

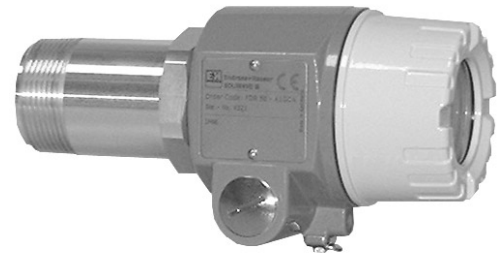


Technical Information
TI 378F/97/en/08.03

Microwave barrier

solivave M FQR 50 / FDR 50

**Non-contact, non-wearing detection
of bulk solids of all kinds**



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

Endress + Hauser

The Power of Know How



Mode of operation and system structure

Measuring principle

The FQR 50 emitter puts out the microwave signal via an integrated horn antenna. The FDR 50 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.

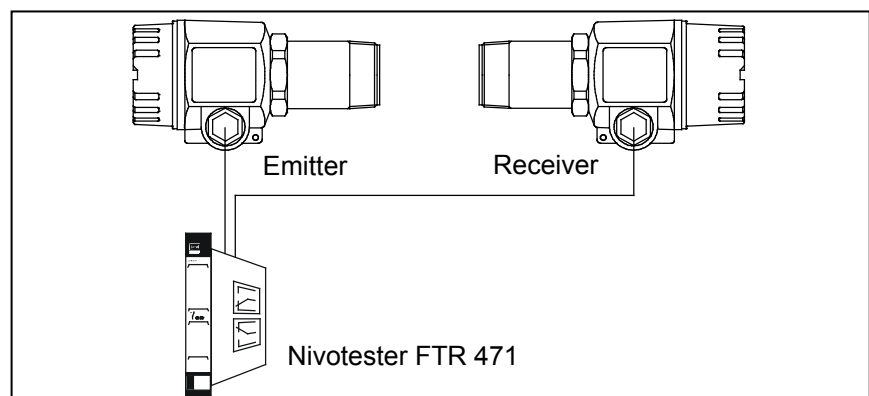
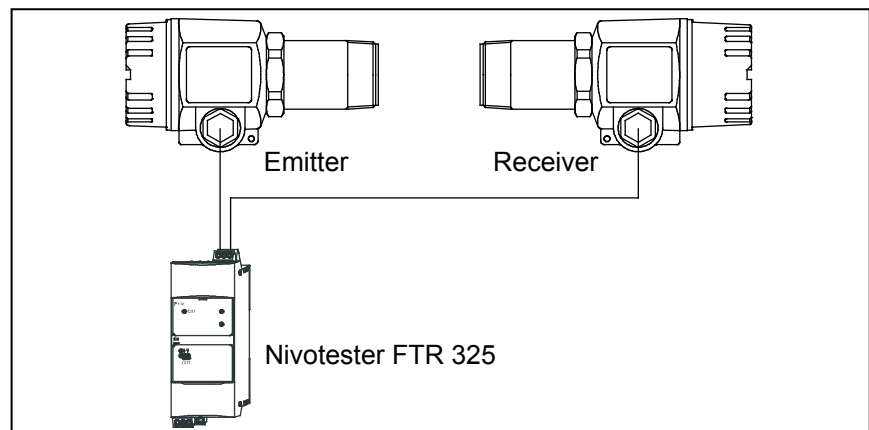
The range of the path is influenced by the different types of materials. The weakening of the microwaves here depends on the electric characteristics of the attenuating material. Materials with the capacity to conduct electricity, for example, metals, reflect the waves and other materials with lower 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 FQR 50
- a receiver FDR 50
- and
- an evaluator Nivotester FTR

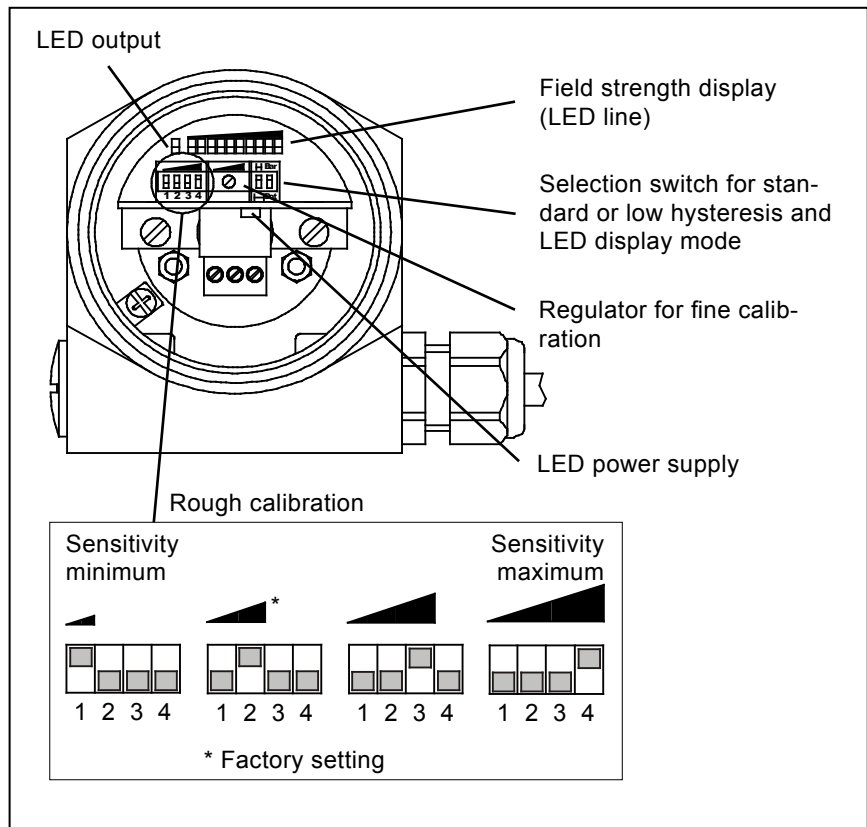
Optical or acoustic signallers, contactors, relays, solenoid etc. may be connected with the Nivotester..



