equipment combinations are impossible:

- FQR50/FDR50-C* (ATEX II 1/2G Ex ia IIC T4 and ATEX II 1/2D Ex iaD 20/21 IP66 T98°C resp.) with Nivotester FTR325-A* (non hazardous area)
- FQR50/FDR50-C* (ATEX II 1/2G Ex ia IIC T4 and ATEX II 1/2D Ex iaD 20/21 IP66 T98°C resp.) with Nivotester FTR325-D* (IECEx [Zone 0] [Ex ia] IIC and IECEx [Ex iaD] resp.)
- FQR50/FDR50-D* (IECEx Zone 0/1 Ex ia IIC T4 and IECEx Ex iaD 20/21 IP66 T98°C resp.) with Nivotester FTR325-A* (non hazardous area)
- FQR50/FDR50-D* (IECEx Zone 0/1 Ex ia IIC T4 and IECEx Ex iaD 20/21 IP66 T98°C resp.) with Nivotester FTR325-B* (ATEX II (1)G [Ex ia] IIC and ATEX II (1)D [Ex iaD] resp.)

Input

Measured variable	Absorption of the electromagnetic waves produced by the FQR50 emitter.
Measuring range (range of detection)	When there is an unrestricted path between the emitter and the receiver the maximum range, depending on the version (see ordering information), is 8 m or 20 m. The range is also dependent on the container walls to be penetrated.
Operating frequency	24.125 GHz
Transmitter power	The maximum power produced by the FQR50 emitter is 100 mW e.i.r.p. (equivalent isotrope radiation performance). <ul style="list-style-type: none">■ Power density directly in front of the emitter: 1 mW / cm²■ Power density at a distance of 1 m: 0.3 μW / cm² Note: The power density is significantly below the recommended limit values of the ICNIRP guidelines " <i>Guidelines for Limiting Exposure to Time-Varying Electric, Magnetic, and Electromagnetic Fields (up to 300 GHz)</i> " and is thus harmless for humans!

Output

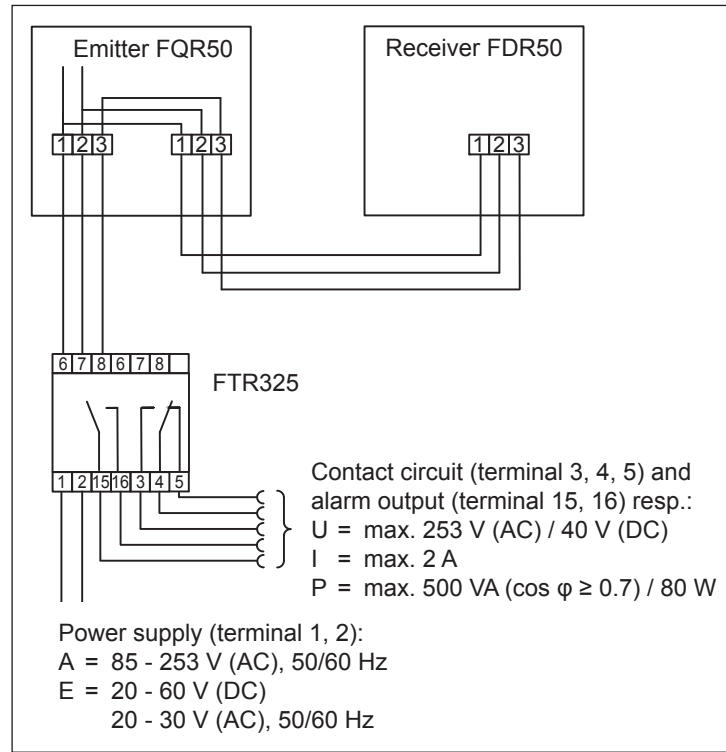
Output signal	Switching signal for the Nivotester FTR325
Switching frequency FDR50	max. 2 Hz

Power supply

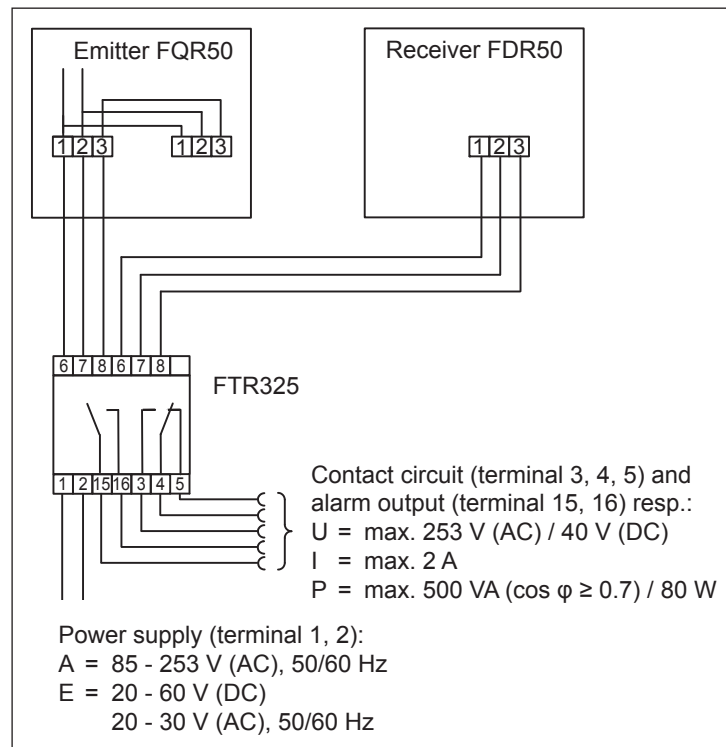
Electrical connection

A suitable wire (see "Wire specification") is used to connect the emitter and receiver of the Soliwave M microwave barrier with the Nivotester FTR325. The following wiring variants are permitted:

Ring wiring



Star wiring



Cable entry

- M20 x 1.5 or
- ½ NPT

Cable gland

- M20 x 1.5:
 - Degree of protection IP66
 - Scope of supply: 2

Wire specification

- Usual commercial installation wire
- Conductor cross-section: max. 1.5 mm
- Resistance: $15 \Omega/\text{km} \leq R' \leq 150 \Omega/\text{km}$
- Inductance: $0.4 \text{ mH}/\text{km} \leq L' \leq 1 \text{ mH}/\text{km}$
- Capacitance: $45 \text{ nF}/\text{km} \leq C' \leq 200 \text{ nF}/\text{km}$
- Length of spurs max. 1000 m (IIC) and 5000 m (IIB) respectively

Example cable length

Copper cable, specific resistance $\rho = 0.0172 \Omega\text{mm}^2/\text{m}$, cross section 0.75mm^2

It applies: $R [\Omega] = (\rho [\Omega\text{mm}^2/\text{m}] * l [\text{m}]) / A [\text{mm}^2]$

The maximum cable length is 1090 m.

Operating conditions

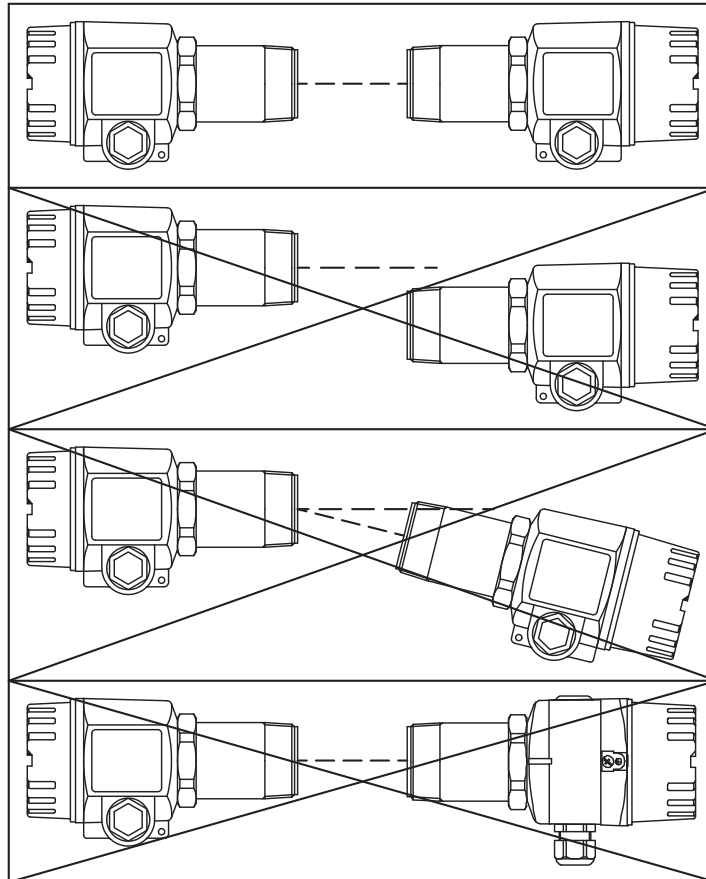
Installation instructions

Both the FQR50 emitter and the FDR50 receiver are equipped with a standard thread (R 1½ in compliance with EN10226 and 1½" NPT in compliance with ANSI/ASME B1.20.1) as a process connector. This makes a simple installation in the existing container sleeves or fittings possible.

Note:

- The fronts of the emitter and the receiver should face each other and be concentric.
- Since the microwaves are polarised the FQR50 emitter and the FDR50 receiver may not be rotated around their longitudinal axis, unless they are rotated exactly 180°.
- Disturbing reflections at metal parts are to be avoided.
- An improvement in the signal quality can be achieved by an adjustable mounting of emitter and receiver of ± 15 mm along their longitudinal axis (see "Angle installation" on page 12).

