



Level



Pressure



Flow



Temperature



Liquid
Analysis



Registration



Systems
Components



Services

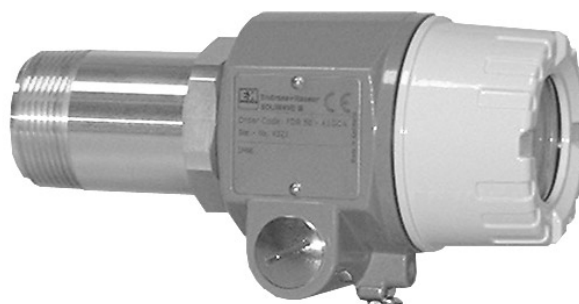
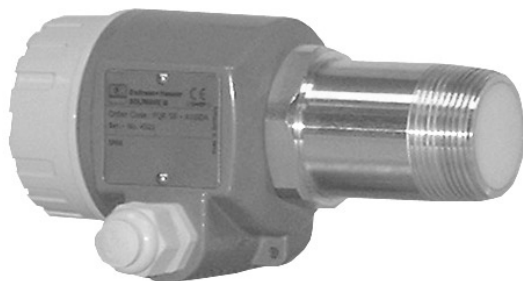


Solutions

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 1 ½ - or 1 ½ NPT - thread
- Conforms to ATEX II 1/2 D and ATEX II 1/2 G

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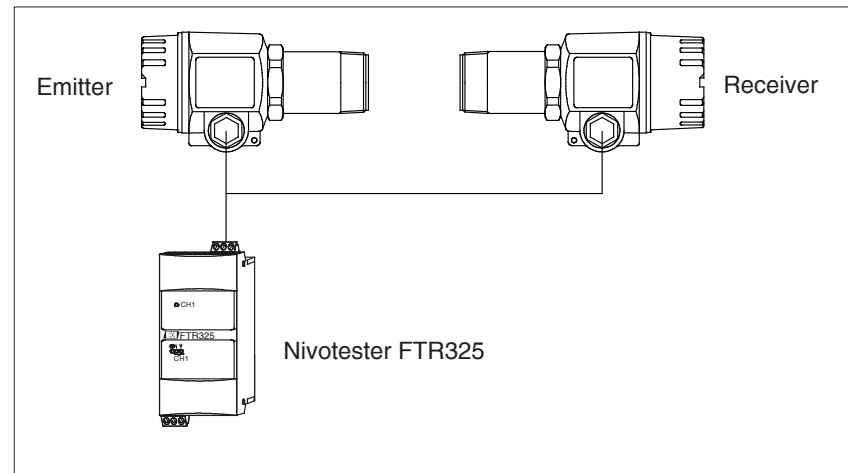
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Function and system design

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.



Microwave barrier FQR50 / FDR50 with Nivotester FTR325

Measuring device

The complete measuring system for limit detection consists of:

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

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

Note:

The Nivotester FTR471 is no longer available, it has been replaced by the FTR325.

Equipment combinations

The emitter and receiver unit FQR50/FDR50-A* and -B* respectively of the microwave barrier Soliwave M (non hazardous area and ATEX II 1/2 D respectively) may be combined with selected earlier equipment components. You may use the Nivotester FTR471, but only with the Nivotester FTR325 you can use the extended functionality.

The emitter and receiver unit FQR50/FDR50-C* (ATEX II 1/2 GD) may only be combined with the Nivotester FTR325-B* (intrinsically safe circuit).

The following equipment combinations are possible:

- | | |
|---------------------------------------|--|
| ■ FQR50/FDR50-A* (non hazardous area) | with FTR325-A* (non hazardous area) and FTR471 |
| ■ FQR50/FDR50-B* (ATEX II 1/2 D) | with FTR325-A* (non hazardous area) and FTR471 |
| ■ FQR50/FDR50-C* (ATEX II 1/2 GD) | with FTR325-B* (ATEX II (1) GD) |
| ■ FQR50-A*/DR30 | with FTR471 |
| ■ QR30/FDR50-A* | with FTR471 |

The following equipment combinations are **impossible**:

- | | |
|---------------------------------------|-------------------------------------|
| ■ FQR50/FDR50-A* (non hazardous area) | with FTR325-B* (ATEX II (1) GD) |
| ■ FQR50/FDR50-B* (ATEX II 1/2 D) | with FTR325-B* (ATEX II (1) GD) |
| ■ FQR50/FDR50-C* (ATEX II 1/2 GD) | with FTR325-A* (non hazardous area) |
| ■ FQR50/DR30 | with FTR325 |
| ■ QR30/FDR50 | with FTR325 |
| ■ FQR50/DR10 | with FTR325 and FTR471 |
| ■ QR10/FDR50 | with FTR325 and FTR471 |

Characteristics

Measuring variables	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). ■ 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!
Switching frequency FDR50	max. 2 Hz

Configurations

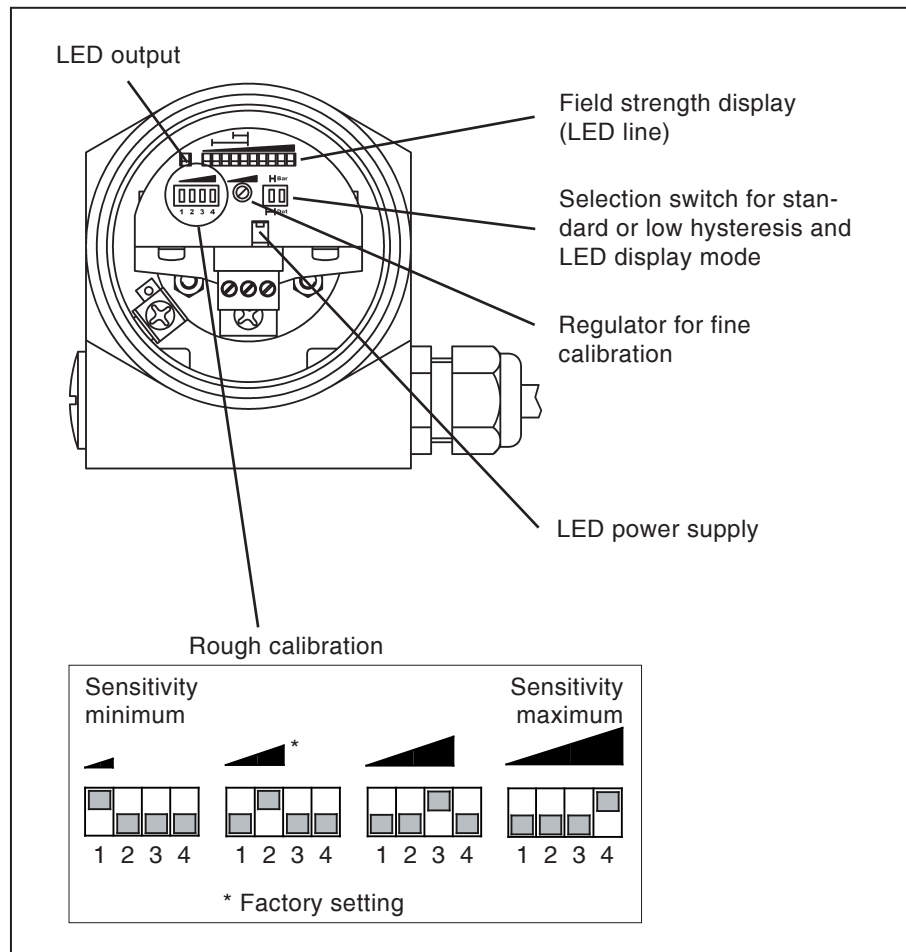
By using frequencies in the 24 GHz range it is possible to detect products having low attenuation even with low amounts of bulk product between the emitter and the receiver. The calibration options of the units offer the necessary flexibility to be able to adjust the barrier to individual situations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

- Rough/fine calibration
- Hysteresis selected in 2 stages
- LED field strength is displayed as an adjustment and positioning aid

Sensitivity adjustment

The microwave barrier Soliwave M is calibrated using 4 DIP switches for rough calibration and a potentiometer for fine calibration 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 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.

- 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.



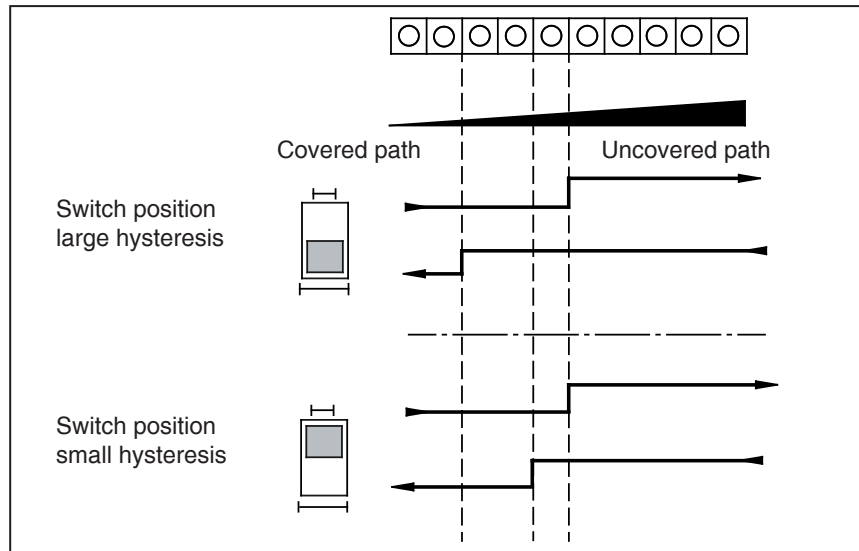
Sensitivity adjustments at FDR50 receiver

**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***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.

Auxiliary energy

Electrical connection

The FQR50 emitter and the FDR50 receiver of the microwave barrier Soliwave M are linked with the Nivotester FTR325 via a three-conductor shielded cable.