Parameters

Measured variables	Absorption of the electromagnetic waves produced by the emitter.
Measured 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 structure, page 17) is 8 m or 20 m. The range is also dependent on the container walls to be penetrated.
Actual frequency	24,125 GHz
Transmitter power	The power produced by the 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 <p>Note: The power density is clearly under the recommended limit values of the ICNIRP guidelines "Guidelines for Limiting Exposure to Time-Varying Electric, Magnetic, and Electromagnetic Fields (up to 300 GHz)" and is thus harmless for humans completely!</p>
Switching frequency (receiver FDR 50)	max. 2 Hz
Sensitivity adjustment	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 waves to individual situations without a problem. <ul style="list-style-type: none"> • Rough/fine calibration • Hysteresis selected in 2 stages • LED field strength display as an adjustment and positioning aid <p>The microwave barrier 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 an external evaluator (FTR 325 or FTR 471). Field status and operation status are optionally indicated on the spot by a bar graph or by a dot display.</p>

Sensitivity adjustment



High sensitivity can be set for the detection of materials with a very high dielectric constant or of metals because the path 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 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)

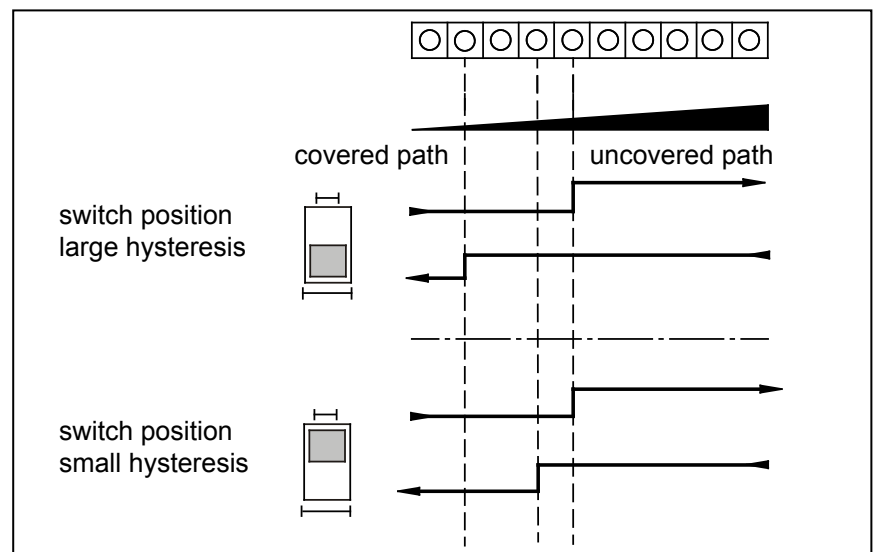
- The sensitivity of the receiver must be adjusted in such a way that as a maximum LED 10 just starts to light up, but at least LED 6 in the LED line must light up.
- With the path covered, only LED 3 must light up in the LED line at the most.
- After a few filling procedures, the sensitivity should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

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 and 2 in the LED line light up.



Auxiliary energy

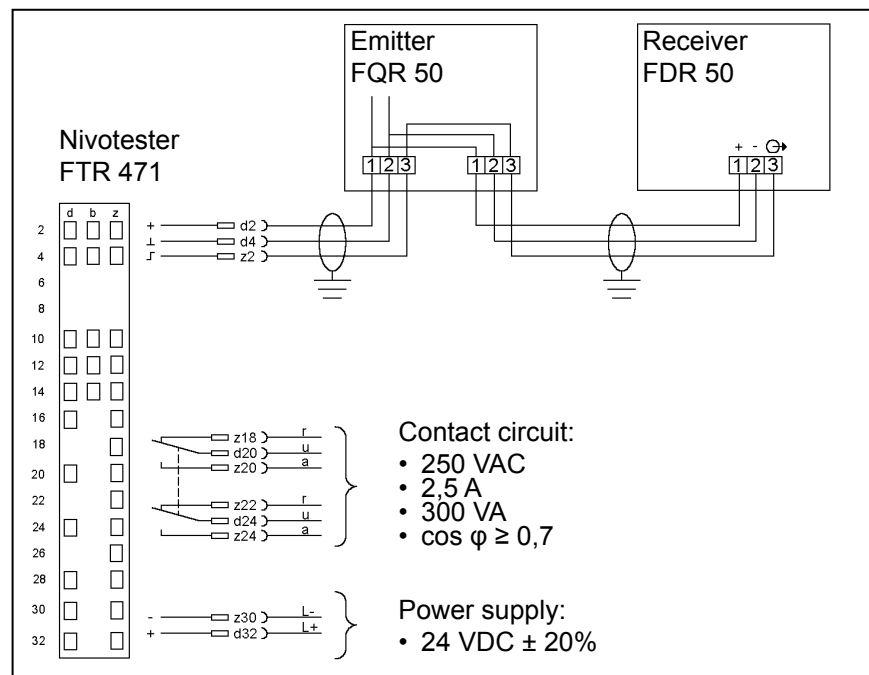
Electrical connection

The emitter and the receiver of the microwave barrier are linked with the Nivotester FTR 325 or FTR 471 via a three-conductor shielded cable. 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 FTR evaluator.

