Operating Instructions

Micropilot M FMR250

Level-Radar

PROFI BUS
PROCESS FIELD BUS

Endress+Hauser

People for Process Automation
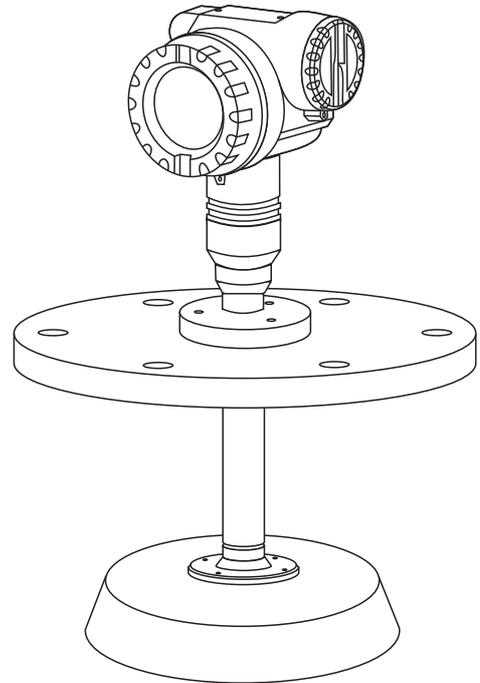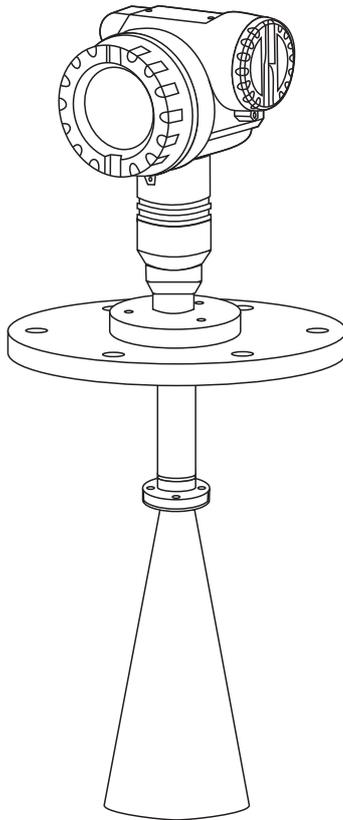
Brief overview

For quick and simple commissioning:

Safety Instructions	
Explanation of the warning symbols You can find special instructions at the appropriate position in the chapter in question. The positions are indicated with the icons Warning ⚠, Caution ♂ and Note ✎.	→ Page 6 ff.

▼

Installation	
The steps for installing the device and installation conditions (e.g. dimensions) can be found here.	→ Page 12 ff.

▼

Wiring	
The device is virtually completely wired on delivery.	→ Page 29 ff.

▼

Display and Operating Elements	
An overview of the position of the display and operating elements can be found here.	→ Page 35 ff.

▼

Commissioning	
In the "Commissioning" section, you learn how to switch on the device and check the functioning.	→ Page 58 ff.

▼

Commissioning via Display VU 331	
In the "Operating" section, you become familiar with the operating elements and the various setting options.	→ Page 33 ff.
Basic Setup with the VU331.	→ Page 61 ff.

▼

Commissioning via Operating Software ToF Tool	
Basic Setup with the ToF Tool. Additional information on the operation of the ToF Tool can be found in the operating instructions BA224F/00, which can be found on the enclosed CD-ROM.	→ Page 76 ff.

▼

Fault Tracking / Trouble Shooting	
If faults occur during operation, use the checklist to localise the cause. Here you can find measures you can take yourself to take remedial action against the fault.	→ Page 84 ff.

▼

Index	
You can find important terms and keywords on the individual sections here. Use the keyword index to find quickly and efficiently the information you need.	→ Page 112 ff.

Brief operating instructions

Micropilot M FMR240/244/245/250 – Brief operating instructions

KA235F/00/a2/08.06
52025245

⚠ Contrast: E + + or E + −

Note!

This operating manual explains the installation and initial start-up for the level transmitter. All functions that are required for a typical measuring task are taken into account here. In addition, the Micropilot M provides many other functions that are not included in this operating manual, such as optimising the measuring point and converting the measured values.

An **overview of all device functions** can be found on Page 106.

The operating manual BA291F/00/en "Description of the instrument functions for Micropilot M" provides an **extensive description of all device functions**, which can be found on the enclosed CD-ROM.

Table of contents

1   Safety instructions

1.1   Designated use

The Micropilot M FMR250 is a compact level radar for the continuous, contactless measurement of predominantly solids. The device can also be freely mounted outside closed metal vessels because of its operating frequency of about 26 GHz and a maximum radiated pulsed energy of 1mW (average power output 1 μW). Operation is completely harmless to humans and animals.

1.2   Installation, commissioning and operation

The Micropilot M has been designed to operate safely in accordance with current technical, safety and EU standards. If installed incorrectly or used for applications for which it is not intended, however, it is possible that application-related dangers may arise, e.g. product overflow due to incorrect installation or calibration. For this reason, the instrument must be installed, connected, operated and maintained according to the instructions in this manual: personnel must be authorised and suitably qualified. The manual must have been read and understood, and the instructions followed. Modifications and repairs to the device are permissible only when they are expressly approved in the manual.

1.3   Operational safety

1.3.1   Hazardous areas

Measuring systems for use in hazardous environments are accompanied by separate "Ex documentation", which is an integral part of this Operating Manual. Strict compliance with the installation instructions and ratings as stated in this supplementary documentation is mandatory.

- Ensure that all personnel are suitably qualified.
- Observe the specifications in the certificate as well as national and local standards and regulations.

1.3.2   FCC approval

This device complies with part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

Caution!
Changes or modifications not expressly approved by the part responsible for compliance could void the user's authority to operate the equipment.

1.4 Notes on safety conventions and symbols

In order to highlight safety-relevant or alternative operating procedures in the manual, the following conventions have been used, each indicated by a corresponding symbol in the margin.

Safety conventions		
	Warning!	A warning highlights actions or procedures which, if not performed correctly, will lead to personal injury, a safety hazard or destruction of the instrument
	Caution!	Caution highlights actions or procedures which, if not performed correctly, may lead to personal injury or incorrect functioning of the instrument
	Note!	A note highlights actions or procedures which, if not performed correctly, may indirectly affect operation or may lead to an instrument response which is not planned
Explosion protection		
	Device certified for use in explosion hazardous area	If the device has this symbol embossed on its name plate it can be installed in an explosion hazardous area
	Explosion hazardous area	Symbol used in drawings to indicate explosion hazardous areas. Devices located in and wiring entering areas with the designation "explosion hazardous areas" must conform with the stated type of protection.
	Safe area (non-explosion hazardous area)	Symbol used in drawings to indicate, if necessary, non-explosion hazardous areas. Devices located in safe areas still require a certificate if their outputs run into explosion hazardous areas
Electrical symbols		
	Direct voltage	A terminal to which or from which a direct current or voltage may be applied or supplied
	Alternating voltage	A terminal to which or from which an alternating (sine-wave) current or voltage may be applied or supplied
	Grounded terminal	A grounded terminal, which as far as the operator is concerned, is already grounded by means of an earth grounding system
	Protective grounding (earth) terminal	A terminal which must be connected to earth ground prior to making any other connection to the equipment
	Equipotential connection (earth bonding)	A connection made to the plant grounding system which may be of type e.g. neutral star or equipotential line according to national or company practice
	Temperature resistance of the connection cables	States, that the connection cables must be resistant to a temperature of at least 85 °C.

2   Identification

2.1   Device designation

2.1.1   Nameplate

The following technical data are given on the instrument nameplate:
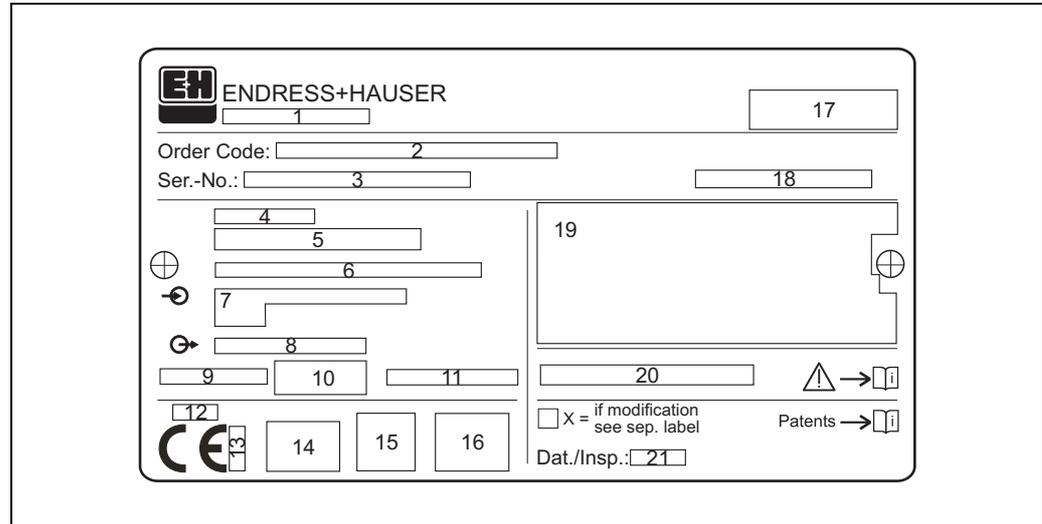
Fig. 1:   Information on the nameplate of the Micropilot M (example)

1   Instrument designation
2   Order code
3   Serial number
4   Process pressure
5   Process temperature
6   Length (optional)
7   Power supply
8   Current supply
9   Ambient temperature
10   Cable specification
11   Factory sealed
12   Radio equipment number
13   TÜV identification mark
14   Certificate symbol (optional) e.g. Ex, NEPSI
15   ertificate symbol (optional) e.g. 3A
16   Certificate symbol (optional) e.g. SIL, FF
17   Place of production
18   Degree of protection z.B. IP65, IP67
19   Certificates and approvals
20   Document number of safety instructions e.g. XA, ZD, ZE
21   Dat./Insp. xx / yy (xx = week of production, yy = year of production)

2.1.2   Ordering structure

Ordering structure Micropilot M FMR250

10		Approval:
	A	Non-hazardous area
	1	ATEX II 1/2G EEx ia IIC T6
	4	ATEX II 1/2G EEx d [ia] IIC T6
	G	ATEX II 3G EEx nA II T6
	B	ATEX II 1/2GD EEx ia IIC T6, Alu blind cover
	C	ATEX II 1/2G EEx ia IIC T6, ATEX II 1/3D
	D	ATEX II 1/2D, Alu blind cover
	E	ATEX II 1/3D
	S	FM IS-Cl.I/II/III Div.1 Gr.A–G
	T	FM XP-Cl.I/II/III Div.1 Gr.A–G
	N	CSA General Purpose
	U	CSA IS-Cl.I/II/III Div.1 Gr.A–G
	V	CSA XP-Cl.I/II/III Div.1 Gr.A–G
	Y	Special version

20		Antenna:
	D	Horn 80mm/3", increased near distance dynamics
	E	Horn 80mm/3", increased near distance dynamics
	G	Parabolic 200mm/8", increased near distance dynamics
	H	Parabolic 250mm/10", increased near distance dynamics
	4	Horn 80mm/3"
	5	Horn 80mm/3"
	6	Parabolic 200mm/8"
	9	Special version, to be specified

30		Antenna seal; Temperature:
	E	FKM Viton GLT; -40...200°C/-40...392 °F
	Y	Special version

40		Antenna extension:
	1	Not selected
	2	250mm/10"
	3	450mm/18"
	9	Special version

50		Process connection:
	GGJ	Thread EN10226 R1-1/2, 316L
	GNJ	Thread ANSI NPT1-1/2, 316L
	X3J	UNI flange DN200/8"/200, 316L max PN1/14.5lbs/1K, compatible DN200 PN10/16, 8" 150lbs, 10K 200
	X5J	UNI flange DN250/10"/250, 316L max PN1/14.5lbs/1K, compatible DN250 PN10/16, 10" 150lbs, 10K 250
	XCJ	Top target pos., UNI DN100/4"/100, 316L max PN1/14.5lbs/1K, compatible DN100 PN10/16, 4" 150lbs, 10K 100
	XEJ	Top target pos., UNI DN200/8"/200, 316L max PN1/14.5lbs/1K, compatible DN200 PN10/16, 8" 150lbs, 10K 200
	XFJ	Top target pos., UNI DN250/10"/250, 316L max PN1/14.5lbs/1K, compatible DN250 PN10/16, 10" 150lbs, 10K 250
	CMJ	DN80 PN10/16 B1, 316L flange EN1092-1 (DIN2527 C)
	CQJ	DN100 PN10/16 B1, 316L flange EN1092-1 (DIN2527 C)
	ALJ	3" 150lbs RF, 316/316L flange ANSI B16.5
	APJ	4" 150lbs RF, 316/316L flange ANSI B16.5
	KLJ	10K 80A RF, 316L flange JIS B2220
	KPJ	10K 100A RF, 316L flange JIS B2220
	YY9	Special version, to be specified

FMR250-		Product designation (part 1)

Ordering structure Micropilot M FMR250 (continued)

60							Output; Operation:
						A	4–20mA HART; 4–line display VU331, envelope curve display on site
						B	4–20mA HART; w/o display, via communication
						K	4–20mA HART; prepared for FHX40, remote display (Accessory)
						C	PROFIBUS PA; 4–line display VU331, envelope curve display on site
						D	PROFIBUS PA; w/o display, via communication
						L	PROFIBUS PA; prepared for FHX40, remote display (Accessory)
						E	FOUNDATION Fieldbus; 4–line display VU331, envelope curve display on site
						F	FOUNDATION Fieldbus; w/o display, via communication
						M	FOUNDATION Fieldbus; prepared for FHX40, remote display (Accessory)
						Y	Special version

70							Housing:
						A	F12 Alu, coated IP65 NEMA4X
						B	F23 316L IP65 NEMA4X
						C	T12 Alu, coated IP65 NEMA4X, separate connection compartment
						D	T12 Alu, coated IP65 NEMA4X + OVP, separate connection compartment, OVP = overvoltage protection
						Y	Special version

80							Cable entry:
						2	Gland M20x1.5 (EEx d > thread M20)
						3	Thread G1/2
						4	Thread NPT1/2
						9	Special version

90							Additional option:
						K	Air purge connection G1/4
						M	Air purge connection NPT1/4
						Y	Special version

FMR250–							Complete product designation

2.2   Scope of delivery

Caution!
It is essential to follow the instructions concerning the unpacking, transport and storage of
measuring instruments given in the chapter "Incoming acceptance, transport, storage" on Page 12!

The scope of delivery consists of:
- Assembled instrument
- Endress+Hauser oprating program (on the enclosed CD-ROM
- Accessories ($\rightarrow$ Chap. 8)

Accompanying documentation:
- Short manual (basic setup/troubleshooting): housed in the instrument
- Operating manual (this manual)
- Approval documentation: if this is not included in the operating manual.

Note!
The operating manual "Description of Instrument Functions" you can be found on the enclosed CD-
ROM.

2.3   Certificates and approvals

CE mark, declaration of conformity
The device is designed to meet state-of-the-art safety requirements, has been tested and left the
factory in a condition in which it is safe to operate. The device complies with the applicable
standards and regulations as listed in the EC declaration of conformity and thus complies with the
statutory requirements of the EC directives. Endress+Hauser confirms the successful testing of the
device by affixing to it the CE mark.

2.4   Registered trademarks

KALREZ®, VITON®, TEFLON®
Registered trademark of the company, E.I. Du Pont de Nemours & Co., Wilmington, USA

TRI-CLAMP®
Registered trademark of the company, Ladish & Co., Inc., Kenosha, USA

PROFIBUS®
Registered trademark of the PROFIBUS Trade Organisation, Karlsruhe, Germany

ToF®
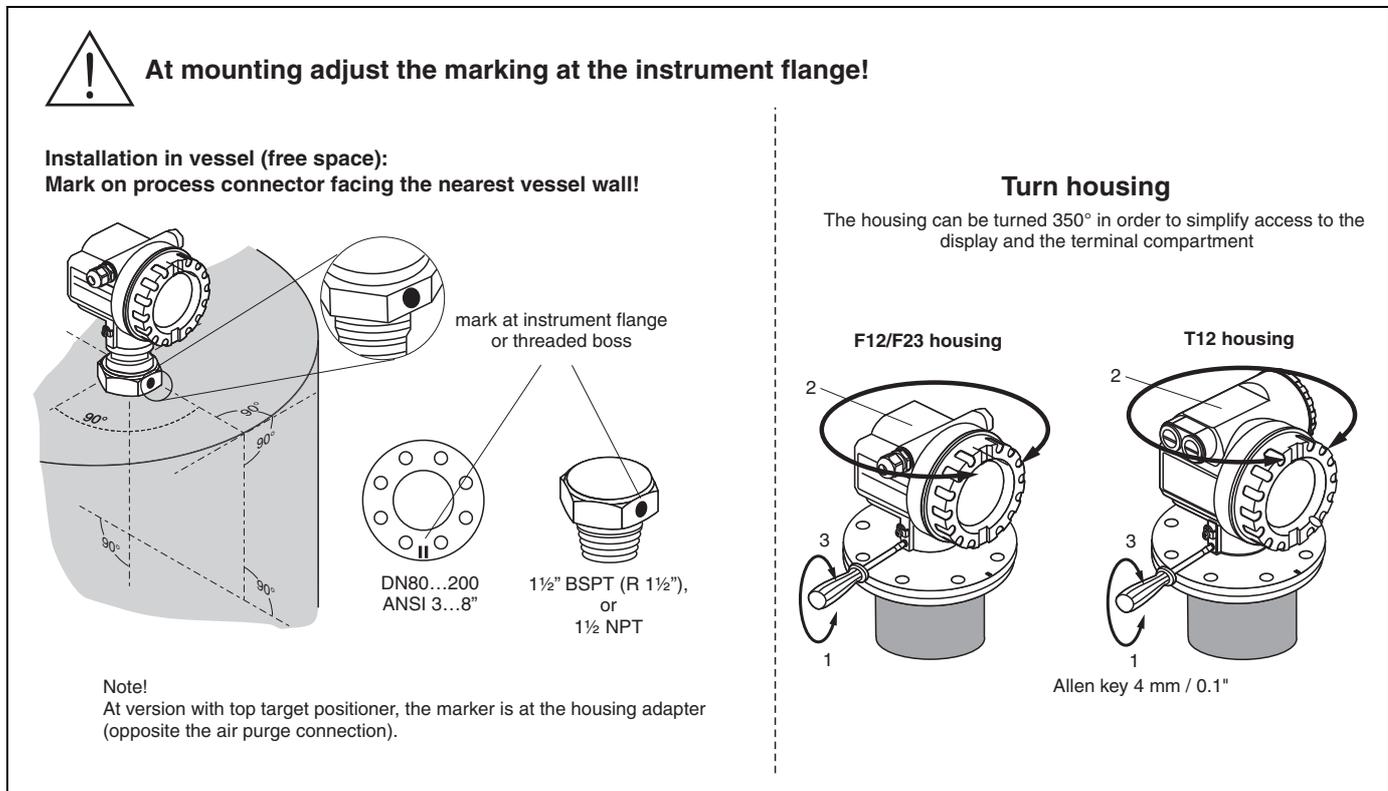Registered trademark of the company Endress+Hauser GmbH+Co. KG, Maulburg, Germany

PulseMaster®
Registered trademark of the company Endress+Hauser GmbH+Co. KG, Maulburg, Germany

PhaseMaster®
Registered trademark of the company Endress+Hauser GmbH+Co. KG, Maulburg, Germany

3 Installation

3.1 Quick installation guide

⚠ At mounting adjust the marking at the instrument flange!

Installation in vessel (free space):
Mark on process connector facing the nearest vessel wall!

mark at instrument flange
or threaded boss

DN80…200
ANSI 3…8"

1½" BSPT (R 1½"),
or
1½ NPT

Note!
At version with top target positioner, the marker is at the housing adapter
(opposite the air purge connection).

Turn housing

The housing can be turned 350° in order to simplify access to the
display and the terminal compartment

F12/F23 housing

T12 housing

Allen key 4 mm / 0.1"

L00-FMR250xx-17-00-00-en-011

3.2 Incoming acceptance, transport, storage

3.2.1 Incoming acceptance

Check the packing and contents for any signs of damage.
Check the shipment, make sure nothing is missing and that the scope of supply matches your order.

3.2.2 Transport

Caution!
Follow the safety instructions and transport conditions for instruments of more than
18 kg.
Do not lift the measuring instrument by its housing in order to transport it.
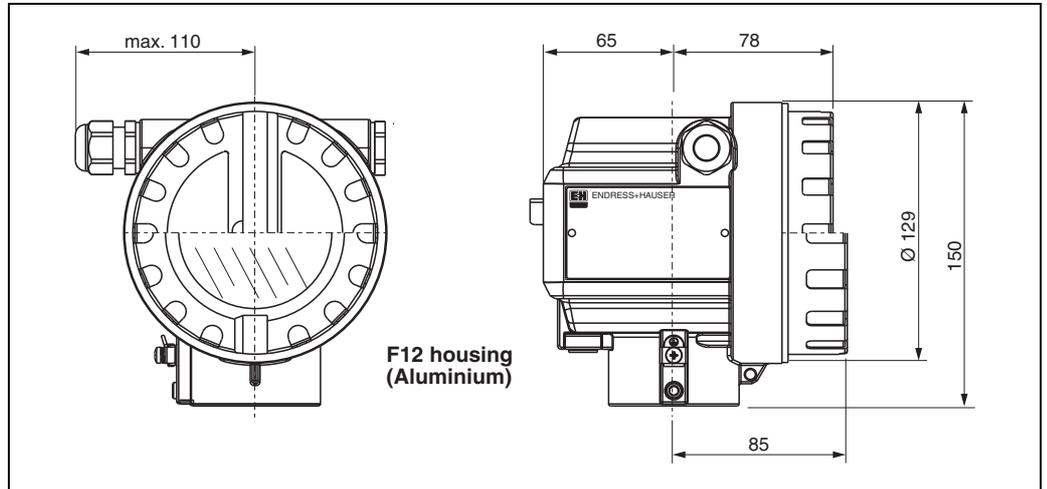
3.2.3 Storage

Pack the measuring instrument so that is protected against impacts for storage and transport. The
original packing material provides the optimum protection for this.
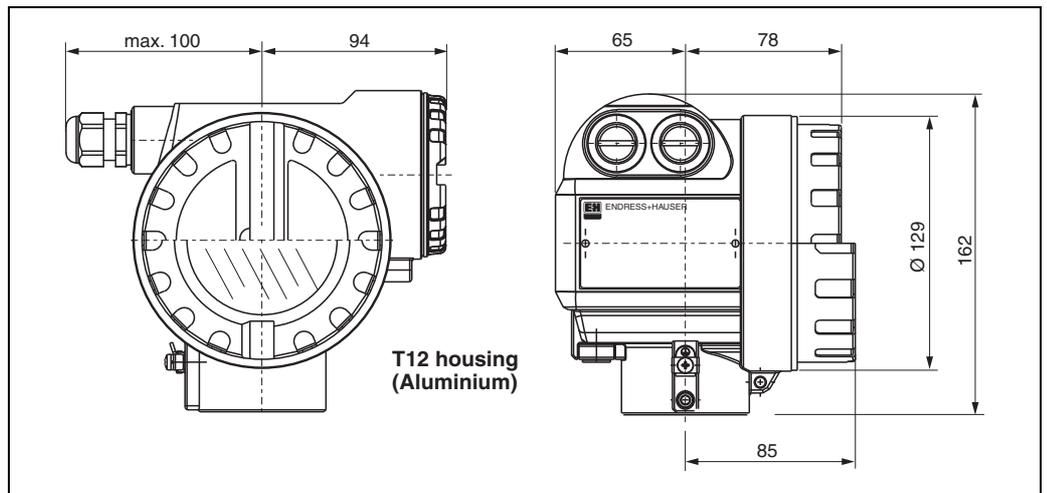The permissible storage temperature is –40 °C…+80 °C.