Note:

The Nivotester FTR471 is no longer available, it will be replaced by the FTR325.

The microwave barrier may optionally be wired in a ring or in a star connection. The necessary auxiliary energy is provided by the FTR325 evaluator.

Note:

The Nivotester FTR325-B* provides an intrinsically safe supply voltage for the FQR50-C* emitter and the FDR50-C* receiver.

This device may only be combined with the associated emitter and receiver (see page 3 "Equipment combinations")!

Cable entry

- Cable entry:
M20 x 1.5 or ½ NPT
 - Cable gland (included in delivery)
 - Emitter FQR50: 2
 - Receiver FDR50: 1
 - Enclosure: IP 66
-

Cable specification

FQR50/FDR50-A* (non hazardous area) and FQR50/FDR50-B* (explosive dust atmospheres) with FTR325-A*:

- Off-the-shelf installation cable, 3-conductor, shielded
- Line resistance maximum 25 Ω per wire

Example cable length

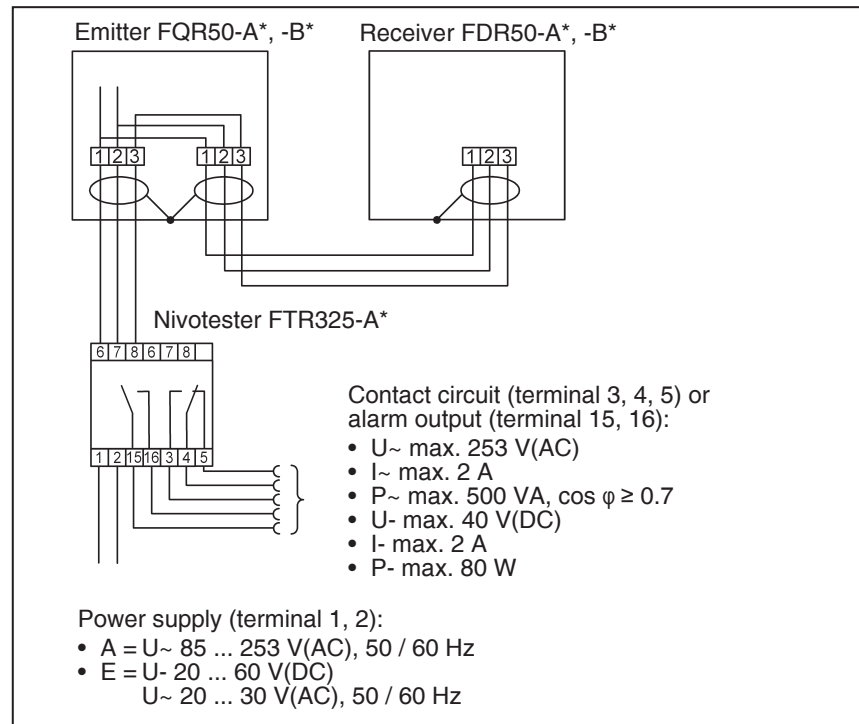
Copper cable, specific resistance $\rho = 0.0172 \Omega\text{mm}^2/\text{m}$, cross section 0.75mm^2
The maximum cable length is 1090 m.

FQR50/FDR50-C* (explosive gas/dust atmospheres, intrinsically safe) with FTR325-B*:

- Off-the-shelf installation cable, 3-conductor, non-shielded
- 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

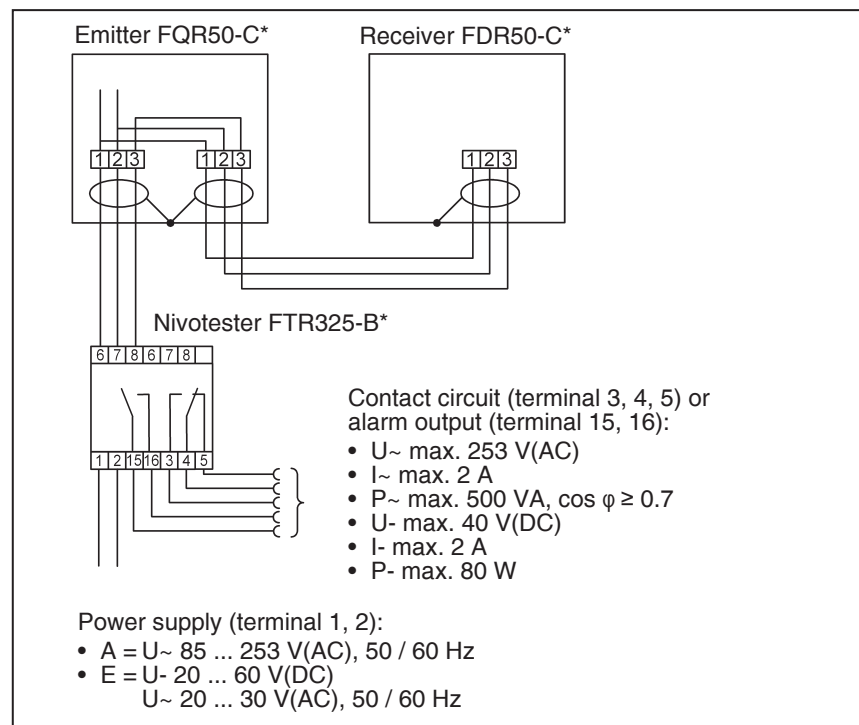
Wiring

Wiring example 1 (non hazardous area/explosive dust atmospheres):

Soliwave M FQR50/FDR50-A* and -B* microwave barrier with Nivotester FTR325-A* for rail mounting in ring wiring

Ring wiring FQR50/FDR50-A*, -B* with the FTR325-A*

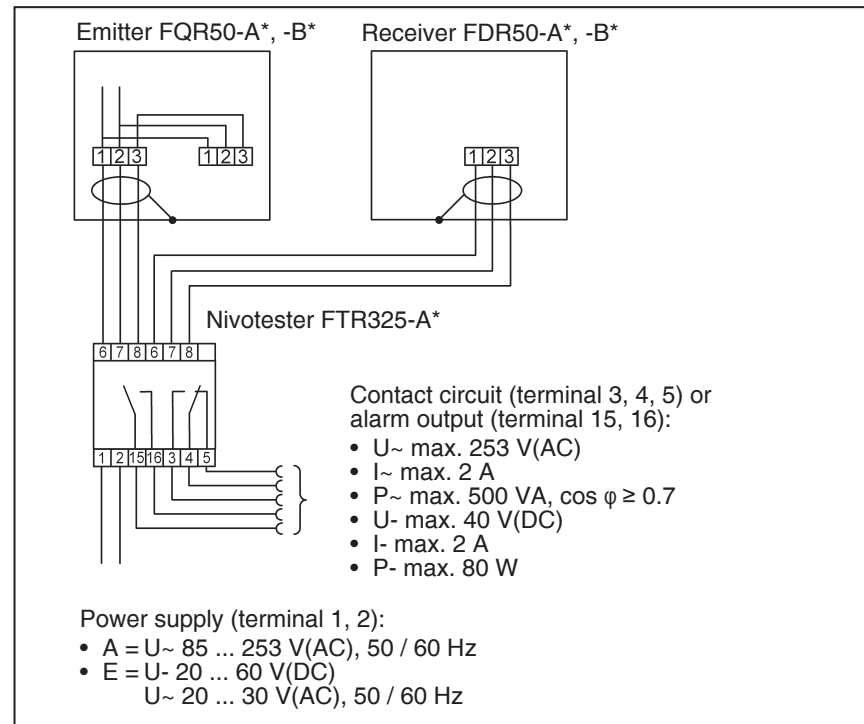
Wiring example 2 (explosive gas/dust atmospheres, intrinsically safe):

Soliwave M FQR50/FDR50-C* microwave barrier with Nivotester FTR325-B* for rail mounting in ring wiring

Ring wiring FQR50/FDR50-C* with the FTR325-B*

Wiring example 3 (non hazardous area/explosive dust atmospheres):