Wiring

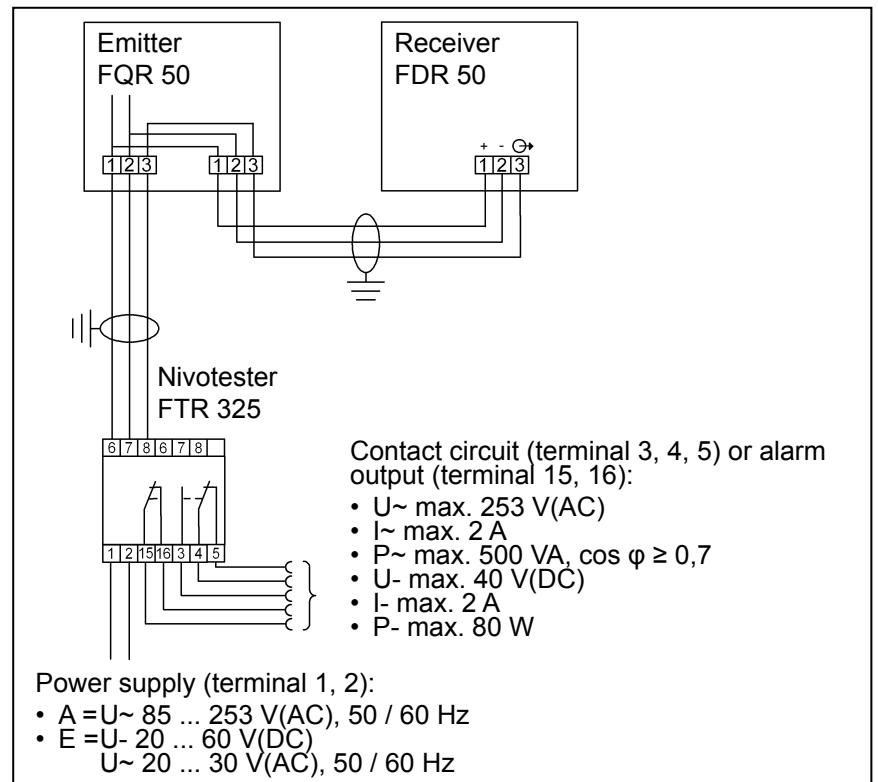
Wiring example 1:

Soliwave M FQR 50 / FDR 50 microwave barrier with Nivotester FTR 471 for rack mounting in ring wiring



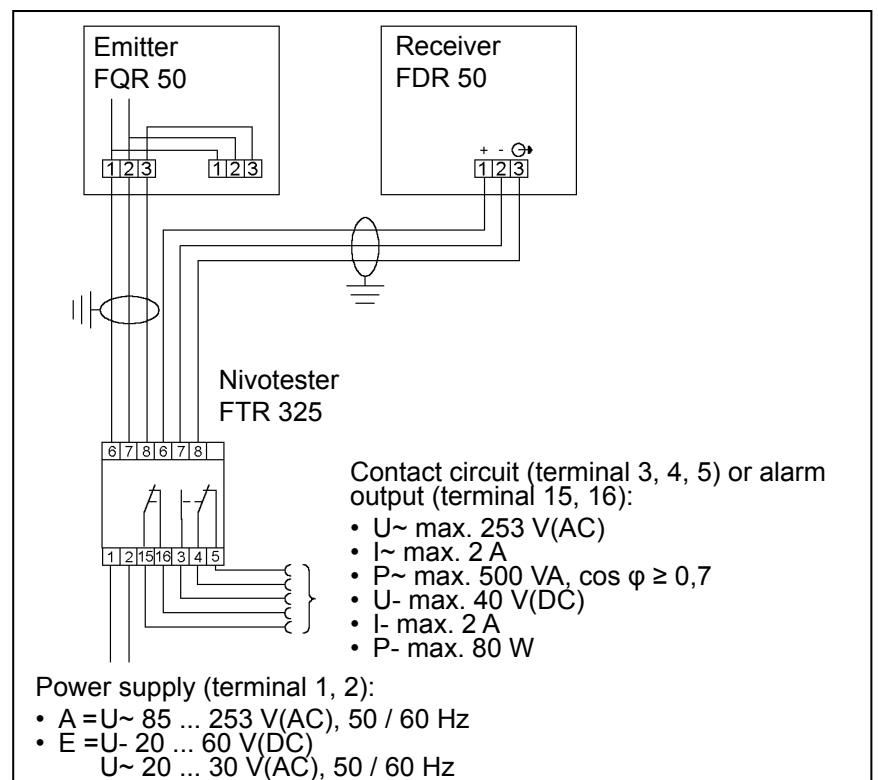
Wiring example 2:

Soliwave M FQR 50 / FDR 50 microwave barrier with Nivotester FTR 325 for rail mounting in ring wiring



Wiring example 3:

Soliwave M FQR 50 / FDR 50 microwave barrier with Nivotester FTR 325 for rail mounting in star wiring

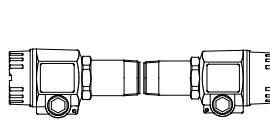
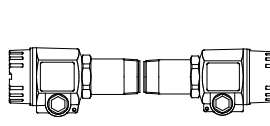
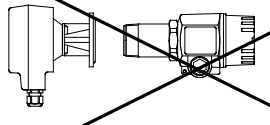
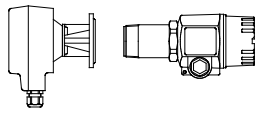
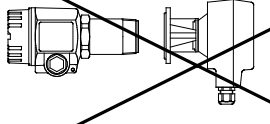
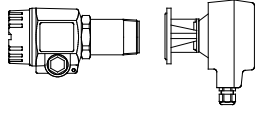
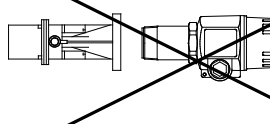
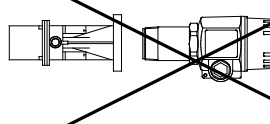
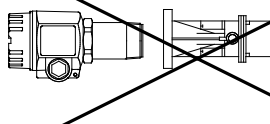
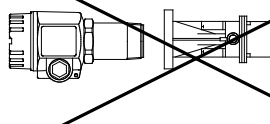


Equipment combinations

The emitter and receiver unit FQR 50 / FDR 50 of the microwave barrier Soliwave M may be combined with earlier equipment components.