3.3   Installation conditions
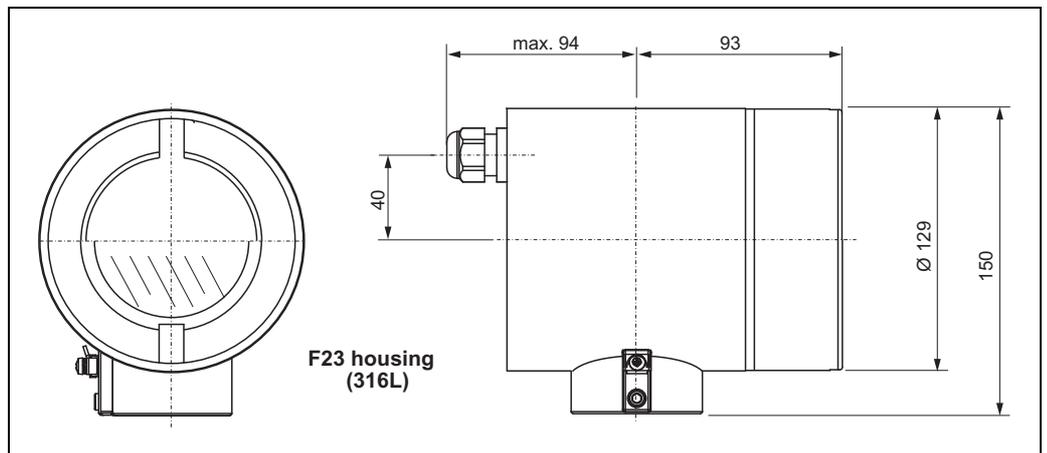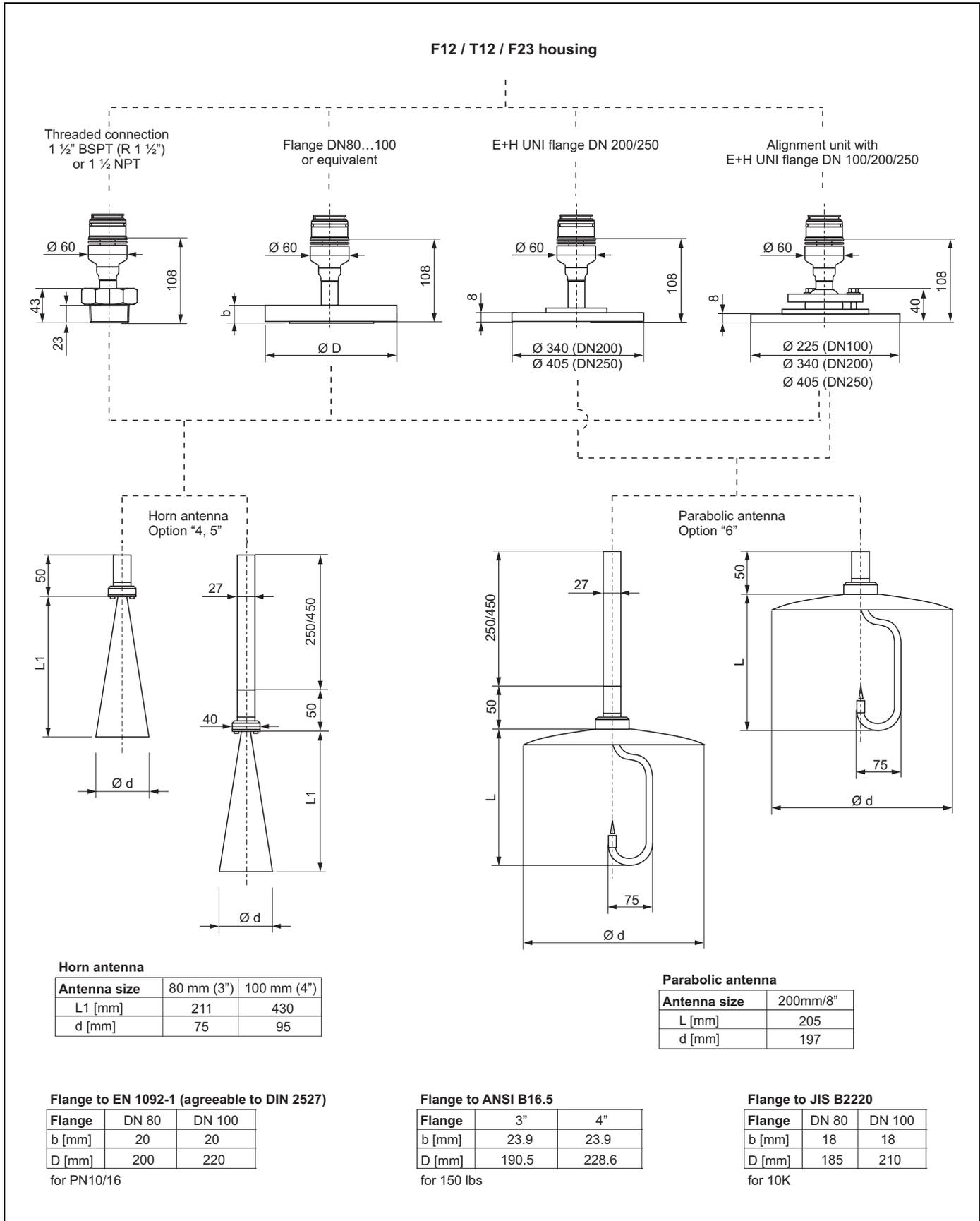
3.3.1   Dimensions

Housing dimensions

F12 housing
(Aluminium)

L00-F12xxxx-06-00-00-en-001

T12 housing
(Aluminium)

L00-T12xxxx-06-00-00-en-001

F23 housing
(316L)

L00-F23xxxx-06-00-00-en-001

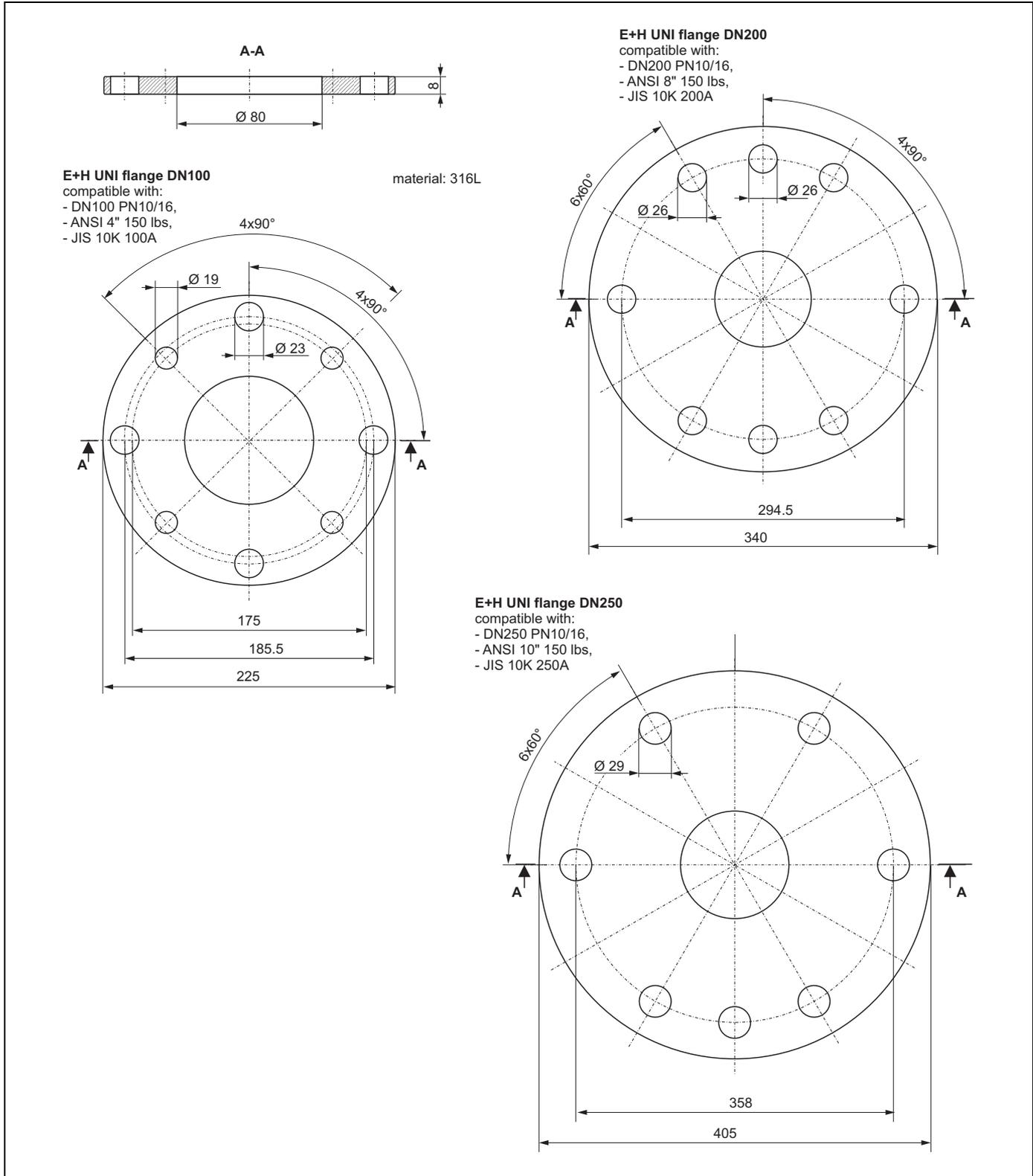**Micropilot M FMR250 – process connection and antenna (option "4, 5, 6")**

F12 / T12 / F23 housing

Threaded connection
1 ½" BSPT (R 1 ½")
or 1 ½ NPT

Flange DN80…100
or equivalent

E+H UNI flange DN 200/250

Alignment unit with
E+H UNI flange DN 100/200/250

Ø 340 (DN200)
Ø 405 (DN250)

Ø 225 (DN100)
Ø 340 (DN200)
Ø 405 (DN250)

Horn antenna
Option "4, 5"

Parabolic antenna
Option "6"

Horn antenna

Antenna size	80 mm (3")	100 mm (4")
L1 [mm]	211	430
d [mm]	75	95

Parabolic antenna

Antenna size	200mm/8"
L [mm]	205
d [mm]	197

Flange to EN 1092-1 (agreeable to DIN 2527)

Flange	DN 80	DN 100
b [mm]	20	20
D [mm]	200	220
for PN10/16		

Flange to ANSI B16.5

Flange	3"	4"
b [mm]	23.9	23.9
D [mm]	190.5	228.6
for 150 lbs		

Flange to JIS B2220

Flange	DN 80	DN 100
b [mm]	18	18
D [mm]	185	210
for 10K		

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Micropilot M FMR250 – process connection and antenna (option "D, E, G, H")

Horn antenna

Antenna size	80 mm (3")	100 mm (4")
L1 [mm]	211	430
d [mm]	75	95

Parabolic antenna

Antenna size	200mm (8")	250mm (10")
L1 [mm]	60.6	88.4
d [mm]	173	236

Parabolic antenna

Antenna size / flange	200 mm (8") UNI	250 mm (10") UNI
L2 [mm]	50	37

Flange to EN 1092-1 (agreeable to DIN 2527)

Flange	DN 80	DN 100
b [mm]	20	20
D [mm]	200	220
for PN10/16		

Flange to ANSI B16.5

Flange	3"	4"
b [mm]	23.9	23.9
D [mm]	190.5	228.6
for 150 lbs		

Flange to JIS B2220

Flange	DN 80	DN 100
b [mm]	18	18
D [mm]	185	210
for 10K		

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E+H UNI flange

The number of bolts has sometimes been reduced. The bolt-holes have been enlarged for adaption of dimensions, therefore, the flange needs to be properly aligned to the counterflange before the bolts are tightened.

Top target positioner with E+H UNI flange

A-A

Ø 85

clamping screw
3 x M8 shifty at 120°

40

8

Viton seal

E+H UNI flange
DN100/200/250

±15°
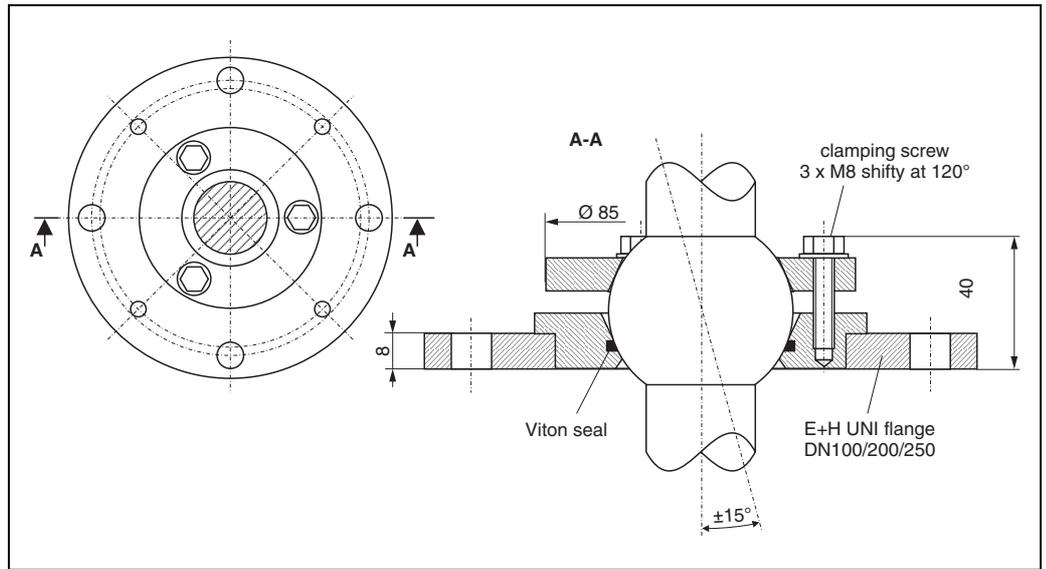
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3.3.2   Engineering hints

Orientation

- Recommended distance (1) wall – **outer edge** of nozzle: ~1/6 of vessel diameter. However, the device should not, under any circumstances, be mounted less than 20 cm/ 8" from the vessel wall.
  Note!
  If the tank wall is not smooth (corrugated metal, welding seams, irregularities etc.) the distance from the wall should be kept as large as possible. If necessary, use a top target positioner to prevent interference reflections from the tank wall.
- Not in the centre (3), interference can cause signal loss.
- Not above the fill stream (4).
- It is recommended to use a weather protection cover (2) in order to protect the transmitter from direct sun or rain. Assembly and disassembly is simply done by means of a tension clamp (→ Chap. 8 on Page 81).
- In extremely dusty applications, the integrated air purge connection can prevent clogging of the antenna.

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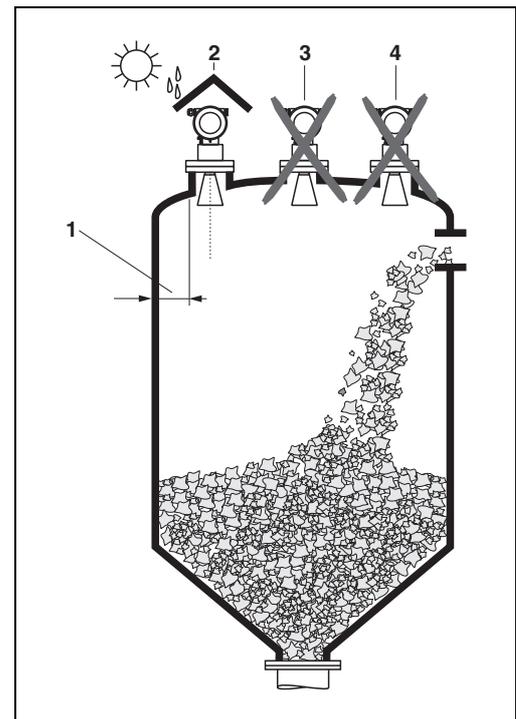
Vessel installations

- Avoid any installations (1), like limit switches, struts, etc., inside the signal beam (refer to beam angle see "" on).
- Symmetrical installations (2), i.e. reinforcing rings, heating coils, etc., can also interfere with the measurement.

Optimization options

- Antenna size: the bigger the antenna, the smaller the beam angle, the less interference echoes.
- Mapping: the measurement can be optimized by means of electronic suppression of interference echoes.
- Antenna alignment: refer to "Optimum mounting position"
- In devices with top target positioner, the sensor can be optimally aimed within the vessel and/or interference reflections can be avoided.
  The max. angle β is ±15°.
- In particular, sensor alignment serves to:
  – prevent interference reflections
  – extend the maximum possible measuring range in conical outlets.
- Metallic screens (3) mounted at a slope spread the radar signals and can, therefore, reduce interference echoes.

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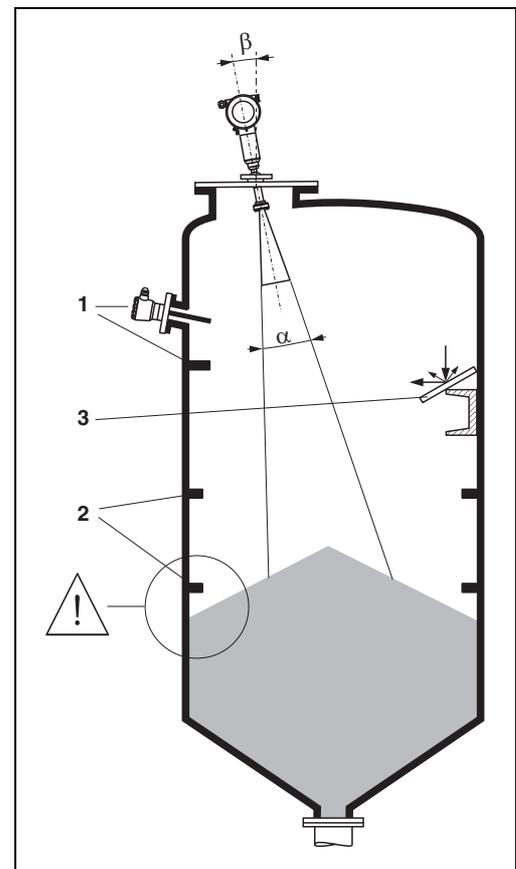
Please contact Endress+Hauser for further information.

Measurement in a plastic tank

If the outer wall of the tank is made of a non-conductive material (e.g. GRP), microwaves can also be reflected off interfering installations outside the signal beam (e.g. metallic pipes (1), ladders (2), grates (3), …). Therefore, there should be no such interfering installations in the signal beam.
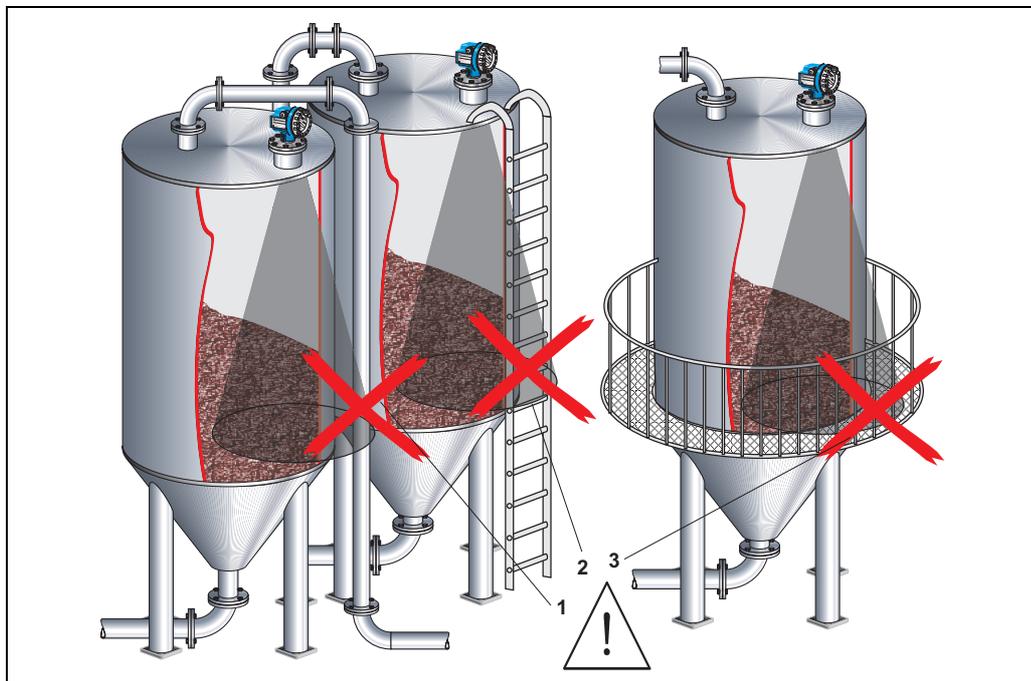
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Please contact Endress+Hauser for further information.

Beam angle

The beam angle is defined as the angle a where the energy density of the radar waves reaches half the value of the maximum energy density (3dB-width). Microwaves are also emitted outside the signal beam and can be reflected off interfering installations. Beam diameter **W** as function of antenna type (beam angle α) and measuring distance **D**:

Antenna size FMR250	Horn antenna		Parabolic antenna	
	80 mm (3")	100 mm (4")	200 mm (8")	250 mm (10")
Beam angle α	10°	8°	4°	3.5°

Measuring distance (D)	Beamwidth diameter (W)			
	80 mm (3")	100 mm (4")	200 mm (8")	250 mm (10")
5 m (16 ft)	0.87 m (2.80 ft)	0.70 m (2.24 ft)	0.35 m (1.12 ft)	0.3 m (0.98 ft)
10 m (32 ft)	1.75 m (5.60 ft)	1.40 m (4.48 ft)	0.70 m (2.23 ft)	0.61 m (2 ft)
15 m (49 ft)	2.62 m (8.57 ft)	2.10 m (6.85 ft)	1.05 m (3.42 ft)	0.92 m (3.01 ft)
20 m (65 ft)	3.50 m (11.37 ft)	2.80 m (9.09 ft)	1.40 m (4.54 ft)	1.22 m (4 ft)
30 m (98 ft)	5.25 m (17.15 ft)	4.20 m (13.71 ft)	2.10 m (6.84 ft)	1.83 m (6 ft)
40 m (131 ft)	7.00 m (22.92 ft)	5.59 m (18.32 ft)	2.79 m (9.15 ft)	2.44 m (8 ft)
50 m (164 ft)	8.75 m (28.70 ft)	6.99 m (22.94 ft)	3.50 m (11.45 ft)	3.06 m (10.04 ft)

$$W = 2 \cdot D \cdot \tan \frac{\alpha}{2}$$
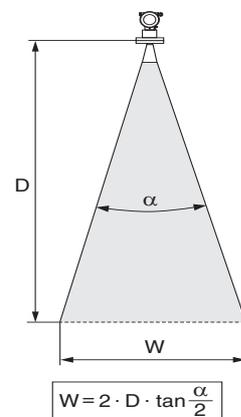
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Measuring conditions

- The measuring range begins, where the beam hits the vessel bottom. Particularly with dish bottoms or conical outlets the level cannot be detected below this point.
  The maximum measuring range can be increased in such applications by using a top target positioner (see Page 18).
- In case of media with a low dielectric constant (groups A and B), the vessel bottom can be visible through the medium at low levels. In order to guarantee the required accuracy in these cases, it is recommended to position the zero-point at a distance **C** = 50...150 mm above the vessel bottom (see Fig.).
- In principle it is possible to measure up to the tip of the antenna with the FMR250. However, due to considerations regarding abrasion and build-up and depending on the orientation of the product surface (angel of repose), the end of the measuring range should be at a distance of approx. **A**=400mm (see Fig.). If required, and if some conditions (high DC value, flat angle of repose) are met, shorter distances can be achieved.
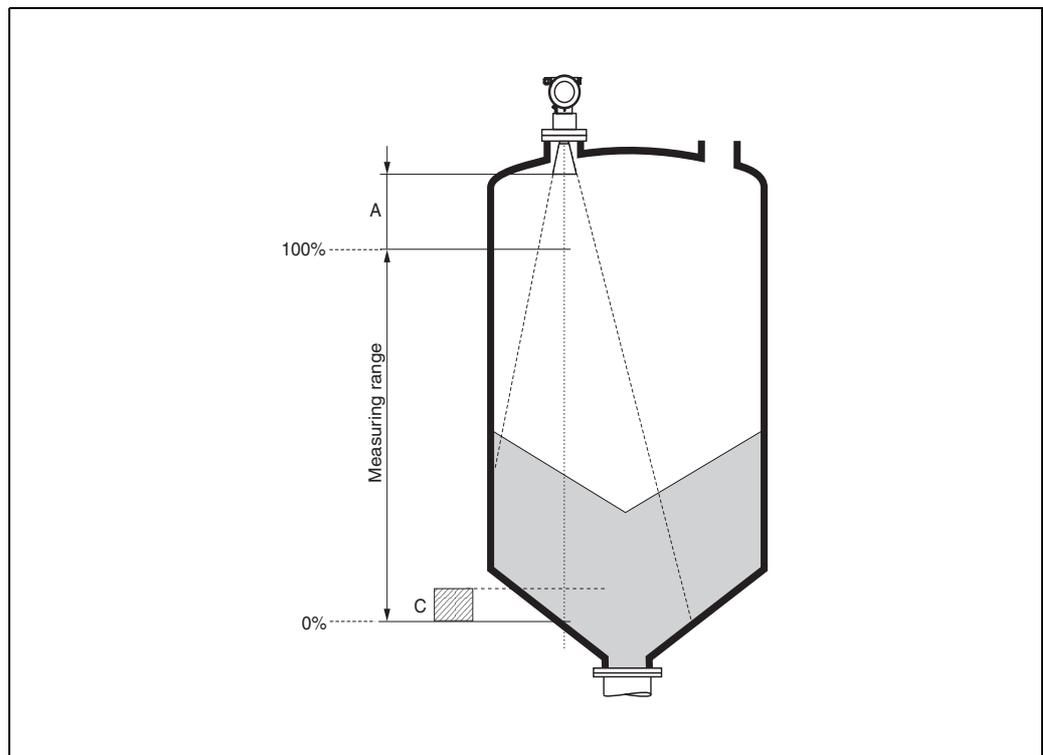
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Measuring range

The usable measuring range depends on the size of the antenna, the reflectivity of the medium, the mounting location and eventual interference reflections. The maximum configurable range is 70 m (229 ft) for Micropilot M FMR250.

To achieve an optimised Signal strength it is recommended to use an antenna with as large as possible diameter (DN200/8" parabolic antenna, DN100/4" horn).

Reduction of the max. possible measuring range through:
- Media with poor reflection properties (= small DC). For examples refer to table 1.
- Angle of repose.
- Extremely loose surfaces of bulk solids, e.g. bulk solids with low bulk weight for pneumatic filling.
- Build-up, above all of moist products.

Table 1:
The following table describes the media groups and the dielectric constant εr.

Media group	DC (εr)	Examples	Signal attenuation
A	1.6...1.9	– Plastic granulate – White lime, special cement – Sugar	19...16 dB
B	1.9...2.5	– Portland cement, plaster	16...13 dB
C	2.5...4	– Grain, seeds – Ground stones – Sand	13...10 dB
D	4...7	– Naturally moist (ground) stones, ores – Salt	10...7 dB
E	> 7	– Metallic powder – Carbon black – Coal	< 7 dB

The respective lower group applies for very loose or loosened bulk solids.