Notes to orientation

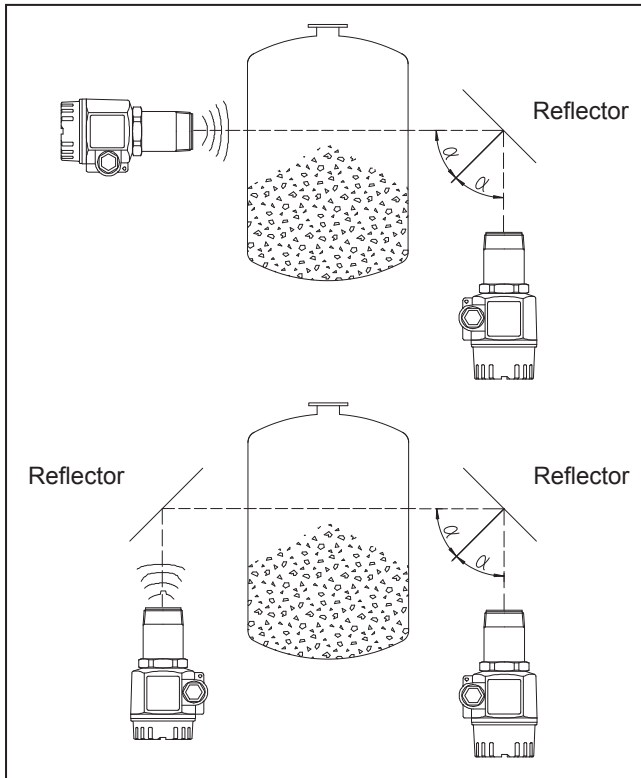


Minimum distance from emitter to receiver

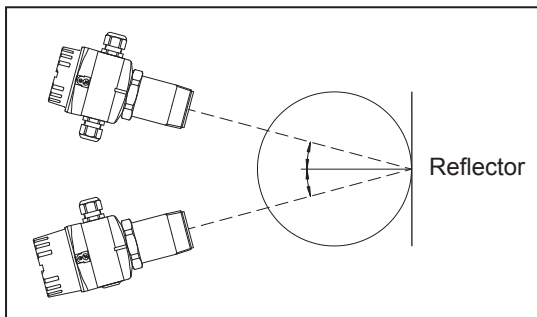
A minimum distance of 30 mm should be maintained between the emitter and the receiver.

Installation using reflectors

If, for construction reasons, a direct confrontation of the FQR50 emitter and the FDR50 receiver is not possible, the microwave beam can be redirected via a flat metal mirror (reflectors). By using reflectors the range of the microwave barrier is reduced by approximately 10% per reflector.

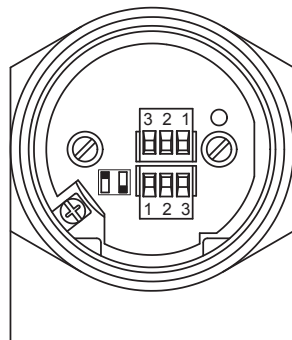


Please make sure that FQR50 emitter and FDR50 receiver are placed at symmetrical angles toward the reflector (entry angle = exit angle), since otherwise the receiver will get no evaluable signal.



Parallel operation

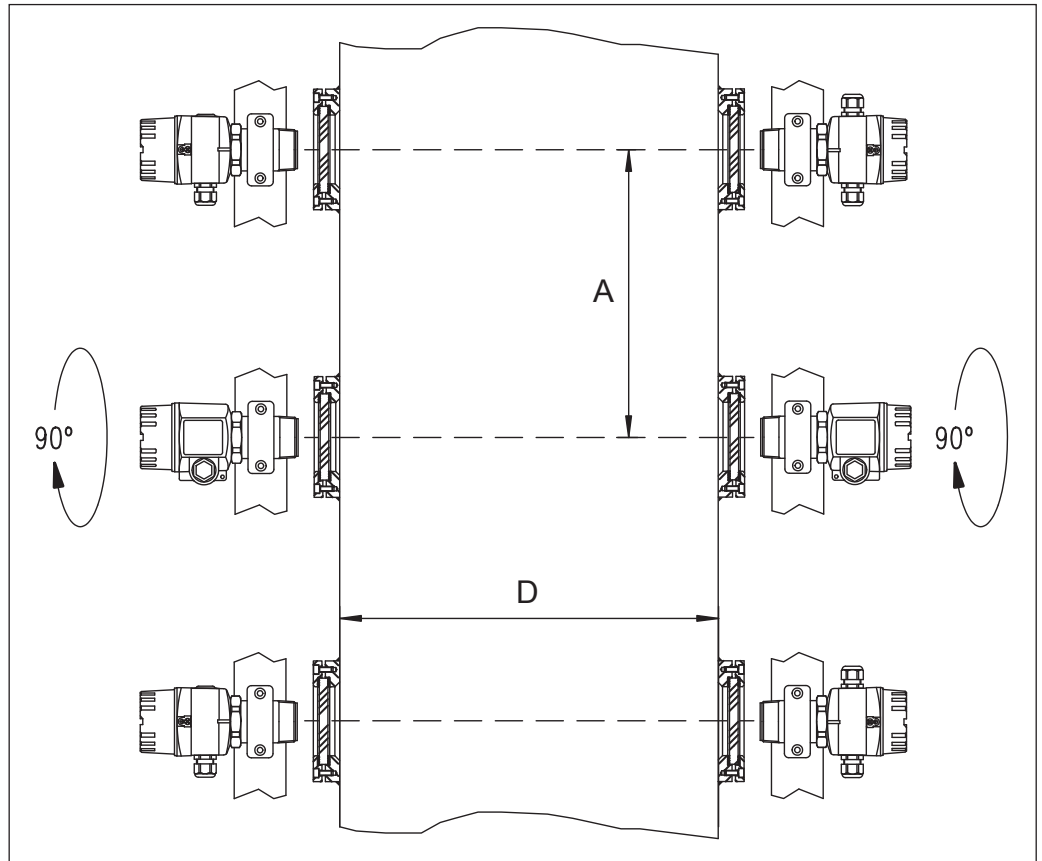
It may be necessary to utilize several microwave barriers (each consisting of a FQR50 emitter, a FDR50 receiver and a FTR325 Nivotester) in one place (for example for detecting several limit states in a pipeline, see figure). To prevent interferences between the microwave paths, various modulation frequencies can be adjusted on the FQR50 emitter (as of production date July 2008).



Switch setting S1	Modulation frequency
	1 (factory setting)
	2
	3

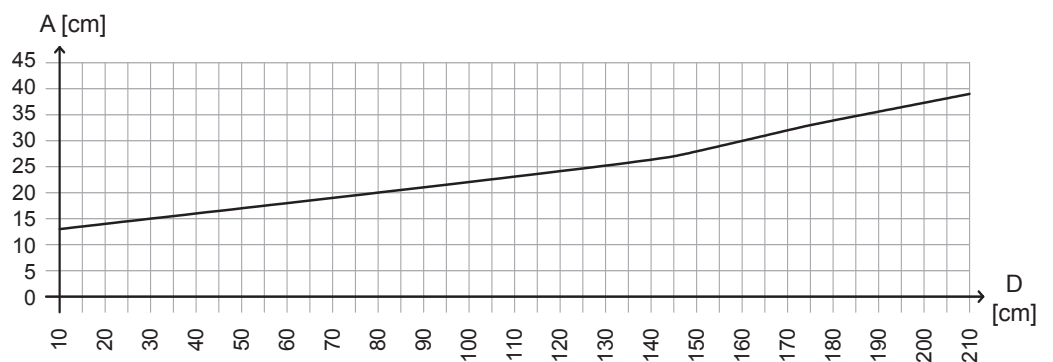
The switch setting of S1 has no effect when using a single microwave barrier and can be any way. Regard the following advice for parallel use of several microwave barriers:

- Use the different modulation frequencies in sequence, e.g. 1, 2, 3, 1, ...
- Regard the minimum distance **A** depending on the detection distance **D**.
- Rotate every other microwave barrier by 90° to eliminate interferences (see figure, pertains to emitter and receiver).



Relation between detection and minimum distance

The following relation between detection distance **D** and minimum distance between microwave barriers **A** applies to parallel operation of several barriers using emitters with selectable modulation frequency as shown in the figure.