Note:

- The Nivotester FTR 471 can still be used.

 FQR 50 / FDR 50 Nivotester FTR 325	 FQR 50 / FDR 50 Nivotester FTR 471
 QR 30 / FDR 50 Nivotester FTR 325	 QR 30 / FDR 50 Nivotester FTR 471
 FQR 50 / DR 30 Nivotester FTR 325	 FQR 50 / DR 30 Nivotester FTR 471
 QR 10 / FDR 50 Nivotester FTR 325	 QR 10 / FDR 50 Nivotester FTR 471
 FQR 50 / DR 10 Nivotester FTR 325	 FQR 50 / DR 10 Nivotester FTR 471

Cable entries

M 20 x 1,5

Cable gland

- Enclosure IP 66
- Scope of delivery:
 - Emitter: 2
 - Receiver: 1

Cable specification

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

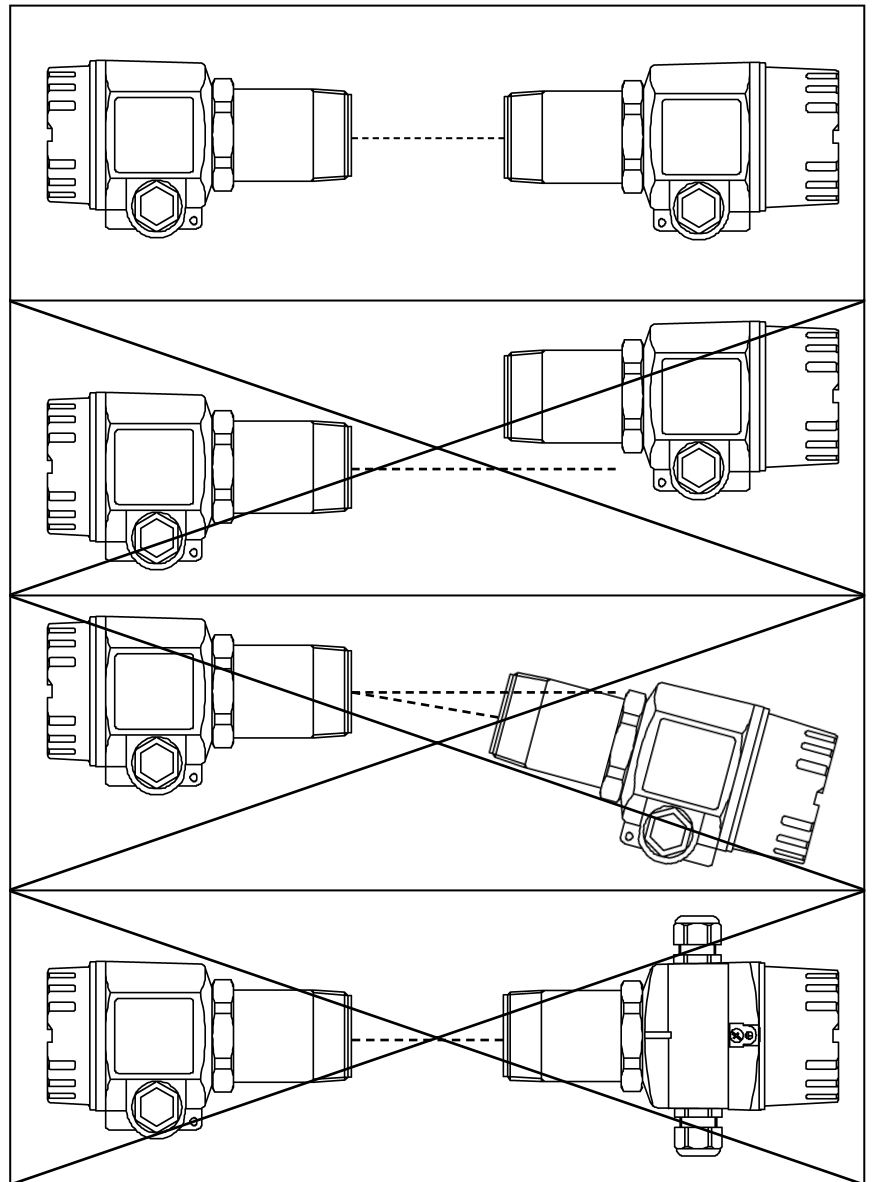
Conditions of application / installation

Installation note

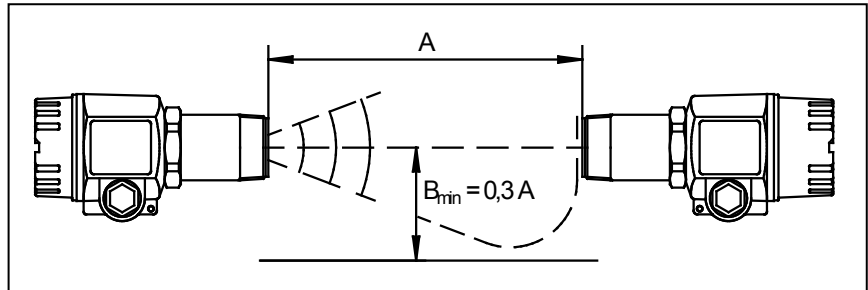
Both the emitter and the receiver are equipped with a standard R 1½ thread screw in compliance with DIN 2999, T.1 as a process connector. This makes a simple installation in the existing container sleeves or supports possible.