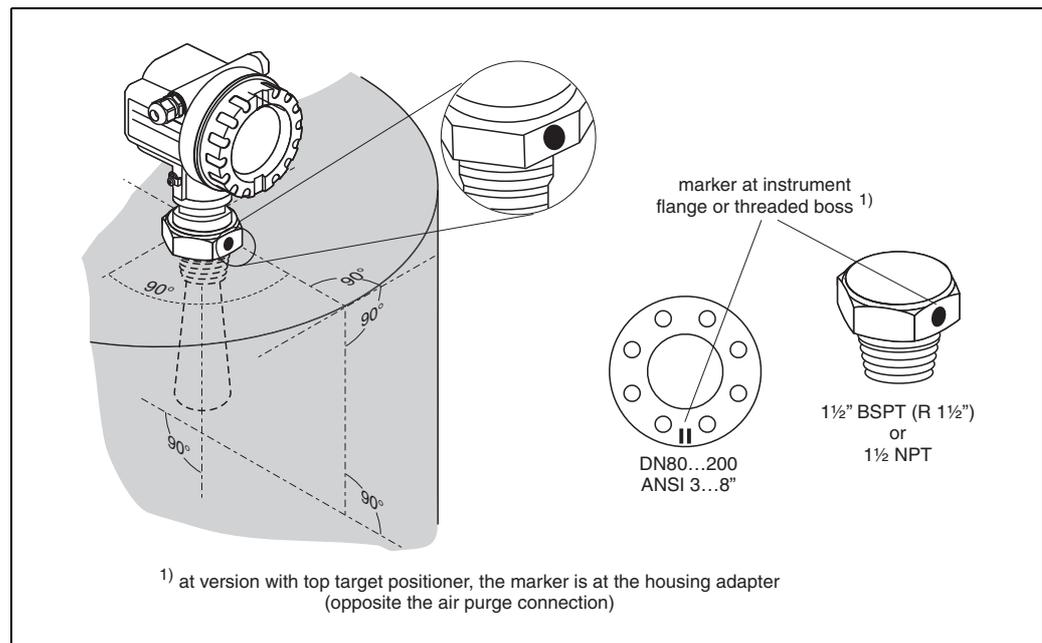## 3.4   Installation instructions

3.4.1   Mounting kit

For the mounting , you will require the following tool:
- The tool for flange mounting or
- a key AF60 for threaded boss and
- 4 mm/0.1" Allen wrench for turning the housing.

3.4.2   Installation in vessel (free space)

Optimum mounting position

marker at instrument flange or threaded boss [1]

DN80…200
ANSI 3…8"

1½" BSPT (R 1½")
or
1½ NPT

[1] at version with top target positioner, the marker is at the housing adapter (opposite the air purge connection)

L00-FMR250xx-17-00-00-en-009

Standard installation FMR250 with horn antenna
- Observe installation instructions on Page 18.
- Marker is aligned towards vessel wall.
- The marker is always exactly in the middle between two bolt-holes in the flange.
- After mounting, the housing can be turned 350° in order to simplify access to the display and the terminal compartment.
- The horn antenna should protrude from the nozzle.
 If this is not possible for mechanical reasons, larger nozzle heights can be accepted.
  Note!
  Please contact Endress+Hauser for application with higher nozzle.
- **Vertical horn antenna.**
  Ideally, the horn antenna should be installed vertically.
  To avoid interference reflections or for optimum alignment within the vessel, the FMR250 with optional top target positioner can be swiveled by 15° in all directions.

L00-FMR250xx-17-00-00-en-004
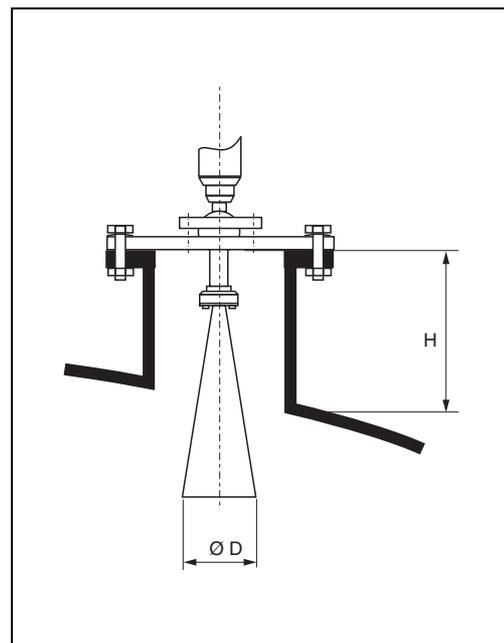
Antenna size	80 mm / 3"	100 mm / 4"
D [mm / inch]	75 (3)	95 (3.7)
H [mm (inch)] (without antenna extension)	< 260 (< 10.2)	< 480 (< 18.8)

Standard installation FMR250 with parabolic antenna

- Observe installation instructions on Page 18.
- Marker is aligned towards vessel wall.
- The marker is always exactly in the middle between two bolt-holes in the flange.
- After mounting, the housing can be turned 350° in order to simplify access to the display and the terminal compartment.
- Ideally the parabolic antenna should protrude from the nozzle (1).
  Particularly when using the top target positioner, please ensure that the parabolic reflector is protruding from the nozzle/roof so as not to inhibit alignment.
  Note!
  For applications with higher nozzle it may be necessary to install the parabolic antenna completely in the nozzle (2), including the RF-wave guide (3) for the antenna (option "6").
 The maximum height of the nozzle (H_{max}) to the parabolic mirror (option "G, H") should not exceed 500 mm. Interfering edges within the nozzle should be avoided.
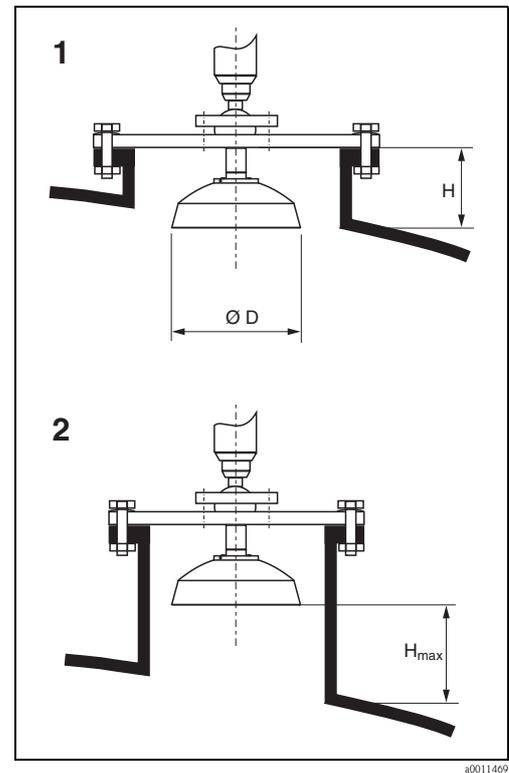- **Vertical parabolic antenna.**
  Ideally, the parabolic antenna should be installed vertically.
  To avoid interference reflections or for optimum alignment within the vessel, the FMR250 with optional top target positioner can be swiveled by 15° in all directions.
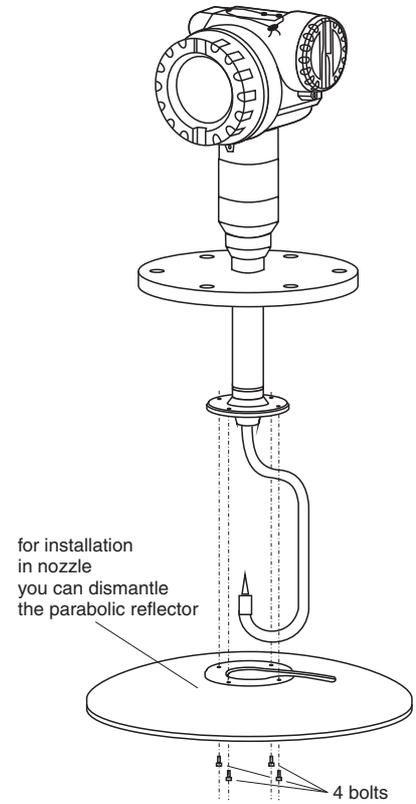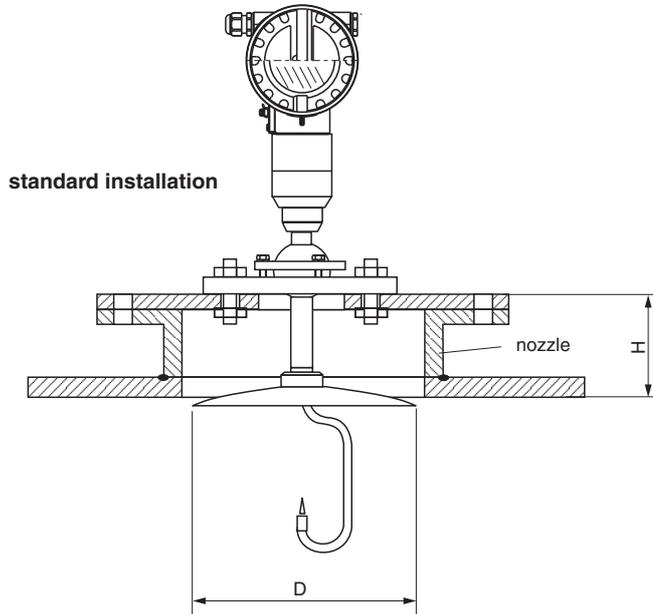
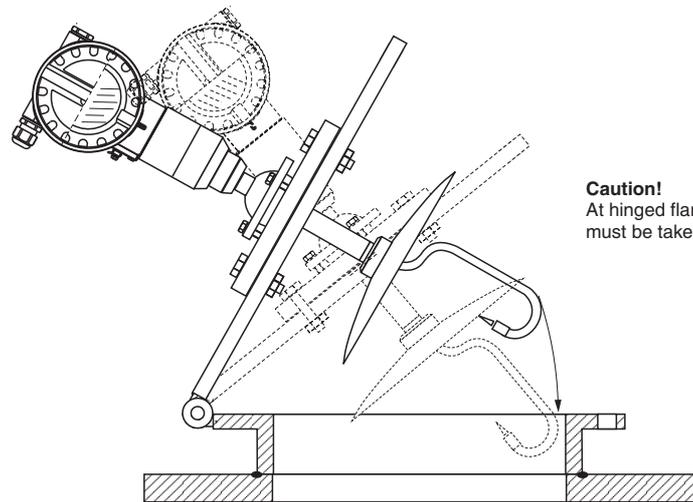| Parabolic antenna (Option "6")	Parabolic antenna (Option "G, H")

a0011468

a0011469
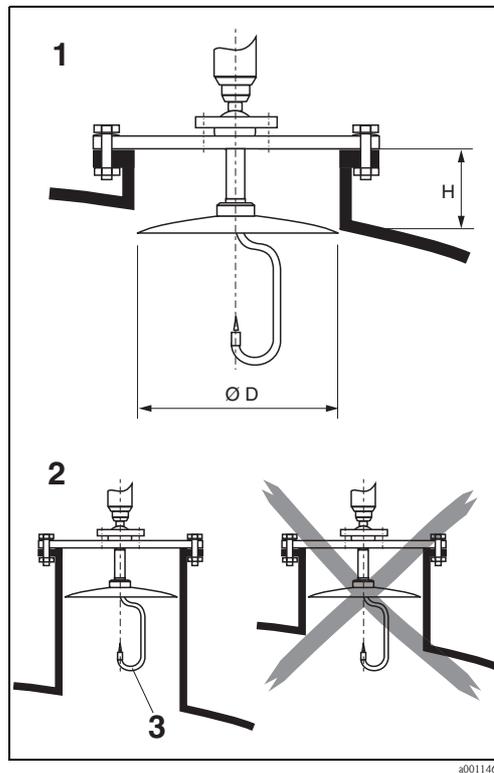
Parabolic antenna	Option "6"	Option "G"	Option "H"
Antenna size	200 mm (8")	200 mm (8")	250 mm (10")
D [mm / inch]	197 (7.75)	173 (6.81)	236 (9.29)
H [mm (inch)] (without antenna extension)	< 50 (< 1.96)	< 50 (< 1.96)	< 50 (< 1.96)

**Examples for installation with small flange (< parabolic reflector)
for parabolic antenna (option "6")**

standard installation

nozzle

H

D

for installation
in nozzle
you can dismantle
the parabolic reflector

4 bolts

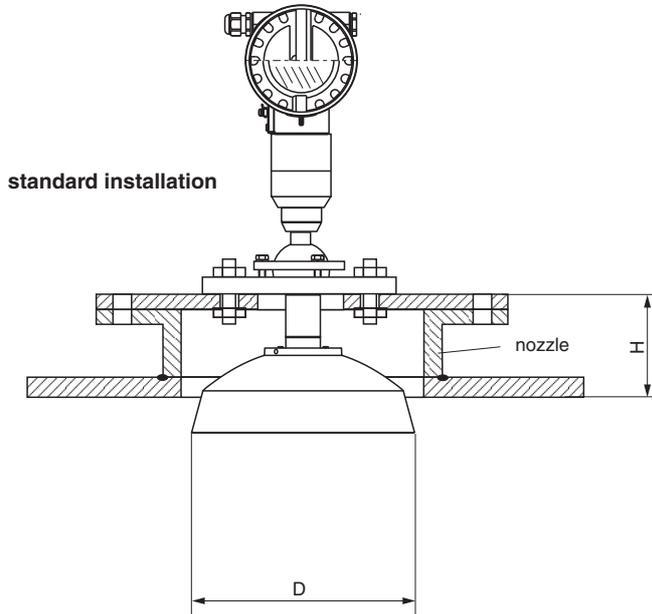| Antenna size	200 mm (8")
D [mm (inch)]	197 (7.75)
H [mm (inch)] [1]	< 50 (< 1.96)

[1] without antenna extension

Caution!
At hinged flanges, the length of the antenna
must be taken into account!

a0011470-en

**Examples for installation with small flange (< parabolic reflector)
for parabolic antenna (option "G, H")**

standard installation

nozzle

H

D

for installation
in nozzle
you can dismantle
the parabolic reflector

4 bolts

Antenna size	200 mm (8")	250 mm (10")
D [mm (inch)]	173 (6.81)	236 (9.29)
H [mm (inch)] [1]	< 50 (< 1.96)	< 50 (< 1.96)

[1] without antenna extension

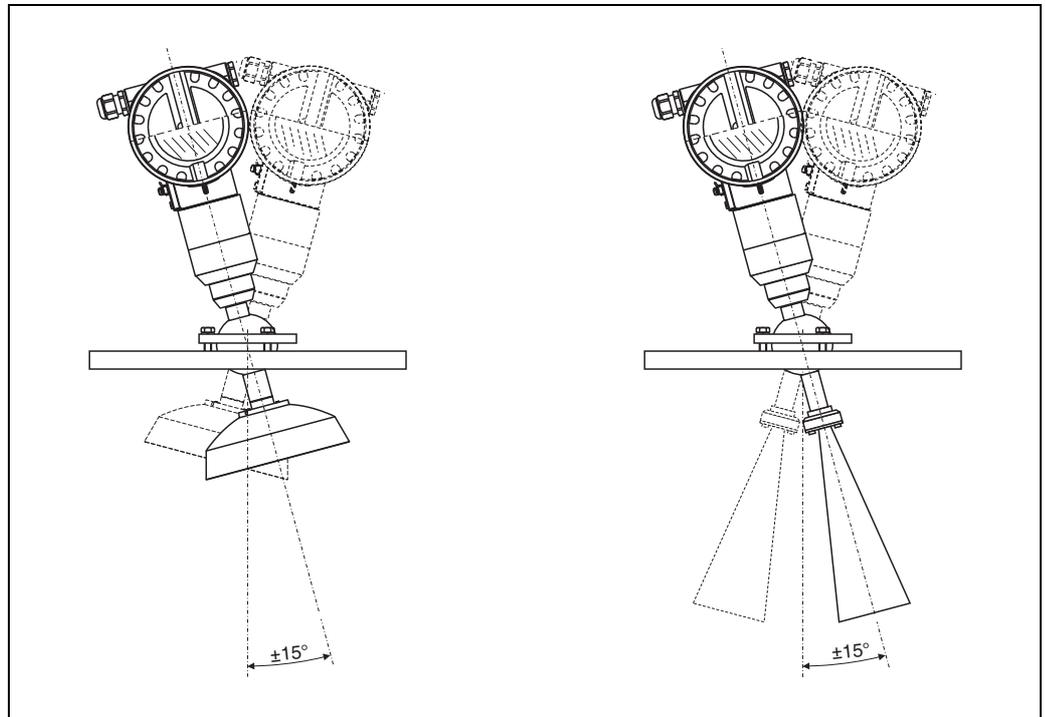**Caution!**
At hinged flanges, the length of the antenna
must be taken into account!
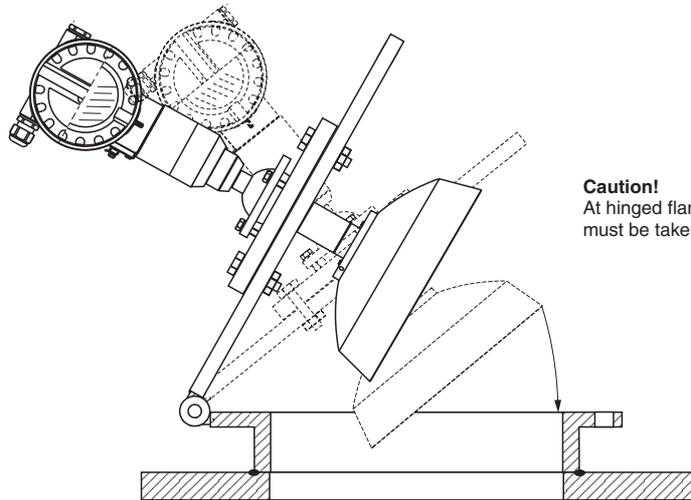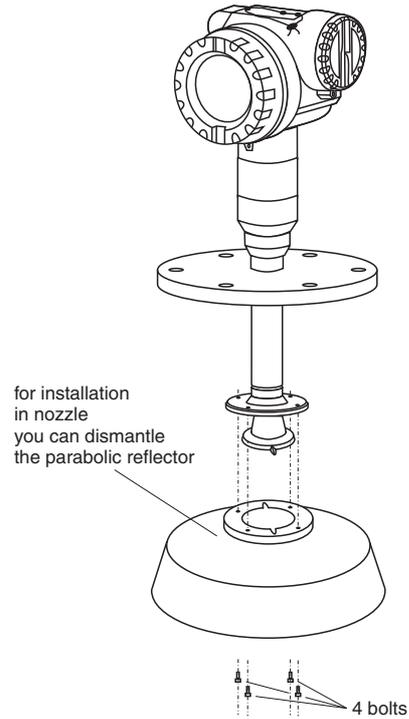
a0011471-en

FMR250 with top target positioner

Using top target positioner it is possible to tilt the antenna axis by up to 15° in all directions. The top target positioner is used for the optimum alignment of the radar beam with the bulk solids surface.

a0011472

Align antenna axis:

1. Loosen screws.

2. Align antenna axis (here this is possible up to max. ±15° in all directions).

3. Tighten screws.

Integrated air purge connection

In extremely dusty applications, the integrated air purge connection can prevent clogging of the antenna. Pulsed operation is recommended.

- Pulsed operation:
  max. pressure of purge air: 6 bar abs.
- Permanent operation:
  recommended pressure range of the purge air: 200...500 mbar.

Caution!
Make sure to use dry purge air.

air purge connection:
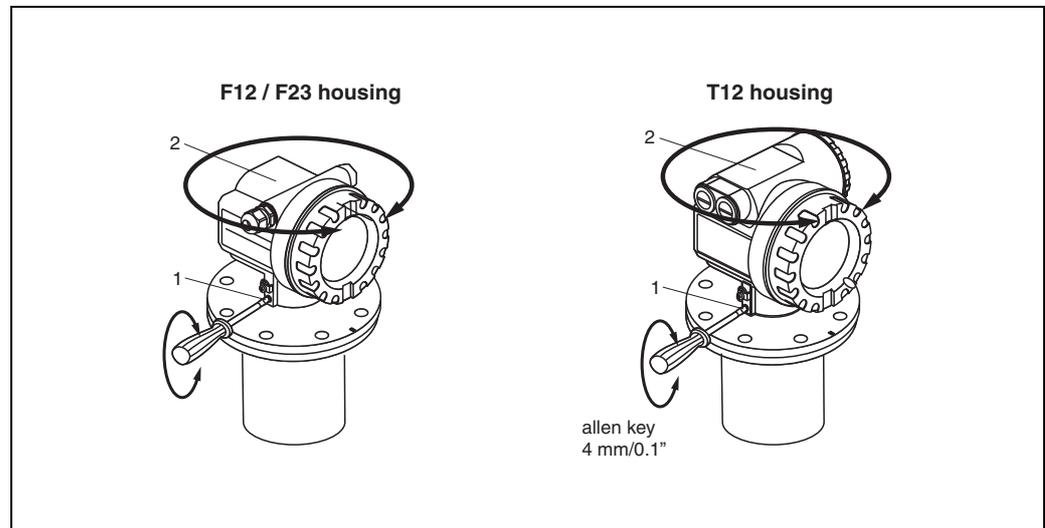NPT ¼
or
G ¼ (max. torque 3.5 Nm)
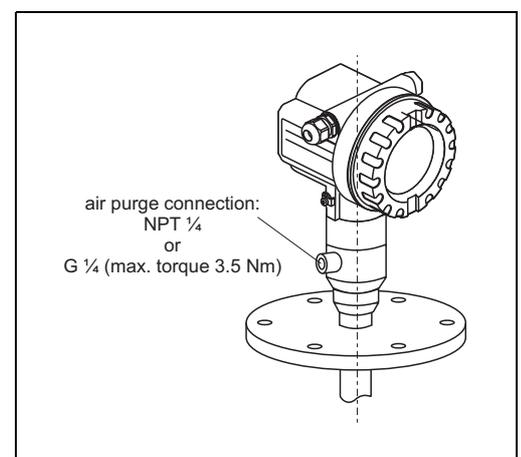
L00-FMR250xx-17-00-00-en-010

3.4.3   Turn housing

After mounting, the housing can be turned 350° in order to simplify access to the display and the terminal compartment. Proceed as follows to turn the housing to the required position:
- Undo the fixing screws (1)
- Turn the housing (2) in the required direction
- Tighten up the fixing screws (1)

L00-FMR2xxxx-17-00-00-en-010

3.5   Post-installation check

After the measuring instrument has been installed, perform the following checks:
- Is the measuring instrument damaged (visual check)?
- Does the measuring instrument correspond to the measuring point specifications such as process temperature/pressure, ambient temperature, measuring range, etc.?
- Is the flange marking correctly aligned? (→ Page 12)
- Have the flange screws been tightened up with the respective tightening torque?
- Are the measuring point number and labeling correct (visual check)?
- Is the measuring instrument adequately protected against rain and direct sunlight (→ Page 81)?
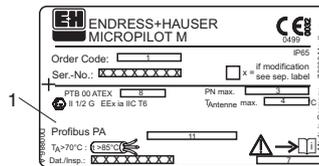
4   Wiring

4.1   Quick wiring guide

Wiring in F12/F23 housing

Caution!

Before connection please note the following:

● PROFIBUS devices are marked on the nameplate (1). The voltage is determined by the PROFIBUS standard and the desired safety concept. (see chapter 4.3).

● Connect potential matching line to transmitter earth terminal before connecting up the device.

● Tighten the locking screw:
It forms the connection between the antenna and the housing earth potential.

When you use the measuring system in hazardous areas, make sure you comply with national standards and the specifications in the safety instructions (XA's). Make sure you use the specific cable gland.

EX

On devices supplied with a certificate, the explosion protection is designed as follows:

● Housing F12/F23 - EEx ia:
Power supply must be intrinsically safe.

● The electronics and the current output are galvanically separated from the antenna circuit.
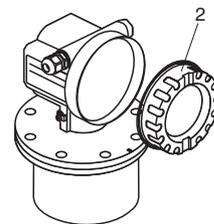
Connect up the Micropilot M as follows:

● Unscrew housing cover (2).

● Remove any display (3) if fitted.

● Remove cover plate from terminal compartment (4).

● Pull out terminal module slightly using pulling loop.

● Insert cable (5) through gland (6).
Use screened, twisted wire pair.

EX

Only earth screen conductor (7) on sensor side.

● Make connection (see pin assignment).

● Re-insert terminal module.

● Tighten cable gland (6).

● Tighten screws on cover plate (4).

● Insert display if fitted.

● Screw on housing cover (2).

Unplug display connector!

Sealed terminal compartment

plant ground

L00-FMR2xxxx-04-00-00-en-016
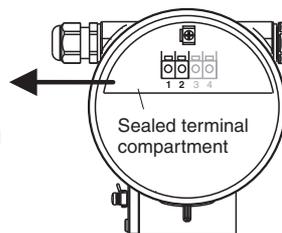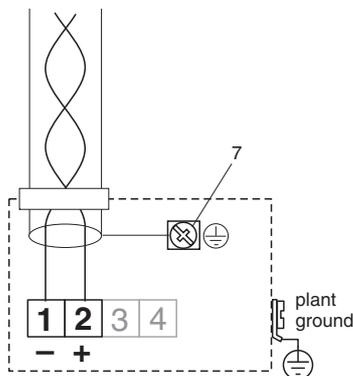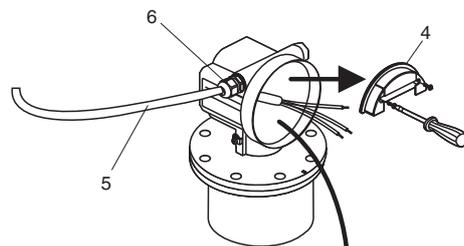
Wiring in T12 housing

Before connection please note the following:

Caution!

● PROFIBUS devices are marked on the nameplate (1). The voltage is determined by the PROFIBUS standard and the desired safety concept. (see chapter 4.3).

● Connect potential matching line to transmitter earth terminal before connecting up the device.

● Tighten the locking screw:
It forms the connection between the antenna and the housing earth potential.

When you use the measuring system in hazardous areas, make sure you comply with national standards and the specifications in the safety instructions (XA's).
Make sure you use the specific cable gland.

Connect up the Micropilot M as follows:

EX

Before unscrew housing cover (2) at seperate connection room turn off the power supply!

● Insert cable (3) through gland (5).
Use screened, twisted wire pair.

EX

Only ground screening of the line (5) on sensor side.

● Make connection (see pin assignment).

● Tighten cable gland (4).

● Screw on housing cover (2).