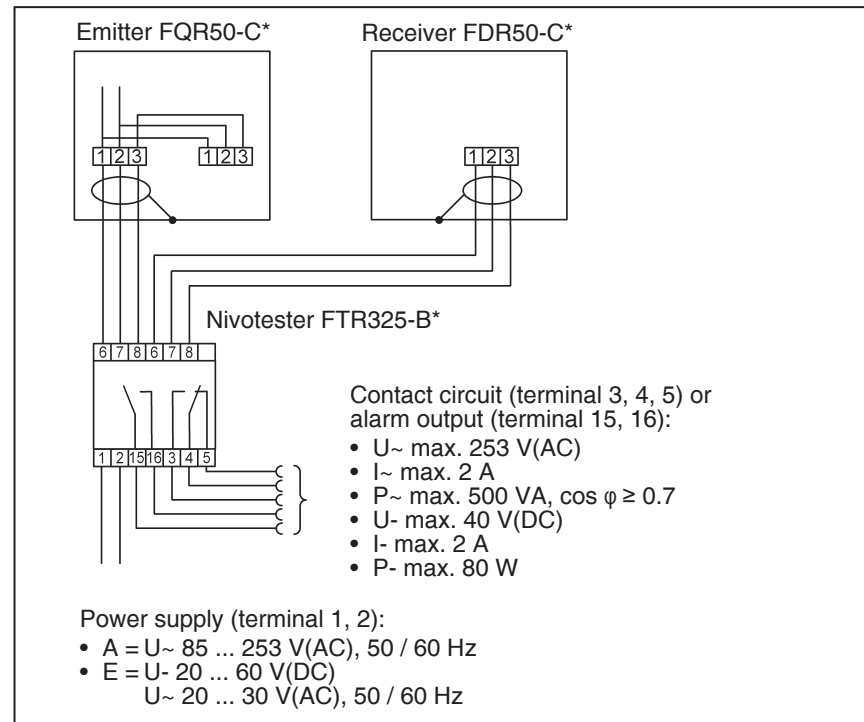
Soliwave M FQR50/FDR50-A* and -B* microwave barrier with Nivotester FTR325-A* for rail mounting in star wiring



Star wiring FQR50/FDR50-A*, -B* with the FTR325-A*

Wiring example 4 (explosive gas/dust atmospheres, intrinsically safe):

Soliwave M FQR50/FDR50-C* microwave barrier with Nivotester FTR325-B* for rail mounting in star wiring



Star wiring FQR50/FDR50-C* with the FTR325-B*

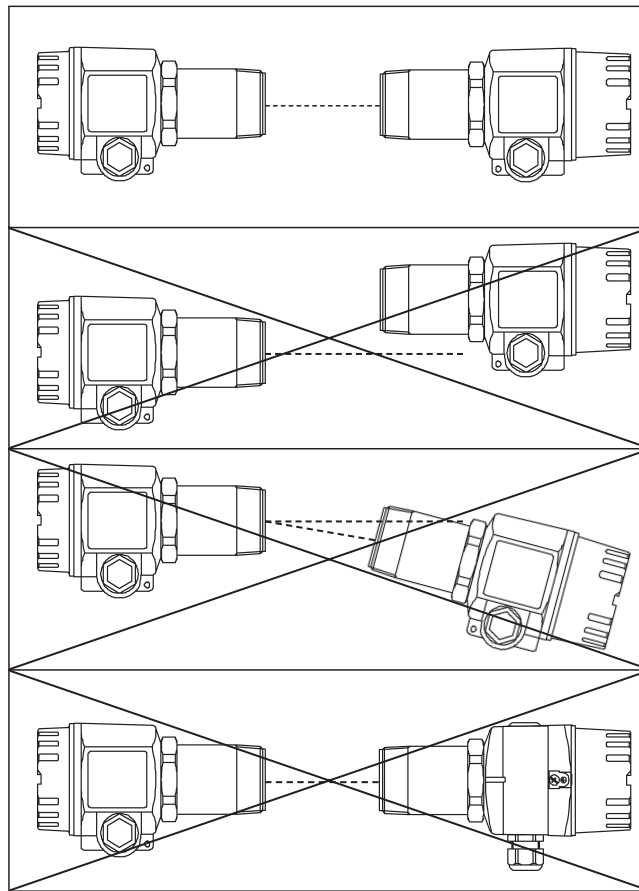
Operating conditions

Installation note

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 "Assembly with bracket" on page 15).



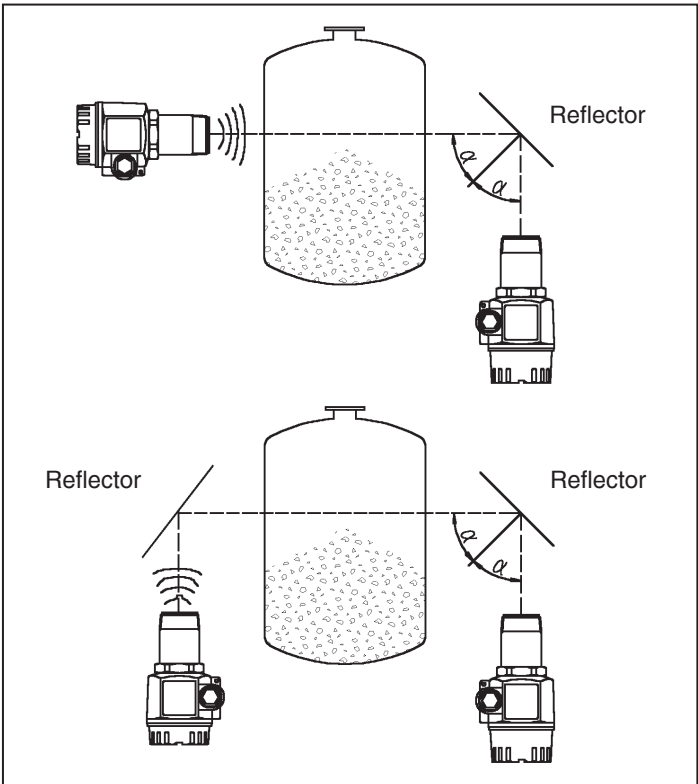
Installation note

Minimum distance from emitter to receiver

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

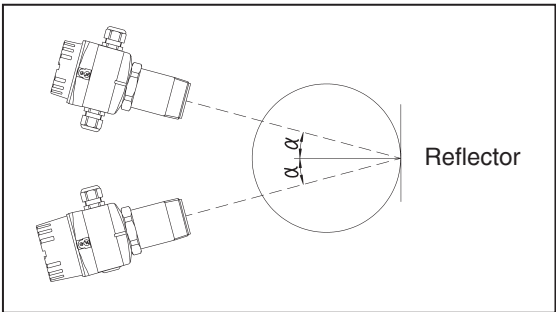
Installation using reflectors

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.



Example for using reflectors

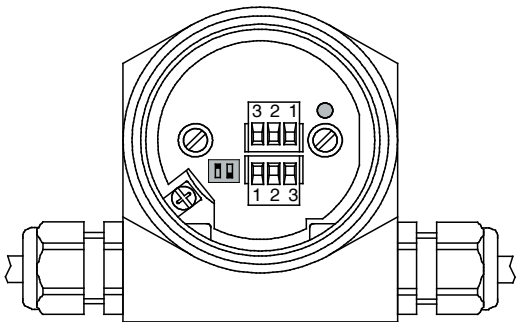
Please make sure that FQR50 emitter and FDR50 receiver are placed at symmetrical angles toward the reflector (entry angle = exit angle), since otherwise the receiver will get no evaluable signal.



Arrangement emitter and receiver to the reflector

Parallel operation

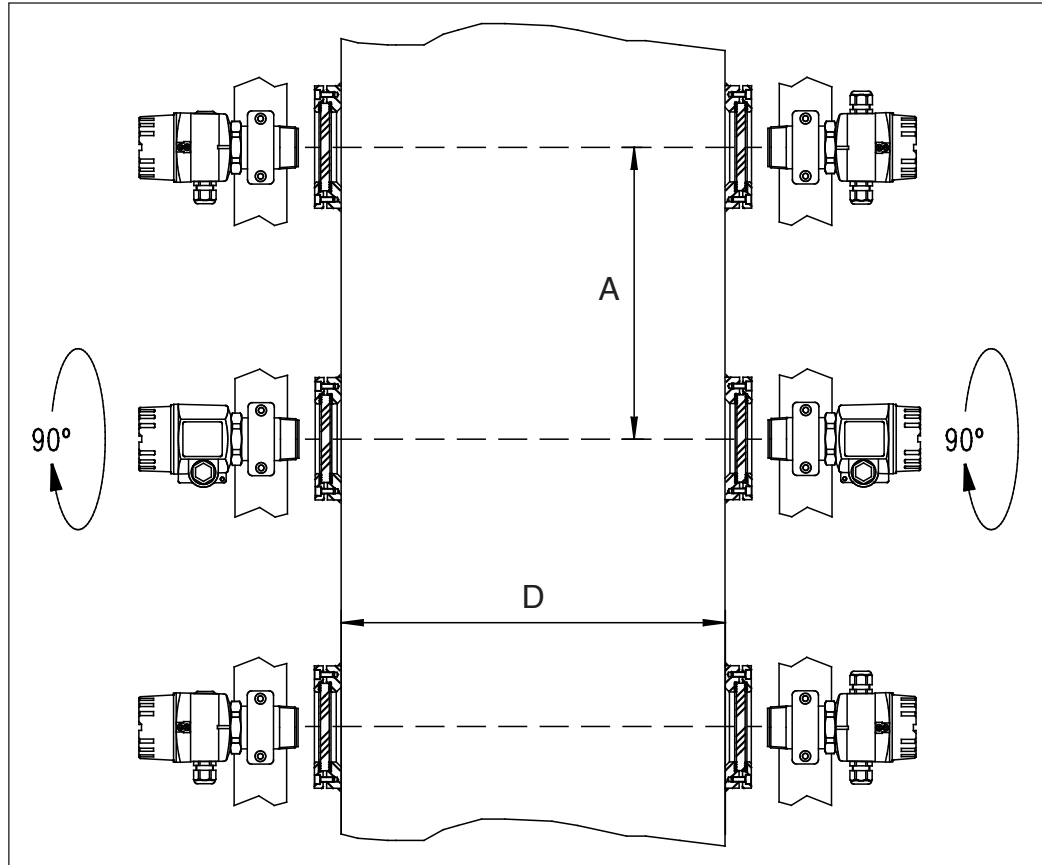
It may be necessary to utilize several microwave barriers (each consisting of a FQR50 emitter, a FDR50 receiver and a FTR325 Nivotester) in one place (for example for detecting several limit states in a pipeline, see figure). To prevent interferences between the microwave paths, various modulation frequencies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