Note:

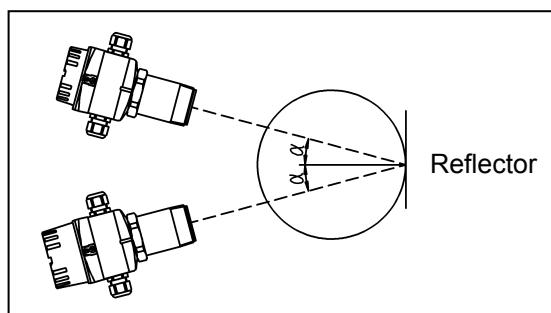
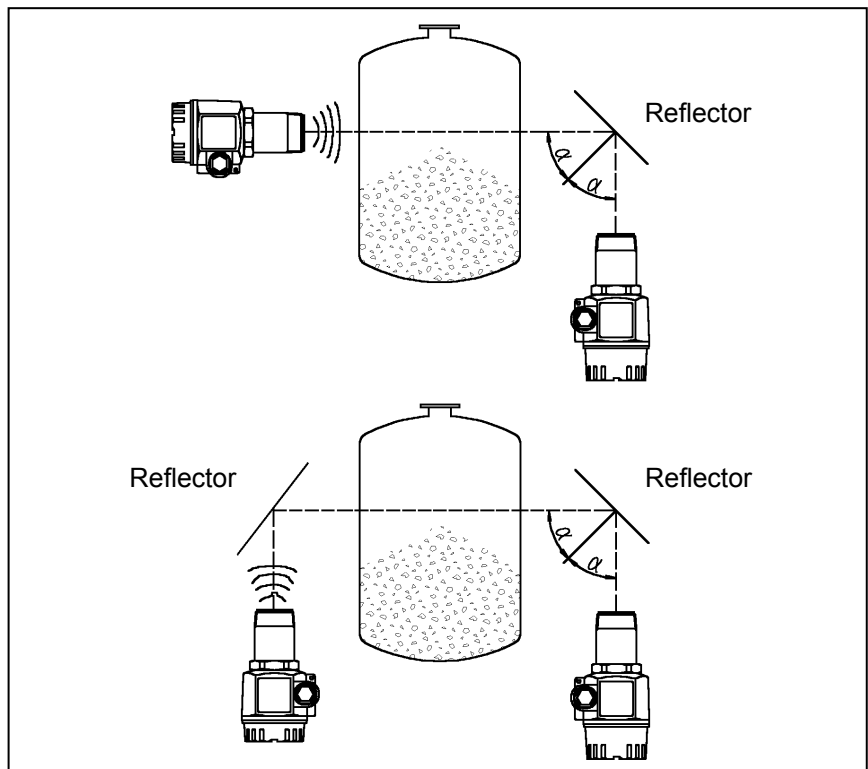
- The fronts of the emitter and the receiver should face each other and be concentric.
- Since the microwaves are polarised the emitter and the receiver may not be rotated around their longitudinal axis, unless they are rotated exactly 180°.



- Disturbing reflections at metal parts are to be avoided. The distance between the microwave beam and metal parts should be at least 30% of the distance between the emitter and the receiver.

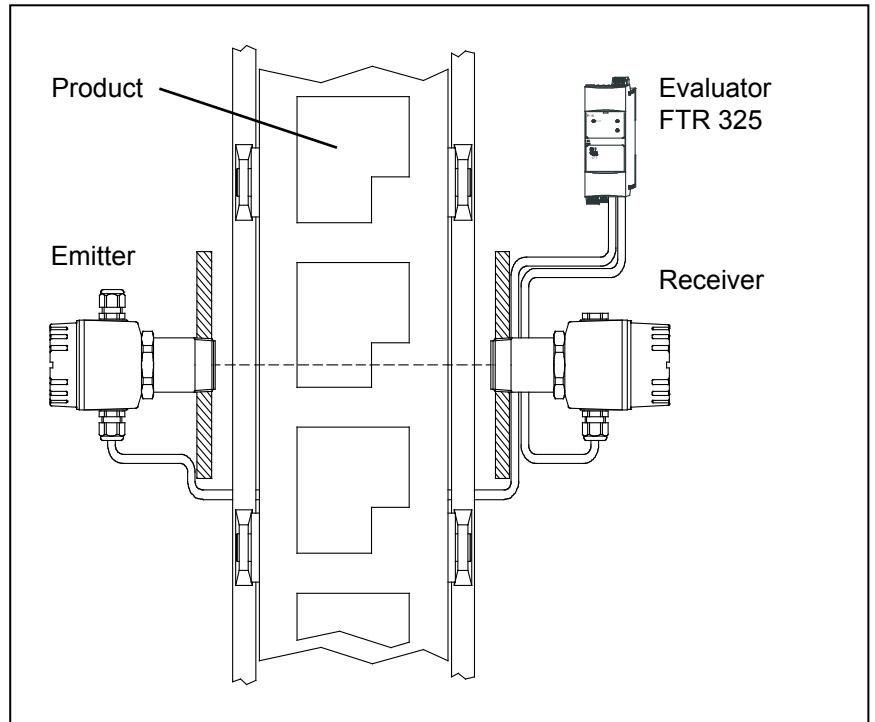
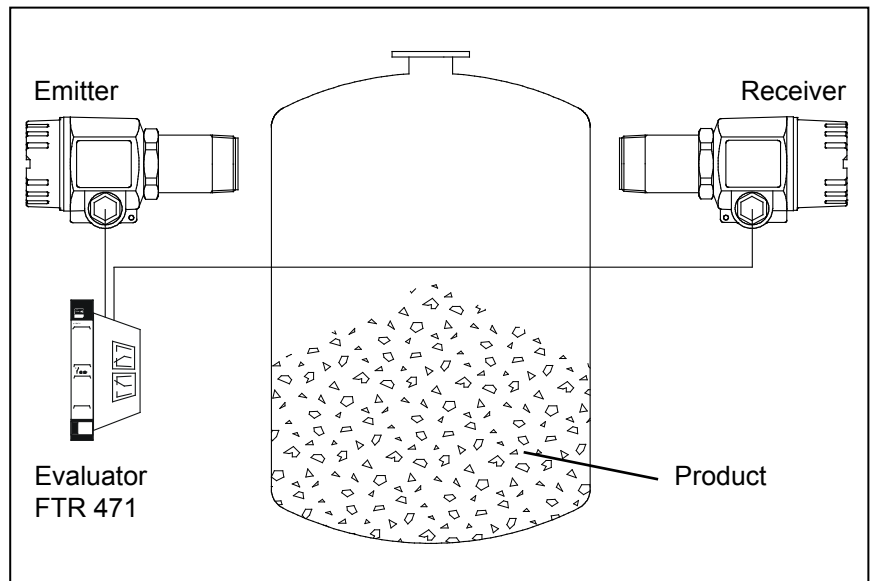