● Switch on power supply.

plant ground
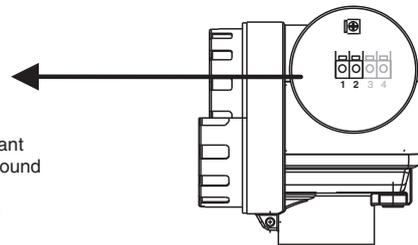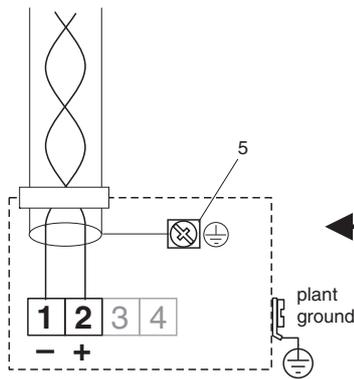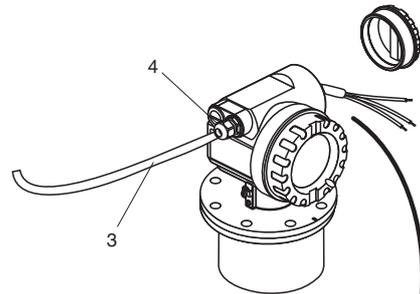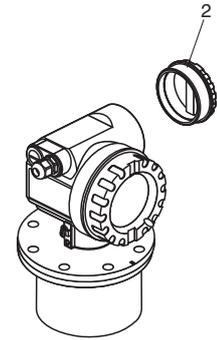
L00-FMR2xxxx-04-00-00-en-022

4.1.1 Cable specification PROFIBUS

Twisted, screened pairs must be used. The following specification must be met for explosion hazardous application (EN 50 020, FISCO model):

- Loop-resistance (DC): 15…150 Ω/km,
- Specific inductance: 0.4…1 mH/km,
- Specific capacitance: 80…200 nF/km

The following cable types can be used, for example

Non-Ex-area:
- Siemens 6XV1 830-5BH10 (black),
- Kerpen CEL-PE/OSCR/PVC/FRLA FB-02YS(ST)YFL (grey)
- Belden 3076F (orange)

Ex-area:
- Siemens 6XV1 830-5AH10 (blue),
- Belden 3076F, Kerpen CEL-PE/OSCR/PVC/FRLA FB-02YS(ST)YFL (blue)

4.2 Connecting the measuring unit

4.2.1 Cable entry

- Cable gland: M20x1.5
- Cable entry: G ½ or ½ NPT

4.2.2 Supply voltage

The following values are the voltages across the terminals directly at the instrument:

Type	Terminal voltage	
	minimum	maximum
standard	9 V	32 V
EEx ia (FISCO model)	9 V	17, 5 V
EEx ia (Entity concept)	9 V	24 V

4.2.3 Current consumption

approx 13 mA for the range of voltages given above

4.3   Recommended connection

For maximum EMC protection please observe the following points:
- The external ground terminal on the transmitter must be connected to ground.
- The continuity of the cable screening between tapping points must be ensured.
- If potential equalisation is present between the individual grounding points, ground the screening at each cable end or connect it to the device housing (as short as possible).
- If there are large differences in potential between grounding points, the grounding should run via a capacitor that is suitable for high frequency use (e.g. ceramic 10 nF/250 V~).

Caution!
Applications, which are subject to the explosion prevention, permit only under special conditions the repeated grounding of the protective screen , see to EN 60 079-14..

4.4   Degree of protection

- with closed housing: IP65, NEMA4X (higher degree of protection e.g. IP68 on request)
- with open housing: IP20, NEMA1 (also ingress protection of the display)
- antenna: IP68 (NEMA6P)

4.5   Post-connection check

After wiring the measuring instrument, perform the following checks:
- Is the terminal allocation correct (→ Page 29 and)?
- Is the cable gland tight?
- Is the housing cover screwed tight?
- If auxiliary power is available:
  Is the instrument ready for operation and does the liquid crystal display show any value?

5   Operation

5.1   Quick operation guide
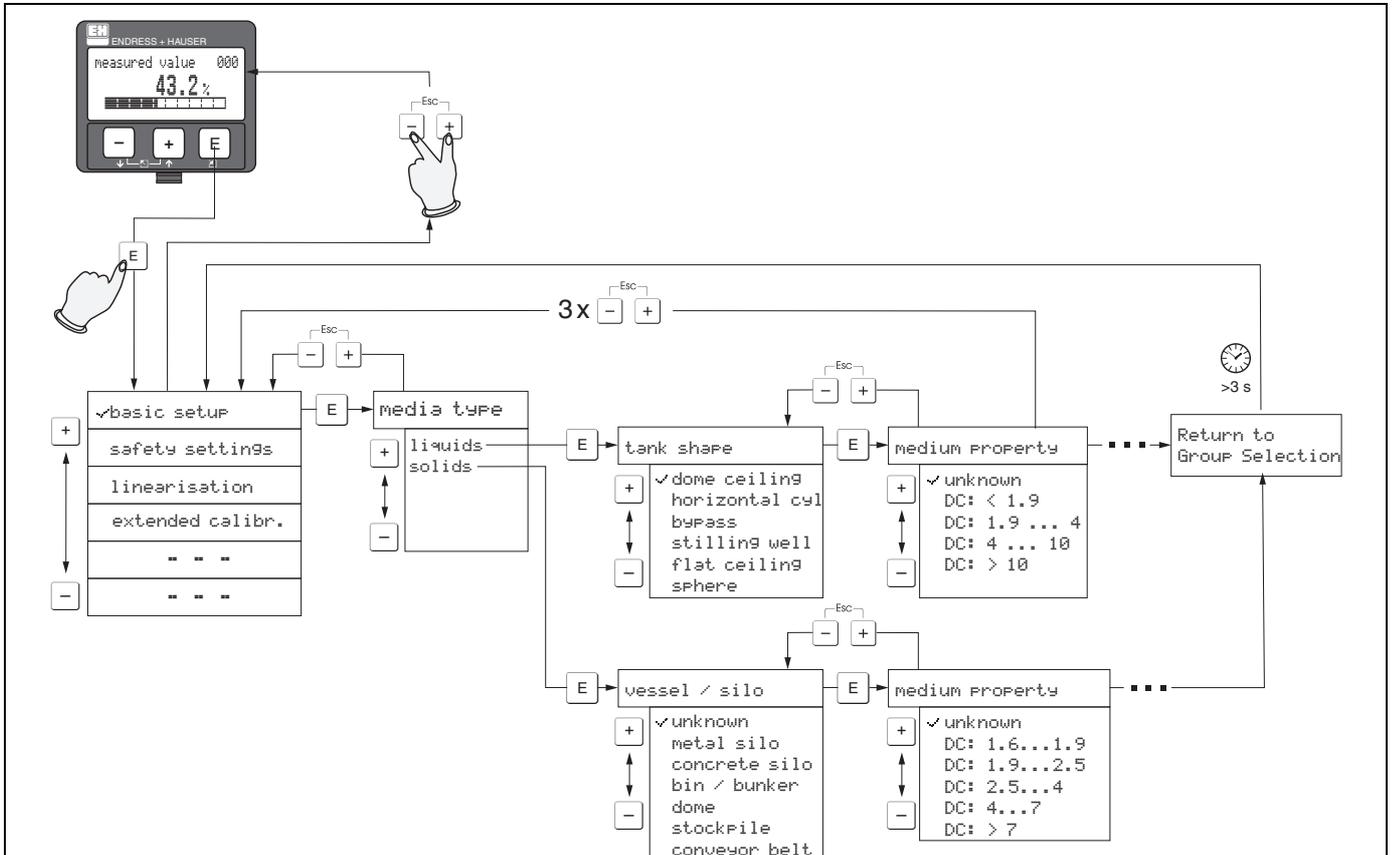
Example - Selection and configuration in Operation menu:

1.) Change from Measured Value Display to **Group Selection** by pressing E

2.) Press − or + to select the required **Function Group** (e.g.. "basic setup (00)") and confirm by pressing
    E → First f**unction** (e.g. "tank shape (002)") is selected.
    Note!
    The active selection is marked by a ✓ in front of the menu text.

3.) Activate Edit mode with + or −.
    Selection menus:
    a) Select the required **Parameter** in selected **function** (e.g. "tank shape (002)") with − or +.
    b) E confirms selection → ✓ appears in front of the selected parameter
    c) E confirms the edited value → system quits Edit mode
    d) + + − (= Esc) interrupts selection → system quits Edit mode
    Typing in numerals and text:
    a) Press + or − to edit the first character of the **numeral / text** (e.g. "empty calibr. (005)")
    b) E positions the cursor at the next character → continue with (a) until you have completed your input
    c) if a ↵ symbol appears at the cursor, press E to accept the value entered
       → system quits Edit mode
    d) + + − (= Esc) interrupts the input, system quits Edit mode

4) Press E to select the next **function** (e.g. "medium property (003)")

5) Press + + − (= Esc) once → return to previous **function** (e.g. "tank shape (002)")
   Press + + − (= Esc) twice → return to **Group selection**

6) Press + + − (= Esc) to return to **Measured value display**

L00-FMR250xx-19-00-00-en-002

5.1.1   General structure of the operating menu

The operating menu is made up of two levels:
- **Function groups (00, 01, 03, ..., 0C, 0D):** The individual operating options of the instrument are split up roughly into different function groups. The function groups that are available include, e.g.: "**basic setup**", "**safety settings**", "**output**", "**display**", etc.
- **Functions (001, 002, 003, ..., 0D8, 0D9):** Each function group consists of one or more functions. The functions perform the actual operation or parameterisation of the instrument. Numerical values can be entered here and parameters can be selected and saved. The available functions of the "**basic setup**" **(00)** function group include, e.g.: "**tank shape**" **(002)**, "**medium property**" **(003)**, "**process cond.**" **(004)**, "**empty calibr.**" **(005)**, etc.

If, for example, the application of the instrument is to be changed, carry out the following procedure:

1. Select the "**basic setup**" **(00)** function group.

2. Select the "**tank shape**" **(002)** function (where the existing tank shape is selected).

5.1.2   Identifying the functions

For simple orientation within the function menus (QUERVERWEIS), for each function a position is shown on the display.

L00-FMRxxxxx-07-00-00-en-005

The first two digits identify the function group:

- **basic setup**   00
- **safety settings**   01
- **linearisation**   04
. . .
The third digit numbers the individual functions within the function group:

- **basic setup**   00   →   ■ **tank shape**   002
                                    ■ **medium property**   003
                                    ■ **process cond.**   004
                                         . . .

Hereafter the position is always given in brackets (e.g. "**tank shape**" **(002)**) after the described function.

5.2   Display and operating elements

Fig. 2:   Layout of the display and operating elements

The VU331 LCD display can be removed to ease operation by simply pressing the snap–fit (see graphic above). It is connected to the device by means of a 500 mm cable.

✎   Note!
To access the display the cover of the electronic compartment may be removed even in hazardous area (IS and XP).

5.2.1   Display

Liquid crystal display (LCD):

Four lines with 20 characters each. Display contrast adjustable through key combination.
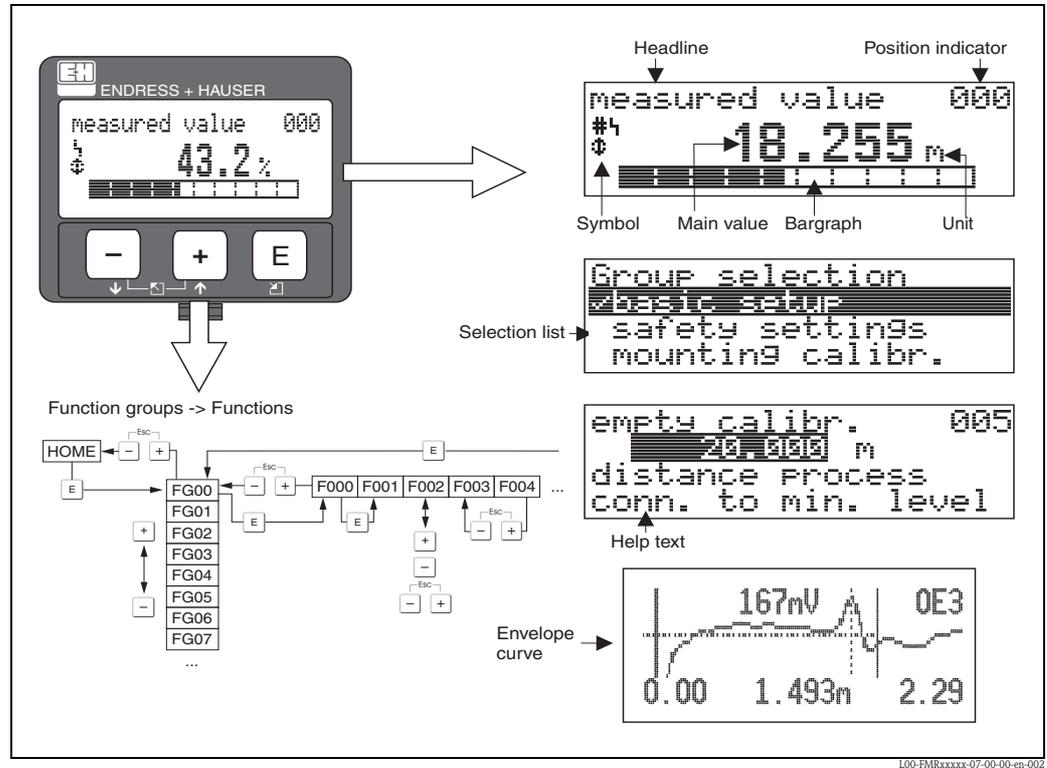
Fig. 3:   Display

5.2.2   Display symbols

The following table describes the symbols that appear on the liquid crystal display:

Sybmol	Meaning
	ALARM_SYMBOL This alarm symbol appears when the instrument is in an alarm state. If the symbol flashes, this indicates a warning.
	LOCK_SYMBOL This lock symbol appears when the instrument is locked,i.e. if no input is possible.
	COM_SYMBOL This communication symbol appears when a data transmission via e.g. HART, PROFIBUS PA or FOUNDATION Fieldbus is in progress.

5.2.3   Key assignment

The operating elements are located inside the housing and are accessible for operation by opening the lid of the housing.

Function of the keys

Key(s)	Meaning
⊕ or ↑	Navigate upwards in the selection list Edit numeric value within a function
⊖ or ↓	Navigate downwards in the selection list Edit numeric value within a function
⊖ ⊕ or ◄	Navigate to the left within a function group
E	Navigate to the right within a function group, confirmation.
⊕ and E or ⊖ and E	Contrast settings of the LCD
⊕ and ⊖ and E	Hardware lock / unlock After a hardware lock, an operation of the instrument via display or communication is not possible! The hardware can only be unlocked via the display. An unlock parameter must be entered to do so.

5.3   Local operation

5.3.1   Locking of the configuration mode

The Micropilot can be protected in two ways against unauthorised changing of instrument data, numerical values or factory settings:

"unlock parameter" (0A4):

A value **<> 2457** (e.g. 2450) must be entered in "**unlock parameter**" **(0A4)** in the "**diagnostics**" **(0A)** function group. The lock is shown on the display by the ⌇ symbol and can be released again either via the display or by communication.

Hardware lock:

The instrument is locked by pressing the ⊞ and ⊟ and Ⓔ keys at the same time.
The lock is shown on the display by the ⌇ symbol and can **only** be unlocked again
via the display by pressing the ⊞ and ⊟ and Ⓔ keys at the same time again. It is **not** possible to unlock the hardware by communication. All parameters can de displayed even if the instrument is locked.

⊞ and ⊟ and Ⓔ press simultaneous

The LOCK_SYMBOL appears on the LCD.
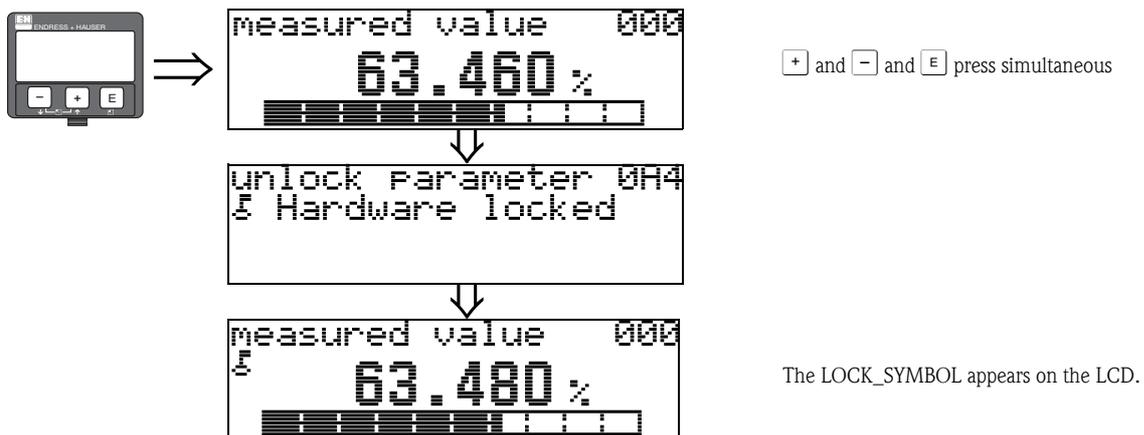
5.3.2   Unlocking of configuration mode

If an attempt is made to change parameters on display when the instrument is locked, the user is automatically requested to unlock the instrument:

unlock parameter" (0A4):

By entering the unlock parameter (on the display or via communication)

2457 = for PROFIBUS PA devices

the Micropilot is released for operation.

Hardware unlock:

After pressing the ⊞ and ⊟ and Ⓔ keys at the same time, the user is asked to enter the unlock parameter

2457 = for PROFIBUS PA devices.

⊞ and ⊟ and Ⓔ press simultaneous

Please enter unlock code and confirm with Ⓔ.
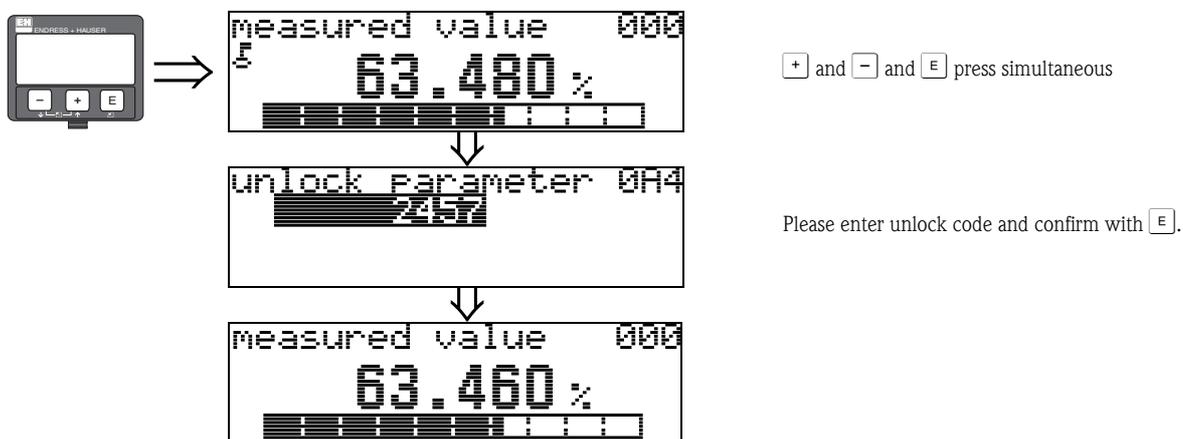
✍ Caution!
Changing certain parameters such as all sensor characteristics, for example, influences numerous functions of the entire measuring system, particularly measuring accuracy. There is no need to change these parameters under normal circumstances and consequently, they are protected by a special code known only to the E+H service organization. Please contact Endress+Hauser if you have any questions.

5.3.3   Factory settings (Reset)

Caution!
A reset sets the instrument back to the factory settings. This can lead to an impairment of the measurement. Generally, you should perform a basic setup again following a reset.

A reset is only necessary:
- if the instrument no longer functions
- if the instrument must be moved from one measuring point to another
- if the instrument is being de-installed /put into storage/installed

```
reset               0A3
          ▓▓▓▓▓▓▓▓▓▓▓0
for reset code
see manual
```

```
reset               0A3
          ▓▓▓▓▓▓▓▓▓▓▓0
for reset code
see manual
```

User input ("reset" (0A3)):
- 33333 = customer parameters

33333 = reset customer parameters
This reset is recommended whenever an instrument with an unknown 'history' is to be used in an application:
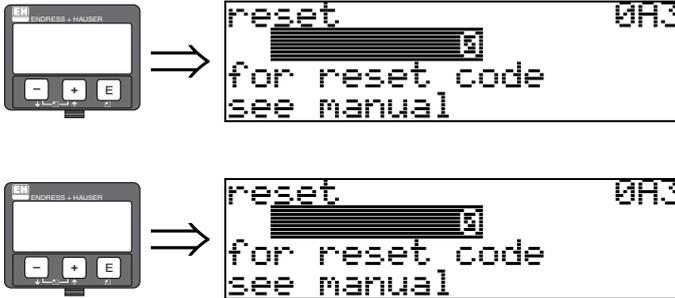- The Micropilot is reset to the default values.
- The customer specific tank map is not deleted.
- A linearisation is switched to "**linear**" although the table values are retained. The table can be reactivated in the "**linearisation**" **(04)** function group.

List of functions that are affected by a reset:
- tank shape (002) – liquids only
- vessel / silo (00A) – solids only
- empty calibr. (005)
- full calibr. (006)
- pipe diameter (007) – liquids only
- output on alarm (010)
- output on alarm (011)
- outp. echo loss (012)
- ramp %span/min (013)
- delay time (014)
- safety distance (015)
- in safety dist. (016)

- level/ullage (040)
- linearisation (041)
- customer unit (042)
- diameter vessel (047)
- range of mapping (052)
- pres. Map dist (054)
- offset (057)
- simulation (065)
- simulation value (066)
- format display (094)
- distance unit (0C5)
- download mode (0C8)

The tank map can also be reset in the "**mapping**" **(055)** function of the "**extended calibr.**" **(05)** function group.

This reset is recommended whenever an instrument with an unknown 'history' is to be used in an application or if a faulty mapping was started:
- The tank map is deleted. The mapping must be recommenced.

5.4 Display and acknowledging error messages

Type of error

Errors that occur during commissioning or measuring are displayed immediately on the local display. If two or more system or process errors occur, the error with the highest priority is the one shown on the display.

The measuring system distinguishes between two types of error:
- **A (Alarm):**
  Instrument goes into a defined state (e.g. MAX 22 mA)
  Indicated by a constant ⌐ symbol.
  (For a description of the codes, see Page 85)
- **W (Warning):**
  Instrument continue measuring, error message is displayed.
  Indicated by a flashing ⌐ symbol.
  (For a description of the codes, see Page 85)
- **E (Alarm / Warning):**
  Configurable (e.g. loss of echo, level within the safety distance)
  Indicated by a constant/flashing ⌐ symbol.
  (For a description of the codes, see Page 85)


```
present error      0A0
linearisation ch1
not complete,
not usable          A671
```
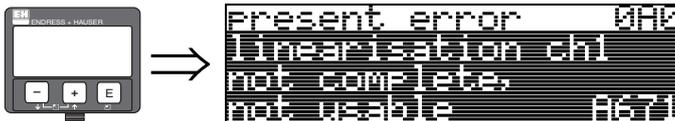
5.4.1 Error messages

Error messages appear as four lines of plain text on the display. In addition, a unique error code is also output. A description of the error codes is given on Page 85.

- The "**diagnostics**" **(0A)** function group can display current errors as well as the last errors that occurred.
- If several current errors occur, use [+] or [-] to page through the error messages.
- The last occurring error can be deleted in the "**diagnostics**" **(0A)** function group with the funktion"**clear last error**" **(0A2)**.

5.5   PROFIBUS PA communication

5.5.1   Synopsis

L00-FMR2xxxx-14-00-06-en-002
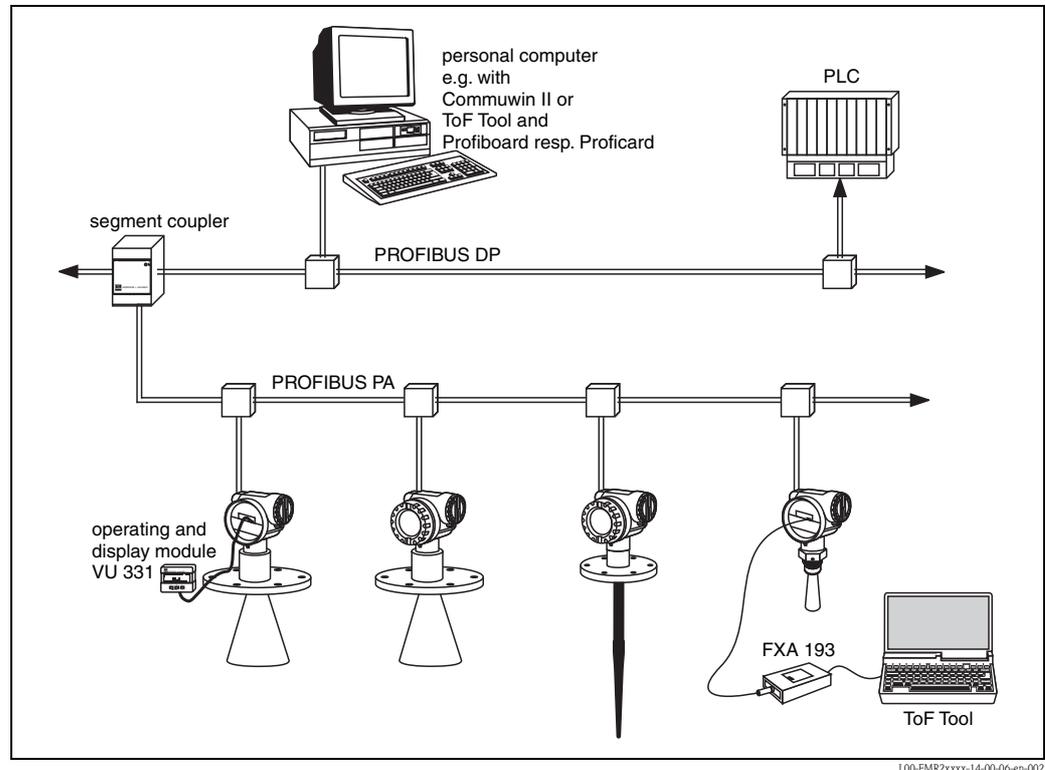
A maximum of 32 transmitters can be connected to the bus (only 8 in explosion hazardous areas EEx ia IIC according to the FISCO model). The bus power is supplied by the segment coupler. On-site– as well as remote operation are possible. For detailed information on the PROFIBUS–PA standard refer to Operation Instructions BA 198F/00/en and the standards EN 50 170/DIN 19 245 (PROFIBUS–PA) and EN 50 020 (FISCO model).

