



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 1/2 D

Table of contents

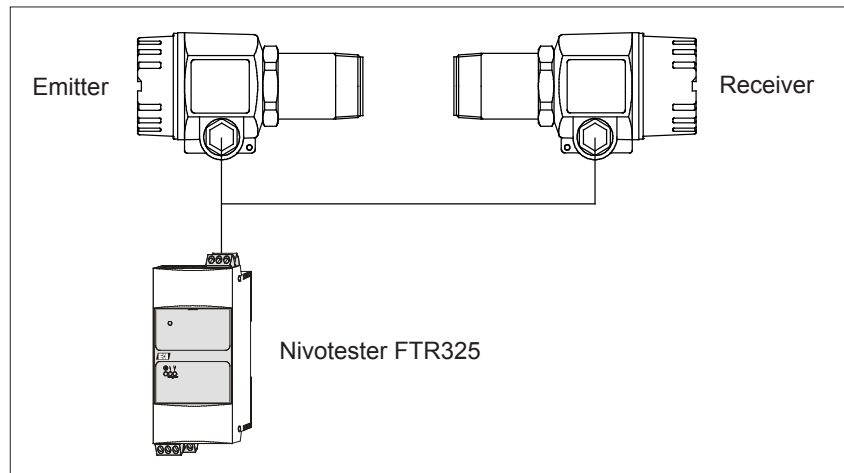
Function and system design	3	Accessories	19
Measuring principle	3	Installation clamp	19
Measuring device	3	Adapter flange	19
Equipment combinations	3	Sightglass fittings	21
Characteristics	4	Certificates and approvals	23
Measuring variables	4	CE mark	23
Measuring range	4	Radio certification	23
Operating frequency	4	Ex approvals	23
Transmitter power	4	External standards and directives	23
Switching frequency FDR50	4	Supplementary documentation	23
Configurations	5	Operating instructions (KA)	23
Sensitivity adjustment	5	Technical information	23
Calibration with covered path	6		
Calibration with free path	6		
Configuration of the hysteresis	6		
Calibration in applications with very low attenuation	6		
Auxiliary energy	7		
Electrical connection	7		
Cable specification	7		
Wiring	7		
Operating conditions	9		
Installation note	9		
Minimum distance from emitter to receiver	10		
Ambient conditions	11		
Process conditions	11		
Installation examples	11		
Assembly using a flange	12		
Direct assembly with R 1½ thread	13		
Assembly using clamps	13		
Assembly using sightglass fittings	14		
Safety instructions	15		
Designation according to directive 94/9/EC (ATEX)	15		
Safety notes for electrical equipment	15		
Dimensions	16		
Dimensions (Standard version)	16		
Weight	16		
Material	16		
Process connection	16		
Cable entry	16		
Version made of stainless steel	17		
Dimensions (Stainless steel)	17		
Ordering information	18		
Ordering information Soliwave M	18		
Type plate	18		

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 FTR 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 and 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 will be replaced by the FTR325.

Equipment combinations

The emitter and receiver unit FQR50 / FDR50 of the microwave barrier Soliwave M 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 following equipment combinations are possible:

- FQR50 / FDR50 and Nivotester FTR325
- FQR50 / FDR50 and Nivotester FTR471
- FQR50 / DR30 and Nivotester FTR471
- QR30 / FDR50 and Nivotester FTR471

Characteristics

Measuring variables	Absorption of the electromagnetic waves produced by the FQR50 emitter.
Measuring range (range of detection)	<p>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.</p> <p>The range is also dependent on the container walls to be penetrated.</p>
Operating frequency	24.125 GHz
Transmitter power	<p>The maximum power produced by the FQR50 emitter is 100 mW e.i.r.p. (equivalent isotrope radiation performance).</p> <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 <p>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!</p>
Switching frequency FDR50	max. 2 Hz

Configurations

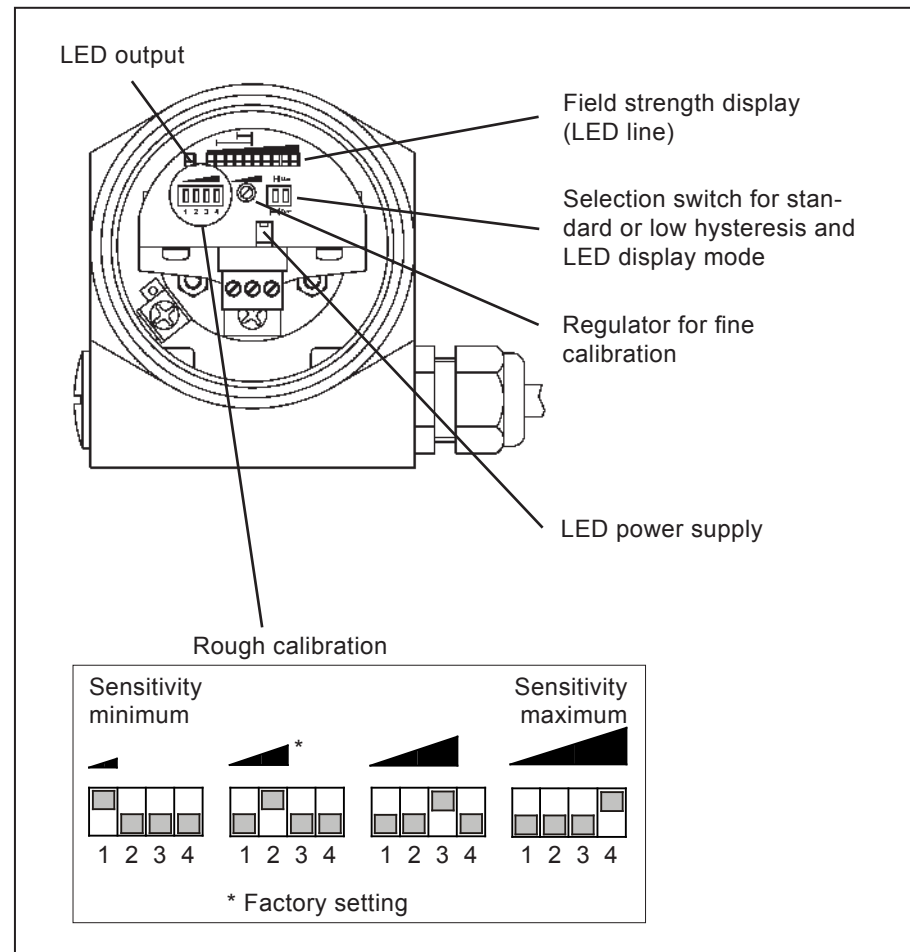
By using frequencies in the 24 GHz range it is possible to detect products having low attenuation even with low amounts of bulk product between the emitter and the receiver. The calibration options of the units offer the necessary flexibility to be able to adjust the barrier to individual situations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