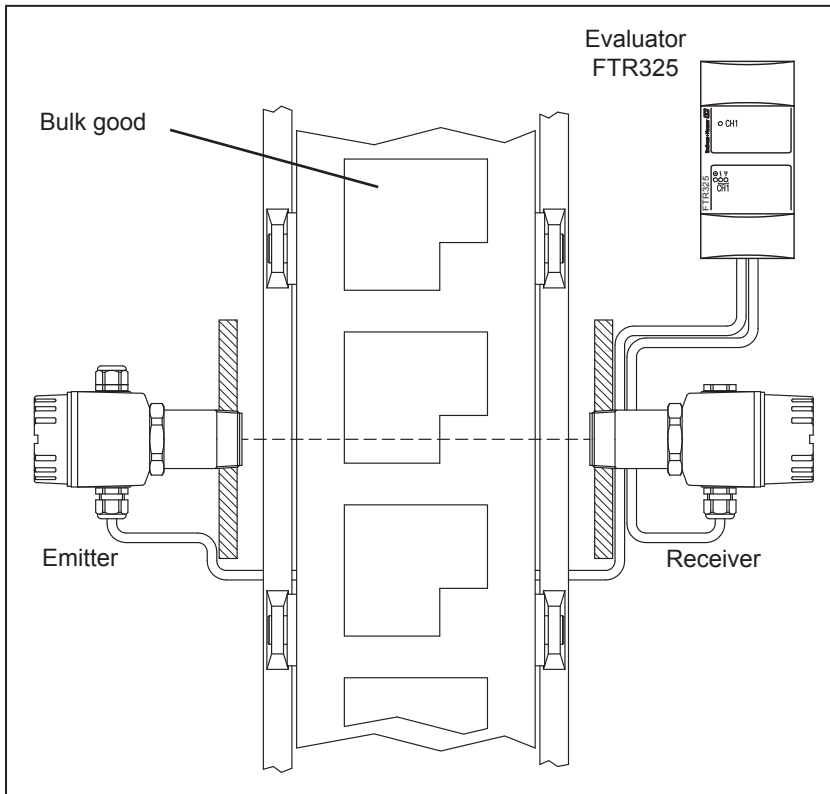


Note:

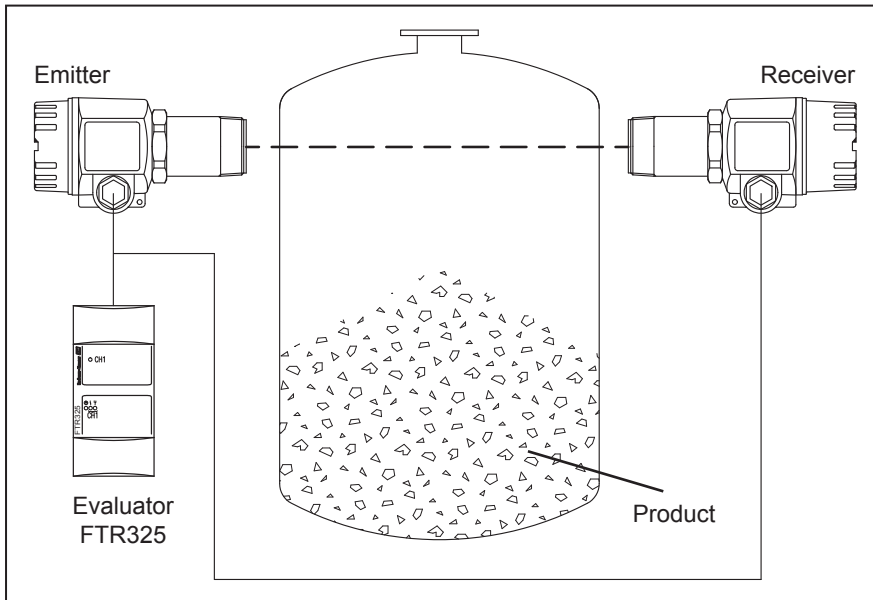
The values given in the diagram relate to optimum installation conditions and may vary depending on the actual installation situation. The spacing of the microwave barriers may have to be adjusted with installations in sealed metal containers, funnels, or similar, due to occurring reflections for example.

Installation examples

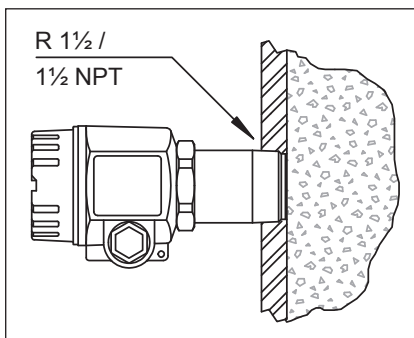
Example 1: Bulk counting



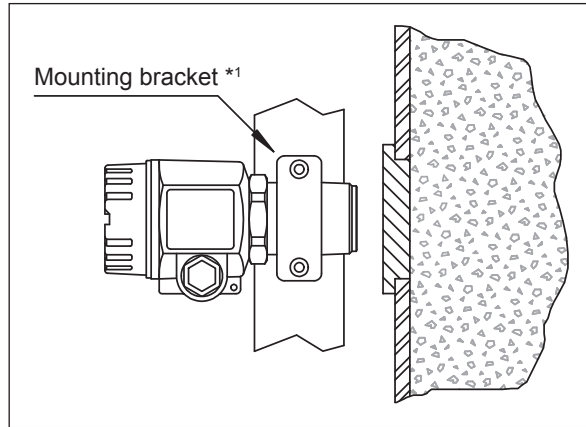
Example 2: Limit detection of bulk solids



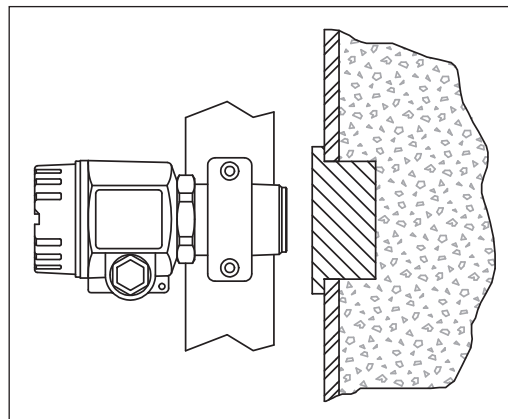
Direct installation with threaded connection



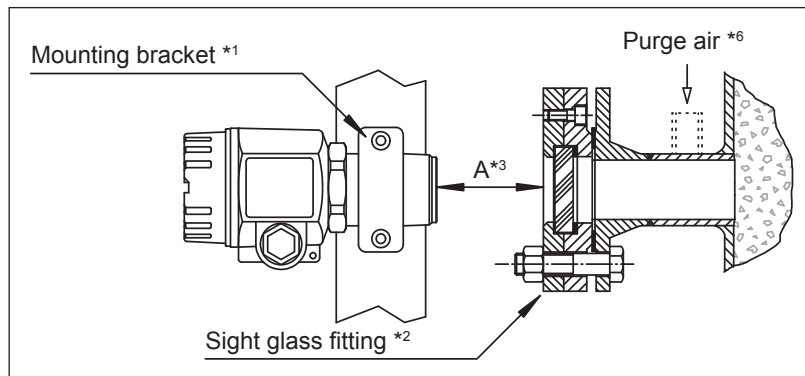
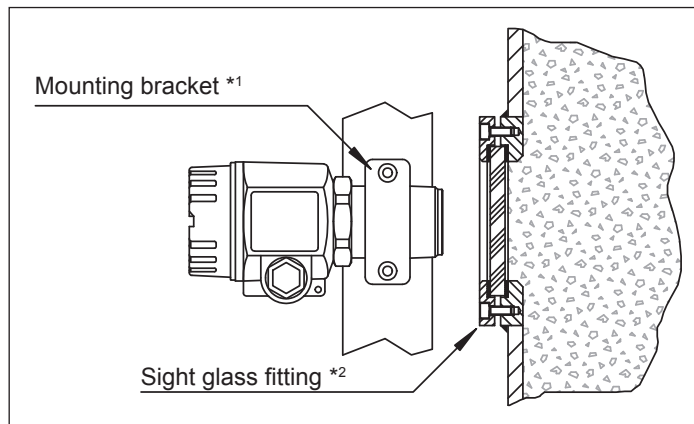
Bracket installation in front of microwave-permeable window



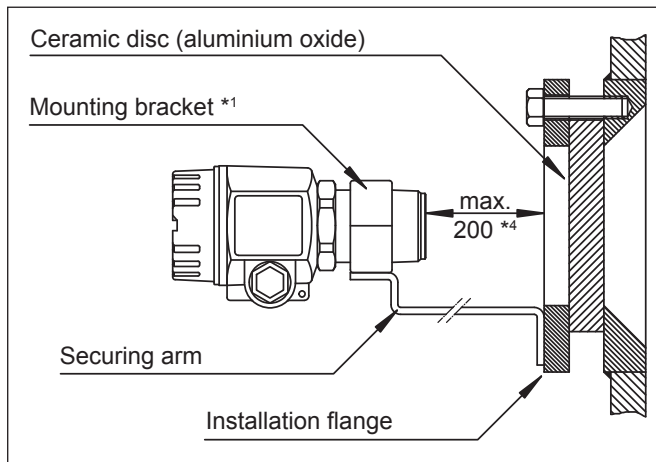
Bracket installation in front of microwave-permeable window with danger of condensation on the container's inner wall



Bracket installation in front of microwave-permeable sight glass fitting

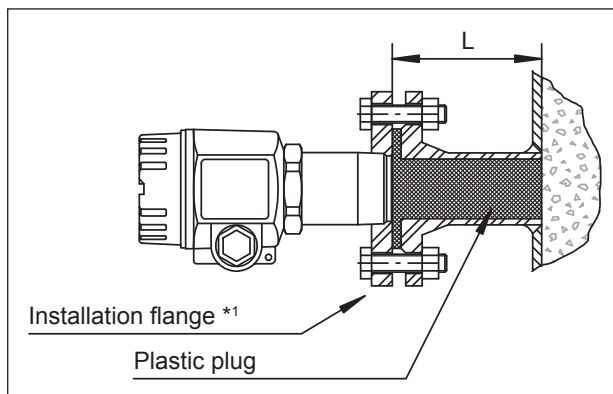


Angle installation on container



- *1 Suitable installation brackets are available as accessories, see "Accessories"
- *2 Suitable microwave-permeable sight glass fittings are available as accessories, see "Accessories"
- *3 The distance **A** depends on the nominal diameter of the sight glass fitting (or the diameter of the sight glass) and the temperature at the fitting. To prevent possible signal attenuation, we recommend keeping the distance as short as possible (e. g. max. 40 mm at DN50).
- *4 Distance for temperature reduction between the process temperature and max. 70°C at the microwave barrier
- *5 Various installation adapters (e. g. for angle installation) are available as special equipment packages.
- *6 We recommend using purge air to prevent fouling (material accumulation) in the nozzle that is open to the process. Alternatively, you can also close the nozzle using a plastic plug.