5.5.2   Device address

Selecting the device address

- Every PROFIBUS–PA device must be given an address. If the address is not set correctly, the device will not be recognised by the process control system.
- A device address may appear only once within a particular PROFIBUS–PA network, see BA 198F.
- Valid device addresses are in the range 1 and 126. All devices are delivered from the factory with the software address 126.
- The default address can be used to check the function of the device and connect it to an operating PROFIBUS–PA system. Afterwards the address must be changed to allow other devices to be connected to the network.

Software addressing

Software addressing comes into operation, when DIP–switch 8 is in the position "ON". BA 198F/ 00/en, chap. 5.7 describes, how to set the address in this case.
In ToF Tool, the address can be set via the "**Set address**" function in the "**Device**" menu.

Hardware addressing
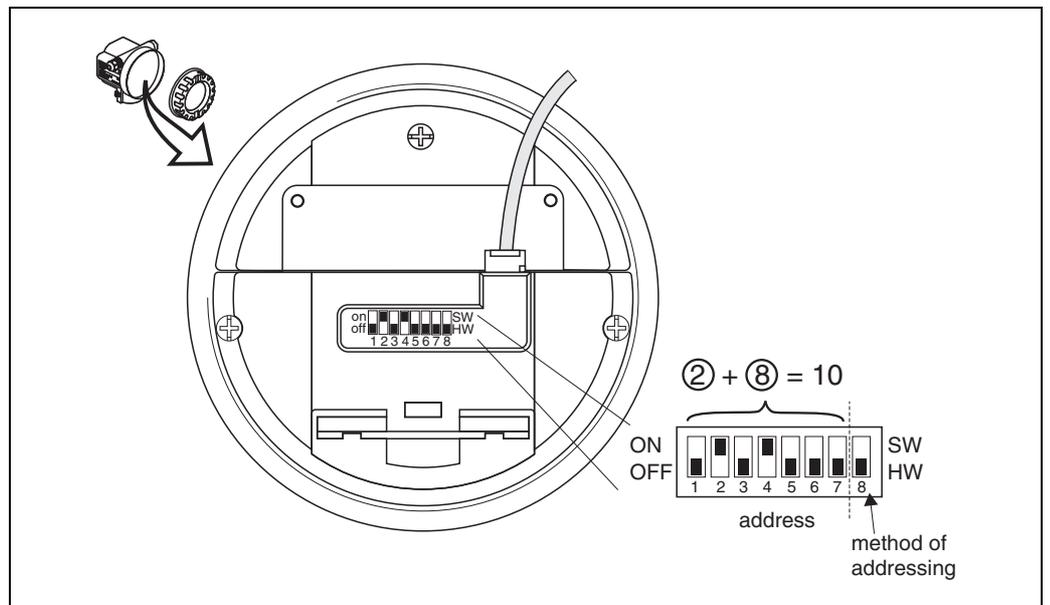
L00-FMU4xxxx-19-00-00-en-014

Hardware addressing comes into operation, when DIP switch 8 is in the position "HW (OFF)". In this case the address is determined by the position of DIP-switches 1 to 7 according to the following table:

Switch No.	1	2	3	4	5	6	7
Value in position "OFF"	0	0	0	0	0	0	0
Value in Position "ON"	1	2	4	8	16	32	64

The new address becomes valid 10 seconds after switching.
It results a new device restart.

5.5.3 Device database and type files (GSD)

A device database file (GSD) contains a description of the properties of the PROFIBUS-PA device, e.g. the supported transmission rates and the type and format of the digital information output to the PLC.
Additional bitmap files are required in order to represent the device by an icon in the network design software.
Every device is allocated an identity code by the PROFIBUS User Organisation (PNO). This appears in the device data base file name (.gsd). The Micropilot M has the ID number 0x152D (hex) = 5421 (dec).

Source of supply

- Internet (ftp-Server): ftp://194.196.152.203/pub/communic/gsd/Micropilot_m.EXE
- CD-ROM with GSD files for all E+H devices. Order-Code: 50097200
- GSD library of the PROFIBUS User Organisation (PNO):http: //www.PROFIBUS.com

Directory structure

The files are oranized in the folowing strucutre:

```
Micropilot_M/PA/Profile3/Revision1.0/
                              ├──BMP/
                              │     ├──Eh1522_d.bmp
                              │     ├──Eh1522_n.bmp
                              │     └──Eh1522_s.bmp
                              ├──DIB/
                              │     ├──Eh1522_d.dib
                              │     ├──Eh1522_n.dib
                              │     └──Eh1522_s.dib
                              ├──GSD/
                              │     ├──Extended/Eh3x1522.gsd
                              │     └──Standard/Eh3_1522.gsd
                              ├──Typdat5x/Eh31522x.200
                              └──Info/
                                    ├──Liesmich.pdf
                                    └──Readme.pdf
```

L00-FMR23xxx-02-00-00-de-001
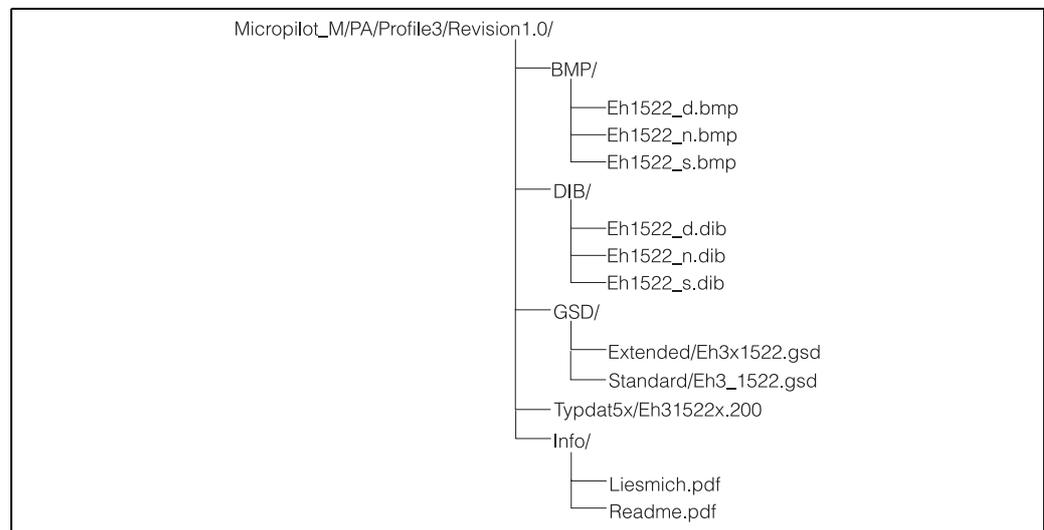
- The GSD files in the directory "Extended" are needed for the network design software STEP 7 of the S7-300/400 PLC family.
- The GSD files in the directory "Standard" are used for PLCs, which do not support an identifier format but only an identifier byte (e.g. PLC5 of Allen-Bradley)
- For the network design tool COM ET200 with Siemens S5 instead of an GSD file the Type file "EH_1522x.200" and instead of the BMP files the DIB files have to be used.

Universal Database File

As an alternative to the device specific GSD file, the PNO provides an universal database file with the designation PA139700.gsd for devices with one analogue input block. This file supports the transmission of the main value. Transmission of a second cyclic value or a display value is not supported.
When the universal database is used, the option "**profile**" must be selected in the function "**Ident number**" **(061)**.

5.5.4   Cyclic data exchange

Block model of the Micropilot M
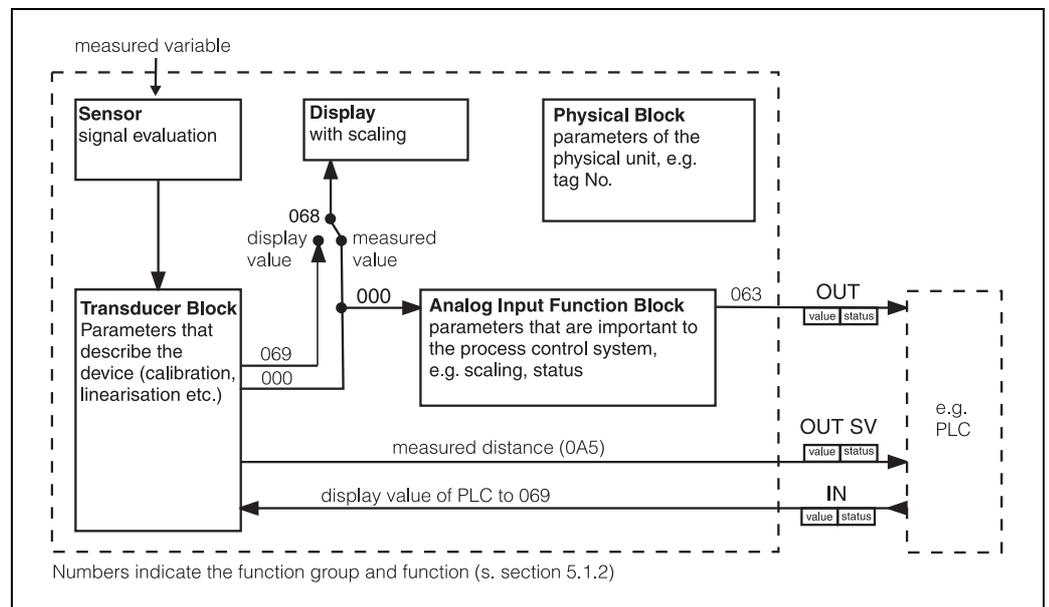
L00-FMR230xx-02-00-00-en-001

The block model shows, which data are exchanged continously (i.e. by cyclic data transfer) between the Micropilot M and the PLC. The numbers refer to the function groups and functions:

- After linearization and integration in the transducer block the "**measured value**" **(000)** is transmitted to the Analog–Input Block. There, it may be scaled and checked for limit transgression, and is written out over "**OUT value**" **(063)** to the PLC.
- The function "**select V0H0**" (068) determines whether at the display of the device in the field for the main measured value the "**measured value**" **(000)** or the value from the PLC "**display value**" **(069)** are displayed.

Modules for the cyclic data telegram

For the cyclic data telegram the Prosonic provides the following modules:

1. **Main Process Value**
    This is the main measured value scaled by the Analog Input Block (063).

2. **2nd Cyclic Value**
    This is the measured distance between the sensor mebrane and the product surface (0A5) or the measured temperature (030).

3. **Display Value**
    This is a value which can be transferred from the PLC to the Micropilot M in order to be shown on the display.

4. **FREE PLACE**
    This module must be applied during configuration (see below), if the 2nd cyclic value or the display value are not to appear in the data telegram.

Configuration of the cyclic data telegram

Use the configuration software of your PLC in order to compose the data telegram from these modules in one of the following ways:

1. **Main value**
   In order to transmit the main measured value, selct the module "**Main Process Value**".

2. **Main value and second cyclic value**
   In order to transmit the main value and the second cyclic value (temperature or measured distance), select the modules in the following order: "**Main Process Value**", "**2nd Cyclic Value**", "**FREE PLACE**".

3. **Main value and display value**
   In order to transmitt the main value and to receive a display value select the modules in the following order: "**Main Process Value**", "**FREE PLACE**", "**Display Value**".

4. **Main value, second cyclic value and display value**
   In order to transmit the main value and the second cyclic value and to receive a display value, select the modules in the following order: "**Main Process Value**", "**2nd Cyclic Value**", "**Display Value**".

The exact way of performing the configuration depends on the configuration software of the PLC.

Structure of the input data (Micropilot M → PLC)

The input data are transmitted according to the following structure:

Index Input Data	Data	Access	Format/Remarks
0, 1, 2, 3	Main value (level)	read	32 bit floating point number (IEEE-754)
4	Status code for main value	read	see "Status codes"
5, 6, 7, 8 (option)	Secondary value (measured distance)	read	32 bit floating point number (IEEE-754)
9 (option)	Status code for secondary value	read	see "Status codes"

Structure of the output data (PLC → Micropilot M)

Die Output-Daten von der SPS für das Display am Gerät haben folgende Struktur:

Index Input Data	Data	Access	Format/Remarks
0, 1, 2, 3	Display value	write	32 bit floating point number (IEEE-754)
4	Status code for Display value	write	see "Status codes"

IEEE-745 Floating Point Number

The measured value is transmitted as a IEEE 754 floating point number, whereby
Measured value = $(-1)^{VZ}$ x $2^{(E-127)}$ x $(1+F)$

			Byte 1								Byte 2				
Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
VZ	2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0	2^{-1}	2^{-2}	2^{-3}	2^{-4}	2^{-5}	2^{-6}	2^{-7}
	Exponent (E)								Mantisse (F)						

			Byte 3								Byte 4				
Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
2^{-8}	2^{-9}	2^{-10}	2^{-11}	2^{-12}	2^{-13}	2^{-14}	2^{-15}	2^{-16}	2^{-17}	2^{-18}	2^{-19}	2^{-20}	2^{-21}	2^{-22}	2^{-23}
Mantisse (F)															

Example:

40 F0 00 00 (hex)   = 0**100 0000 1**111 0000 0000 0000 0000 0000 (bin)
                    = $(-1)^0$ x $2^{(129-127)}$ x $(1 + 2^{-1} + 2^{-2} + 2^{-3})$
                    = 1 x 2^2 x $(1 + 0.5 + 0.25 + 0.125)$
                    = 1 x 4 x 1.875
                    = 7.5

Status codes

The status codes comprise one byte and have got the following meaning:

Status-Code	Device status	Significance	Primary value	Secondary value
0C Hex	BAD	device error		X
0F Hex	BAD	device error	X	
1F Hex	BAD	out-of-service (target mode)	X	
40 Hex	UNCERTAIN	non-specific (simulation)		X
47 Hex	UNCERTAIN	last usable value (Fail-safe-Mode aktiv)	X	
4B Hex	UNCERTAIN	Substitute set (fail-Safe mode active)	X	
4F Hex	UNCERTAIN	initial value (fail-Safe mode active)	X	
5C Hex	UNCERTAIN	Configuration error (limits not set correctly)	X	
80 Hex	GOOD	OK	X	X
84 Hex	GOOD	Active block alarm (static revision counter incremented)	X	
89 Hex	GOOD	LOW_LIM (alarm active)	X	
8A Hex	GOOD	HI_LIM (alarm active)	X	
8D Hex	GOOD	LOW_LOW_LIM (alarm active)	X	
8E Hex	GOOD	HI_HI_LIM (alarm active)	X	

If a status other than "GOOD" is sent to the device, the display indicates an error.

5.5.5 Acyclic data exchange

Acyclic data exchange allows device parameters to be changed independently of the communication between the device and a PLC.
 Acyclic data exchange is used
- to transmit device parameters during commissioning and maintenance;
- to display measured values that are not acquired in cyclic traffic.

There are two types of acyclic data exchange:

Acyclic communication with a Class 2 master (MS2AC)

In the case of MS2AC, a Class 2 master opens a communication channel via a so-called service access point (SAP) in order to access the device. Class 2 masters are for example:
- ToF Tool
- FieldCare
- PDM

Before data can be exchanged via PROFIBUS, however, the Class 2 master must be made aware of the parameters contained within the field device. This can be done by:
- a device description (DD)
- a device type manager (DTM)
- a software component within the master, which accesses the parameters via slot and index addresses.

✎ Note!
- The DD or DTM is supplied by the device manufacturer.
- The number of Class 2 masters that can simultaneously access a device, is determined by the number of SAPs that the device can provide.
- The use of a Class 2 master increases the cycle time of the bus system. This must be taken into consideration when the control system or PLC is programmed.

Acyclic communication with a Class 1 master (MS1AC)

In the case of MS1AC, a Class 1 master that is already communicating cyclically with a device opens a communication channel via SAP 0x33, a special access point for MS1AC. As is the case for a Class 2 master, the parameter is read or written via the slot and index.

✎ Note!
- At the time of writing, there are only a few PROFIBUS masters that support this type of communication.
- Not all PROFIBUS field devices support MS1AC.

☞ Caution!
Permanent writing of parameters, e.g. with every cycle of the application program, must be avoided, since this can drastically reduce the life of the device.
Acyclic write parameters are stored electrically in the RAM (EEPROM, Flash...). The RAM modules are design for a limited number of write operations only. In standard operation without MS1AC, i.e. during parametrisation of the device, the number of write operations is negligible when compared to the limit. If the application program is badly designed, however, this limit can be reached quickly, and the RAM will fail

The device Micropilot M supports MS2AC communication with two SAPs.
The device Micropilot M does not support MS1AC communication.

5.5.6 Slot/index tables

The device parameters are listed in the following tables. The parameters are accessed via the slot and index number.

The Analog-Input and physical blocks contain standard parameters, block parameters and manufacturer-specific parameters. The transducer block of the Micropilot M is E+H specific.

The parameters of the Analog-Input block are not available when operating via the display or via ToF Tool.

Device Management

Parameter	E+H Matrix (CW II)	Slot	Index	Size [bytes]	Type	Read	Write	Storage Class
Directory object header		1	0	12	Array of UNSIGNED16	X		constant
Composite list directory entries		1	1	24	Array of UNSIGNED16	X		constant
GAP Directory continuous		1	2–8					
GAP reserved		1	9–15					

Analog-Input-Block

Parameter	E+H Matrix (CW II)	Slot	Index	Size [bytes]	Type	Read	Write	Storage Class
Standard parameters								
Block Data		1	16	20	DS-32*	X		constant
Static revision		1	17	2	UNSIGNED16	X		non-vol.
Device tag		1	18	32	OSTRING	X	X	static
Strategy		1	19	2	UNSIGNED16	X	X	static
Alert key		1	20	1	UNSIGNED8	X	X	static
Target Mode		1	21	1	UNSIGNED8	X	X	static
Mode		1	22	3		X		dynamic non-vol. constant
Alarm summary		1	23	8		X		dynamic
Batch		1	24	10		X	X	static
Gap		1	25					
Block parameters								
Out	V6H2 (Wert) V6H3 (Status)	1	26	5	DS-33*	X		dynamic
PV Scale	V0H5 V0H6	1	27	8	Array of FLOAT	X	X	static
Out Scale		1	28	11	DS-36*	X	X	static
Linearisation type		1	29	1	UNSIGNED8	X	X	static
Channel		1	30	2	UNSIGNED16	X	X	static
Gap		1	31					
PV fail safe time		1	32	4	FLOAT	X		non-vol.
Fail safe type		1	33	1	UNSIGNED8	X	X	static
Fail safe value		1	34	4	FLOAT	X	X	static
Alarm Hysteresis		1	35	4	FLOAT	X	X	static

Parameter	E+H Matrix (CW II)	Slot	Index	Size [bytes]	Type	Read	Write	Storage Class
Gap		1	36					
HI HI Limit		1	37	4	FLOAT	X	X	static
Gap		1	38					
HI Limit		1	39	4	FLOAT	X	X	static
Gap		1	40					
LO Limit		1	41	4	FLOAT	X	X	static
Gap		1	42					
LO LO Limit		1	43	4	FLOAT	X	X	static
Gap		1	44-45					
HI HI Alarm		1	46	16	DS-39*	X		dynamic
HI Alarm		1	47	16	DS-39*	X		dynamic
LO Alarm		1	48	16	DS-39*	X		dynamic
LO LO Alarm		1	49	16	DS-39*	X		dynamic
Simulate		1	50	6	DS-51*	X	X	non-vol.
Out unit text		1	51	16	OSTRING	X	X	static
Gap reserved		1	52-60					
Out unit text		1	61	16	OSTRING	X	X	static
Gap		1	62-64					

Physical Block

Parameter	E+H Matrix (CW II)	Slot	Index	Size [bytes]	Type	Read	Write	Storage Class
Standard parameters								
Block Data		1	65	20	DS-32*	X		constant
Static revision		1	66	2	UNSIGNED16	X		non-vol.
Device tag	VAH0	1	67	32	OSTRING	X	X	static
Strategy		1	68	2	UNSIGNED16	X	X	static
Alert key		1	69	1	UNSIGNED8	X	X	static
Target mode		1	70	1	UNSIGNED8	X	X	static
Mode		1	71	3		X		dynamic non-vol. constant
Alarm summary		1	72	8		X		dynamic
Block parameters								
Software revision		1	73	16	OSTRING	X		constant
Hardware revision		1	74	16	OSTRING	X		constant
Device manufacturer ID		1	75	2	UNSIGNED16	X		constant
Device ID		1	76	16	OSTRING	X		constant
Device serial number		1	77	16	OSTRING	X		constant
Diagnosis		1	78	4	OSTRING	X		dynamic
Diagnosis extension		1	79	6	OSTRING	X		dynamic
Diagnosis mask		1	80	4	OSTRING	X		constant
Diagnosis mask ext.		1	81	6	OSTRING	X		constant

Parameter	E+H Matrix (CW II)	Slot	Index	Size [bytes]	Type	Read	Write	Storage Class
Device certification		1	82	32	OSTRING	X	X	constant
Security locking	V9H9	1	83	2	UNSIGNED16	X	X	non-vol.
Factory reset	V9H5	1	84	2	UNSIGNED16		X	non-vol.
Descriptor		1	85	32	OSTRING	X	X	static
Device message		1	86	32	OSTRING	X	X	static
Device instal. date		1	87	8	OSTRING	X	X	static
Gap reserved		1	88					
Ident number select	V6H0	1	89	1	UNSIGNED8	X	X	static
HW write protection		1	90	1	UNSIGNED8	X	X	dynamic
Gap reserved		1	91-97					
Gap		1	98-102					
E+H-Parameters								
error code	V9H0	1	103	2	UNSIGNED16	X		dynamic
last error code	V9H1	1	104	2	UNSIGNED16	X	X	dynamic
Up Down features		1	105	1	OSTRING	X		constant
Up Down control		1	106	1	UNSIGNED8		X	dynamic
Up Down param		1	107	20	OSTRING	X	X	dynamic
Bus address	V9H4	1	108	1	UNSIGNED8	X		dynamic
Device SW No.	V9H3	1	109	2	UNSIGNED16	X		dynamic
set unit to bus	V6H1	1	110	1	UNSIGNED8	X	X	static
input value	V6H6	1	111	6	FLOAT+U8+U8	X		dynamic
Select Main value	V6H5	1	112	1	UNSIGNED8	X	X	dynamic
PA profile revision	V6H7	1	113	16	OSTRING	X		constant
Gap		1	114-118					
Gap reserved		1	119-125					
Phys. Block View 1		1	126	17	OSTRING	X		dynamic
Gap		1	127-129					

E+H specific level transducer block

Parameter	E+H Matrix (CW II)	Slot	Index	Size [bytes]	Type	Read	Write	Storage Class
Standard parameters								
Block data		1	130	20	DS–32*	X		constant
Static revision		1	131	2	UNSIGNED16	X		non-vol.
Device tag		1	132	32	OSTRING	X	X	static
Strategy		1	133	2	UNSIGNED16	X	X	static
Alert key		1	134	1	UNSIGNED8	X	X	static
Target mode		1	135	1	UNSIGNED8	X	X	static
Mode		1	136	3	DS–37*	X		dynamic non-vol. static
Alarm summary		1	137	8	DS–42*	X		dynamic
E+H-Parameters								
Measured value	V0H0	1	138	4	FLOAT	X		dynamic
gap			139					
tank shape	V0H2	1	140	1	UNSIGNED8	X	X	static
medium cond.	V0H3	1	141	1	UNSIGNED8	X	X	static
process cond.	V0H4	1	142	1	UNSIGNED8	X	X	static
empty calibration	V0H5	1	143	4	FLOAT	X	X	static
full calibration	V0H6	1	144	4	FLOAT	X	X	static
pipe diameter	V0H7	1	145	4	FLOAT	X	X	static
vessel/silo	V0H8	1	146	1	UNSIGNED8	X	X	static
medium property	V0H9	1	147	1	UNSIGNED8	X	X	static
output on alarm	V1H0	1	148	1	UNSIGNED8	X	X	static
gap			149					
outp. echo loss	V1H2	1	150	1	UNSIGNED8	X	X	static
ramp %span/min	V1H3	1	151	4	FLOAT	X	X	static
delay time	V1H4	1	152	2	UNSIGNED16	X	X	static
safety distance	V1H5	1	153	4	FLOAT	X	X	static
in safety dist.	V1H6	1	154	1	UNSIGNED8	X	X	static
ackn. alarm	V1H7	1	155	1	UNSIGNED8	X	X	static
overspill protection	V1H8	1	156	1	UNSIGNED8	X	X	static
gap			157–166					
process cond.	V0HA	1	167	1	UNSIGNED8	X	X	static
level/ullage	V3H0	1	168	1	UNSIGNED8	X	X	static
linearisation	V3H1	1	169	1	UNSIGNED8	X	X	static
customer unit	V3H2	1	170	2	UNSIGNED16	X	X	static
table no.	V3H3	1	171	1	UNSIGNED8	X	X	static
gap			172					
input volume	V3H5	1	173	4	FLOAT	X	X	static
max. scale	V3H6	1	174	4	FLOAT	X	X	static
diameter vessel	V3H7	1	175	4	FLOAT	X	X	static

Parameter	E+H Matrix (CW II)	Slot	Index	Size [bytes]	Type	Read	Write	Storage Class
check distance	V4H1	1	179	1	UNSIGNED8	X	X	static
range of mapping	V4H2	1	180	4	FLOAT	X	X	static
start mapping	V4H3	1	181	1	UNSIGNED8	X	X	static
pres. map. dist.	V4H4	1	182	4	FLOAT	X		dynamic
cust. Tank map	V4H5	1	183	1	UNSIGNED8	X	X	static
echo quality	V4H6	1	184	1	UNSIGNED8	X		dynamic
offset	V4H7	1	185	4	FLOAT	X	X	static
output damping	V4H8	1	186	4	FLOAT	X	X	static
blocking dist.	V4H9	1	187	4	FLOAT	X	X	static
instrument_addr.	V5H0	1	188	1	UNSIGNED8	X		dynamic
ident number	V5H1	1	189	1	UNSIGNED8	X	X	static
set unit to bus	V5H2	1	190	1	UNSIGNED8	X	X	static
out value	V5H3	1	191	4	FLOAT	X		dynamic
out status	V5H4	1	192	1	UNSIGNED8	X		dynamic
simulation	V5H5	1	193	1	UNSIGNED8	X		static
gap			194					
2nd cyclic value	V5H7	1	195	1	UNSIGNED8	X	X	static
select V0H0	V5H8	1	196	1	UNSIGNED8	X	X	static
input value	V5H9	1	197	4	FLOAT	X		dynamic
gap			198					
display contrast	V6H1	1	199	1	UNSIGNED8	X	X	static
language	V6H2	1	200	1	UNSIGNED8	X	X	static
back to home	V6H3	1	201			X	X	static
format display	V6H4	1	202	1	UNSIGNED8	X	X	static
no. decimals	V6H5	1	203	1	UNSIGNED8	X	X	static
sep. character	V6H6	1	204	1	UNSIGNED8	X	X	static
display test	V6H7	1	205	1	UNSIGNED8	X	X	static
gap			206–227					
present error	V9H0	1	228		STRUCT	X		dynamic
previous error	V9H1	1	229		STRUCT	X		dynamic
clear last error	V9H2	1	230	1	UNSIGNED8	X	X	static
reset	V9H3	1	231	2	UNSIGNED16	X	X	static
unlock parameter	V9H4	1	232	2	UNSIGNED16	X	X	static
measured dist.	V9H5	1	233	4	FLOAT	X		dynamic
measured level	V9H6	1	234	4	FLOAT	X		dynamic
gap			235					
application par.	V9H8	1	236	1	UNSIGNED8	X		dynamic
gap			237					
tag no.	VAH0	1	238		STRING	X		const
profile version	VAH1	1	239		STRING	X	X	static
protocol+sw-no.	VAH2	1	240		STRING	X		const
gap			241					

Parameter	E+H Matrix (CW II)	Slot	Index	Size [bytes]	Type	Read	Write	Storage Class
serial no.	VAH4	1	242		STRING	X	X	static
distance unit	VAH5	1	243	2	UNSIGNED16	X	X	static
gap			244–245					
download mode	VAH8	1	246	1	UNSIGNED8	X	X	static
antenna ext.	VAH9		247	4	FLOAT	X	X	static
input level semi auto	V3H4	1	248	4	FLOAT	X		dynamic
input level manual	V3H4	1	249	4	FLOAT	X	X	static
simulation level	V3H6	1	250	4	FLOAT	X	X	static
simulation volume	V3H6	1	251	4	FLOAT	X	X	static
TB view_1		1	252	22	OSTRING	X		dynamic

Data strings

In der Slot/Index table some data types, e.g. DS–33 are marked by an asterisk. These are data strings according to the PROFIBUS–PA specifications part 1, Version 3.0. They contain several elements, which are addressed by an additional subindex. The following table gives an example.