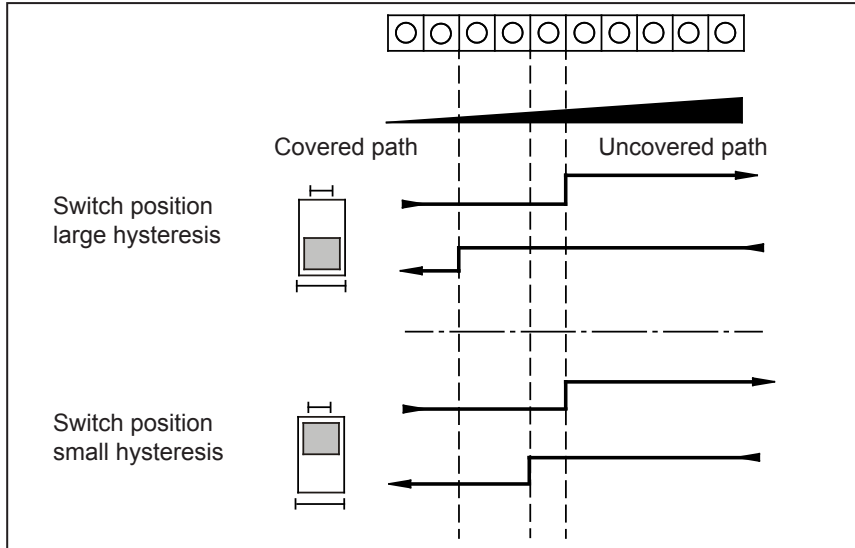
Calibration with covered path (switching point reached)

- 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 of 24 VDC \pm 20% is provided by the FTR325 evaluator.

Cable specification

Off-the-shelf installation cable:

- 3-conductor shielded
- Line resistance maximum 25 Ω per wire

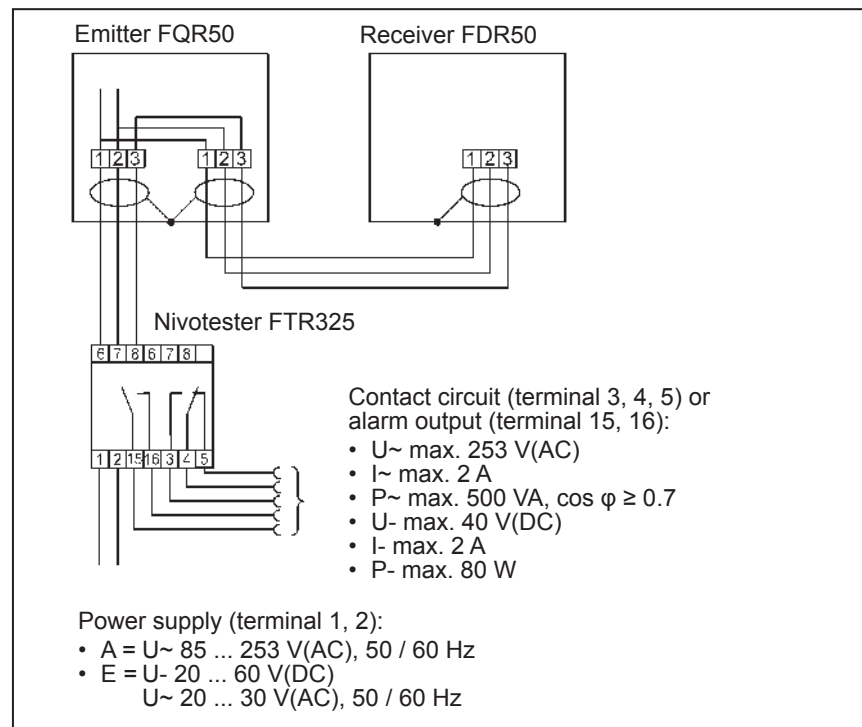
Example cable length

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.

Wiring

Wiring example 1:

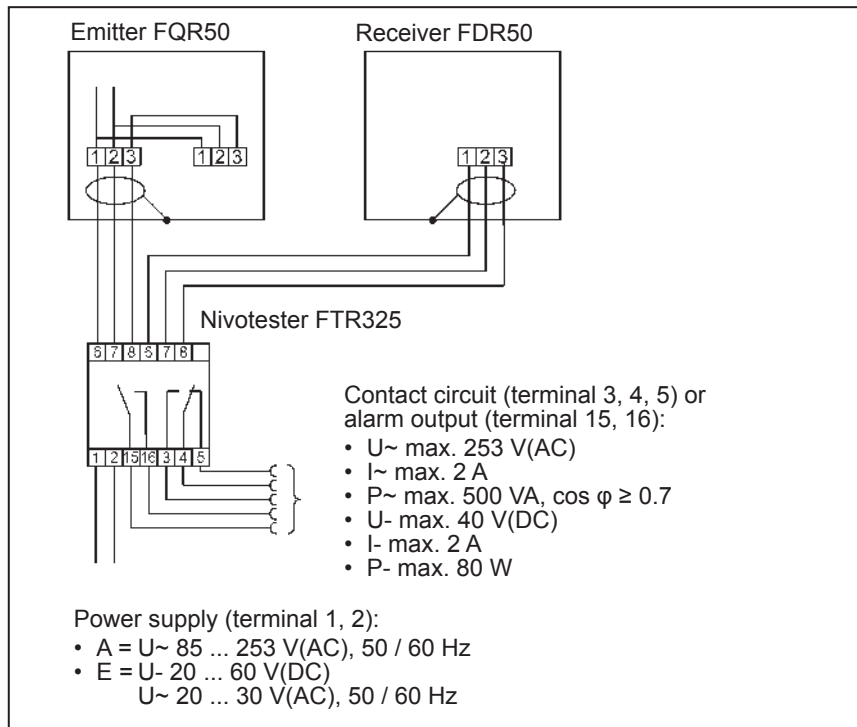
Soliwave M FQR50 / FDR50 microwave barrier with Nivotester FTR325 for rail mounting in ring wiring



Ring wiring with the FTR325

Wiring example 2:

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



Star wiring with the FTR325

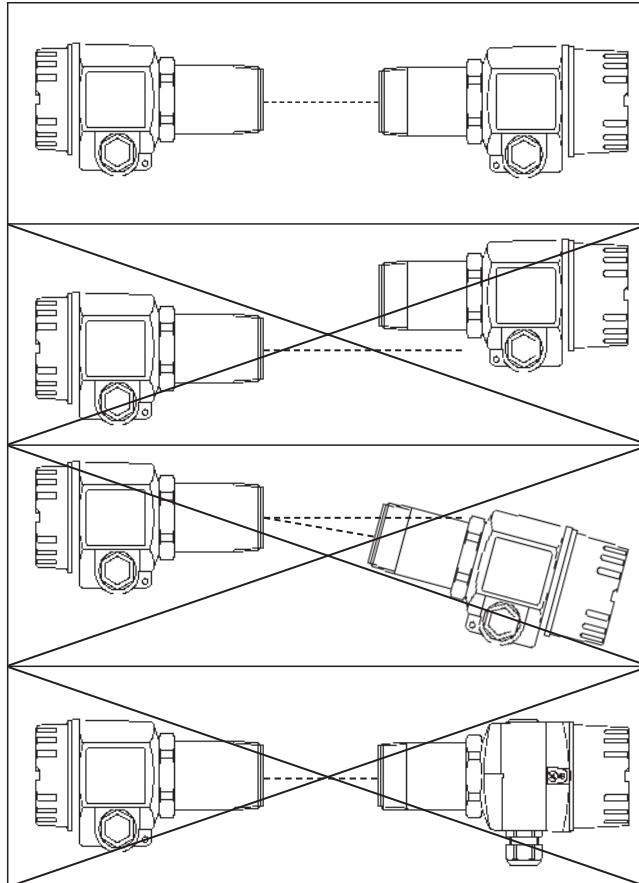
Operating conditions

Installation note

Both the FQR50 emitter and the FDR50 receiver are equipped with a standard R 1½ thread in compliance with DIN 2999, T.1 as a process connector. This makes a simple installation in the existing container sleeves or fittings possible.

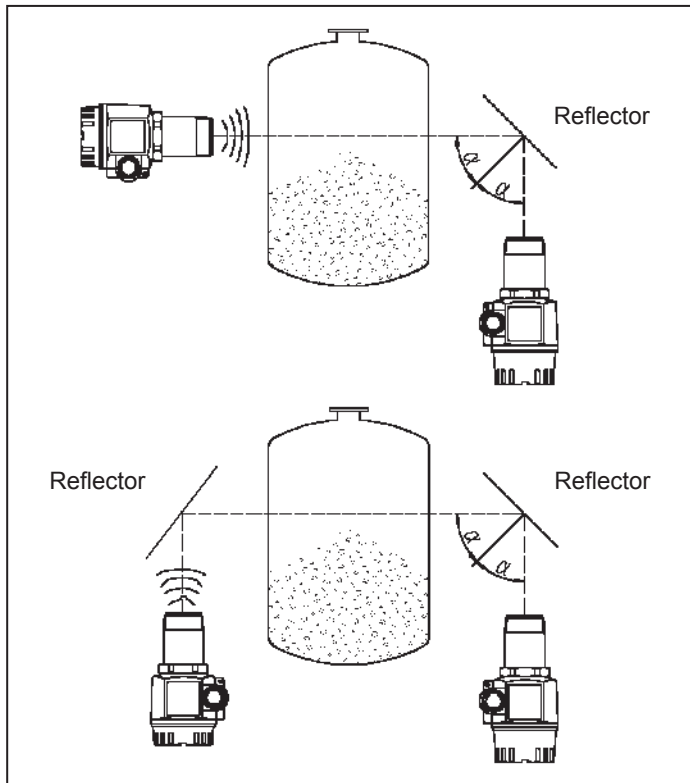
Note:

- 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.



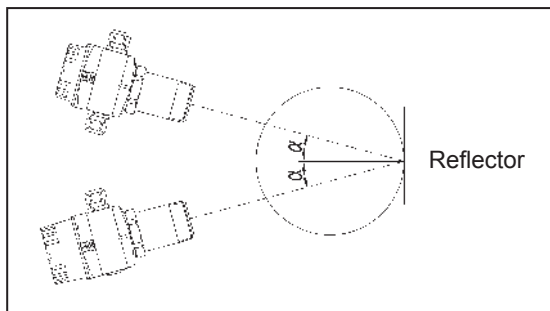
Installation note

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, since otherwise the receiver will get no evaluable signal.



Arrangement emitter and receiver to the reflector

Minimum distance from emitter to receiver

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

Ambient conditions

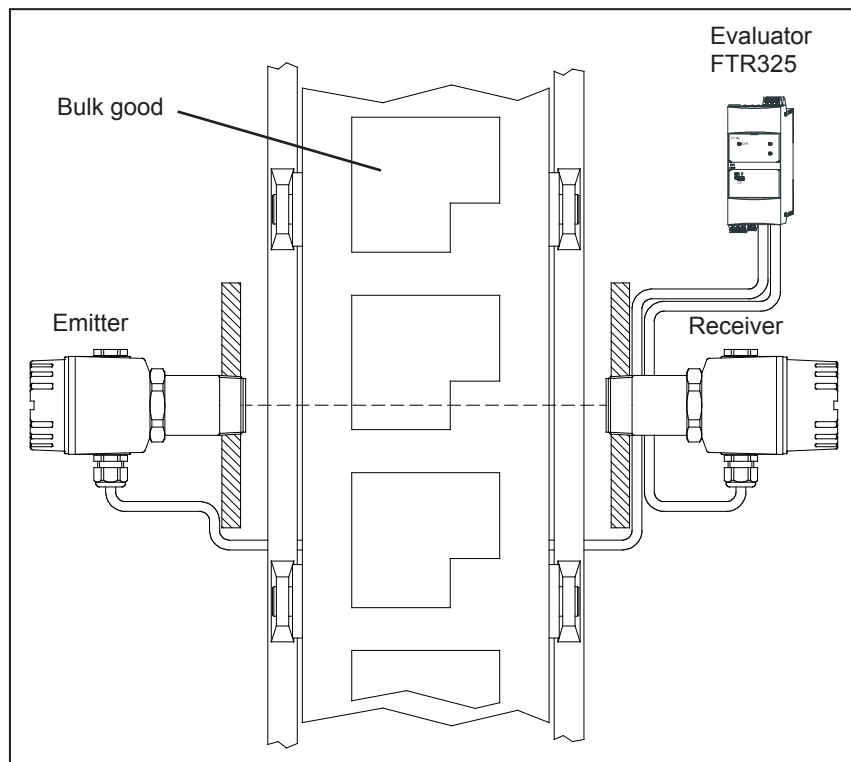
- Ambient temperature: -20°C ... +70°C
- Storage temperature: -40°C ... +80°C
- Enclosure: IP 66
- Electromagnetic compatibility (EMC):
 - Emission in compliance with EN 61326, Class B equipment
 - Immunity in compliance with EN 61326, Appendix A (Industrial location)

Process conditions

- Measuring material temperature range: -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).
- Measuring material pressure range: 0.8 ... 4.8 bar absolute
 (Only to be observed when the FQR50 emitter or the FDR50 receiver is built into the process.)