- If, for construction reasons, a direct confrontation of the emitter and the receiver is not possible, the microwave beam can be redirected via a flat metal mirror (reflectors). By using reflectors the range of the microwave barrier is reduced by approximately 10% per reflector.

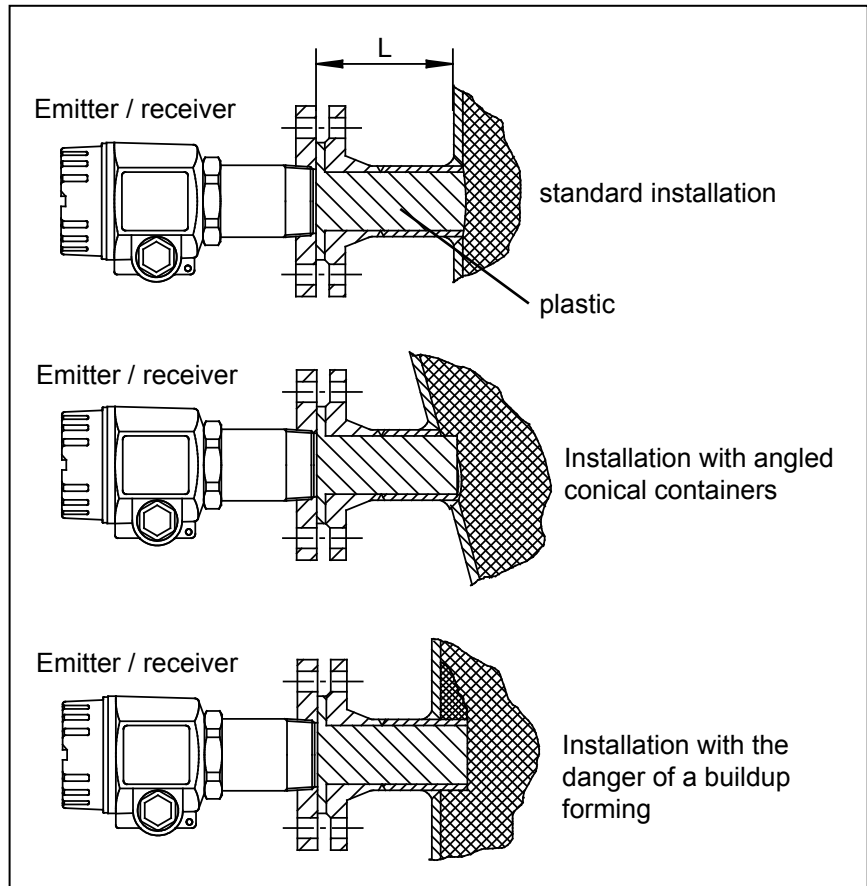


Minimum distance from emitter to receiver

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

Examples of installation**Example of installation 1:
Bulk counting****Example of installation 2:
Limit detection of bulk solids**

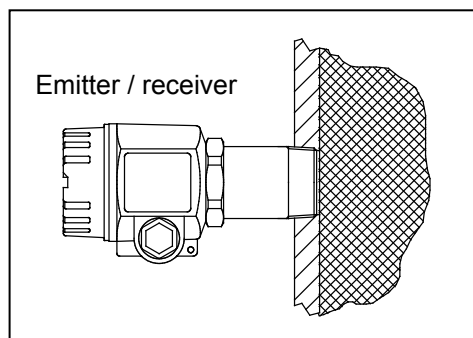
Fastening the emitter and the receiver to containers using a flange