Data type	Subindex	Typ	Size [bytes]
DS-33	1	FLOAT	4
	5	UNSIGNED8	1

5.5.7 Endress+Hauser operating program

ToF Tool – Fieldtool Package

The ToF Tool is a graphic and menu–guided operating program for measuring devices from Endress+Hauser. It is used for the commissioning, data storage, signal analysis and documentation of the devices. The following operating systems are supported: WinNT4.0, Win2000 and Windows XP. You can set all parameters via the ToF Tool.

The ToF Tool supports the following functions:
- Configuration of transmitters in online operation
- Singal analysis via envelope curve
- Tank linearisation
- Loading and saving device data (upload/download)
- Documentation of the measuring point

Connection options:
- HART via Commubox FXA191 and the RS 232 C serial interface of a computer
- HART via Commubox FXA195 and the USB port on a computer
- PROFIBUS PA via segment coupler and PROFIBUS interface card
- FOUNDATION Fieldbus, PROFIBUS PA and HART via the FXA193/FXA291 service interface

✎ Note!
You can use the ToF Tool to configure the Endress+Hauser parameters for devices with "FOUNDATION Fieldbus signal". You need an FF configuration program to be able to configure all the FF–specific parameters and to integrate the device into an FF network.

FieldCare

FieldCare is an Endress+Hauser asset management tool based on FDT technology. With FieldCare, you can configure all Endress+Hauser devices as well as devices from other manufacturers that

support the FDT standard. The following operating systems are supported: WinNT4.0, Win2000 and Windows XP.

FieldCare supports the following functions:
- Configuration of transmitters in online operation
- Singal analysis via envelope curve
- Tank linearisation
- Loading and saving device data (upload/download)
- Documentation of the measuring point

Connection options:
- HART via Commubox FXA191 and the RS 232 C serial interface of a computer
- HART via Commubox FXA195 and the USB port on a computer
- PROFIBUS PA via segment coupler and PROFIBUS interface card

Menu-guided commissioning
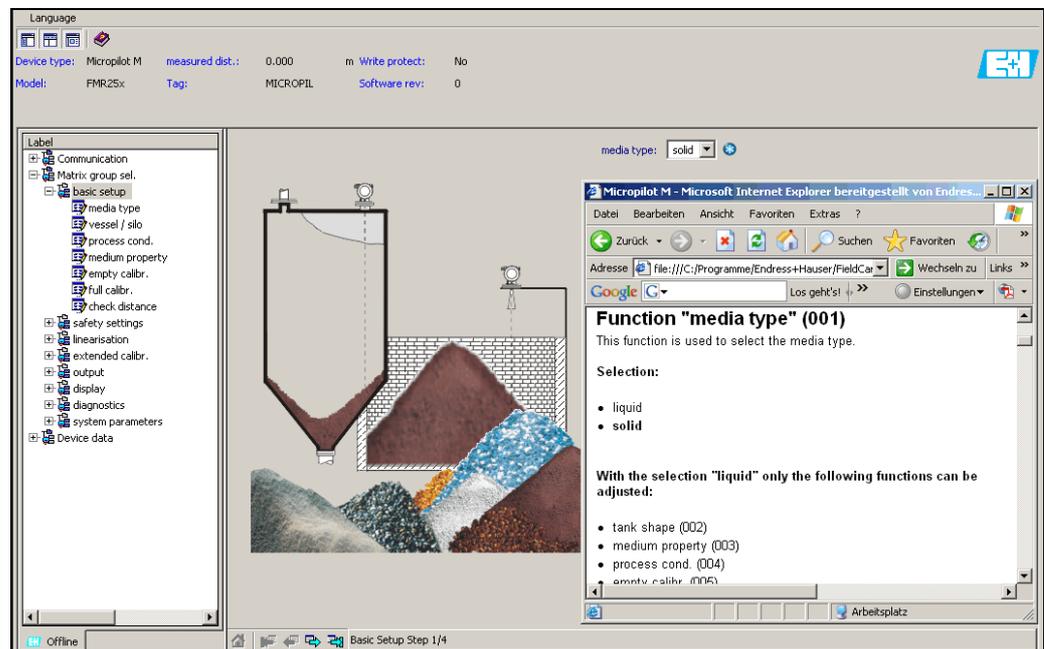
MicropilotM-en-415

Signal analysis via envelope curve
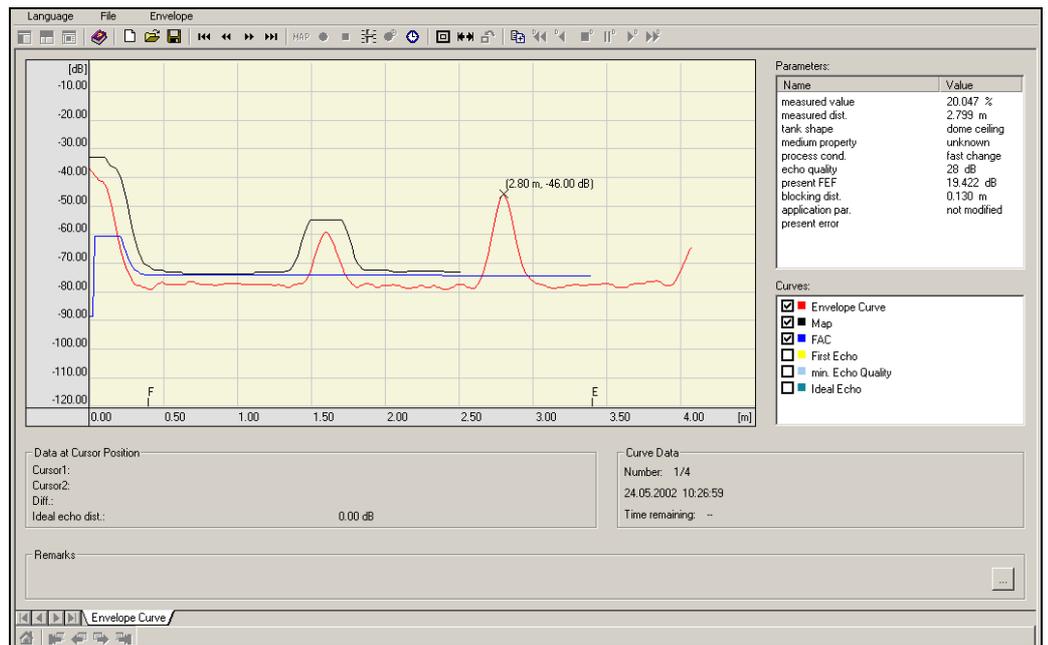
MicropilotM-en-306

Tank linearisation
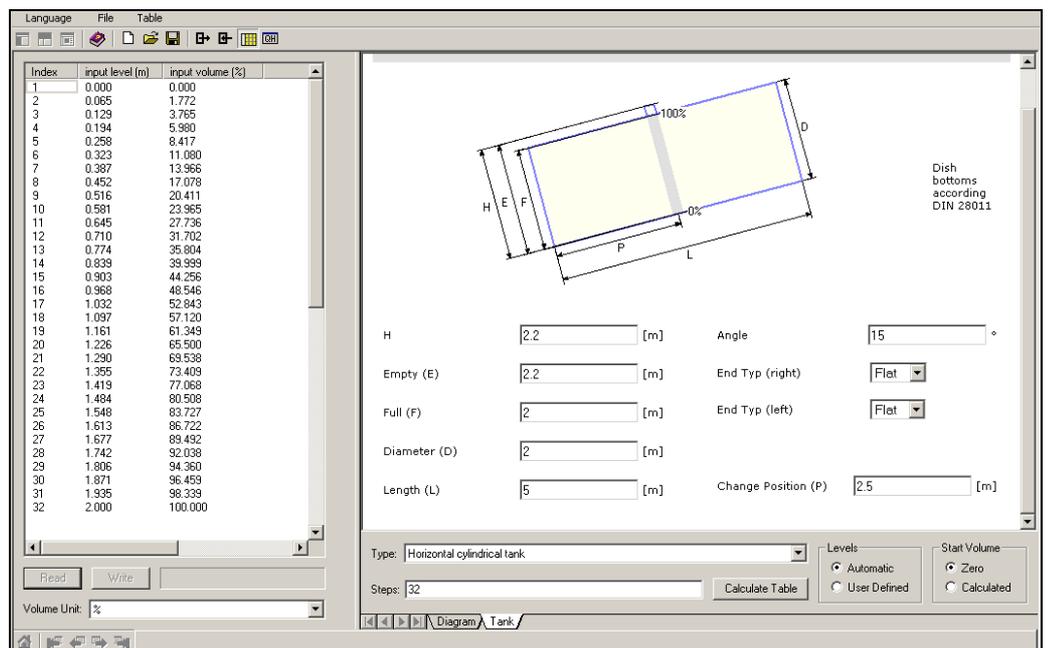
MicropilotM-en-307

6 Commissioning

6.1 Function check

Make sure that all final checks have been completed before you start up your measuring point:
- Checklist "Post installation check" (see Page 28).
- Checklist "Post connection check" (see Page 32).

6.2 Switching on the measuring device

When the instrument is switched on for the first time, the following messages appear on the display:

```
initialization        /


VU 331 01.01.02
```
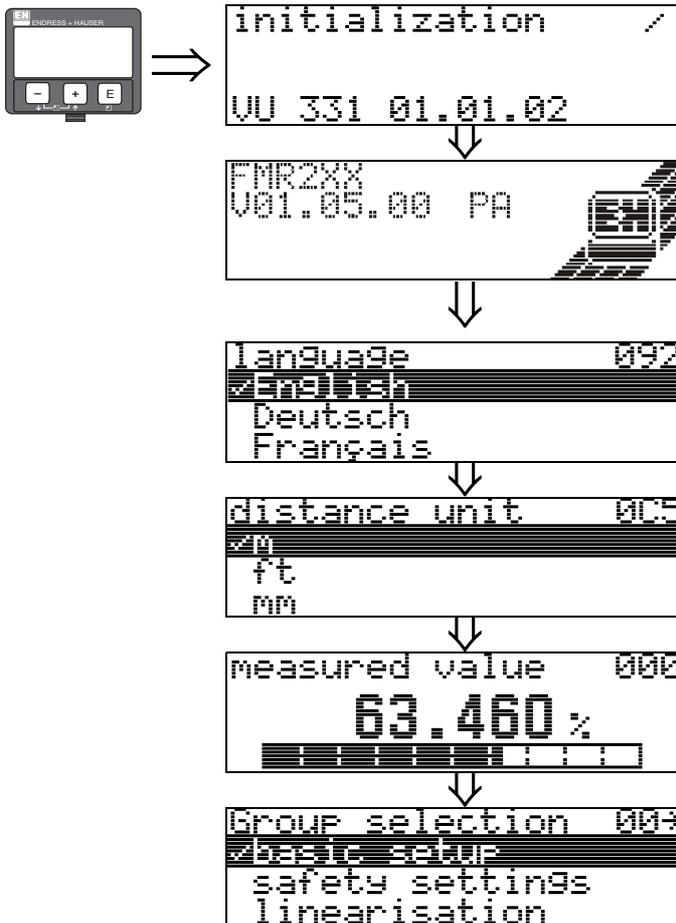
After 5 s, the following message appears

```
FMR2XX
V01.05.00  PA        EH
```

After 5 s or after you have pressed E the following message appears

```
language          092
English
 Deutsch
 Français
```

Select the language (this message appears the first time the instrument is switched on)

```
distance unit     0C5
m
 ft
 mm
```

Select the basic unit (this message appears the first time the instrument is switched on)

```
measured value    000
     63.460 %
```

The current measured value is displayed

After E is pressed, you reach the group selection.

```
Group selection   00→
basic setup
 safety settings
 linearisation
```

This selection enables you to perform the basic setup

6.3   Basic Setup

Grundabgleich (Standard - Flüssigkeiten)

Mediumtyp
Flüssigkeit

↓

Tankgeometrie
Klöpperdeckel

↓

Medium Eigensch.
unbekannt

↓

Messbedingungen
Standard

↓

| Abgleich leer |

↓

| Abgleich voll |

↓

Rohrdurchmesser
(für Bypass/Schwallrohr)

↓

| Ausblendung |

Grundabgleich (Standard - Schüttgüter)

Mediumtyp
Schüttgut

↓

Behälter / Silo
Metallsilo

↓

Medium Eigensch.
unbekannt

↓

Messbedingungen
Standard

↓

| Abgleich leer |

↓

| Abgleich voll |

↓

| Ausblendung |

Optional (Beschreibung siehe BA 291F)

| Sicherheitseinst. |

↓

| Linearisierung |

↓

| erw. Abgleich |

↓

| ... |

Füllstandmessung in Flüssigkeiten

Flansch:
Referenzpunkt
der Messung

Füllstandmessung in Schüttgütern

Flansch:
Referenzpunkt
der Messung

E = Abgleich Leer (= Nullpunkt), Einstellung in 005
F = Abgleich Voll (= Spanne), Einstellung in 006
D = Distanz (Abstand Flansch / Füllgut), Anzeige in 0A5
L = Füllstand, Anzeige in 0A6
SD = Sicherheitsabstand, Einstellung in 015

L00-FMR250xx-19-00-00-de-001

The basic setup is sufficient for successful commissioning in most applications. Complex measuring operations necessitate additional functions that the user can use to customise the Micropilot as necessary to suit his specific requirements. The functions available to do this are described in detail in the BA291F.

Comply with the following instructions when configuring the functions in the "**basic setup**" **(00)**:
- Select the functions as described on Page 33.
- Some functions can only be used depending on the parameterisation of the instrument. For example, the pipe diameter of a stilling well can only be entered if "**stilling well**" was selected beforehand in the "**tank shape**" **(002)** function.
- Certain functions (e.g. starting an interference echo mapping (053)) prompt you to confirm your data entries. Press ⊞ or ⊟ to select "**YES**" and press ⒠ to confirm. The function is now started.
- If you do not press a key during a configurable time period (→ function group "**display**" **(09)**), an automatic return is made to the home position (measured value display).

✎ Note!
- The instrument continues to measure while data entry is in progress, i.e. the current measured values are output via the signal outputs in the normal way.
- If the envelope curve mode is active on the display, the measured values are updated in a slower cycle time. Thus, it is advisable to leave the envelope curve mode after the measuring point has been optimised.
- If the power supply fails, all preset and parameterised values remain safely stored in the EEPROM.

✋ Caution!
All functions are described in detail, as is the overview of the operating menu itself, in the manual "**Description of the instrument functions – BA291F**", which is found on the enclosed CD-ROM.

✎ Note!
The default values of the parameters are typed in **boldface**.

6.4   Basic Setup with the VU331

Function "measured value" (000)

```
measured value   000
   63.460 %
████████████
```

This function displays the current measured value in the selected unit
(see "**customer unit**" **(042)** function). The number of digits after decimal point can be selected in the "**no.of decimals**" **(095)** function.

6.4.1   Function group "basic setup" (00)

```
Group selection  00→
✓basic setup
 safety settings
 linearisation
```

Function "media type" (001)

```
media type       001
✓liquid
 solid
```
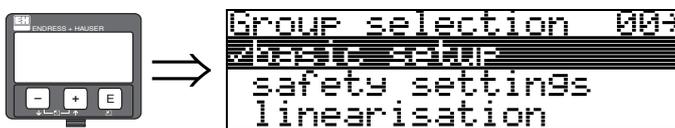
This function is used to select the media type.

Selection:
- liquid
- **solid**

With the selection "liquid" only the following functions can be adjusted:		With the selection "solids" only the following functions can be adjusted:	
tank shape	002	vessel / silo	00A
medium property	003	medium property	00B
process cond.	004	process cond.	00C
empty calibr.	005	empty calibr.	005
full calibr.	006	full calibr.	006
pipe diameter	007	check distance	051
check distance	051	range of mapping	052
range of mapping	052	start mapping	053
start mapping	053	. . .	
. . .			

Function "tank shape" (002), liquids only


```
tank shape              002
✕dome ceiling
 horizontal cyl
 bypass
```
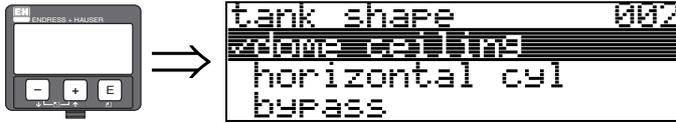
This function is used to select the tank shape.

Selection:
- **dome ceiling**
- horizontal cyl
- bypass
- stilling well
- flat ceiling
- sphere

dome ceiling

horizontal cyl

bypass

stilling well

flat ceiling

sphere
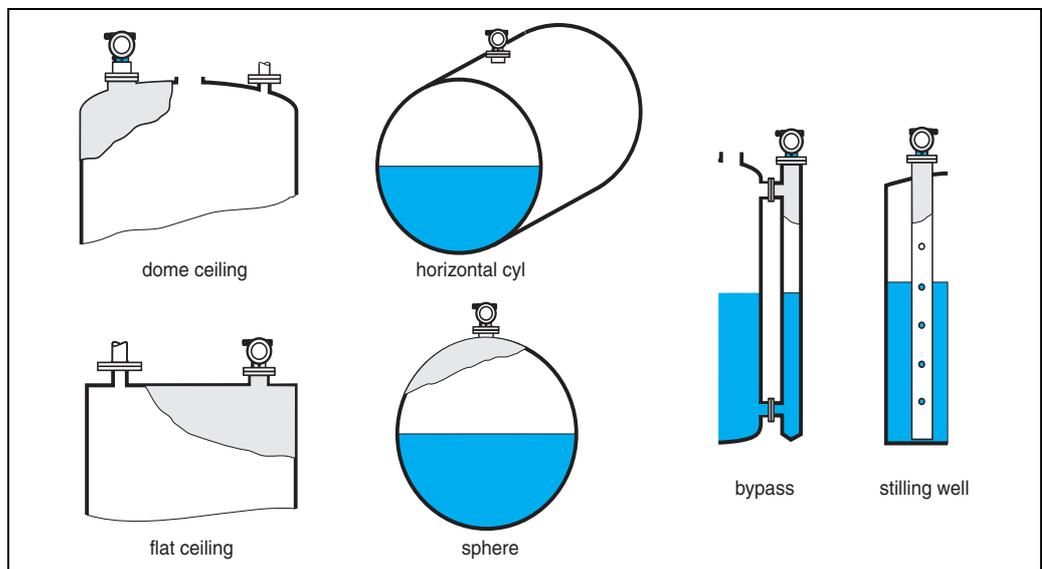
L00-FMR2xxxx-14-00-06-en-007

Function "medium property" (003), liquids only

```
medium property   003
unknown
DC: < 1.9
DC: 1.9 ... 4
```

This function is used to select the dielectric constant.

Selection:
- **unknown**
- DC: < 1.9
- DC: 1.9 ... 4
- DC: 4 ... 10
- DC: > 10

Product class	DC (εr)	Examples
A	1,4...1,9	non-conducting liquids, e.g. liquefied gas [1]
B	1,9...4	non-conducting liquids, e.g. benzene, oil, toluene, …
C	4...10	e.g. concentrated acids, organic solvents, esters, aniline, alcohol, acetone, …
D	>10	conducting liquids, e.g. aqueous solutions, dilute acids and alkalis

[1]   Treat Ammonia NH3 as a medium of group A, i.e. use FMR 230 in a stilling well.

Function "process cond." (004) , liquids only

```
process cond.      004
standard
 calm surface
 turb. surface
```
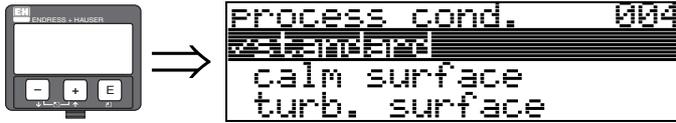
This function is used to select the process conditions.

Selection:
- **standard**
- calm surface
- turb. surface
- agitator
- fast change
- test:no filter

standard	calm surface	turb. surface
For all applications that do not fit into any of the following groups.	Storage tanks with immersion tube or bottom filling	Storage / buffer tanks with rough surface due to free filling or mixer nozzles
The filter and output damping are set to average values.	The averaging filters and output damping are set to high values. → steady meas. value → precise measurement → slower reaction time	Special filters to smooth the input signals are emphasised. → smoothed meas. value → medium fast reaction time
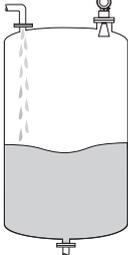
agitator	fast change	test:no filter
Agitated surfaces (with possible vortex) due to agitators	Rapid change of level, particularly in small tanks	All filters can be switched off for service / diagnostic purposes.
Special filters to smooth the input signals are set to high values. → smoothed meas. value → medium fast reaction time → minimization of effects by agitator blades	The averaging filters are set to low values. The output damping is set to 0. → rapid reaction time → possibly unsteady meas. value	All filters off.

Function "vessel / silo" (00A), solids only

```
vessel / silo       00A
✓unknown
 metal silo
 concrete silo
```

This function is used to select the vessel / silo.

Selection:
- **unknown**
- metal silo
- concrete silo
- bin / bunker
- dome
- stockpile
- conveyor belt

Function "medium property" (00B), solids only

```
medium property     00B
✓unknown
 DC: 1.6 ... 1.9
 DC: 1.9 ... 2.5
```
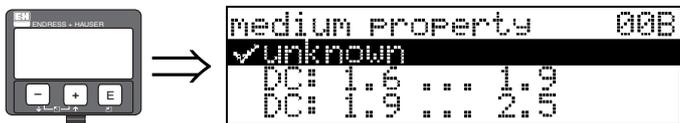
This function is used to select the dielectric constant.

Selection:
- **unknown**
- DC: 1.6 ... 1.9
- DC: 1.9 ... 2.5
- DC: 2.5 ... 4
- DC: 4 ... 7
- DC: > 7

Media group	DK (εr)	Examples
A	1.6...1.9	– Plastic granulate – White lime, special cement – Sugar
B	1.9...2.5	– Portland cement, plaster
C	2.5...4	– Grain, seeds – Ground stones – Sand
D	4...7	– Naturally moist (ground) stones, ores – Salt
E	> 7	– Metallic powder – Carbon black – Coal

The respective lower group applies for very loose or loosened bulk solids.

Function "process cond." (00C), solids only

```
process cond.      00C
✓standard
 fast change
 slow change
```
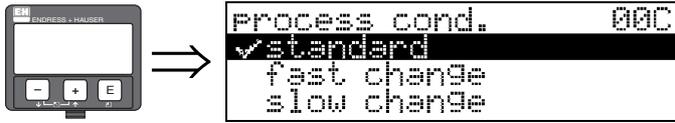
This function is used to select the process conditions.

Selection:
- **standard**
- fast change
- slow change
- test:no filter

Function "empty calibr." (005)

```
empty calibr.    005
▰▰▰5.000 m
distance process
conn. to min. level
```

This function is used to enter the distance from the flange (reference point of the measurement) to the minimum level (=zero).