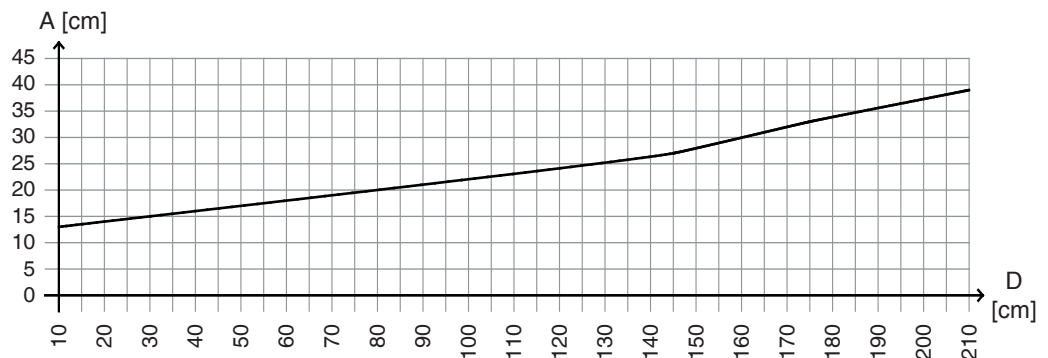
- Use the different modulation frequencies in sequence, e.g. 1, 2, 3, 1, ...
- Regard the minimum distance **A** depending on the detection distance **D**.
- Rotate every other microwave barrier by 90° to eliminate interferences (see figure, pertains to emitter *and* receiver).



Parallel operation

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.

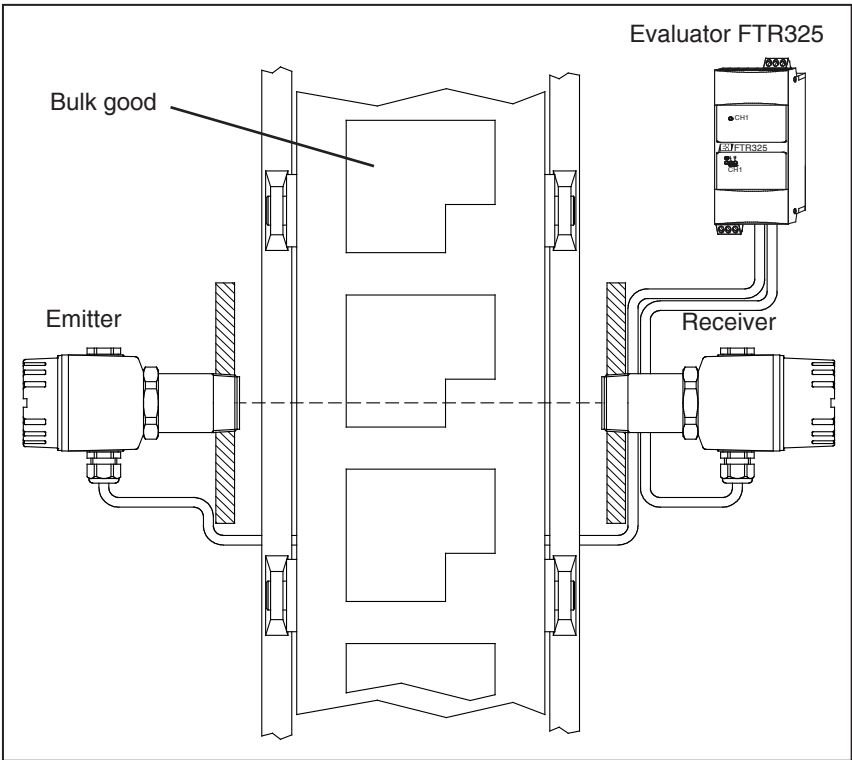


Note:

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.

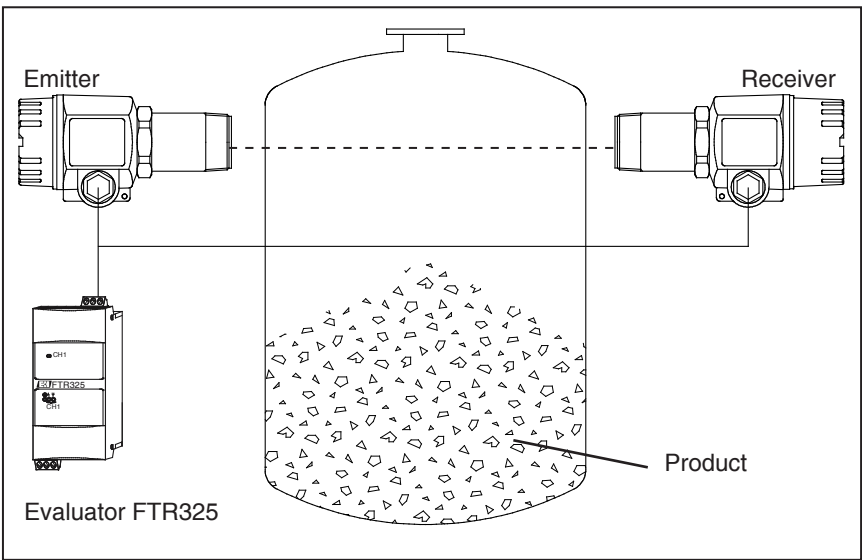
Installation examples

Example 1:
Bulk counting



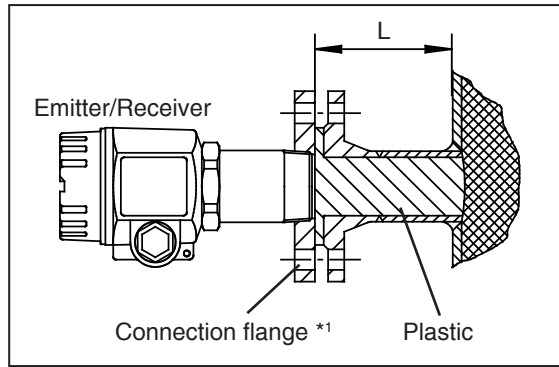
Bulk counting

Example 2:
Limit detection of bulk solids

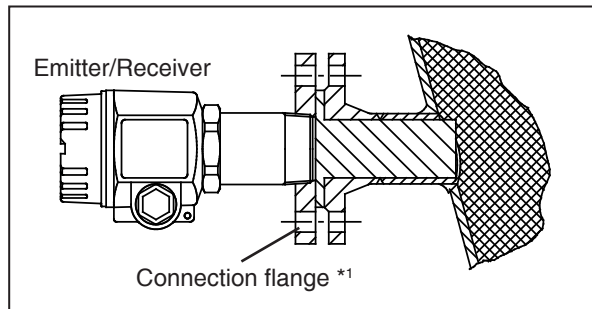


Limit detection of bulk solids

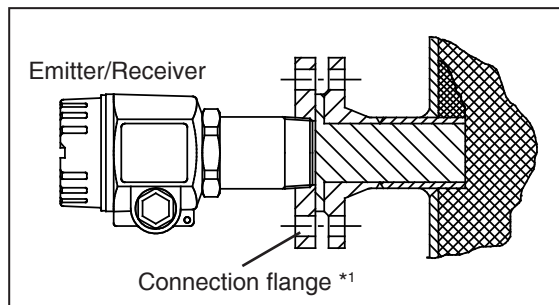
Assembly using a flange



Standard assembly using a flange



Assembly with angled conical containers



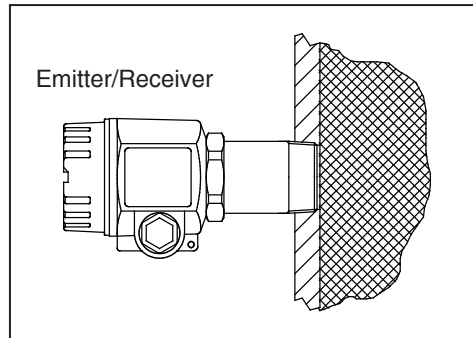
Assembly with the danger of a buildup forming

* 1: Suitable connection flanges are available, see section "Accessories"

Note:

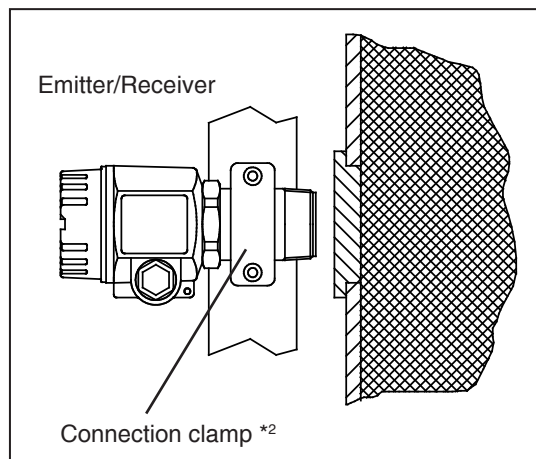
- The maximum length L depends on the dielectric constant and the water absorption of the plastic material. [Pay attention to the manufacturers information!]
- We recommend PTFE as a material, here the length at the emitter and the receiver can be up to 300 mm.
- For optimum positioning, emitter and receiver should be adjustable to ± 15 mm along their longitudinal axis (see "Assembly with bracket" on page 15).