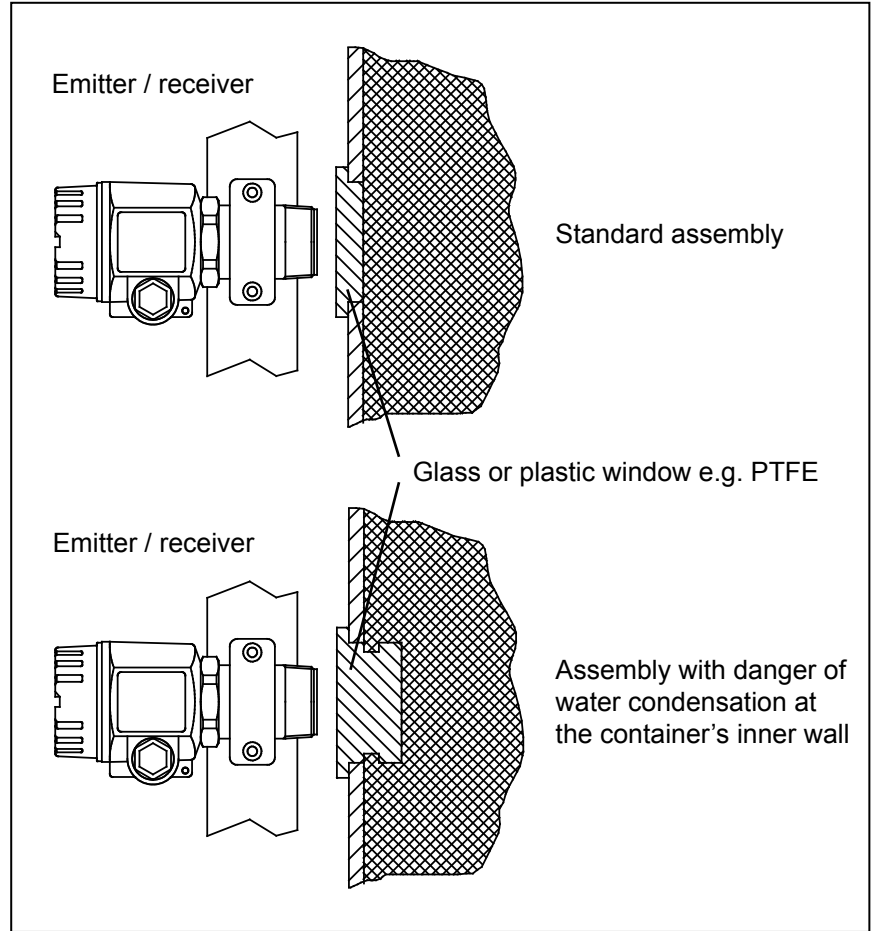
Note:

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

Direct assembly with R 1½ thread



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

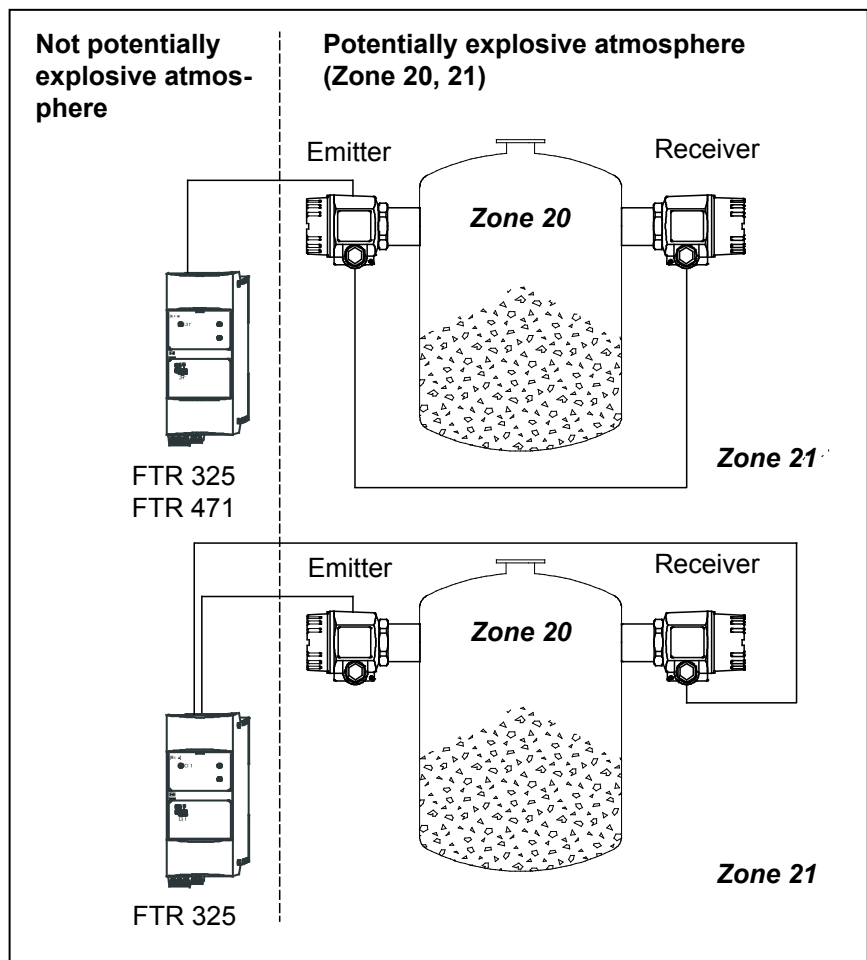


Notes on safety

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

ATEX II 1/2D IP66 T102°C

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



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.

Conditions of application / ambient conditions

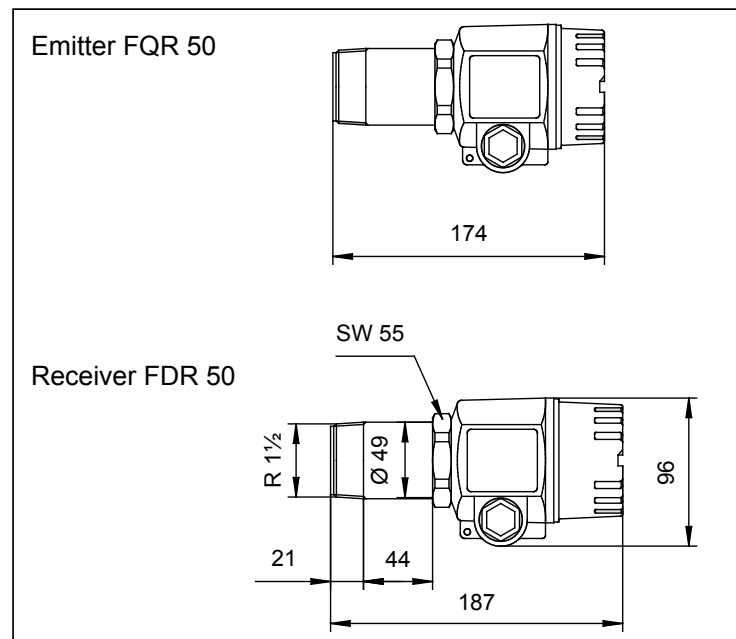
Ambient temperature	- 20°C ... + 70°C
Storage temperature	- 40°C ... + 80°C
Enclosure	IP 66
Electromagnetic compatibility (EMC)	<ul style="list-style-type: none"> • Interference emission in compliance with EN 61326, Class B electrical equipment • Resistance to interference in compliance with EN 61326, appendix A (Industrial range)