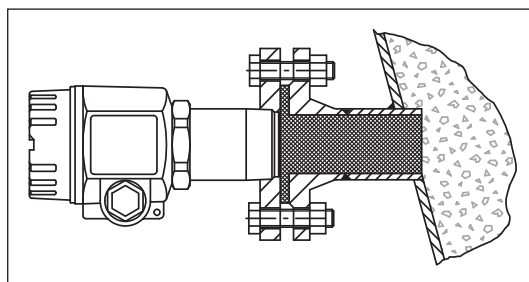
Flange mounting using screw-in flange



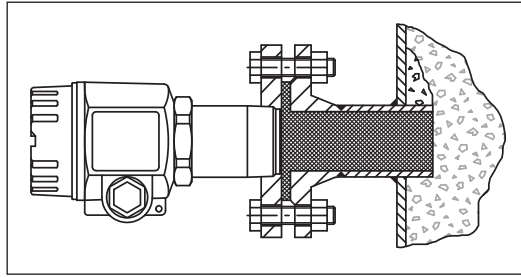
Note:

- The maximum length **L** depends on the dielectric constant and the water absorption of the plastic material. Observe the manufacturer's specifications.
- We recommend PTFE as the material, as this allows the length at the emitter and receiver to be up to 300 mm.
- For optimal orientation, the emitter and receiver should be able to be moved by ± 10 mm along their longitudinal axis.

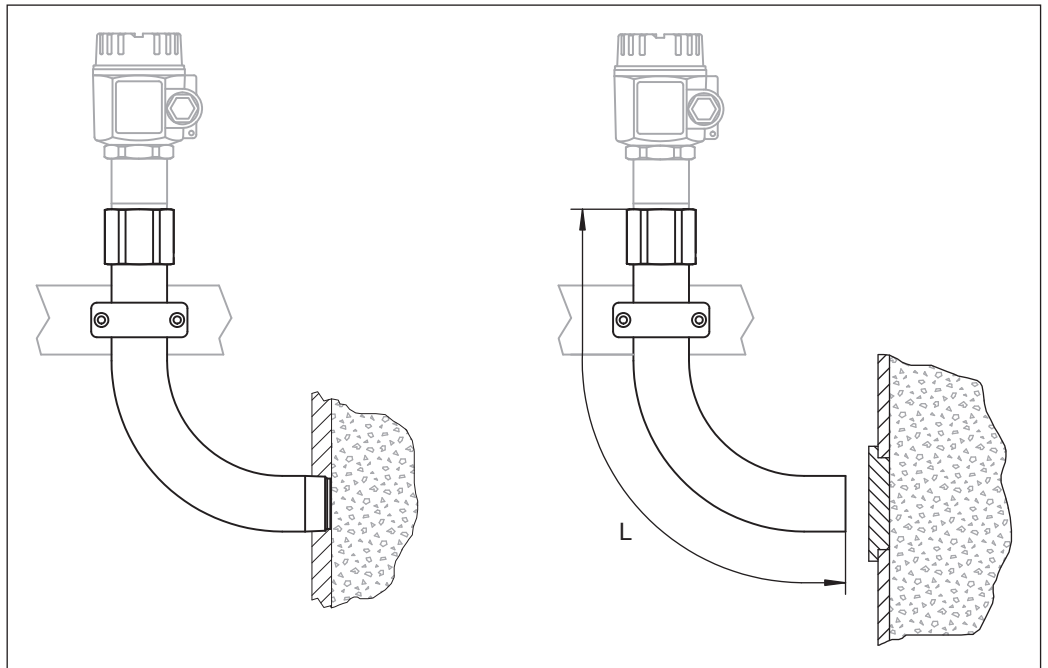
Flange mounting using screw-in flange for oblique conical containers



Flange mounting using screw-in flange with danger of build-up



Installation with pipe as wave guide

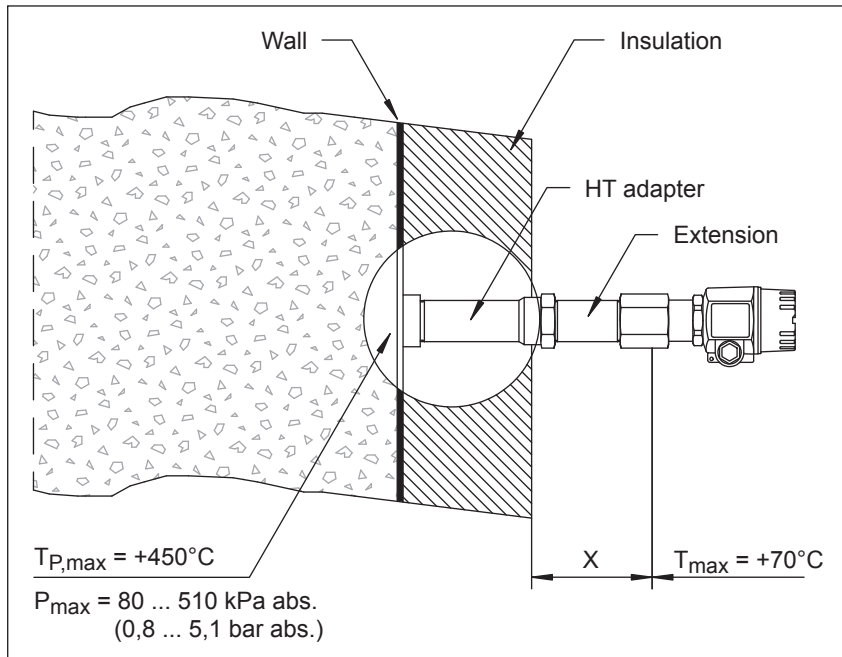


Note:

- This type of mounting is recommended if conditions at the process or in the area surrounding the process are unfavorable (such as high temperatures or heavy contamination) or if the building's situation does not permit direct installation.
- The pipe can be made of any desired metallic material, and the length **L** is unimportant due to the wave-guide effect.
- Edges inside the pipe (for example at transitions) can cause signal attenuation and thus should be avoided wherever possible.

High-temperature application

For applications with process temperatures up to +450°C, the temperature reduction to max. +70°C takes place on the microwave barrier with a corresponding high-temperature adapter (with extension where necessary). The length of the adapter is based on the insulation thickness to be penetrated (if present) and the ambient conditions at the measuring point.



Note:

- To maintain the maximum temperature of +70°C at the FQR50/FDR50, we recommend a minimum difference (**X**) of 200 mm between the process or the insulation and the devices.
- The individual extensions can also be combined in any way desired.
- We recommend the use of variants with a measuring range of max. 20 m, because each high-temperature adapter results in a reduction of the range.

Environment

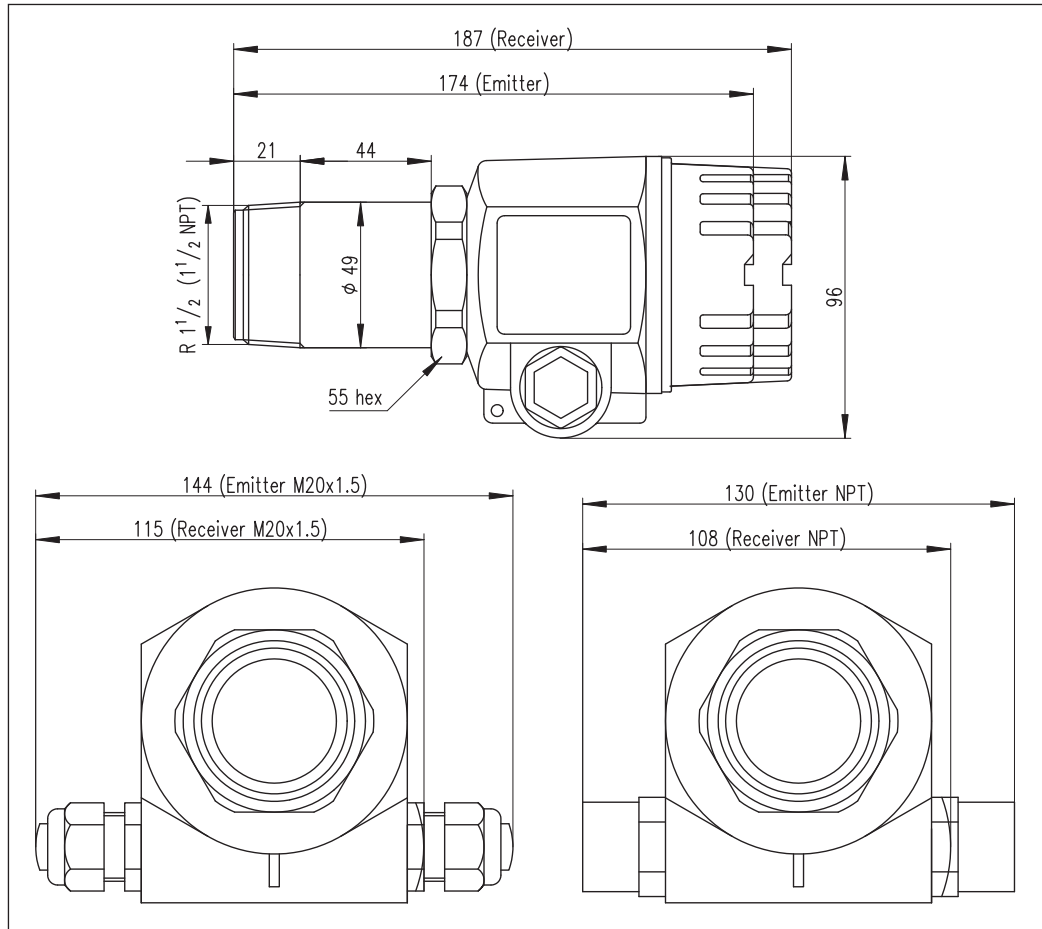
- Ambient temperature** ■ -20°C ... +70°C
- Storage temperature** ■ -40°C ... +80°C
- Degree of protection** ■ With closed housing: IP 66
■ With open housing: IP 20
- Electromagnetic compatibility (EMC)** ■ Interference Emission to EN 61326, Electrical Equipment Class B
■ Interference Immunity to EN 61326, Appendix A (Industrial)