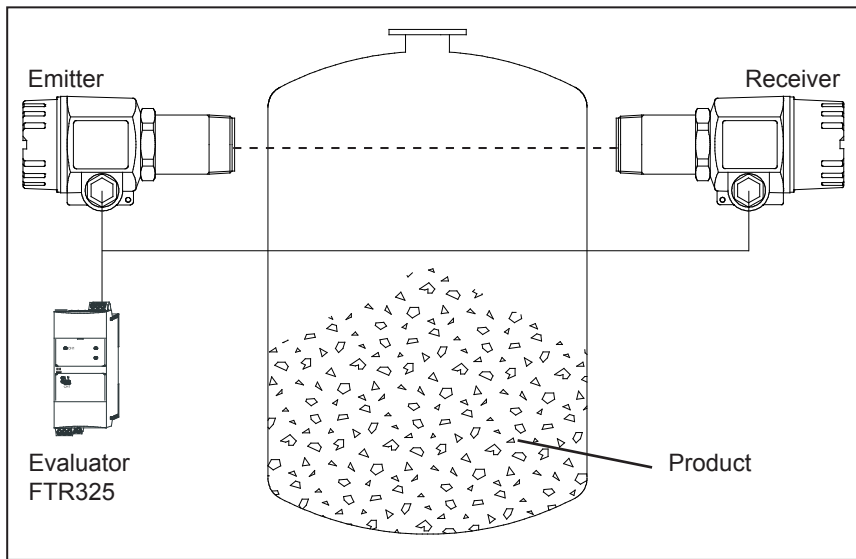
Installation examples

Example 1:
Bulk counting



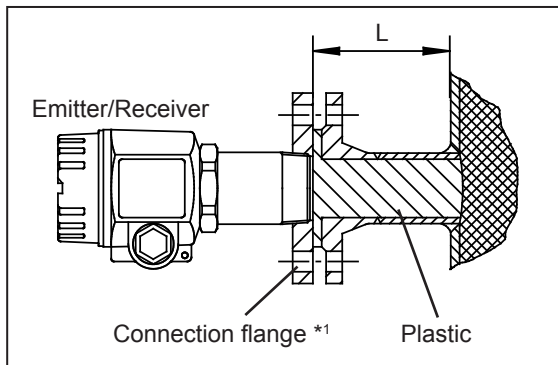
Bulk counting

Example 2:
Limit detection of bulk solids

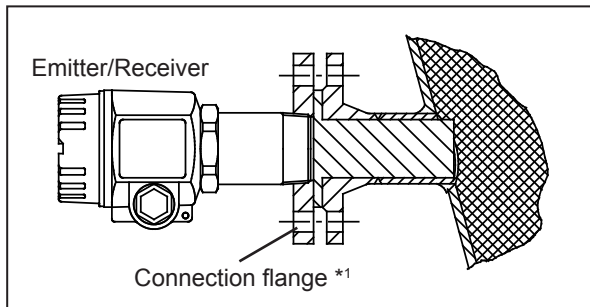


Limit detection of bulk solids

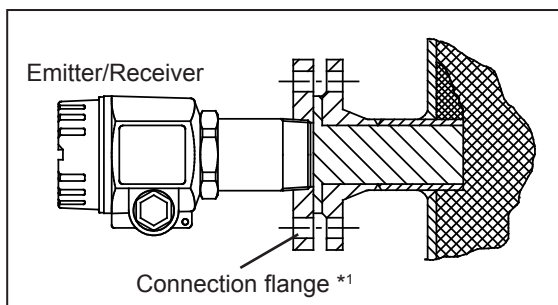
Assembly using a flange



Standard assembly using a flange



Assembly with angled conical containers



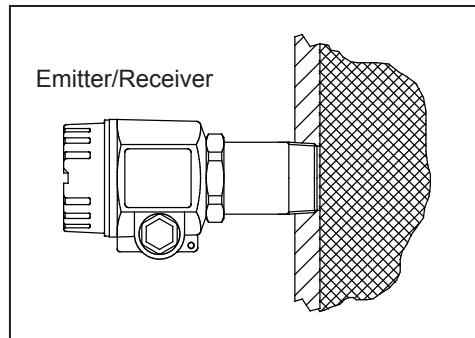
Assembly with the danger of a buildup forming

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

Note:

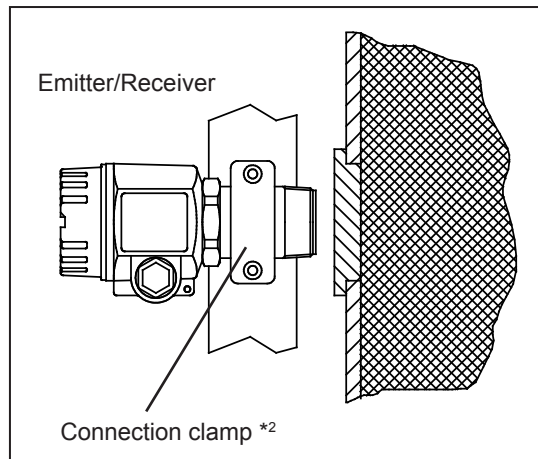
- The maximum length L depends on the dielectric constant and the water absorption of the plastic material. [Pay attention to the manufacturers information!]
- We recommend PTFE as a material, here the length at the emitter and the receiver can be up to 300 mm.