Direct assembly with R 1½ thread

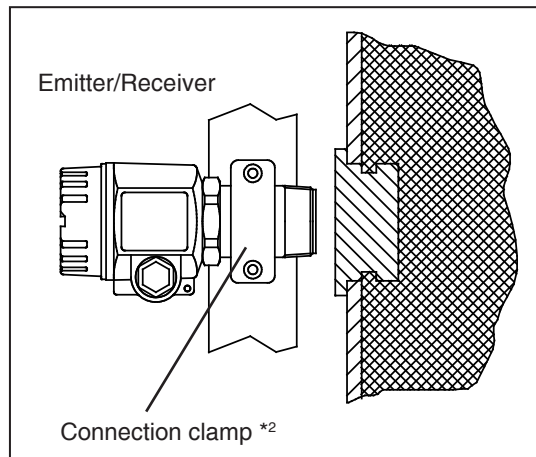


Direct assembly

Assembly using clamps



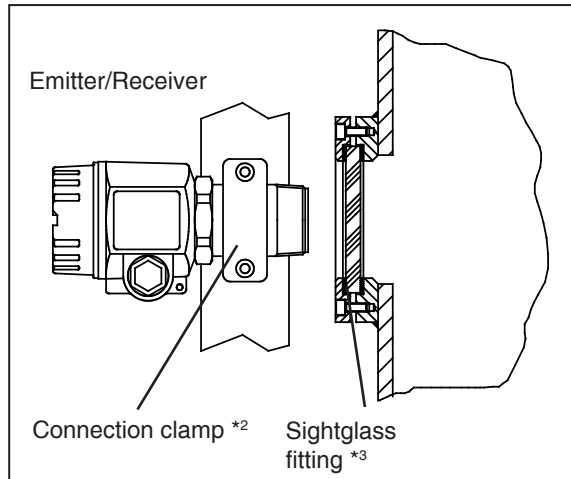
Assembly with clamps in front of a window that allows microwaves to pass through it



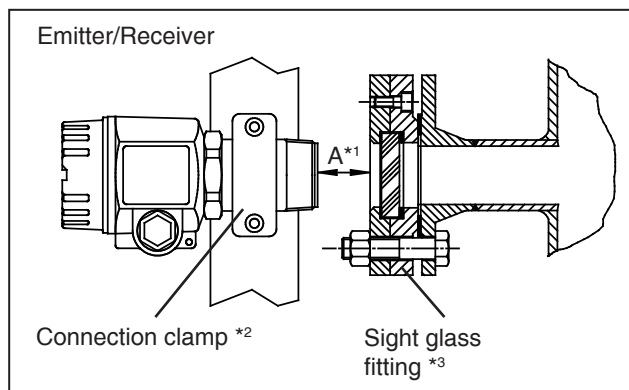
Assembly with danger of water condensation at the containers inner wall

*2: Suitable connection clamps are available, see section "Accessories"

Assembly with clamps in connection with sightglass fittings

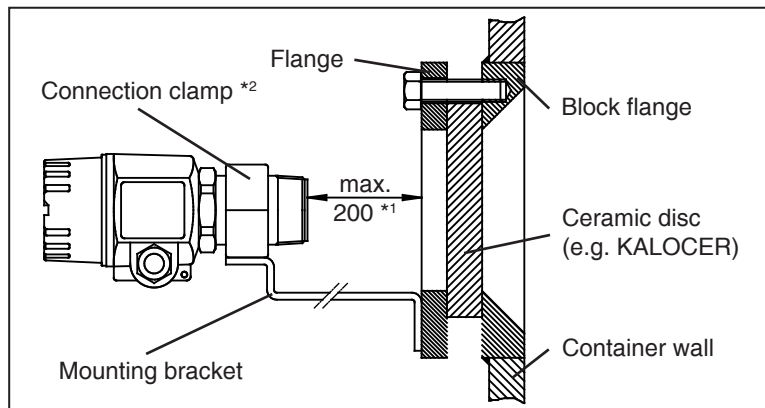


Connected by welding



Connected using bolts

Assembly with bracket on a container



Assembly with bracket that allows microwaves to pass through it

*1: Distance to reduce the process temperature down to max. 70°C on the microwave barrier

*2: Suitable connection clamps are available, see section "Accessories"

*3: Suitable sightglass fittings are available, see section "Accessories"

*4: The distance **A** depends on the nominal width of the sight glass fitting (and the diameter of the sight glass respectively) and the temperature at the fitting. We recommend the shortest possible distance (e. g. max. 40 mm on DN50) to reduce the possibility of signal damping.

Safety instructions

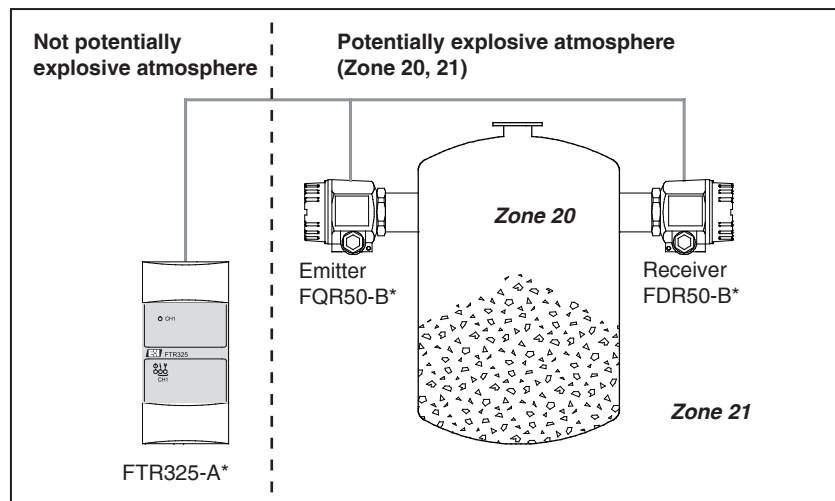
Safety notes for electrical equipment for potentially explosive atmospheres

- Installation is to be in compliance with manufacturer guidelines and with the applicable standards and regulations.
- The device may be installed, connected, commissioned, operated and maintained by qualified and authorised personal only.
- Do not operate the microwave barrier outside the electrical, thermal and mechanical parameters.
- For further information please take a look at the Safety Instructions XA223F/97/a3 (FQR50/FDR50-B*) and XA219F/97/a3 (FQR50/FDR50-C*) respectively.

Designation according to directive 94/9/EC (ATEX)

Type FQR50/FDR50-B* (explosive dust atmospheres) with FTR325-A*:

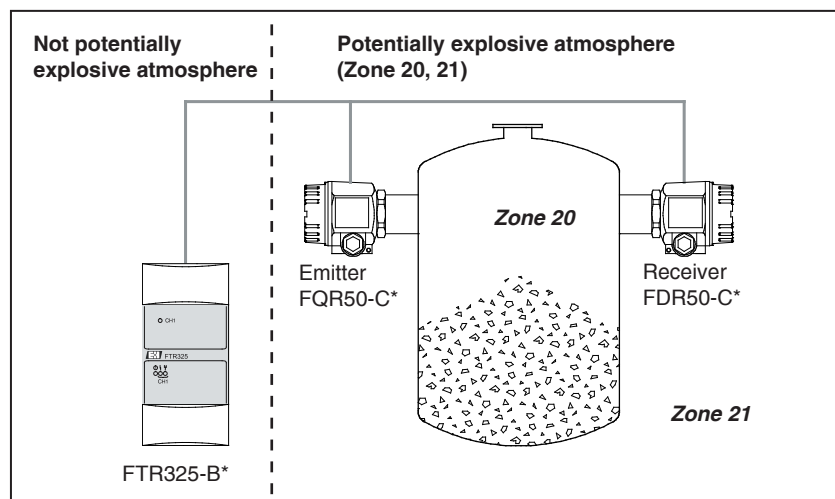
ATEX II 1/2 D IP66 T102°C



Classification of the zones FQR50/FDR50-B with FTR325-A**

Type FQR50/FDR50-C* (explosive dust atmospheres, intrinsically safe) with FTR325-B*:

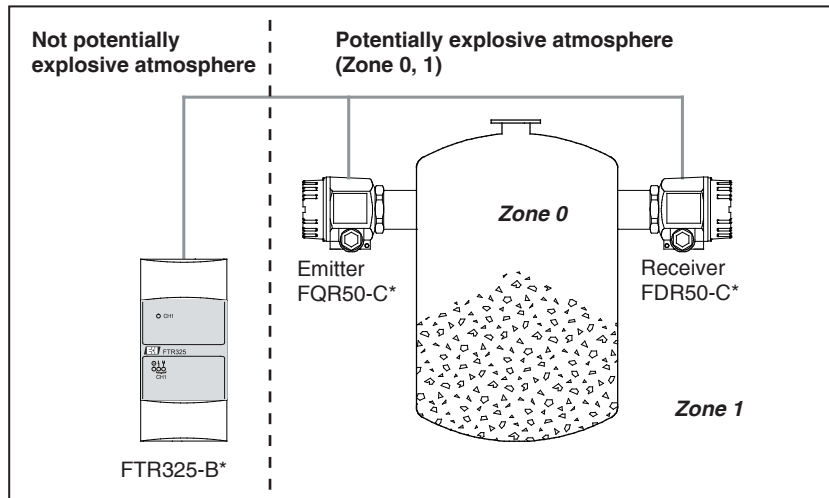
ATEX II 1/2 D Ex iaD 20/21 IP66 T98°C



Classification of the zones FQR50/FDR50-C with FTR325-B**

Type FQR50/FDR50-C* (explosive gas atmospheres, intrinsically safe) with FTR325-B*:

ATEX II 1/2 G Ex ia IIC T4

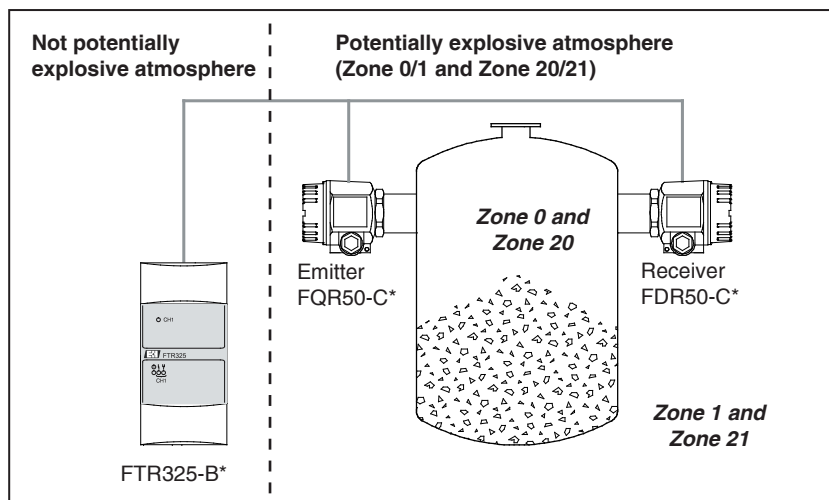


Classification of the zones FQR50/FDR50-C with FTR325-B**

Type FQR50/FDR50-C* (explosive dust/gas atmospheres, intrinsically safe) with FTR325-B*:

ATEX II 1/2 G Ex ia IIC T4

ATEX II 1/2 D Ex iaD 20/21 IP66 T98°C



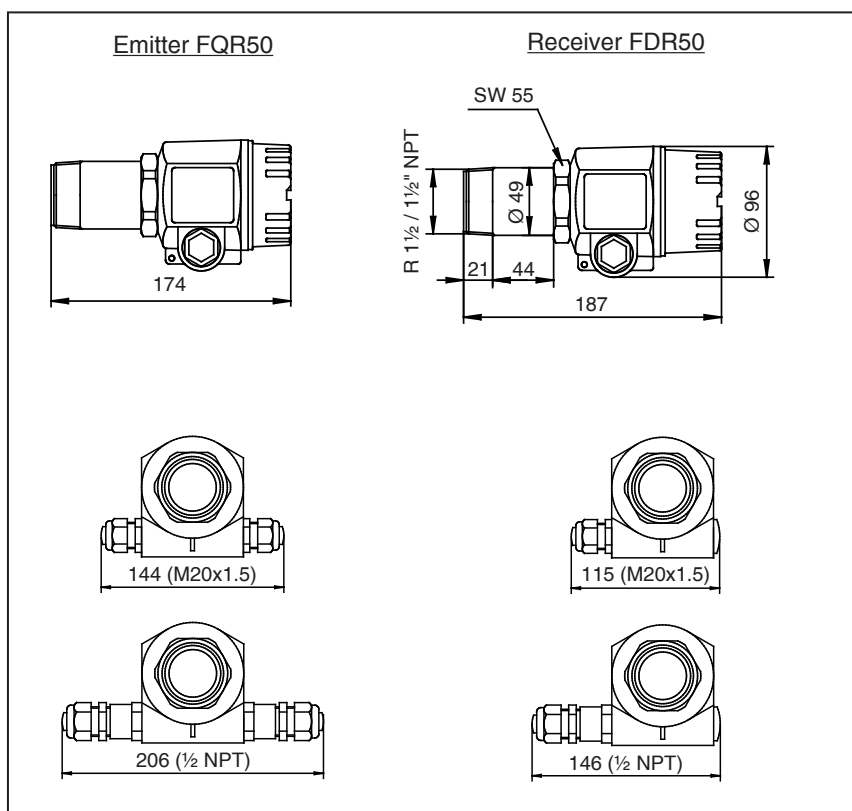
Classification of the zones FQR50/FDR50-C with FTR325-B**

Specific safety notes

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

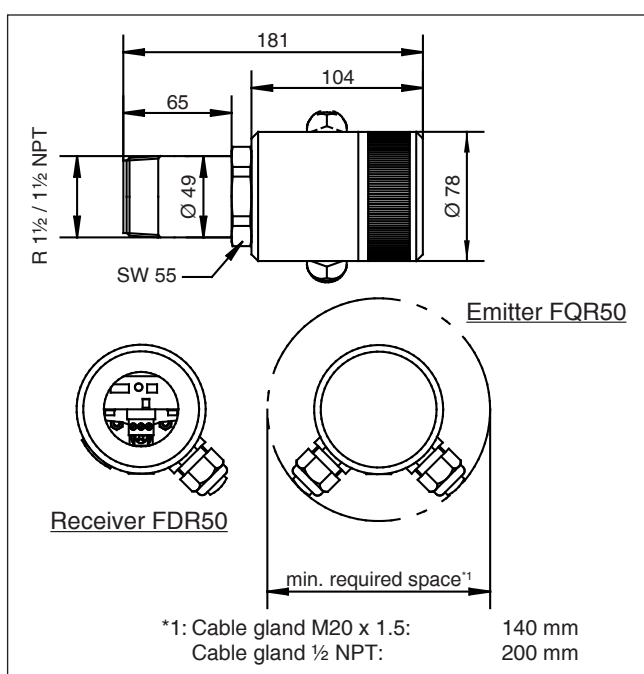
Dimensions

Dimensions aluminium F18-housing



Dimensions of the F18-housing

Dimensions stainless steel housing



Dimensions of the stainless steel housing



Version made of stainless steel

Weight

- Aluminium F18-housing: 1.0 kg
- Stainless steel housing: 2.1 kg

Material

- Housing : aluminium with polyester-based powder coating or stainless steel 316Ti/1.4571
- Sightglass (FDR50)
 - aluminium housing: glass
 - stainless steel housing: plastic
- Housing seals: EPDM / silicone
- Cable gland: PA
- Process connection (parts in contact with the media):
 - aluminium or stainless steel 316Ti/1.4571
 - PTFE (sensor membrane)

Process connection

- Thread R 1 1/2 (EN10226) or
- 1 1/2 NPT (ANSI/ASME B1.20.1)

Ordering information

Ordering information Soliwave M

10	Certificate:				
	A	Variants for the ex-free atmosphere			
	B	ATEX II 1/2D IP66 T102°C			
	C	ATEX II 1/2G Ex ia IIC T4			
		ATEX II 1/2D Ex iaD 20/21 IP66 T98°C			
	Y	Special version, to be specified			
20	Distance of the 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:				
	G	Thread R 1½ EN10226, aluminium			
	N	Thread 1½ NPT ANSI/ASME, aluminium			
	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 IP 66, M20 x 1.5			
	F	Aluminium F18-housing IP 66, ½ NPT			
	G	Stainless steel 316Ti, IP 66, M20 x 1.5			
	H	Stainless steel 316Ti, IP 66, ½ NPT			
	Y	Special version, to be specified			
50	Optional features:				
	A	Basic equipment			
	Y	Special version, to be specified			
FQR50 -					
FDR50 -					
Order code					

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

Comments regarding the product structure

The following limitations apply to devices FQR50/FDR50-B*:

- **Housing and cable entry (40):** (G) and (H) not permitted

The following limitations apply to devices FQR50/FDR50-C*:

- **Process connection and materials (30):** (G) and (N) not permitted



Warning!