Process

- Process temperature range** ■ -40°C to +70°C (without optional adapter for temperature reduction)
■ -40°C to +450°C (with optional adapter for temperature reduction, see "Accessories")
- Process pressure** ■ 80 to 480 kPa absolute (0.8 to 4.8 bar absolute)
(Applies only when FQR50 emitter or FDR50 receiver is installed directly in the process.)
■ 80 to 510 kPa absolute (0.8 to 5.1 bar absolute)
(Applies only when using the optional adapter for temperature reduction.)

Mechanical construction

Design, dimensions F18-housing (aluminium)



Weight

- 1.0 kg

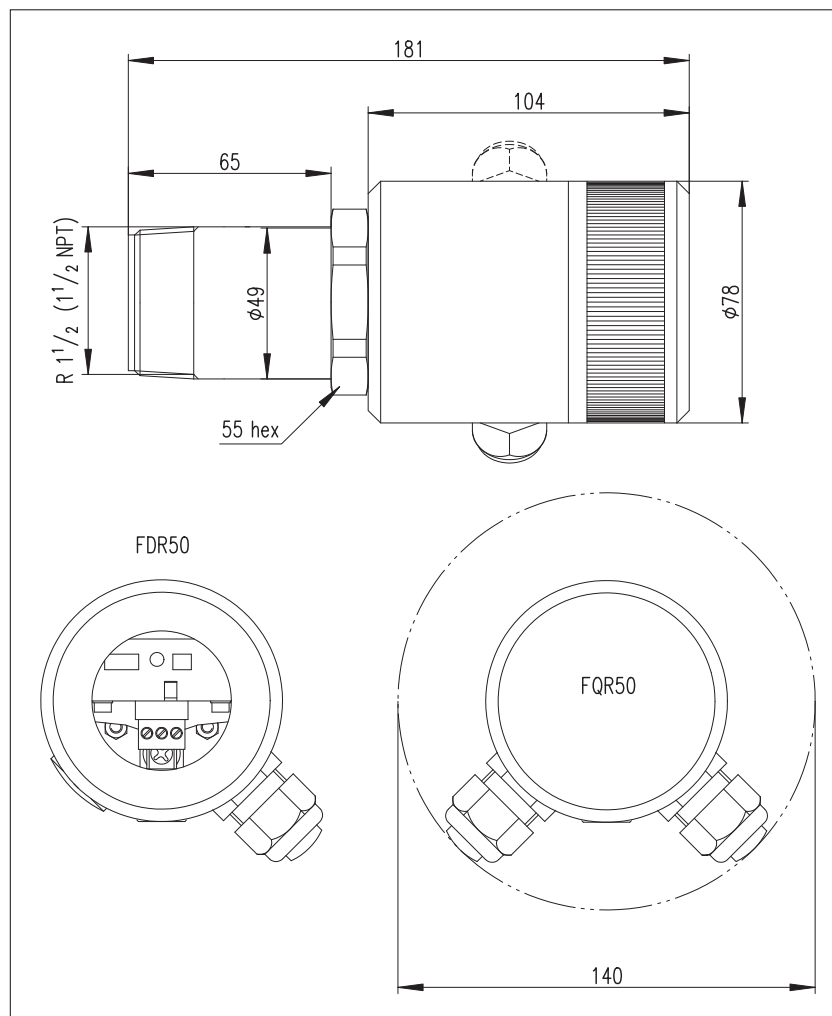
Materials

- Housing: Aluminium
- Process connection (fluid-wetted parts):
 - Stainless steel 316Ti/1.4571
 - Sensor diaphragm: PTFE
- Cable glands: PA

Process connection

- Thread R 1 1/2 (EN 10226) or
- 1 1/2 NPT (ANSI/ASME B1.20.1)

**Design, dimensions
(stainless steel housing)**



Weight

- 2.1 kg

Material

- Housing: Stainless steel 316Ti/1.4571
- Process connection (fluid-wetted parts):
 - Stainless steel 316Ti/1.4571
 - Sensor diaphragm: PTFE
- Cable glands: PA

Process connection

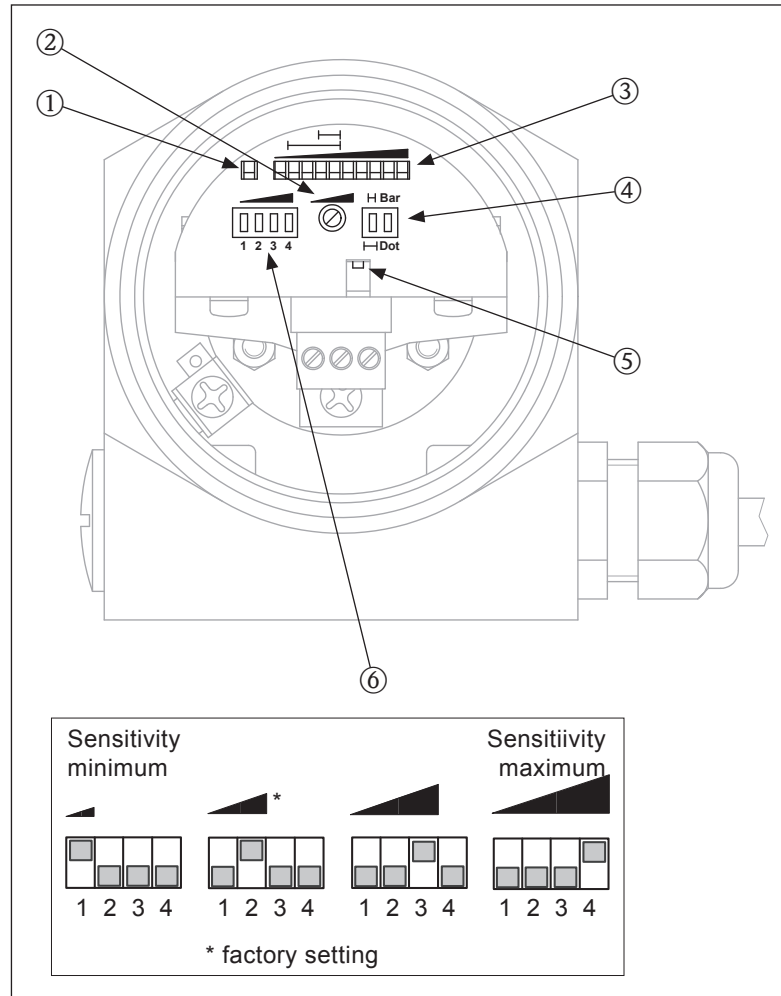
- Thread R 1 1/2 (EN 10226) or
- 1 1/2 NPT (ANSI/ASME B1.20.1)

Human interface

By using frequencies in the 24 GHz range it is possible to detect products having low attenuation even with low amounts of bulk product between the emitter and the receiver. The calibration options of the units offer the necessary flexibility to be able to adjust the barrier to individual situations easily.

- Rough/fine calibration (⑥, ②)
- Hysteresis ④ selected in 2 stages
- LED field strength is displayed as an adjustment and positioning aid
- LED for the switching output ① and for operation status ③ (supply voltage is present)

Display and operating elements (Receiver)



The microwave barrier Soliwave M is calibrated using 4 DIP switches for rough calibration ⑥ and a potentiometer for fine calibration ② on the attenuation necessary for unambiguous product recognition. When there is sufficient attenuation or when the microwaves are interrupted by the product, the receiver reacts with an output (LED ①) on the through connection to the external evaluator FTR325. Field status and operation status are indicated on the spot either by a bar graph or by a dot display ③ (switchable by ④).

- High sensitivity can be set for the detection of materials with a very high dielectric constant or of metals because then the beam is attenuated strongly enough or covered.
- The sensitivity has to be adjusted precisely for the detection of materials with a low dielectric constant.