Direct assembly with R 1½ thread

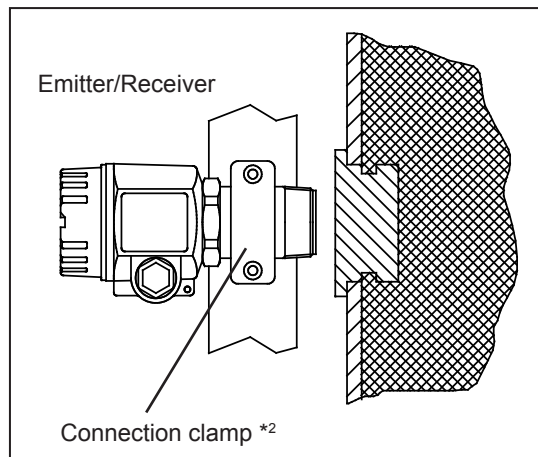


Direct assembly

Assembly using clamps



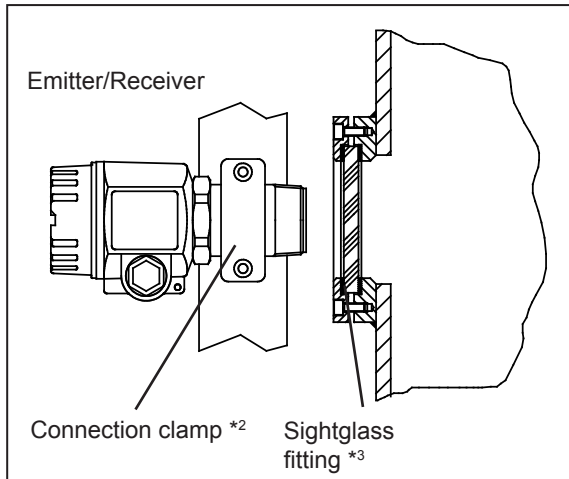
Assembly with clamps in front of a window that allows microwaves to pass through it



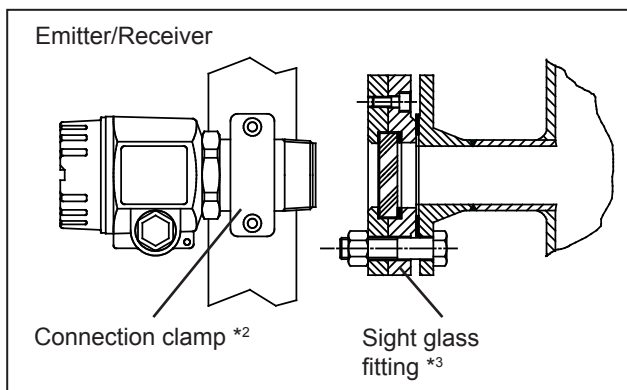
Assembly with danger of water condensation at the containers inner wall

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

Assembly with clamps in connection with sightglass fittings



Connected by welding



Connected using bolts

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

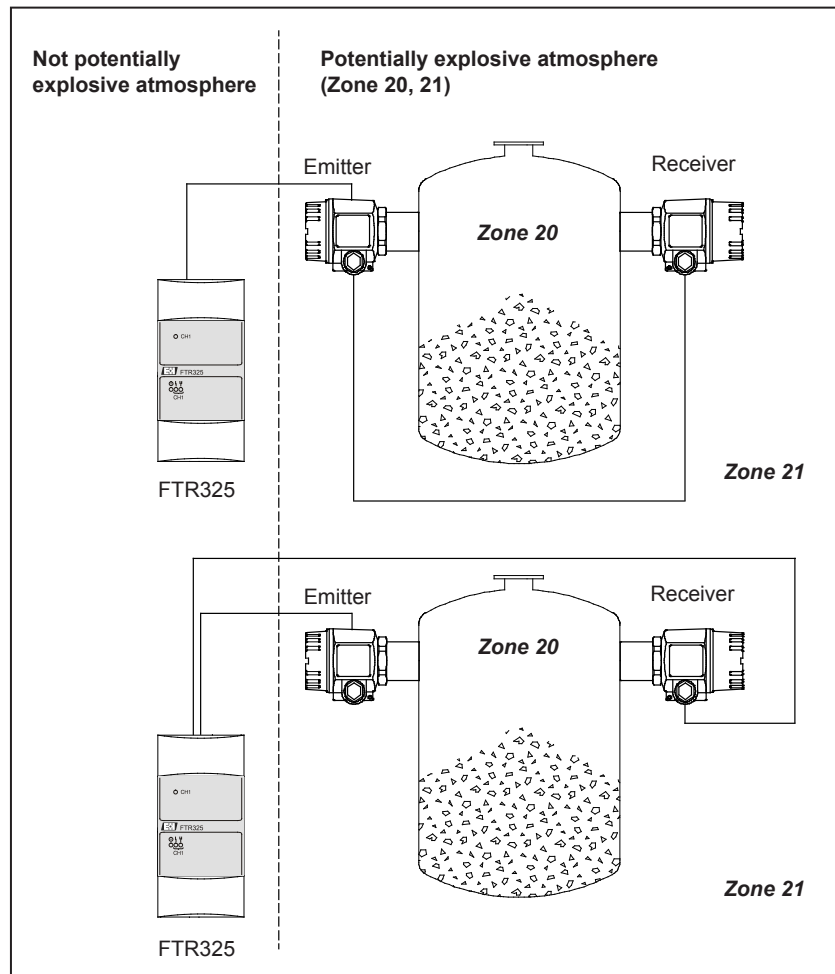
*3: Suitable sightglass fittings are available, see section "Accessories"

Safety instructions

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

ATEX II 1/2D IP66 T102°C

- Device group 2
- Device category: Sensor zone 20 / housing zone 21
- For potentially explosive mixtures of air and combustible dusts
- Protection class: IP 66
- Maximum surface temperature 102°C at $T_a = 70^\circ\text{C}$