The emitter/receiver unit FQR50/FDR50-A*, -B* may only be combined with the Nivotester FTR325-A* and the emitter/receiver unit FQR50/FDR50-C* may only be combined with the Nivotester FTR325-B*!

Type plate

Type plate (two parts, mounted on the device):

Endress+Hauser



Soliwave M

Order Code: FDR50 - B2GDA

Ser.- No. 8B0001KIR01

For connection to FTR325 - A

0044



Oder code (according to type key)

Serial number

Made in Germany



DMT 03 ATEX E 053
II 1/2D IP66 T102°C



KA206F/97

Approval

Additional notes

Appropriate documentation

Accessories

Installation clamp

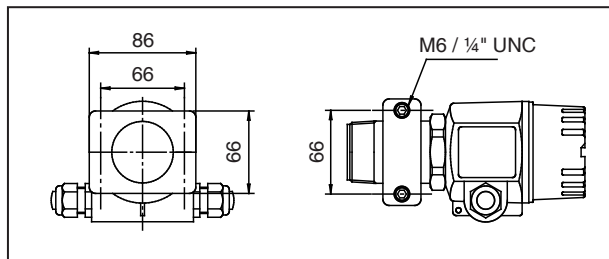
The devices in the Soliwave M range can be mounted to existing frames without any problem using an installation clamp. The installation clamps are available as an option in either aluminium or plastic.



Installation with clamps

Installation clamp for frame assembly of a FQR50 / FDR50

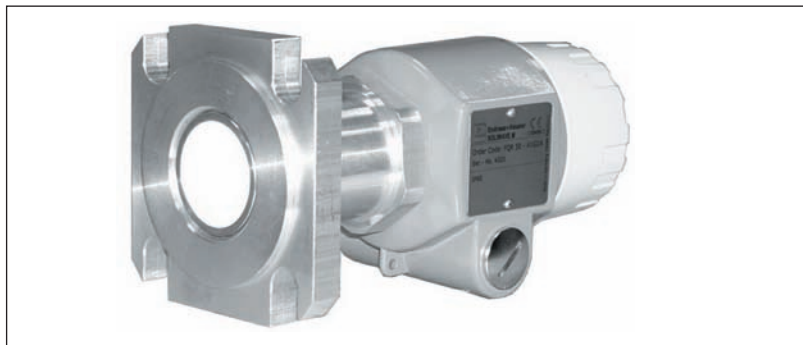
- Aluminium material: Part number 52017501
- Plastic material: Part number 52017502



Dimensions

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.



Installation with adapter flange

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

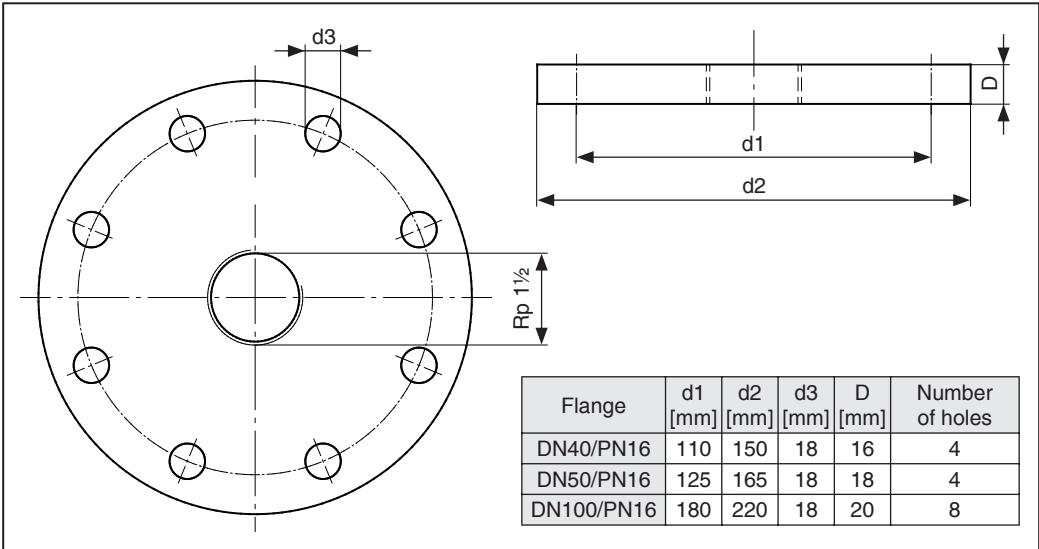
- DN 40 PN 6, connection dimensions according to DIN EN 1092-1, material aluminium, with Rp 1½ thread: Part number 71006345
- 1½" 150 lbs, connection dimensions according to ANSI/ASME B16.5, material aluminium, with 1½ NPT thread: Part number 71006346



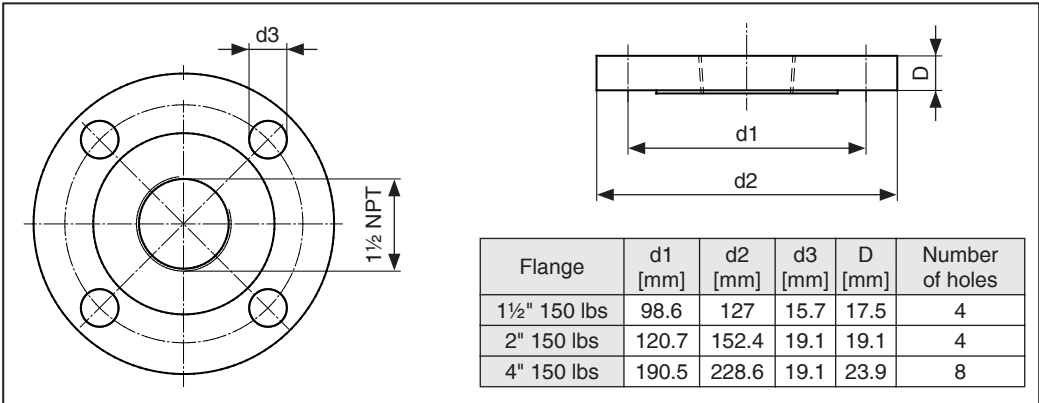
Installation with flange

Mounting flange, material 316Ti (Stainless steel)

- DN 40 PN 16, connection dimensions according to DIN EN 1092-1, with Rp 1½ thread
Part number 71006348
- DN 50 PN 16, connection dimensions according to DIN EN 1092-1, with Rp 1½ thread
Part number 71006350
- DN 100 PN 16, connection dimensions according to DIN EN 1092-1, with Rp 1½ thread
Part number 71006352

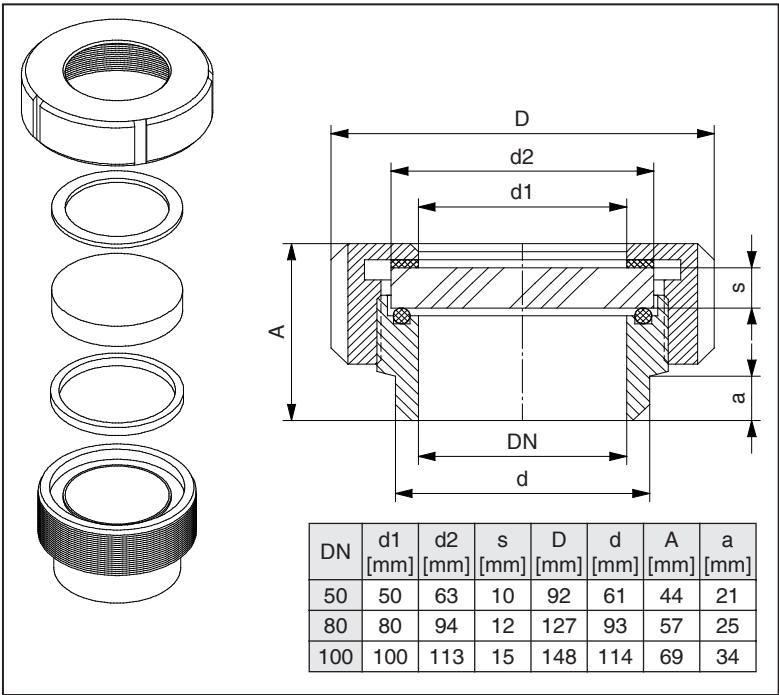


- 1½" 150 lbs, connection dimensions according to ANSI/ASME B16.5, with 1½ NPT thread
Part number 71006349
- 2" 150 lbs, connection dimensions according to ANSI/ASME B16.5, with 1½ NPT thread
Part number 71006351
- 4" 150 lbs, connection dimensions according to ANSI/ASME B16.5, with 1½ NPT thread
Part number 71006353