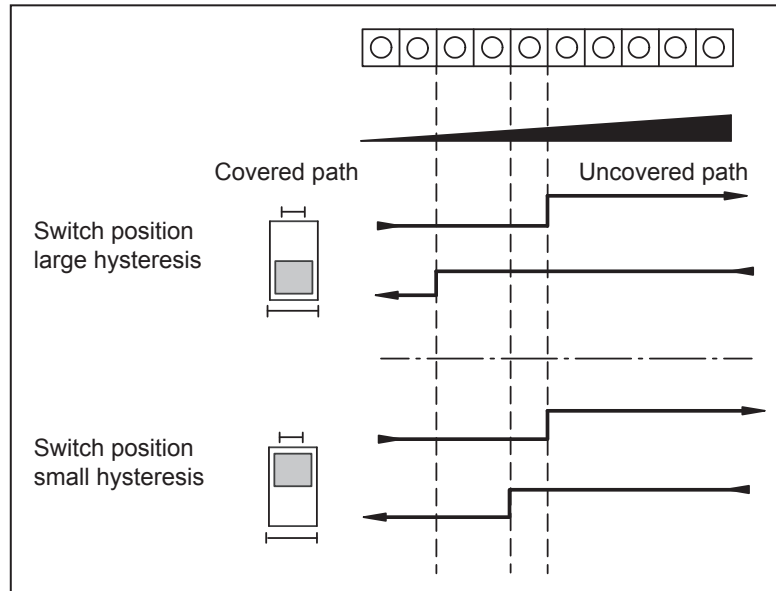
**Calibration with covered path
(switching point reached)**

- The sensitivity of the microwave receiver FDR50 is to be adjusted in such a way that none, as a maximum however the first two LEDs in the LED line light up. If this should not be the case, the sensitivity is to be reduced appropriately.
- With the path uncovered, LED 6 must light up in the LED line as a minimum.

**Calibration with free path
(switching point not reached)**

- The sensitivity of the receiver FDR50 must be adjusted in such a way that as a maximum LED 10 just starts to light up, but at least LED 6 in the LED line must light up.
- With the path covered, only LED 3 must light up in the LED line at the most.
- After a few filling procedures, the sensitivity should be readjusted, if necessary, with the path covered.

Configuration of the hysteresis



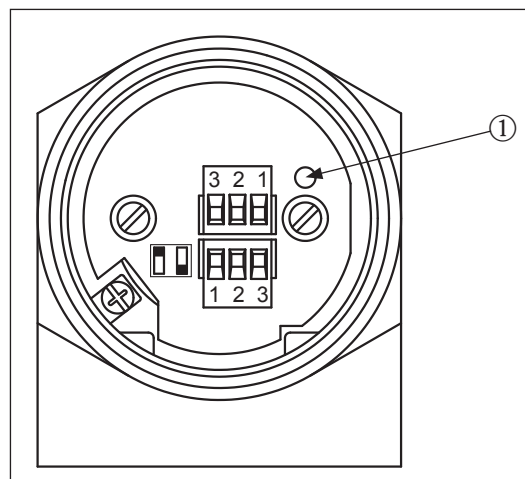
**Calibration in applications
with very low attenuation**

Example: Paper shred

Setting up with covered path

- Reduce hysteresis:
 - adjust switch
- Adjust sensitivity:
 - change the rough and fine calibration so that the LEDs 1 to 3 in the LED line light up.

**Display and operating
elements (emitter)**



The emitter FQR50 has a green LED ①, that signals the operating status (supply voltage present).

Certificates and approvals

CE approval

The Soliwave M microwave barrier is in conformity with the statutory requirements of the EC Directives. The manufacturer confirms successful testing of the device by affixing to it the CE mark.

Ex approval

ATEX II 1/2D Ex iaD 20/21 IP66 T98°C	(Certification number: BVS 07 ATEX E 148 X)
ATEX II 1/2G Ex ia IIC T4	(Certification number: BVS 07 ATEX E 148 X)
IECEX Zone 0/1 Ex ia IIC T4	(Certification number: IECEX BVS 09.0007X)
IECEX Ex iaD 20/21 IP66 T98°C	(Certification number: IECEX BVS 09.0007X)

Radio certification

R&TTE according to EN 300440-2
FCC [FCC ID UAS-FQR50]

Other standards and guidelines

Directive 1999/05/EC Article 3.1 (a) and 3.1 (b) and the included Directives 73/23/EEC and 89/336/EEC

Ordering information

Ordering information Receiver FDR50 / Emitter FQR50

10	Approval:		
	C	ATEX II 1/2G Ex ia IIC T4 ATEX II 1/2D Ex iaD 20/21 IP66 T98°C	
	D	IECEX Zone 0/1 Ex ia IIC T4 IECEX Ex iaD 20/21 IP66 T98°C	
	Y	Special version, to be specified	
20	Distance emitter/receiver:		
	1	Measuring range * ¹ maximum 8 m	
	2	Measuring range * ¹ maximum 20 m	
	9	Special version, to be specified	
30	Process connection and material:		
	R	Thread R 1½ EN10226, stainless steel 316Ti	
	S	Thread 1½ NPT ANSI/ASME, stainless steel 316Ti	
	Y	Special version, to be specified	
40	Housing and cable entry:		
	D	Aluminium F18-housing IP66, M20x1.5	
	F	Aluminium F18-housing IP66, ½ NPT	
	G	Stainless steel 316Ti, IP66, M20x1.5	
	H	Stainless steel 316Ti, IP66, ½ NPT	
	Y	Special version, to be specified	
50	Optional features:		
	A	Basic equipment	
	Y	Special version, to be specified	

FDR50/FDR50 -

*¹ Please select the same version for emitter FQR50 and receiver FDR50

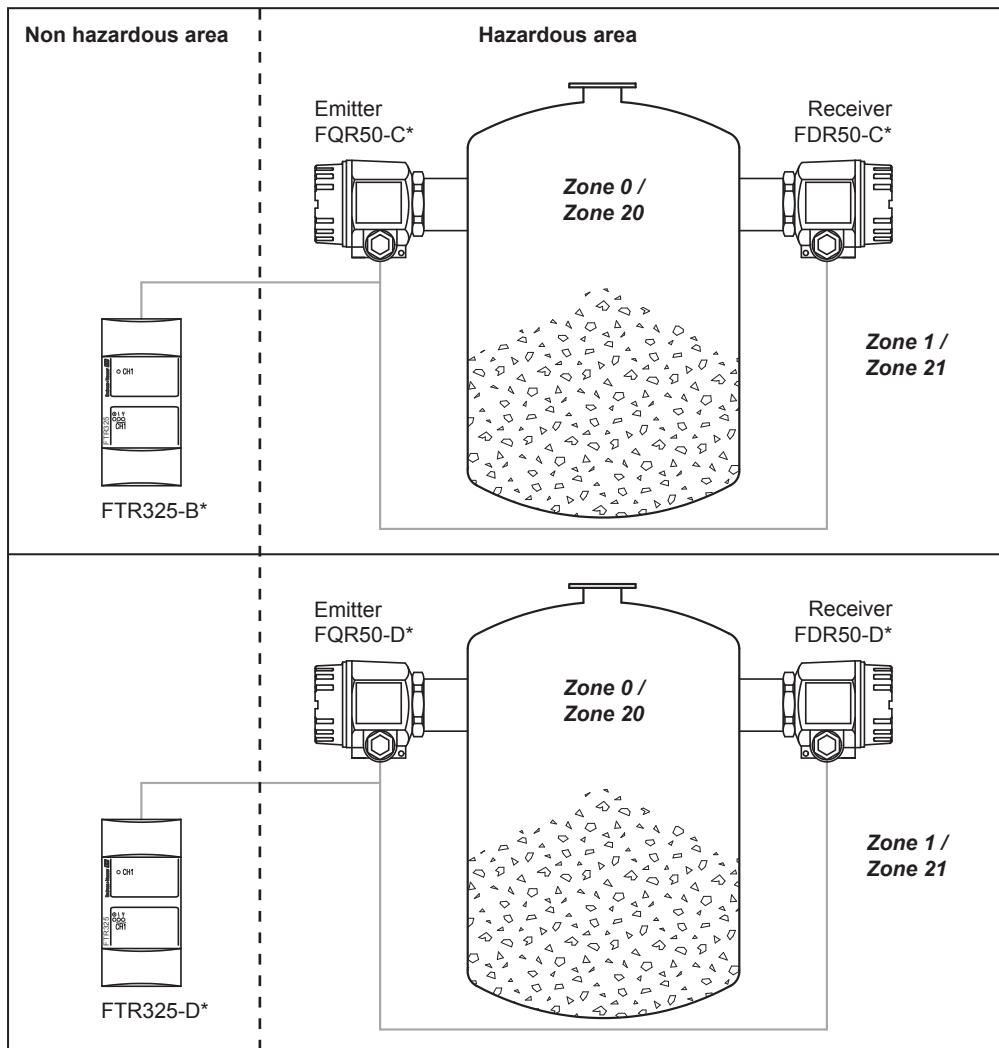
Comments regarding the product structure

Only the following device combinations are possible:

- FQR50/FDR50-C* with FTR325-B*
- FQR50/FDR50-D* with FTR325-D*

Safety instructions

Zone classification



General safety instructions for electrical equipment for hazardous areas

- Install it according to manufacturer's specifications and the standards and regulations applicable in your area.
- Installation, electrical connection, commissioning, operation and, if necessary, maintenance may be carried out only by trained specialists authorized to do so by the facility's owner-operator.
- Do not operate the devices of the microwave barrier outside of the electrical, thermal or mechanical characteristic quantities.
- Seal unused entry glands with approved sealing plugs that correspond to the type of protection. The plastic transportation plug does not meet this requirement and must therefore be changed during the installation process.
- For additional safety instructions, refer to the XA00219F (FQR50/FDR50-C*) or XA00484F (FQR50/FDR50-D*).