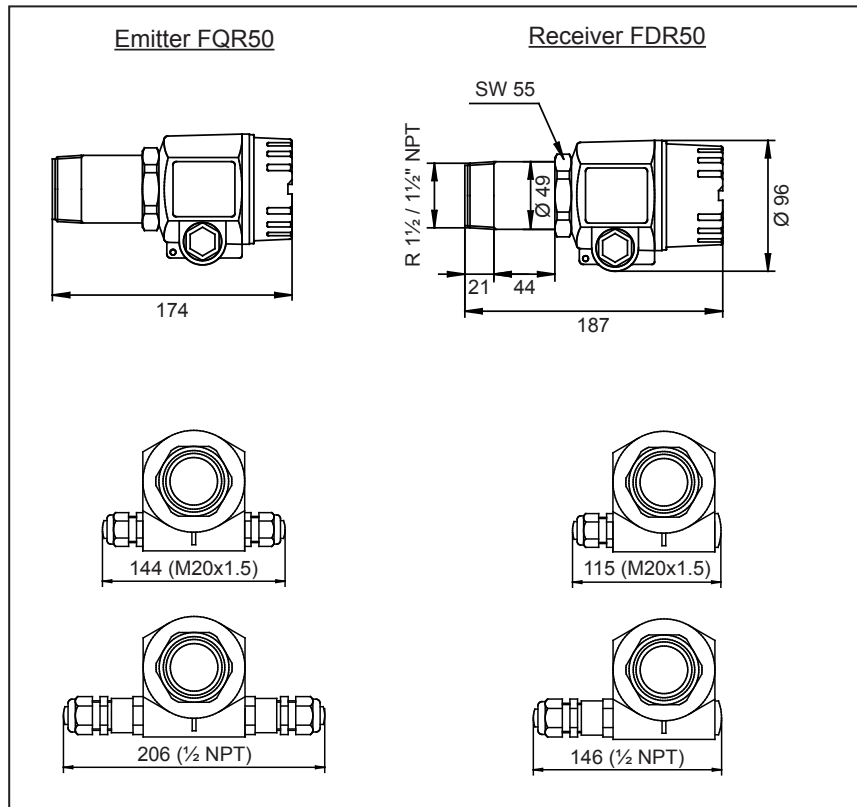
Classification of the zones

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 use of the emitter and receiver unit in potentially explosive atmospheres is permissible only with closed housing.
- The microwave barrier may only be repaired by the manufacturer.
- The requirements of the EN 50281-1-2, for example, regarding dust deposits and temperatures are to be observed.

Dimensions

Dimensions (Standard version)



Dimensions of the standard version

Weight

- Standard version: 1.0 kg
- Stainless steel version: 2.1 kg

Material

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

Process connection

- Thread R 1 1/2 (DIN 2999 T.1) or
- 1 1/2 NPT (ANSI)

Cable entry

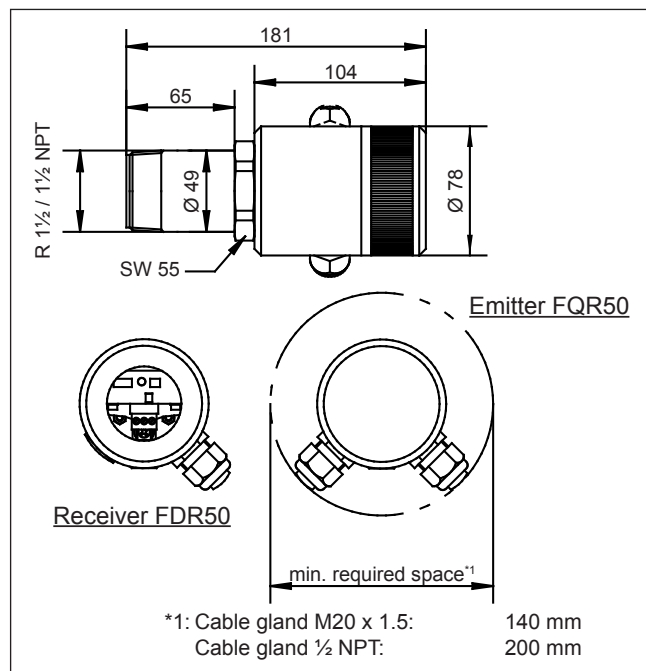
- Cable entry
 - M20 x 1.5 or
 - 1/2 NPT
- Cable gland (included in delivery)
 - Emitter FQR50: 2
 - Receiver FDR50: 1

Version made of stainless steel



Version made of stainless steel

Dimensions
(Stainless steel)



Dimensions of the version made of stainless steel

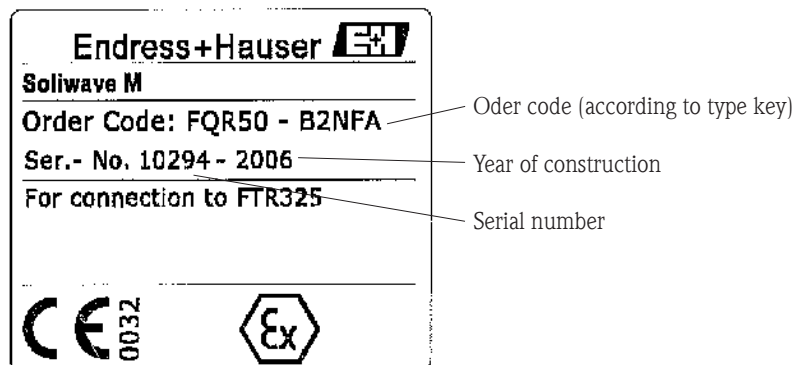
Ordering information

Ordering information Soliwave M

10	Certificate:			
	A	Variants for the ex-free atmosphere		
	B	ATEX II 1/2D IP66 T102°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 DIN 2999 T.1, aluminium		
	N	Thread 1½ NPT ANSI, aluminium		
	R	Thread R 1½ DIN 2999 T.1, stainless steel 316Ti		
	S	Threade 1½ NPT ANSI, 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 -	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Order code
FDR50 -	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	

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

Type plate



Accessories

Installation clamp

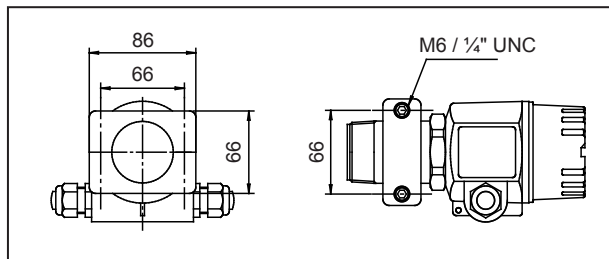
The devices in the Soliwave M range can be mounted to existing frames without any problem using an installation clamp. The installation clamps are available as an option in either aluminium or plastic.