E = empty calibration (= zero)
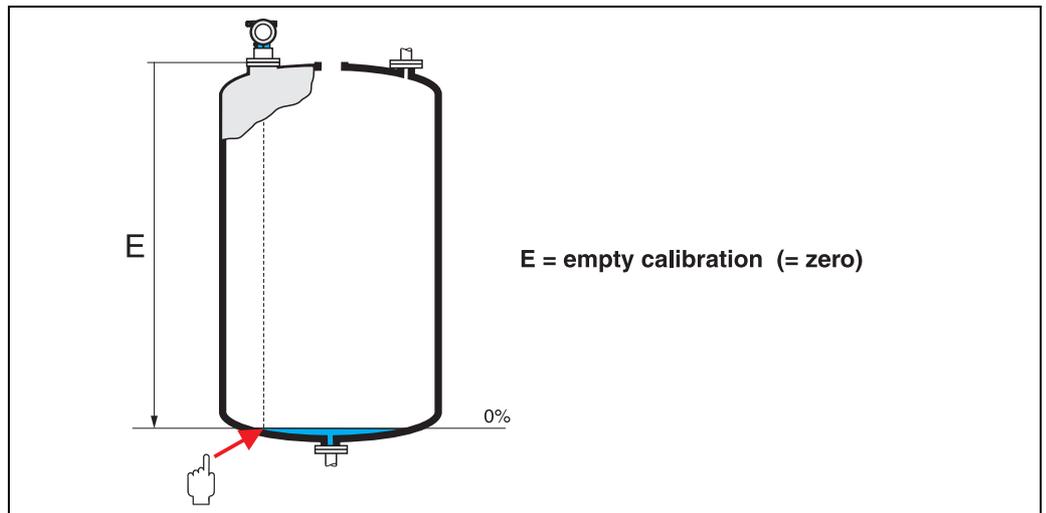
L00-FMR2xxxx-14-00-06-en-008

☞ Caution!
For dish bottoms or conical outlets, the zero point should be no lower than the point at which the radar beam hits the bottom of the vessel.

Function "full calibr." (006)


```
full calibr.        006
          4.000  m
span
```

This function is used to enter the distance from the minimum level to the maximum level (=span).

100%

F = full calibration (= span)

0%
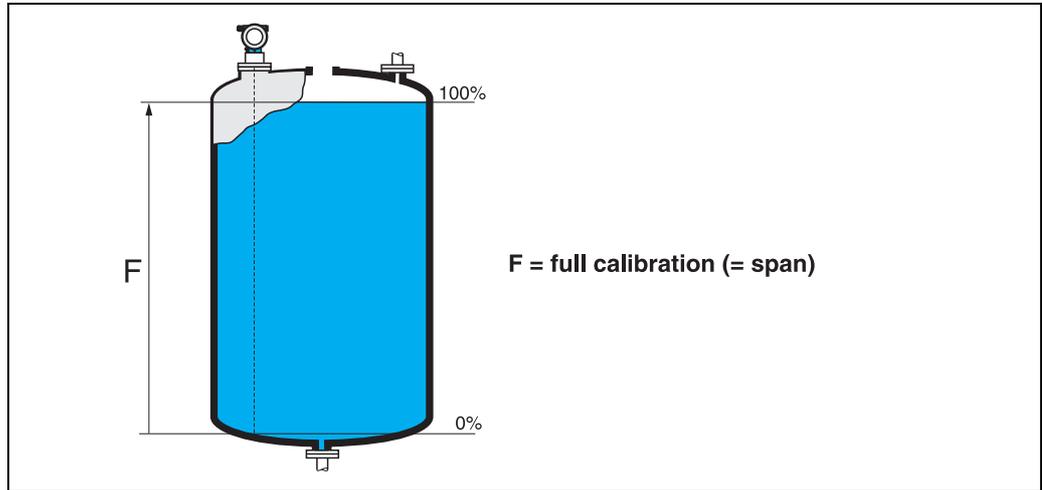
L00-FMR2xxxx-14-00-06-en-009

In principle, it is possible to measure up to the tip of the antenna. However, due to considerations regarding corrosion and build-up, the end of the measuring range should not be chosen any closer than 50 mm (2") to the tip of the antenna.

✎ Note!
If **bypass** or **stilling well** was selected in the "**tank shape**" **(002)** function, the pipe diameter is requested in the following step.

Function "pipe diameter" (007)


```
Pipe diameter    007
▓▓201.425 mm
inner diameter of
bypass/stilling well
```

This function is used to enter the pipe diameter of the stilling well or bypass pipe.
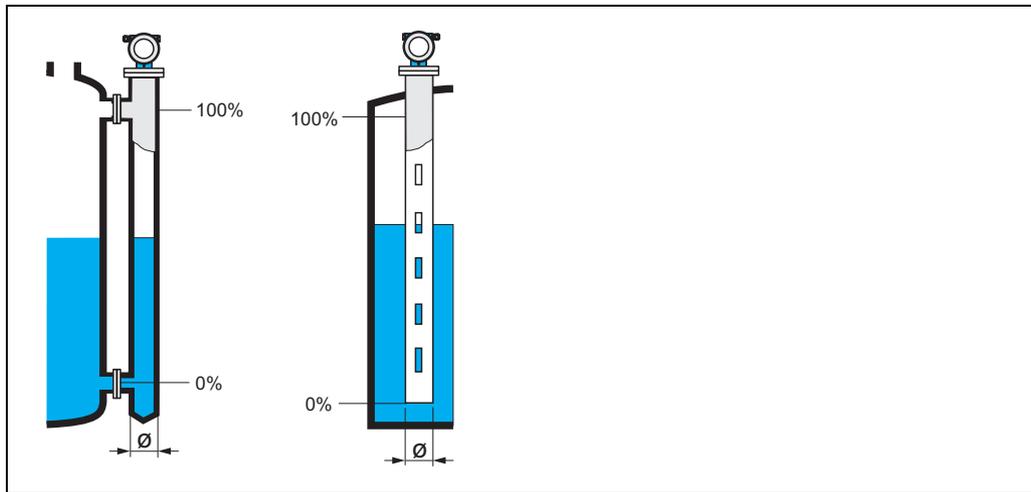
Microwaves propagate more slowly in pipes than in free space. This effect depends on the inside diameter of the pipe and is automatically taken into account by the Micropilot. It is only necessary to enter the pipe diameter for applications in a bypass or stilling well.

display (008)
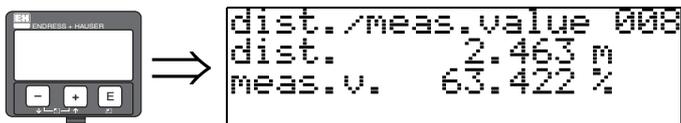

```
dist./meas.value 008
dist.      2.463 m
meas.v.   63.422 %
```

The **distance** measured from the reference point to the product surface and the **level** calculated with the aid of the empty adjustment are displayed. Check whether the values correspond to the actual level or the actual distance. The following cases can occur:

- Distance correct – level correct → continue with the next function, "**check distance**" **(051)**
- Distance correct – level incorrect → Check "**empty calibr.**" **(005)**
- Distance incorrect – level incorrect → continue with the next function, "**check distance**" **(051)**

Function "check distance" (051)

```
check distance    051
dist. unknown
 manual
 distance = ok
```

This function triggers the mapping of interference echoes. To do so, the measured distance must be compared with the actual distance to the product surface. The following options are available for selection:

Selection:
- distance = ok
- dist. too small
- dist. too big
- **dist. unknown**
- manual

L00_FMR2xxxxx-14-00-06-en-010
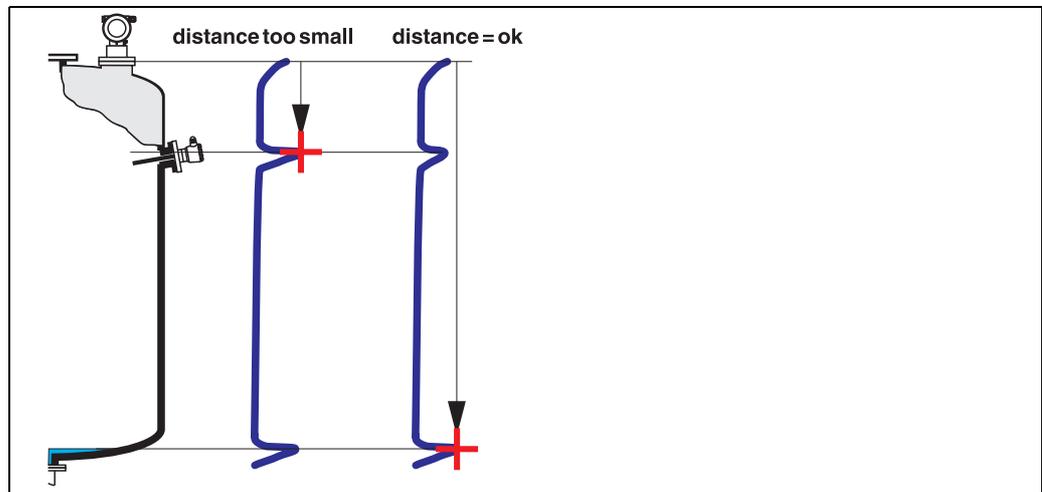
distance = ok
- mapping is carried out up to the currently measured echo
- The range to be suppressed is suggested in the "**range of mapping**" **(052)** function

Anyway, it is wise to carry out a mapping even in this case.

dist. too small
- At the moment, an interference is being evaluated
- Therefore, a mapping is carried out including the presently measured echoes
- The range to be suppressed is suggested in the "**range of mapping**" **(052)** function

dist. too big
- This error cannot be remedied by interference echo mapping
- Check the application parameters **(002), (003), (004)** and "**empty calibr.**" **(005)**

dist. unknown
If the actual distance is not known, no mapping can be carried out.
manual
A mapping is also possible by manual entry of the range to be suppressed. This entry is made in the "**range of mapping**" **(052)** function.

Caution!
The range of mapping must end 0.5 m (20") before the echo of the actual level. For an empty vessel, do not enter E, but E – 0.5 m (20").
If a mapping already exists, it is overwritten up to the distance specified in
"**range of mapping**" **(052)**. Beyond this value the existing mapping remains unchanged.

Function "range of mapping" (052)

```
range of mapping 052
▓▓▓▓0.000▓ m
input of
mapping range
```

This function displays the suggested range of mapping. The reference point is always the reference point of the measurement (see Page 59 ff.). This value can be edited by the operator.
For manual mapping, the default value is 0 m.

Function "start mapping" (053)

```
start mapping    053
✓off
 on
```

This function is used to start the interference echo mapping up to the distance given in "**range of mapping" (052)**.

Selection:
- off → no mapping is carried out
- on → mapping is started

During the mapping process the message "**record mapping**" is displayed.

Caution!
A mapping will be recorded only, if the device is not in alarm–state.

display (008)
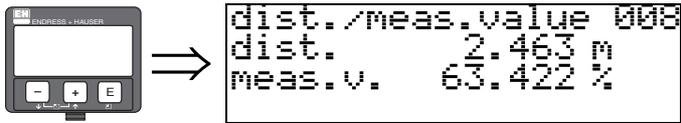
```
dist./meas.value 008
dist.      2.463 m
meas.v.  63.422 %
```

The **distance** measured from the reference point to the product surface and the **level** calculated with the aid of the empty adjustment are displayed. Check whether the values correspond to the actual level or the actual distance. The following cases can occur:

- Distance correct – level correct → continue with the next function, "**check distance**" **(051)**
- Distance correct – level incorrect → Check "**empty calibr.**" **(005)**
- Distance incorrect – level incorrect → continue with the next function, "**check distance**" **(051)**

```
     Return to
  Group Selection
```

⇩

```
Group selection   00→
 basic setup
 safety settings
 linearisation
```
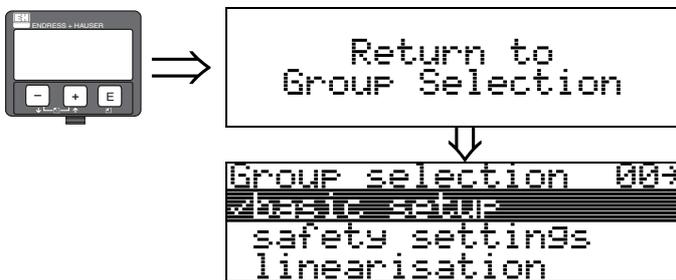
After 3 s, the following message appears

6.4.2   Envelope curve with VU331

After the basic setup, an evaluation of the measurement with the aid of the envelope curve
("**envelope curve**" **(0E)** function group) is recommended.

Function "plot settings" (0E1)


```
plot settings      0E1
xenvelope curve
 env.curve+FAC
 env.curve+cust.map
```
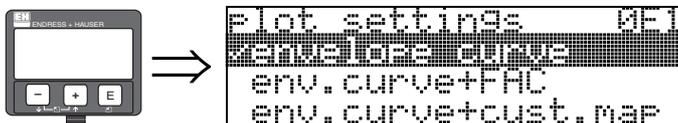
Select which information will be displayed in the LCD:
- **envelope curve**
- env.curve+FAC (on FAC see BA291F)
- env.curve+cust.map (i.e. customer tank map is also displayed)

Function "recording curve" (0E2)

This function defines whether the envelope curve is read as a
- **single curve**
  or
- cyclic.


```
recording curve    0E2
xsingle curve
 cyclic
```

✎   Note!
      If the cyclical envelope curve is active in the display, the measured value is refreshed in a slower
      cycle time. It is therefore recommended to exit the envelope curve display after optimising the
      measuring point.

✎   Note!
      An **orientation** of the Micropilot can help to optimise measurement in applications with very weak
      level echos or strong interference echos by increasing the useful echo/reducing the interference
      echo (see "Orientation of the Micropilot" on Page 91).
      When using the Wave Guide antenna: **No** orientation is required!

Function "envelope curve display" (0E3)

The envelope curve is displayed in this function. You can use it to obtain the following information:
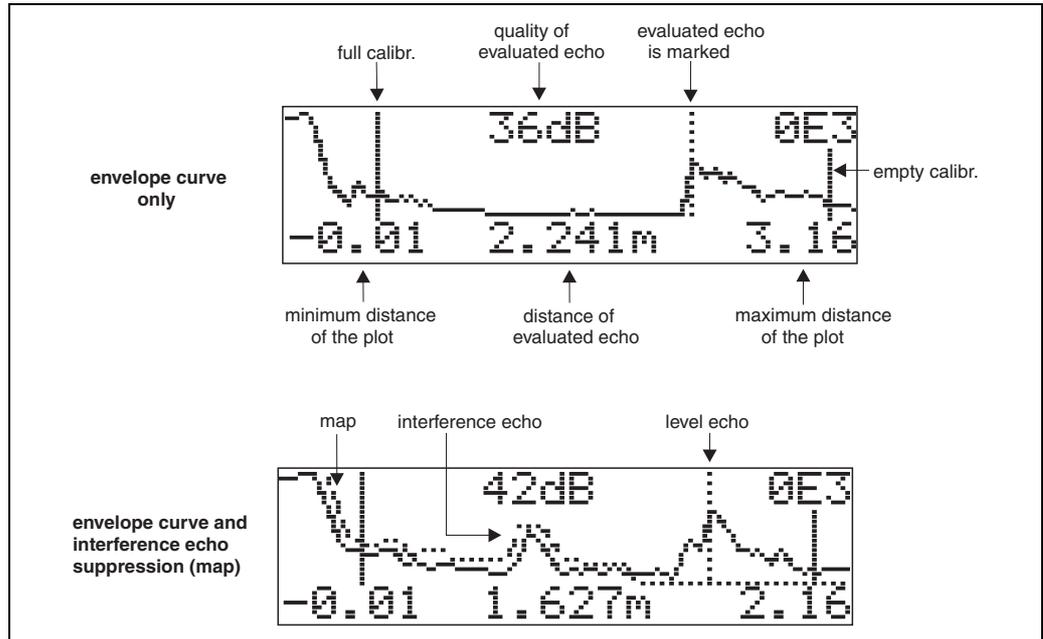
L00-FMU4xxxx-07-00-00-en-003

Navigating in the envelope curve display

Using navigation, the envelope curve can be scaled horizontally and vertically and shifted to the left or the right. The active navigation mode is indicated by a symbol in the top left hand corner of the display.
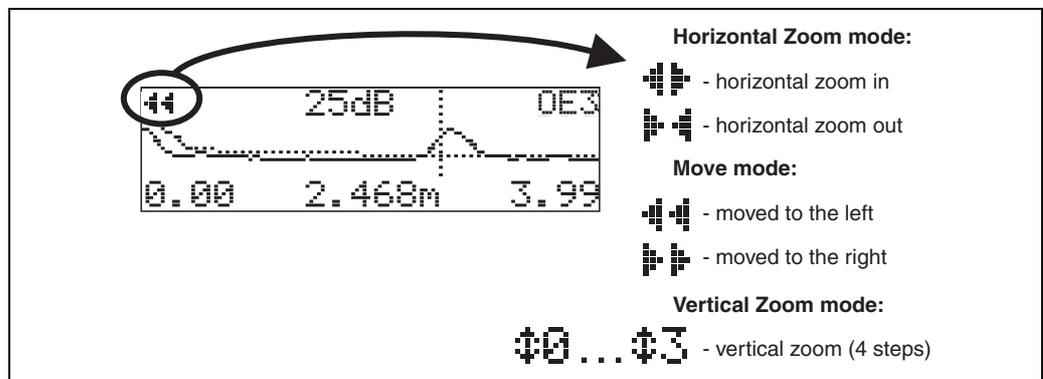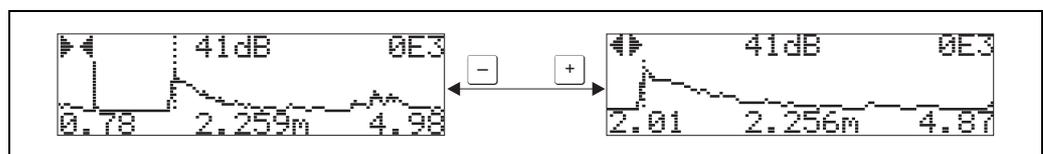

L00-FMxxxxxx-07-00-00-en-004

Horizontal Zoom mode

Firstly, go into the envelope curve display. Then press ⊞ or ⊟ to switch to the envelope curve navigation. You are then in Horizontal Zoom mode. Either ⊹╟⊹ or ╟⊹ is displayed.
- ⊞ increases the horizontal scale.
- ⊟ reduces the horizontal scale.

L00-FMxxxxxx-07-00-00-yy-007

Move mode

Then press E to switch to Move mode. Either ▶▶ or ◀◀ is displayed.
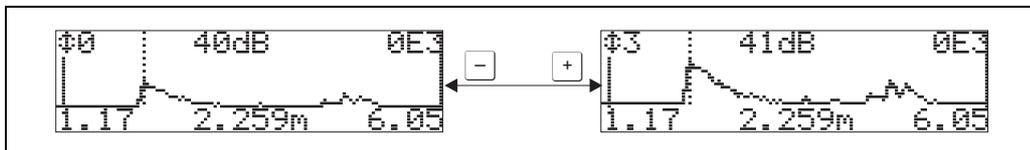- ＋ shifts the curve to the right.
- － shifts the curve to the left.
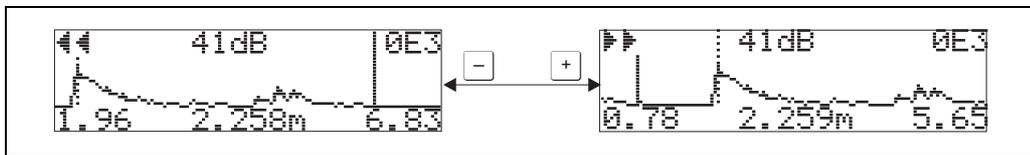
L00-FMxxxxxx-07-00-00-yy-008

Vertical Zoom mode

Press E once more to switch to Vertical Zoom mode. ⬍1 is displayed. You now have the following options.
- ＋ increases the vertical scale.
- － reduces the vertical scale.

The display icon shows the current zoom factor (⬍0 to ⬍3).

L00-FMxxxxxx-07-00-00-yy-009

Exiting the navigation

- Press E again to run through the different modes of the envelope curve navigation.
- Press ＋ and － to exit the navigation. The set increases and shifts are retained. Only when you reactivate the "**recording curve**" **(0E2)** function does the Micropilot use the standard display again.

After 3 s, the following message appears

6.5 Basic Setup with the Endress+Hauser operating program

To carry out the basic setup with the operating program, proceed as follows:
- Start the operating program and establish a connection.
- Select the "**basic setup**" function group in the navigation window.
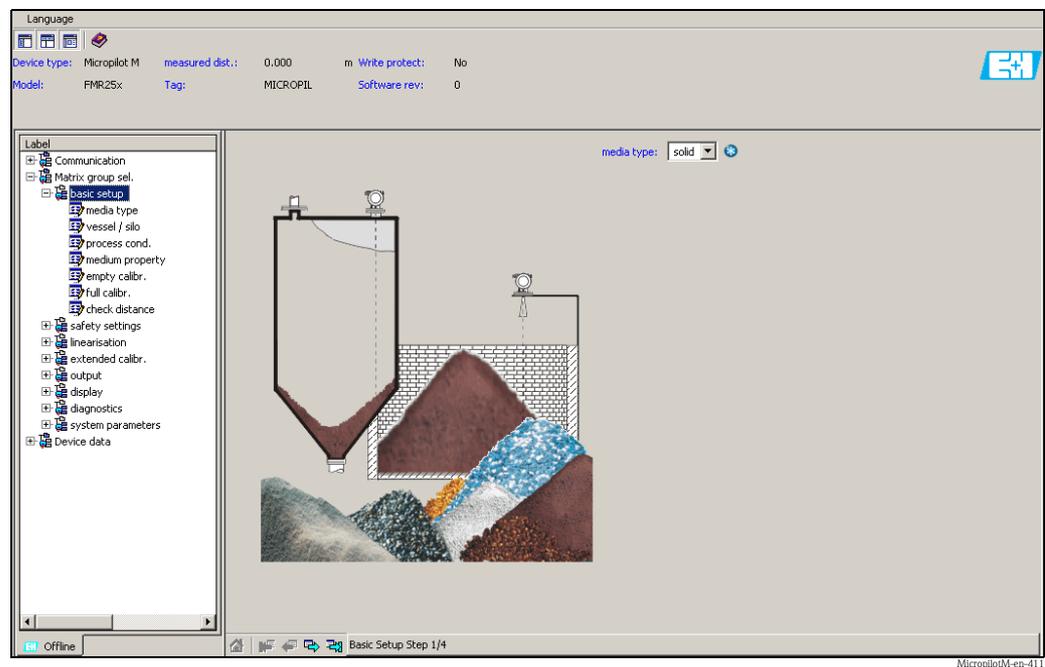
The following display appears on the screen:

Basic Setup step 1/4:

- media type
  - if "**liquid**" is selected in the "**media type**" function for level measurement in liquids
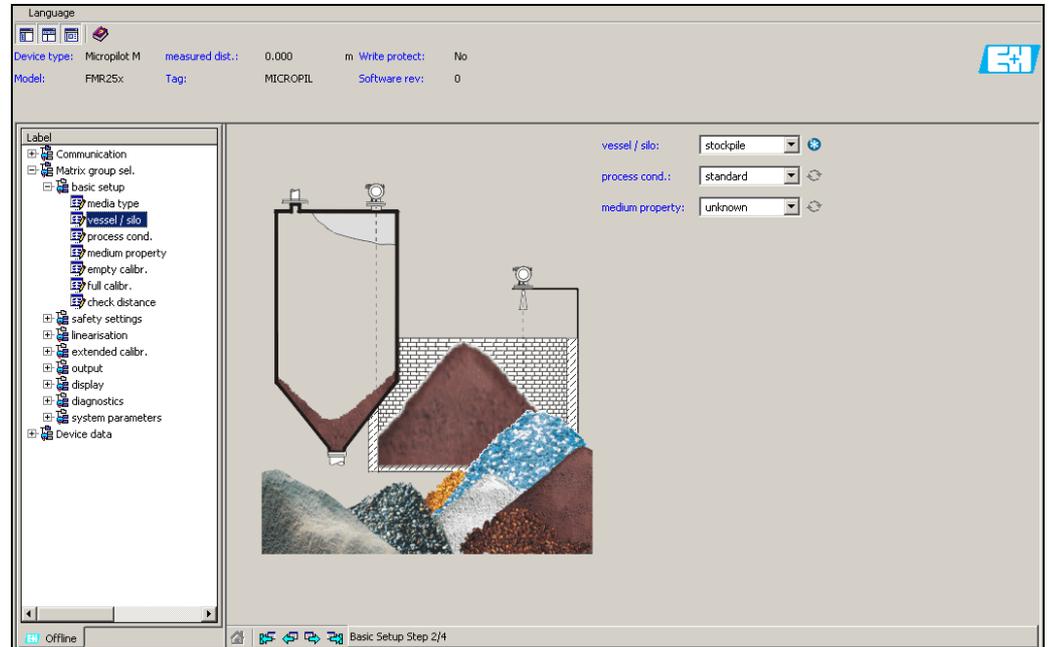 - if "**solid**" is selected in the "**media type**" function for level measurement in solids

✎ Note!
Each parameter that is changed must be confirmed with the **RETURN** key!

MicropilotM-en-411

- The "**Next**" button moves you to the next screen display:

Basic Setup step 2/4:

■ Enter the application parameters:
  – vessel / silo
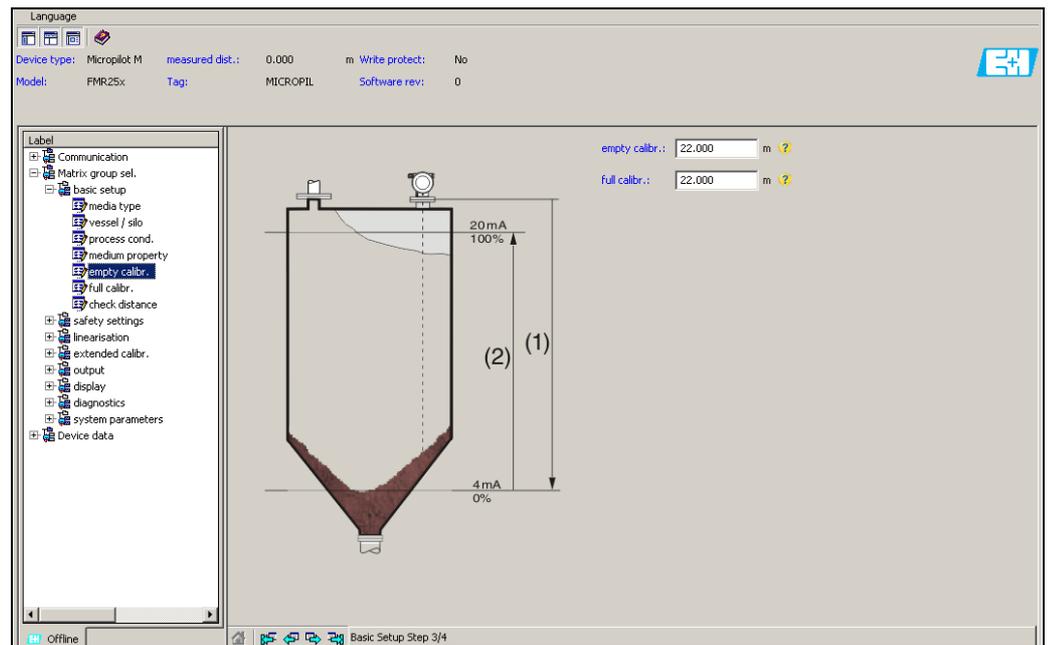 – medium property
  – process cond.