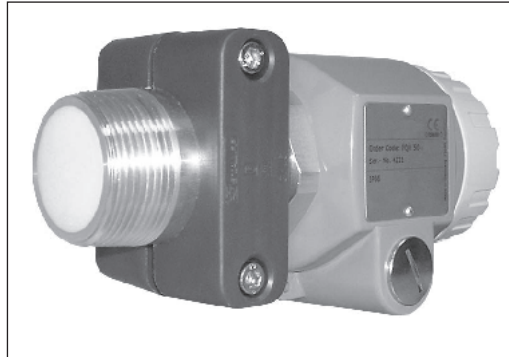
Specific safety instructions

- The emitter/receiver unit FQR50/FDR50-C* may only be combined with the Nivotester FTR325-B*.
- The emitter/receiver unit FQR50/FDR50-D* may only be combined with the Nivotester FTR325-D*.

Accessories

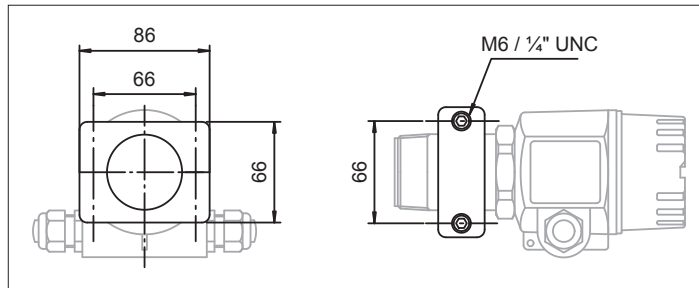
Mounting bracket

The FQR50 emitter and FDR50 receiver can be easily installed on existing frames using a mounting bracket.



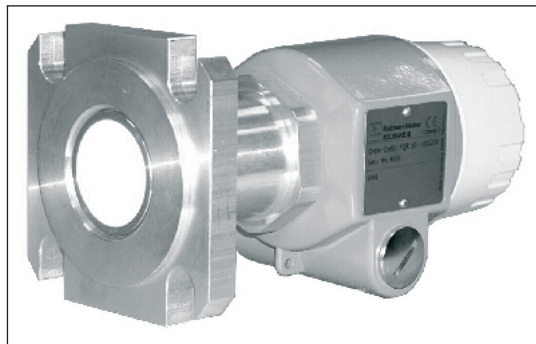
Mounting bracket for frame mounting

- Aluminum material: Part number 52017501
- Plastic material: Part number 52017502



Adapter flange

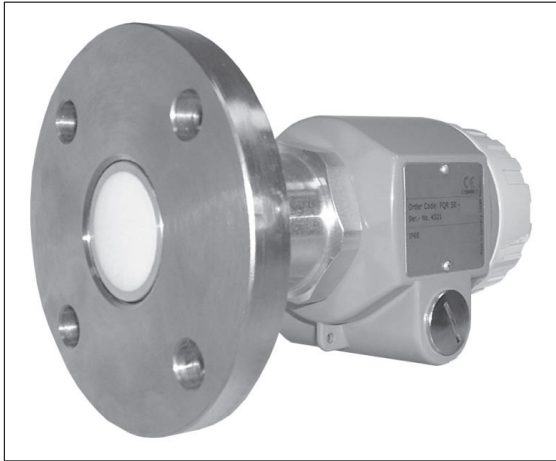
The screw assembly of the microwave barrier Soliwave M is possible by an aluminium adapter flange (directly compatible to the microwave barrier QR30/DR30) or by a DIN flange.



Adapter flange (directly compatible to the microwave barrier QR30/DR30)

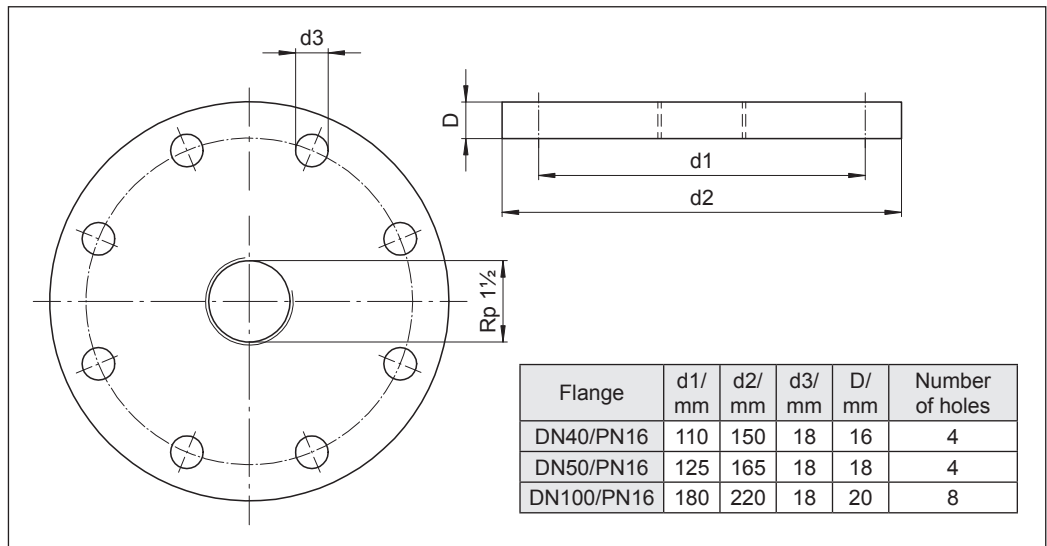
- DN 40 PN 6, connection dimensions according to DIN EN 1092-1, material aluminium, with Rp 1½ thread: Part number 71006345
- 1½" 150 lbs, connection dimensions according to ANSI/ASME B16.5, material aluminium, with 1½ NPT thread: Part number 71006346

**Installation flanges, material:
316Ti (stainless steel)**



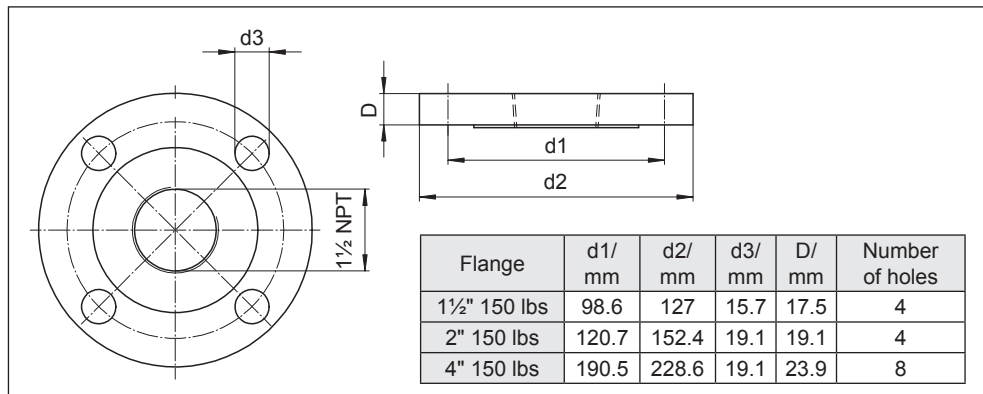
Connection dimensions to DIN EN 1092-1, with Rp 1½ internal thread:

- DN40 PN16 with inspection certificate to EN 10204-3.1 Part number 71006348
- DN50 PN16 with inspection certificate to EN 10204-3.1 Part number 71006350
- DN100 PN16 with inspection certificate to EN 10204-3.1 Part number 71006352



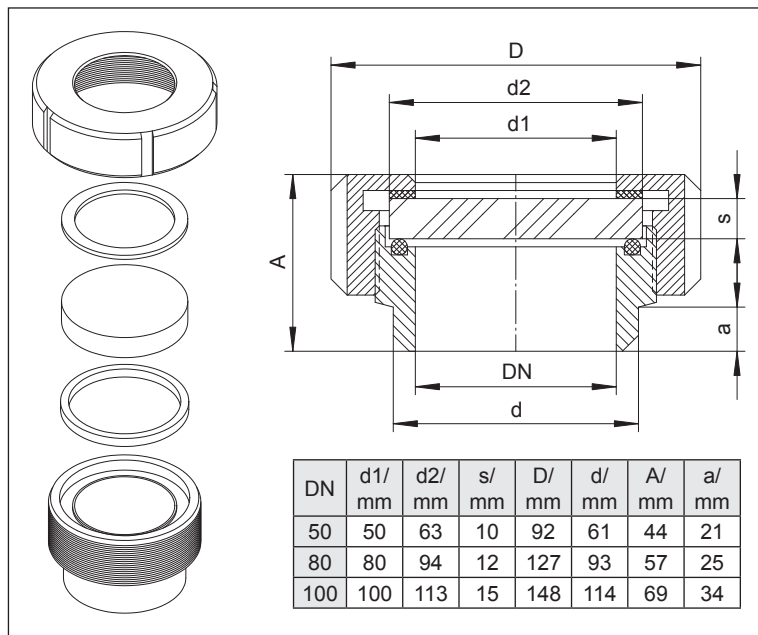
Connection dimensions to ANSI/ASME B16.5, with 1½ NPT internal thread:

- 1½" 150 lbs with inspection certificate to EN 10204-3.1 Part number 71006349
- 2" 150 lbs with inspection certificate to EN 10204-3.1 Part number 71006351
- 4" 150 lbs with inspection certificate to EN 10204-3.1 Part number 71006353