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)

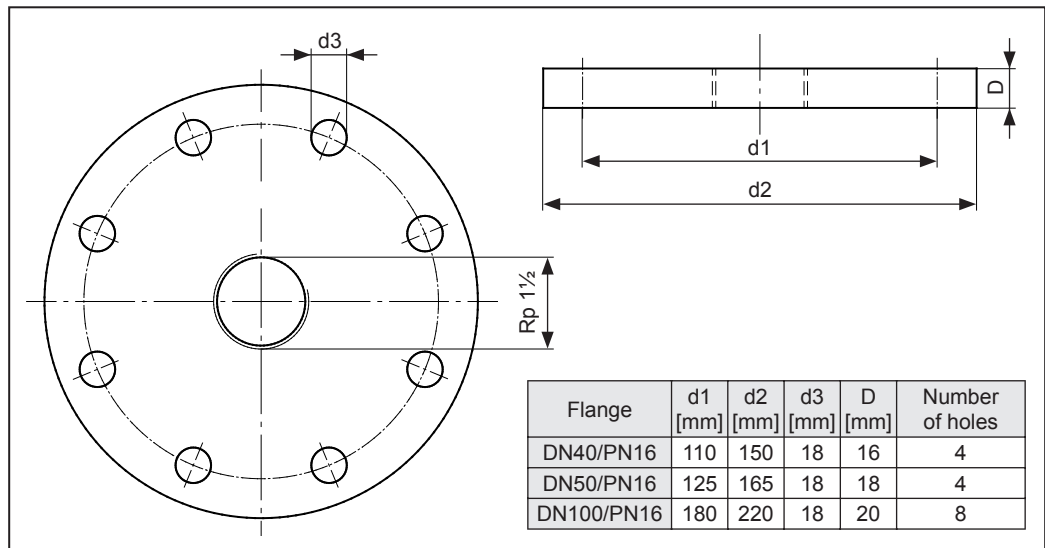
- DN 40 PN 6, connection dimensions according to DIN EN 1092-1, material aluminium, with Rp 1½ thread: Part number 71006345
- 1½" 150 lbs, connection dimensions according to ANSI B16.5, material aluminium, with 1½ NPT thread: Part number 71006346



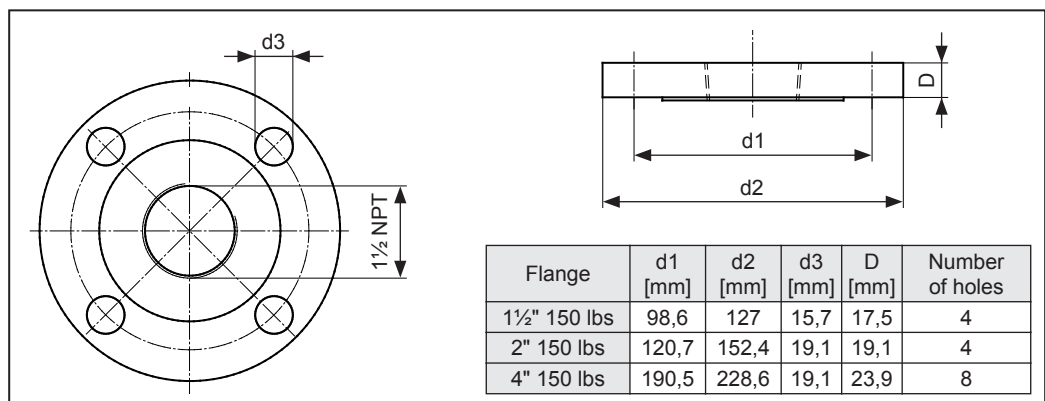
Installation with flange

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

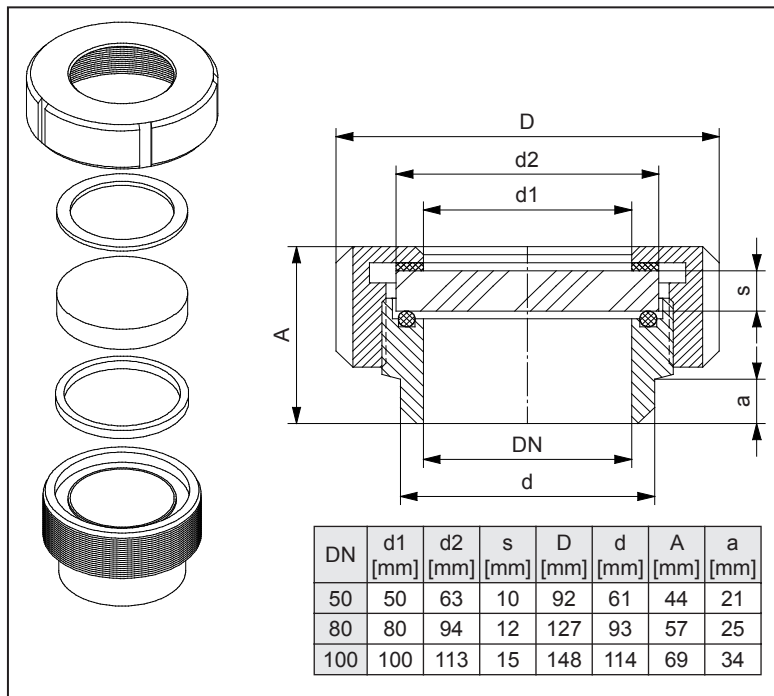


- 1½" 150 lbs, connection dimensions according to ANSI B16.5, with 1½ NPT thread
Part number 71006349
- 2" 150 lbs, connection dimensions according to ANSI B16.5, with 1½ NPT thread
Part number 71006351
- 4" 150 lbs, connection dimensions according to ANSI B16.5, with 1½ NPT thread
Part number 71006353