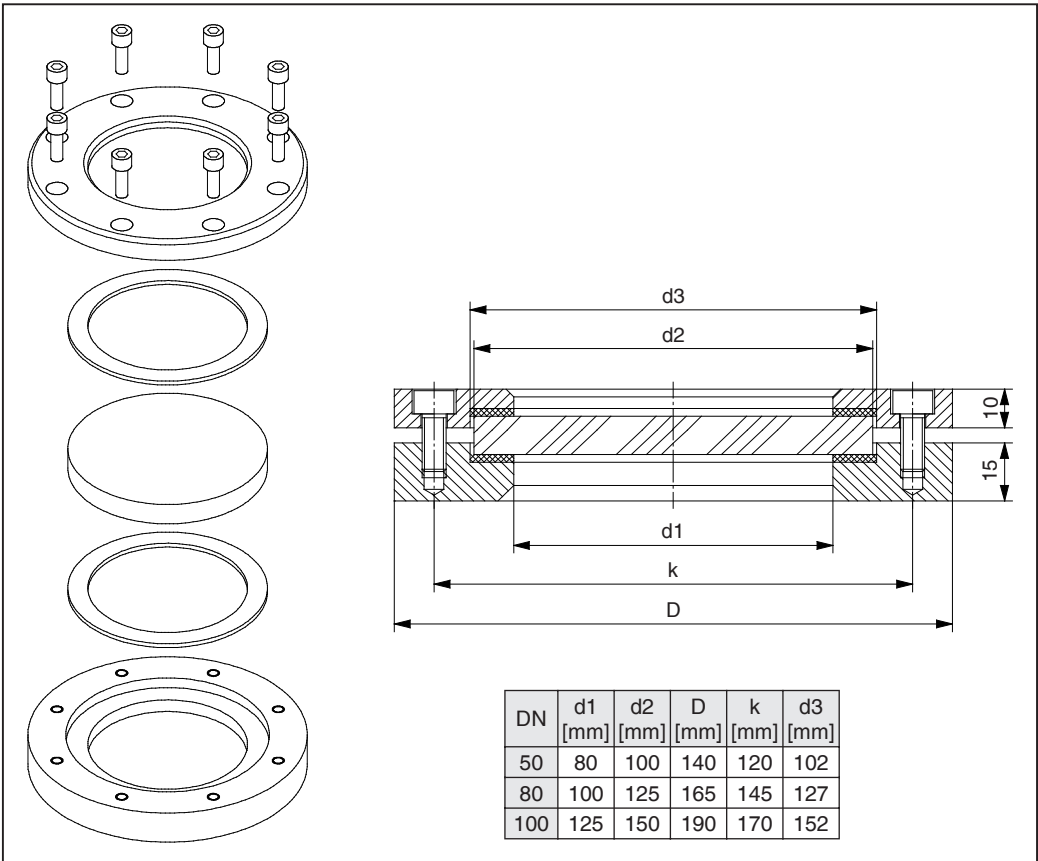
Sightglass fittings

Sightglass, screwed, similar according to DIN 11851, material: Stainless steel 304, silicon and C4400, Pmax = 6 bar, Tmax = 200°C, borosilicate glass, threaded nozzles have weld necks



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

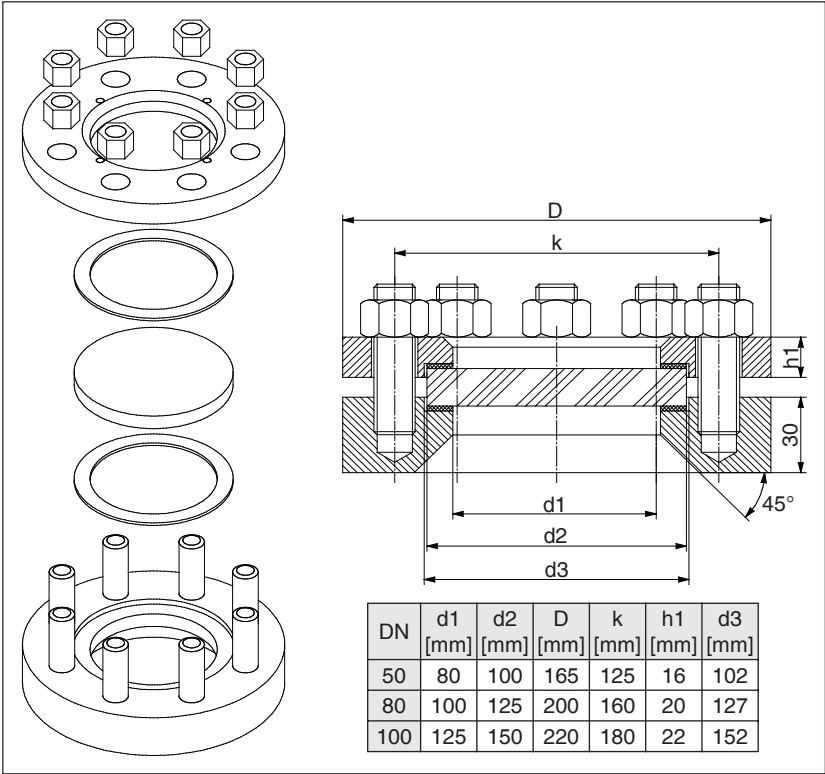
Sightglass fitting with welding flange, for tanks/silos without pressure, material: Stainless steel 316Ti and silicon, Tmax = 200°C, borosilicate glass, installation using bolts



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

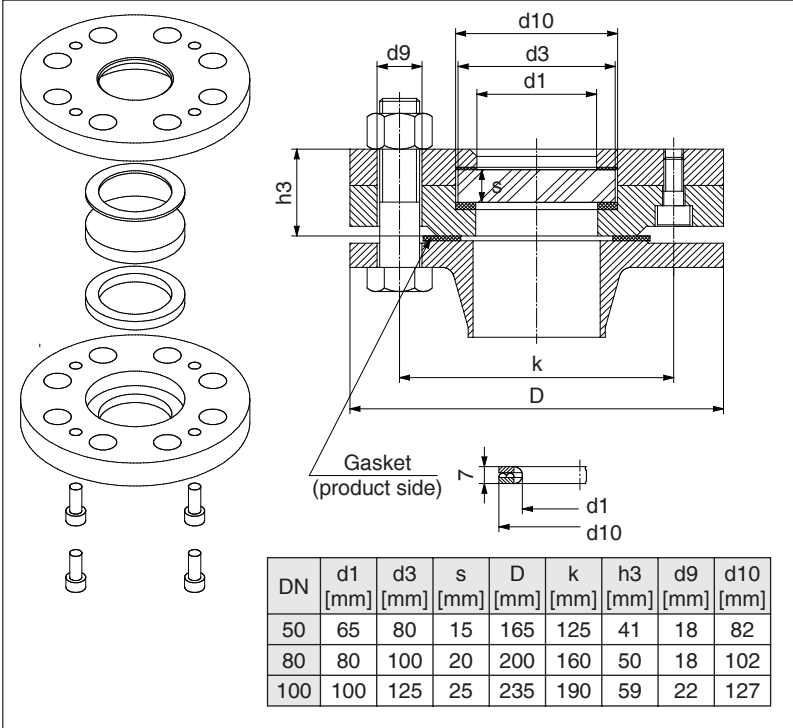
Sightglass fittings
(continuation)

Sightglass fitting suitable for welding into/onto vessel walls, similar according to DIN 28120, material: Stainless steel 316Ti/321 and silicon, Pmax = 10 bar, Tmax = 200°C, borosilicate glass, installation using bolts



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

Sightglass fitting according to DIN 28121, to fit onto flanged nozzles, material: Stainless steel 316Ti, PTFE and C4400, Pmax = 25 bar, Tmax = 200°C, borosilicate glass



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

Ambient conditions

Ambient temperature	■ -20°C ... +70°C
Storage temperature	■ -40°C ... +80°C
Enclosure	■ with closed housing: IP 66 ■ with open housing: IP 20
Electromagnetic compatibility (EMC)	■ Emission in compliance with EN 61326, Class B equipment ■ Immunity in compliance with EN 61326, Appendix A (Industrial location)

Process conditions

Process temperature	■ -40°C ... +70°C At higher processing temperatures the microwave barrier has to be separated from the process by appropriate structural measures, for example, a glass window (see installation note).
Process pressure	■ 0.8 ... 4.8 bar absolute (Only to be observed when the FQR50 emitter or the FDR50 receiver is built into the process.)

Certificates and approvals

CE mark	The microwave barrier Soliwave M fulfils the legal requirements of the EEC directives. The manufacturer confirms the successful examination of the equipment by using the CE mark.
Radio certification	R&TTE according to EN 300440-2 (2001-09) FCC (FCC ID UAS-FQR50)
Ex approvals	ATEX II 1/2D IP66 T102°C (Certification number: DMT 03 ATEX E 053) 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)
External standards and directives	Directive 1999/05/EC article 3.1 (a) and 3.1 (b) and the directives 73/23/EEC and 89/336/EEC found in there

Supplementary documentation

Operating instructions (KA)	Soliwave M FQR50/FDR50 KA206F/97/a6 Nivotester FTR325 KA205F/97/a6
Technical information	Nivotester FTR325 TI377F/97/de
Safety instructions	Soliwave M FQR50/FDR50-B* with Nivotester FTR325-A* XA223F/97/a3 Soliwave M FQR50/FDR50-C* with Nivotester FTR325-B* XA219F/97/a3

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