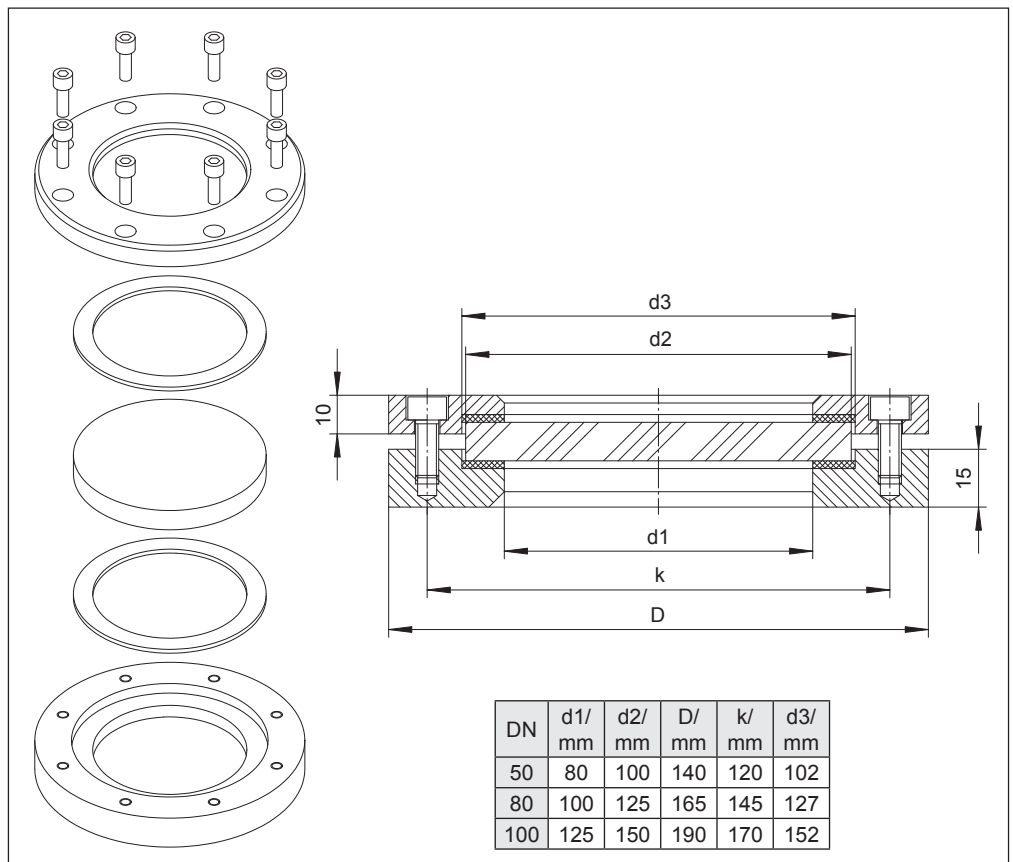
Sight glass fitting

Screw-type fitting similar to DIN 11851, materials: stainless steel 304, silicone and C4400, Pmax = 600 kPa (6 bar), Tmax = 200°C, borosilicate glass, screw-on installation, thread adapter nut



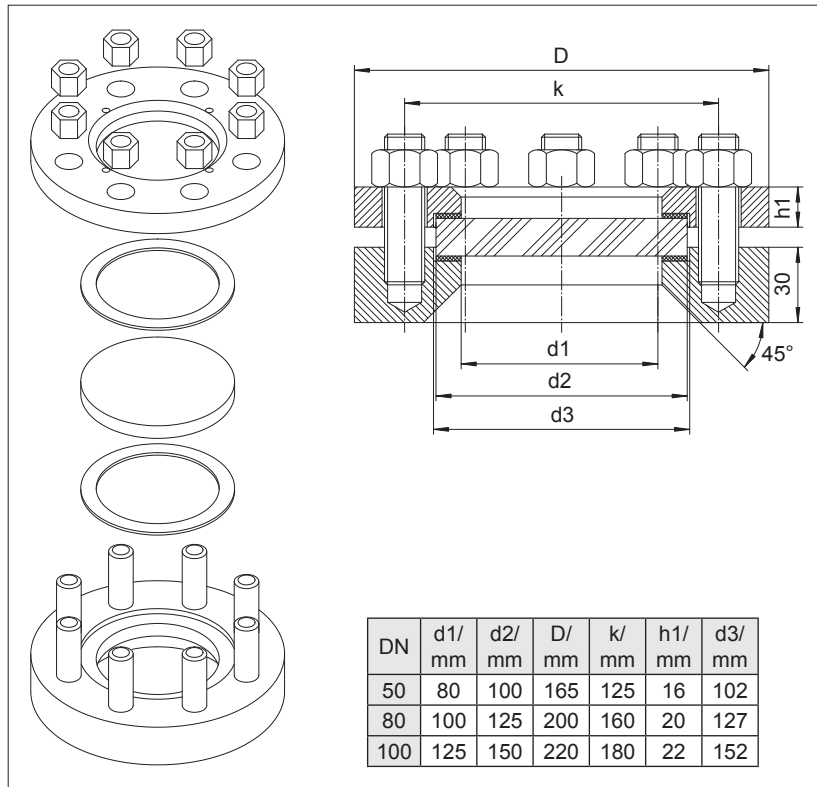
- DN 50 Part number 71026440
- DN 80 Part number 71026441
- DN 100 Part number 71026442

Weld-in fitting for unpressurized containers, materials: stainless steel 316Ti and silicone, Tmax = 200°C, borosilicate glass, screw-on installation



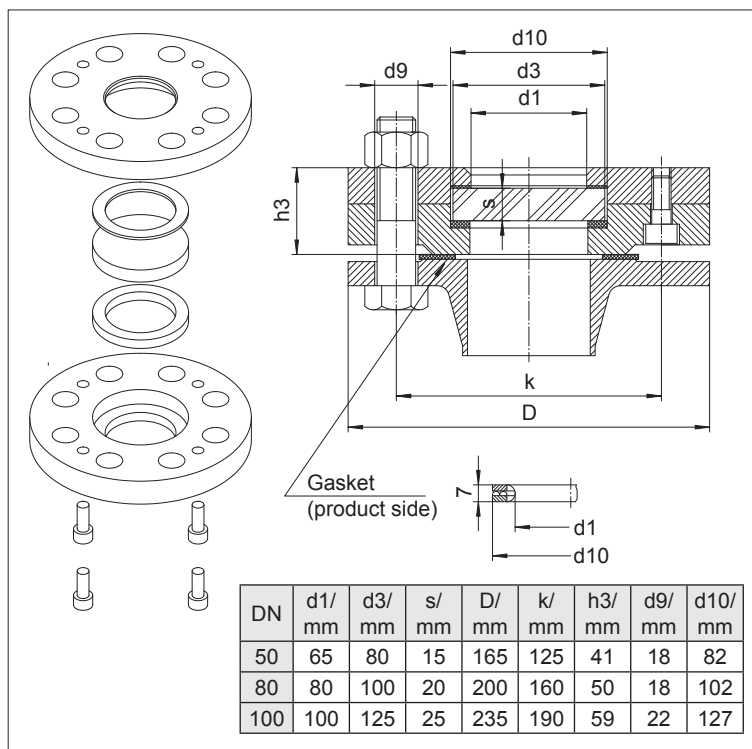
- DN 50 Part number 71026443
- DN 80 Part number 71026444
- DN 100 Part number 71026445

Weld-in fitting to DIN 28120, materials: stainless steel 316Ti/321 and silicone, Pmax = 1 MPa (10 bar), Tmax = 200°C, borosilicate glass, screw-on installation



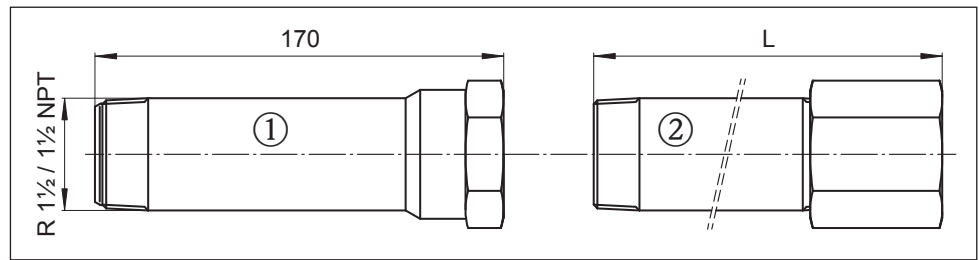
- DN 50 Part number 71026446
- DN 80 Part number 71026447
- DN 100 Part number 71026448

Flange fitting to DIN 28121 for screwing onto existing counterflanges, materials: stainless steel 316Ti, PTFE and C4400, Pmax = 2.5 MPa (25 bar), Tmax = 200°C, borosilicate glass



- DN 50 Part number 71026449
- DN 80 Part number 71026450
- DN 100 Part number 71026451

HT adapter and extension



HT adapter ① with flush-mounted ceramic disk:

- Thread R 1½ or Rp 1½, 55mm hex, 316Ti/1.4571
Part number 71113441
- Thread 1½ NPT, 55mm hex, 316Ti/1.4571
Part number 71113449

Extension for HT adapter ②:

- Thread R 1½ or Rp 1½, 55mm hex, 316Ti/1.4571
 - L = 225 mm Part number 71113450
 - L = 325 mm Part number 71113451
 - L = 525 mm Part number 71113452
- Thread 1½ NPT, 55mm hex, 316Ti/1.4571
 - L = 225 mm Part number 71113453
 - L = 325 mm Part number 71113454
 - L = 525 mm Part number 71113455

Documentation

Operating instructions (KA)	Soliwave M FQR50/FDR50 KA00206F/97/A6 Nivotester FTR325 KA00205F/97/A6
Technical informations	Nivotester FTR325 TI00377F/97/EN
Safety instructions	Soliwave M FQR50/FDR50-C* with the Nivotester FTR325-B* XA00219F/97/A3 Soliwave M FQR50/FDR50-D* with the Nivotester FTR325-D* XA00484F/97/EN

Subject to modification

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