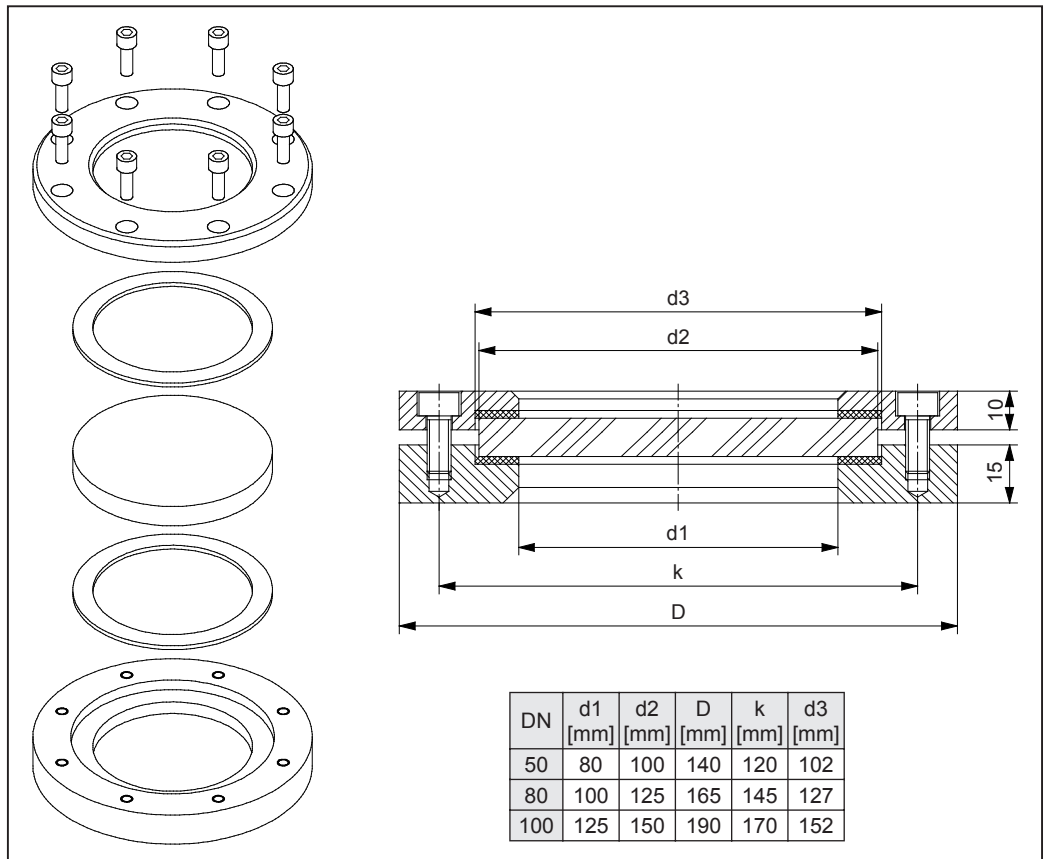
Sightglass fittings

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

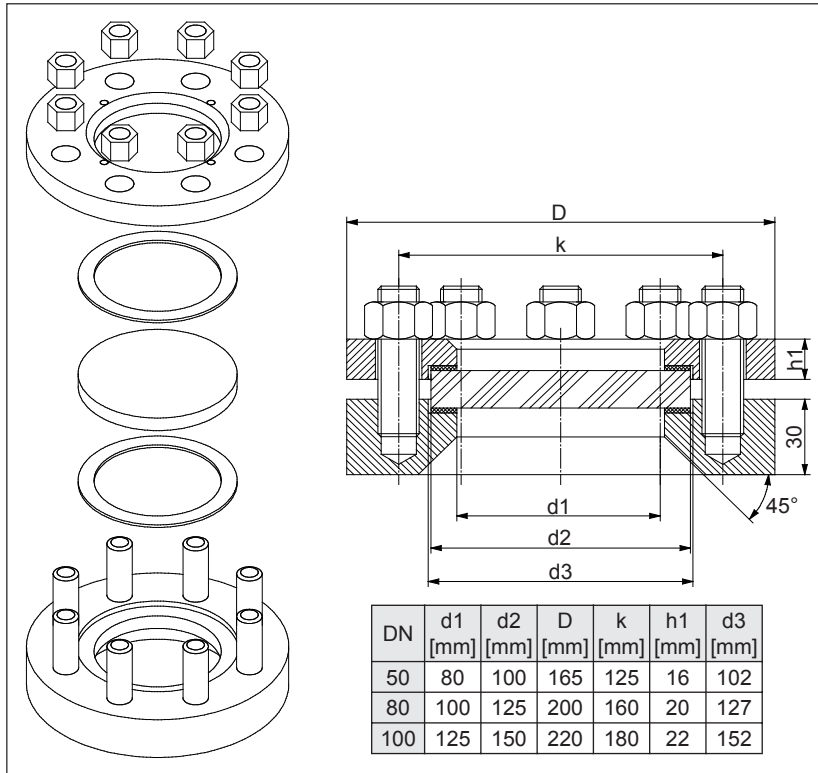
Sightglass fitting with welding flange, for tanks/silos without pressure, Material: Stainless steel 316Ti and silicon, Tmax = 200°C, borosilicate glass, installation using bolts



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

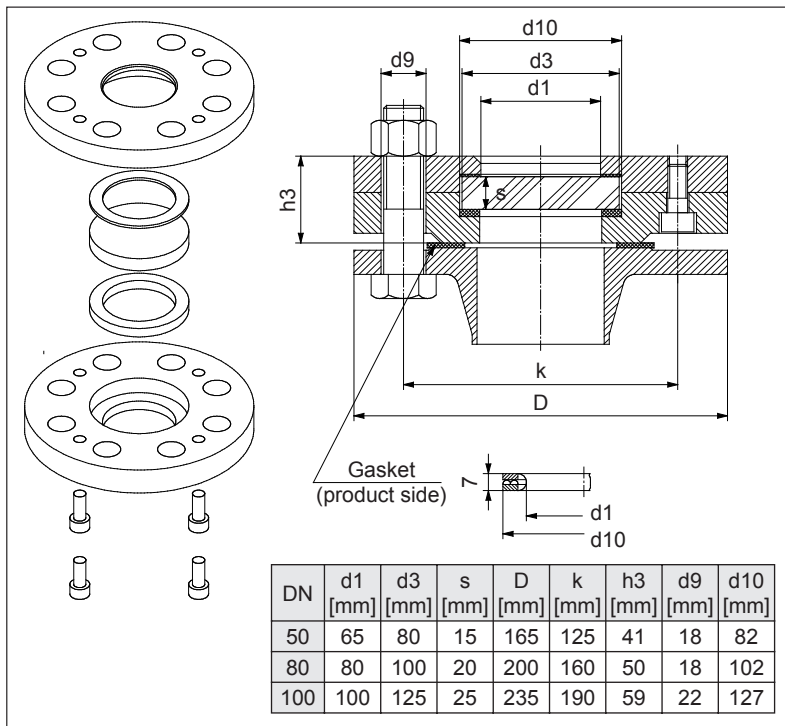
**Sightglass fittings
(continuation)**

Sightglass fitting suitable for welding into/onto vessel walls, similar according to DIN 28120, Material: Stainless steel 316Ti/321 and silicon, P_{max} = 10 bar, T_{max} = 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, P_{max} = 25 bar, T_{max} = 200°C, borosilicate glass



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

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 (see ordering information) Certification number: DMT 03 ATEX E 053
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

Subject to modification

International Head Quarter

Endress+Hauser
GmbH+Co. KG
Instruments International
Colmarer Str. 6
79576 Weil am Rhein
Deutschland

Tel. +49 76 21 9 75 02
Fax +49 76 21 9 75 34 5
www.endress.com
info@ii.endress.com

Endress+Hauser 
People for Process Automation