Conditions of application / processing conditions

Measuring material temperature range	- 20°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 the notes on installation).
Measuring material pressure range	0 ... 4 bar (Only to be observed when the emitter or the receiver is built into the process.)

Structural construction

Structural shape / dimensions



Weight	Emitter FQR 50 : 0.92 kg Receiver FDR 50: 0.98 kg
Materials	Housing: aluminium with polyester-based powder coating Sight (FDR 50): glass Housing seals: EPDM / silicone Cable gland: PA or metal Process connection (parts in contact with the media): aluminium and PTFE (sensor membrane)
Process connection	Screw R 1½ (DIN 2999 T.1) or 1½" NPT (ANSI)
Housing construction	Type of housing: F18 Cable entry: M20 x 1,5 Cable gland (included in delivery): Emitter 2 Receiver 1

Display and operating surface

Display an operating elements	See page 3 (sensitivity settings)
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Certification / permissions

CE - indication	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 tested according EN 300440-2 (2001-09)
Certification according to directive 94/9/EC (ATEX)	ATEX II 1/2D IP66 T102°C (see order information) Certification number: DMT 03 ATEX E 053
External standards and directives	<ul style="list-style-type: none"> • 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

Conditions of application / ambient conditions

Emitter FQR 50

10 Certificate	
A	Variants for the ex-free atmosphere
B	ATEX II 1/2D IP 66 T102°C
Y	Special equipment
20 Distance of the emitter / receiver	
1	Measuring range*1 maximum 8 m
2	Measuring range*1 maximum 20 m
9	Special equipment
30 Process connection and material	
G	Screw R 1½ DIN 2999 T.1, aluminium
N	Screw 1½" NPT ANSI, aluminium
Y	Special equipment
40 Housing and cable entry	
D	Aluminium F18-housing IP 66, M20 x 1,5
Y	Special equipment
50 Optional features	
A	Basic equipment
Y	Other optional equipment
FQR 50 -	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> complete product description



Receiver FDR 50

10 Certificate	
A	Variants for the ex-free atmosphere
B	ATEX II 1/2D IP 66 T102°C
Y	Special equipment
20 Distance of the emitter / receiver	
1	Measuring range*1 maximum 8 m
2	Measuring range*1 maximum 20 m
9	Special equipment
30 Process connection and material	
G	Screw R 1½ DIN 2999 T.1, aluminium
N	Screw 1½" NPT ANSI, aluminium
Y	Special equipment
40 Housing and cable entry	
D	Aluminium F18-housing IP 66, M20 x 1,5
Y	Special equipment
50 Optional features	
A	Basic equipment
Y	Other optional equipment
FDR 50 -	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> complete product description

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

Designation

Emitter FQR 50




 Endress + Hauser SOLIWAVE M	
Order Code: FQR 50 - <input type="text"/>	
Ser.-No. <input type="text"/> - <input type="text"/>	
IP66	

Made in Germany

Order code
(according to type key)

Year of construction

Serial number

 Endress + Hauser SOLIWAVE M	
Order Code: FQR 50 - <input type="text"/>	
Ser.-No. <input type="text"/> - <input type="text"/>	
DMT 03 ATEX E 053 CE 0032  II 1/2D IP66 T102°C	



Made in Germany

Order code
(according to type key)

Year of construction

Serial number

Receiver FDR 50




 Endress + Hauser SOLIWAVE M	
Order Code: FDR 50 - <input type="text"/>	
Ser.-No. <input type="text"/> - <input type="text"/>	
IP66	

Made in Germany

Order code
(according to type key)

Year of construction

Serial number

 Endress + Hauser SOLIWAVE M	
Order Code: FDR 50 - <input type="text"/>	
Ser.-No. <input type="text"/> - <input type="text"/>	
DMT 03 ATEX E 053 CE 0032  II 1/2D IP66 T102°C	

Made in Germany

Order code
(according to type key)

Year of construction

Serial number

Accessories

Installation strap

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



Installation strap for frame assembly of a FQR / FDR 50:
Aluminium material; part number 52017501
Plastic material; part number 52017502

Adapter flange

Screw assembly with a standard DIN flange.



DIN flange with R 1½ - thread to receive a FQR / FDR 50

- DN 32 PN 16 / DIN 2526 form B with Rp 1½ thread
DIN 2999, material 1.4571;
Part number: 55001632
(directly compatible to QR / DR 30- installation flange)
- DN 50 PN 16 / DIN 2526 form B with Rp 1½ thread
DIN 2999, material 1.4571;
Part number: 910218-0002

Supplementary documentation

Operating instructions (KA)

Soliwave M FQR 50 / FDR 50
KA 206F/97/a6

Nivotester FTR 325
KA 205F/97/a6

Technical informations (TI)

Nivotester FTR 325
TI 377F/97/en

Nivotester FTR 471
TI 100F/00/en

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The Power of Know How