MicropilotM-en-412

Basic Setup step 3/4:

If "**metal silo**", "**concrete silo**", "**...**" is selected in the "**vessel / silo**" function, the following display appears on the screen:
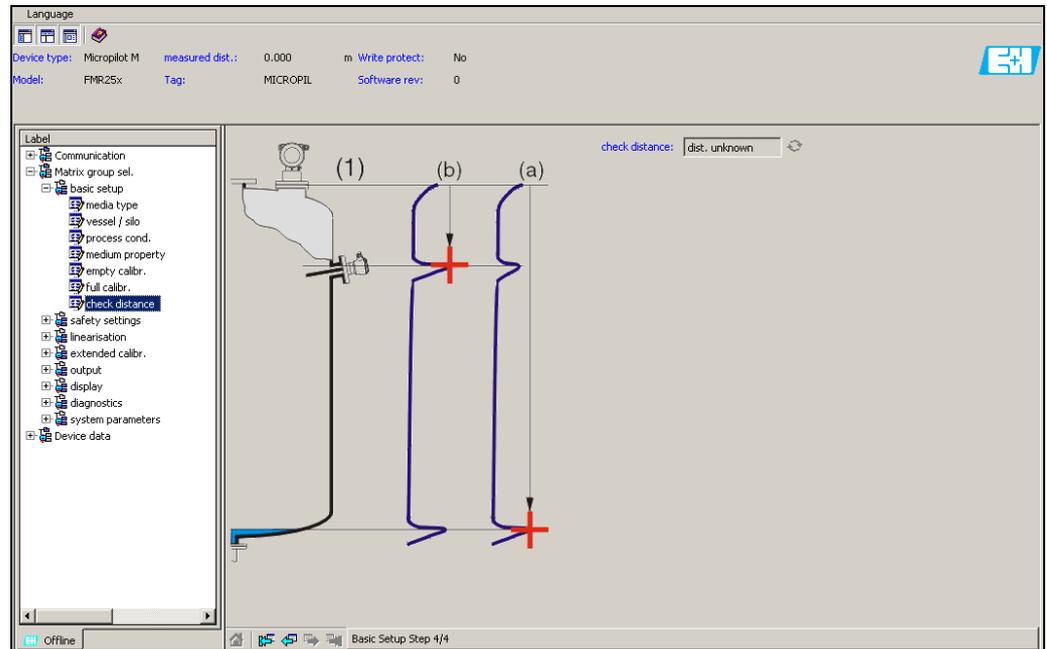■ empty calibr.
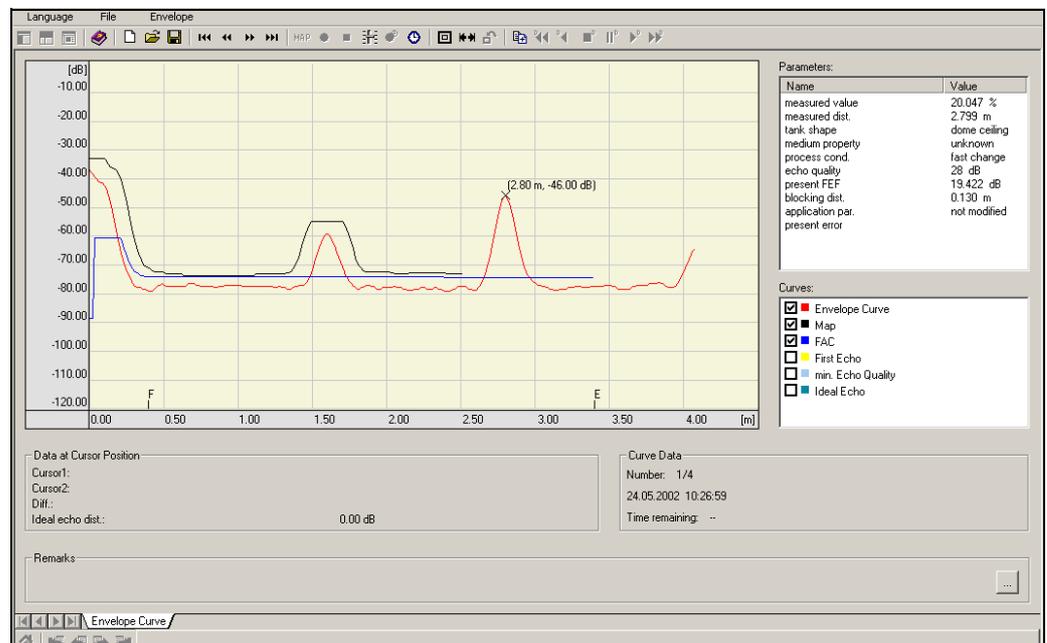■ full calibr.

MicropilotM-en-413

Basic Setup step 4/4:

- This step starts the tank mapping
- The measured distance and the current measured value are always displayed in the header

MicropilotM-en-404

6.5.1   Signal analysis via envelope curve

After the basic setup, an evaluation of the measurement using the envelope curve is recommended.

MicropilotM-en-306

✎ Note!
If the level of echo is very weak or there is a heavy interference echo, an orientation of the Micropilot can help optimise the measurement (increase of the useful echo/reduction of the interference echo).

6.5.2 User-specific applications (operation)

For details of setting the parameters of user-specific applications, see separate documentation BA291F/00/en "Description of the instrument functions for Micropilot M" on the enclosed CD-ROM.

7   Maintenance

The Micropilot M measuring instrument requires no special maintenance.

Exterior cleaning

When cleaning the exterior of measuring devices, always use cleaning agents that do not attack the surface of the housing and the seals.

Replacing seals

The process seals of the sensors must be replaced periodically, particularly if molded seals (aseptic construction) are used. The period between changes depends on the frequency of cleaning cycles and on the temperature of the measured substance and the cleaning temperature.

Repairs

The Endress+Hauser repair concept assumes that the measuring devices have a modular design and that customers are able to undertake repairs themselves. Spare parts are contained in suitable kits. They contain the related replacement instructions. All the spare parts kits which you can order from Endress+Hauser for repairs to the Micropilot M are listed with their order numbers on and . Please contact Endress+Hauser Service for further information on service and spare parts.

Repairs to Ex-approved devices

When carrying out repairs to Ex-approved devices, please note the following:
- Repairs to Ex-approved devices may only be carried out by trained personnel or by the Endress+Hauser Service.
- Comply with the prevailing standards, national Ex-area regulations, safety instructions (XA) and certificates.
- Only use original spare parts from Endress+Hauser.
- When ordering a spare part, please note the device designation on the nameplate. Only replace parts with identical parts.
- Carry out repairs according to the instructions. On completion of repairs, carry our the specified routine test on the device.
- Only Endress+Hauser Service may convert a certified device into a different certified variant.
- Document all repair work and conversions.

Replacement

After a complete Micropilot or electronic module has been replaced, the parameters can be downloaded into the instrument again via the communication interface. Prerequisite to this is that the data were uploaded to the PC beforehand using the ToF Tool / FieldCare.
Measurement can continue without having to carry out a new setup.

- You may have to activate linearisation (see BA291F on the enclosed CD-ROM)
- You may need to record the tank map again (see Basic Setup)

After an antenna component or electronic has been replaced, a new calibration must be carried out. This is described in the repair instructions.

8   Accessories

Various accessories, which can be ordered separately from Endress+Hauser, are available for the Micropilot M.

Weather protection cover

A Weather protection cover made of stainless steel is recommended for outdoor mounting (order code: 543199-0001). The shipment includes the protective cover and tension clamp.
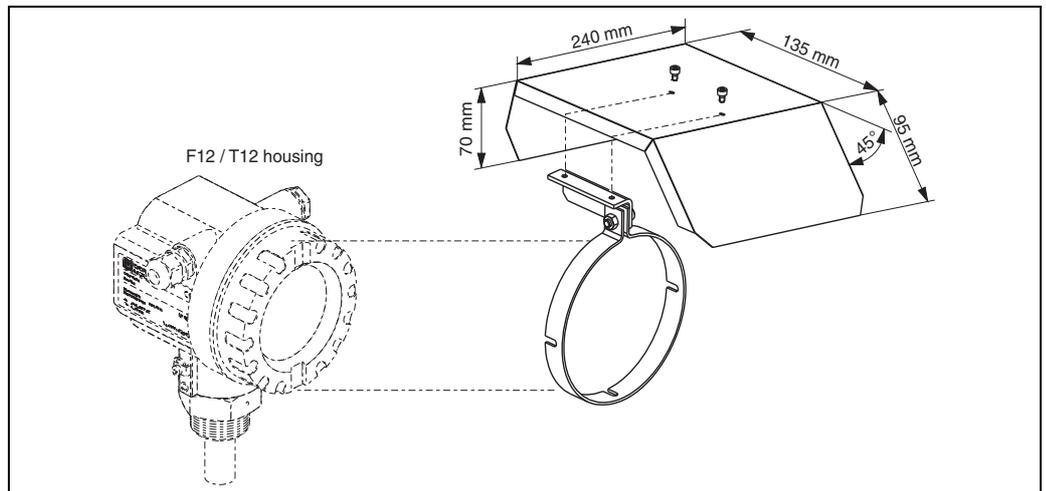
L00-FMR2xxxx-00-00-06-en-001

Commubox FXA291

The Commubox FXA291 connects Endress+Hauser field instruments with CDI interface (= Endress+Hauser Common Data Interface) to the USB interface of a personal computer or a notebook. For details refer to TI405C/07/en.

Note!
For the following Endress+Hauser instruments you need the "ToF Adapter FXA291" as an additional accessory:

- Cerabar S PMC71, PMP7x
- Deltabar S PMD7x, FMD7x
- Deltapilot S FMB70
- Gammapilot M FMG60
- Levelflex M FMP4x
- Micropilot FMR130/FMR131
- Micropilot M FMR2xx
- Micropilot S FMR53x, FMR540
- Prosonic FMU860/861/862
- Prosonic M FMU4x
- Tank Side Monitor NRF590 (with additional adapter cable)
- Prosonic S FMU9x

ToF Adapter FXA291

The ToF Adapter FXA291 connects the Commubox FXA291 via the USB interface of a personal computer or a notebook to the following Endress+Hauser instruments:

- Cerabar S PMC71, PMP7x
- Deltabar S PMD7x, FMD7x
- Deltapilot S FMB70
- Gammapilot M FMG60
- Levelflex M FMP4x
- Micropilot FMR130/FMR131
- Micropilot M FMR2xx
- Micropilot S FMR53x, FMR540
- Prosonic FMU860/861/862
- Prosonic M FMU4x
- Tank Side Monitor NRF590 (with additional adapter cable)
- Prosonic S FMU9x

For details refer to KA271F/00/a2.

Remote display FHX40

L00-FMxxxxxx-00-00-06-en-003
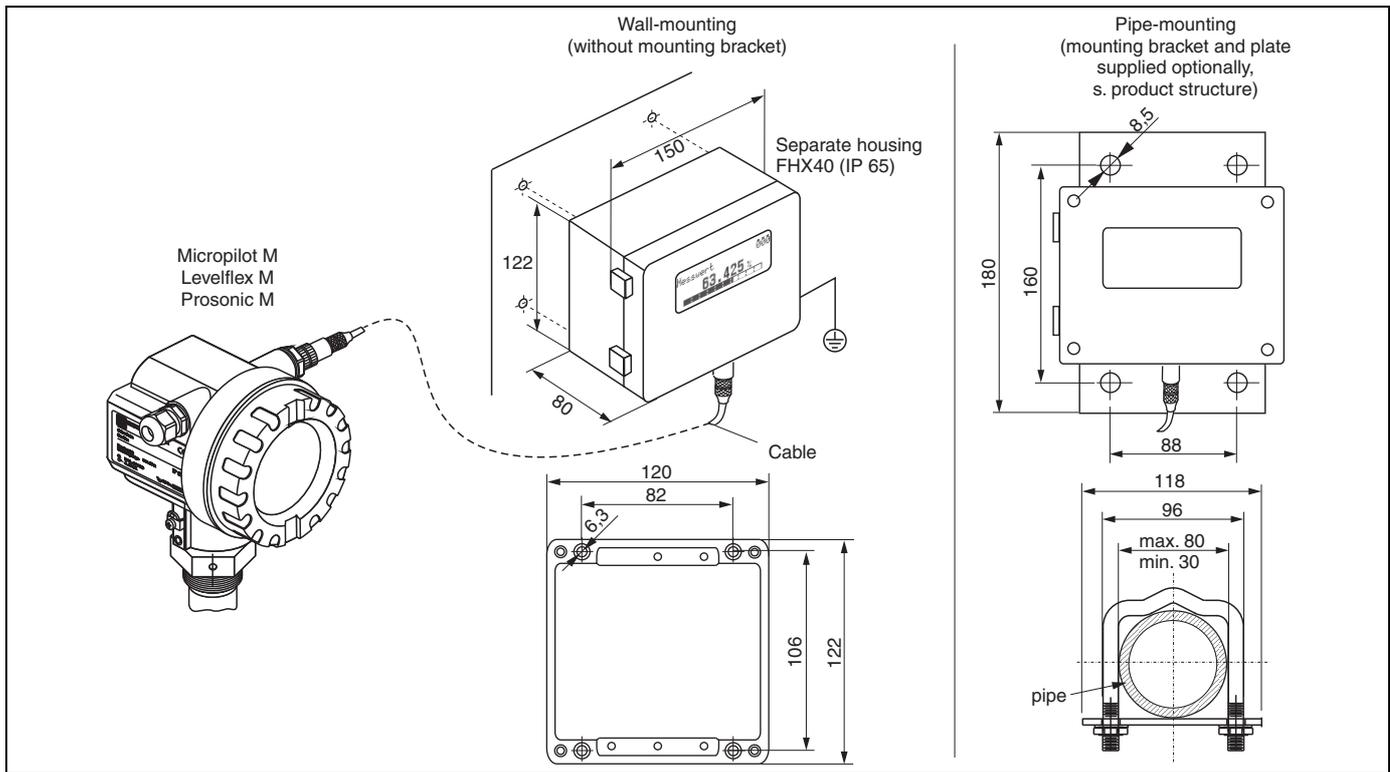
Technical data (cable and housing) and product structure:

Max. cable length	20 m (65 ft)
Temperature range	–30 °C...+70 °C (–22 °F...158 °F)
Degree of protection	IP65/67 (housing); IP68 (cable) acc. to IEC 60529
Materials	Housing: AlSi12; cable glands: nickle plated brass
Dimensions [mm] / [inch]	122x150x80 (HxWxD) / 4.8x5.9x3.2

	Approval:			
	A	Nn-hazardous area		
	1	ATEX II 2 G EEx ia IIC T6, ATEX II 3D		
	S	FM IS Cl.I Div.1 Gr.A-D		
	U	CSA IS Cl.I Div.1 Gr.A-D		
	N	CSA General Purpose		
	K	TIIS ia IIC T6 (in preparation)		
		Cable:		
		1	20m/65ft; for HART	
		5	20m/65ft; for PROFIBUS PA/FOUNDATION Fieldbus	
			Additional option:	
			A	Basic version
			B	Mounting bracket, pipe 1"/ 2"
FHX40 –				Complete product designation

For connection of the remote display FHX40 use the cable which fits the communication version of the respective instrument.

Proficard

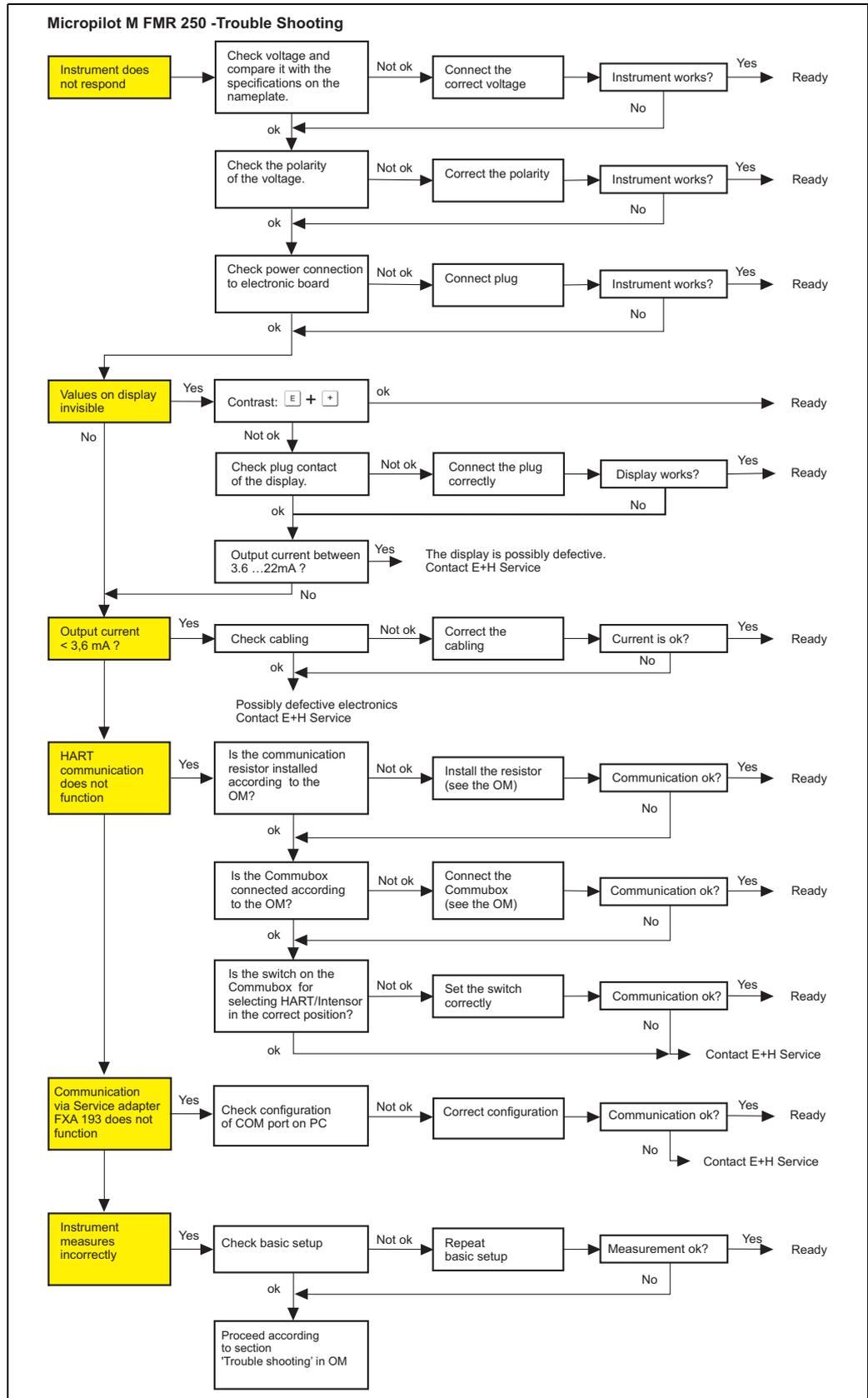For the connection of a Laptop to PROFIBUS

Profiboard

For the connection of a Personal Computer to PROFIBUS

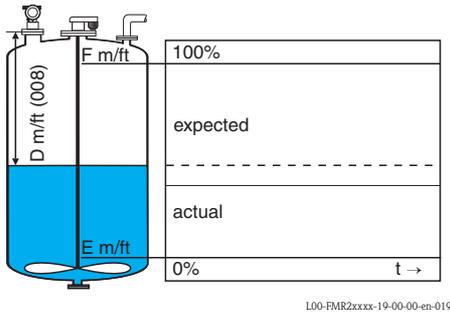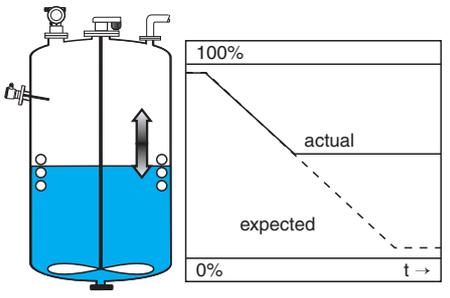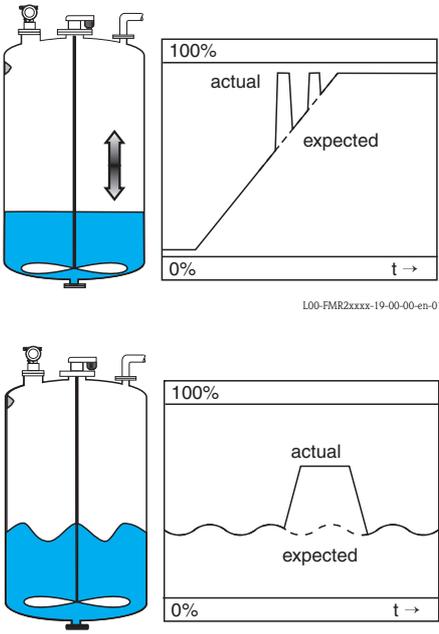# 9 Trouble-shooting

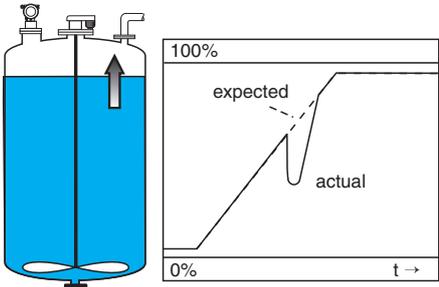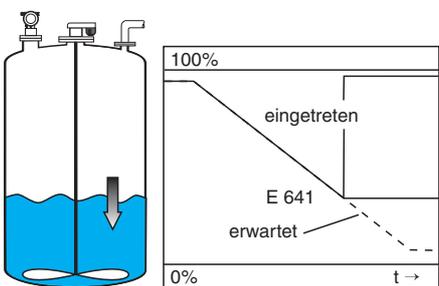## 9.1 Trouble-shooting instructions

Micropilot M FMR 250 -Trouble Shooting

L00-FMR250xx-19-00-00-en-003

9.2   System error messages

Code	Description	Possible cause	Remedy
A102	checksum error general reset & new calibr.required	device has been powered off before data could be stored; emc problem; E²PROM defect	reset; avoid emc problem; if alarm prevails after reset, exchange electronics
W103	initialising – please wait	E²PROM storage not yet finished	wait some seconds; if warning prevails, exchange electronics
A106	downloading please wait	processing data download	wait until warning disappears
A110	checksum error general reset & new calibr.required	device has been powered off before data could be stored; emc problem; E²PROM defect	reset; avoid emc problem; if alarm prevails after reset, exchange electronics
A111	electronics defect	RAM defective	reset; if alarm prevails after reset, exchange electronics
A113	electronics defect	RAM defective	reset; if alarm prevails after reset, exchange electronics
A114	electronics defect	E²PROM defect	reset; if alarm prevails after reset, exchange electronics
A115	electronics defect /error power supply	general hardware problem / too low power supply	reset; if alarm prevails after reset, exchange electronics / higher supply voltage
A116	download error repeat download	checksum of stored data not correct	restart download of data
A121	electronics defect	no factory calibration existant; EPROM defective	contact service
W153	initialising – please wait	initialisation of electronics	wait some seconds; if warning prevails, power off device and power on again
A155	electronics defect	hardware problem	reset; if alarm prevails after reset, exchange electronics
A160	checksum error general reset & new calibr.required	device has been powered off before data could be stored; emc problem; E²PROM defect	reset; avoid emc problem; if alarm prevails after reset, exchange electronics
A164	electronics defect	hardware problem	reset; if alarm prevails after reset, exchange electronics
A171	electronics defect	hardware problem	reset; if alarm prevails after reset, exchange electronics
A231	sensor 1 defect check connection	HF module or electronics defective	exchange HF module or electronics
W511	no factory calibration ch1	factory calibration has been deleted	record new factory calibration
A512	recording of mapping please wait	mapping active	wait some seconds until alarm disappears
A601	linearisation ch1 curve not monotone	linearisation not monotonously increasing	correct linearisation table
W611	less than 2 linearisation points for channel 1	number of entered linearisation points < 2	correct linearisation table
W621	simulation ch. 1 on	simulation mode is active	switch off simulation mode

Code	Description	Possible cause	Remedy
E641	no usable echo channel 1 check calibr.	echo lost due to application conditions or built up on antenna	check installation; optimize orientation of antenna; clean antenna (cf. OM)
E651	level in safety distance – risk of overspill	level in safety distance	alarm will disappear as soon as level leaves safety distance;
A671	linearisation ch1 not complete, not usable	linearisation table is in edit mode	activate linearisation table
W681	current ch1 out of range	current out of range (3.8 mA...21.5 mA)	check calibration and linearisation

                                            Endress+Hauser

9.3   Application errors in liquids

Error	Output	Possible cause		Remedy
A warning or alarm has occurred.	Depending on the configuration	See table of error messages (see Page 85)		1. See table of error messages (see Page 85)
Measured value (00) is incorrect	 L00-FMR2xxxx-19-00-00-en-019	Measured distance (008) OK?	yes →	1. Check empty calibr. (005) and full calibr. (006). 2. Check linearisation: → level/ullage (040) → max. scale (046) → diameter vessel (047) → Check table
		no ↓		
		Measurement in bypass or stilling well?	yes →	1. Is bypass or stilling well selected in tank shape (002)? 2. Is the pipe diameter (007) correct?
		no ↓		
		An interference echo may have been evaluated.	yes →	1. Carry out tank mapping → basic setup
No change off measured value on filling/emptying	 L00-FMR2xxxx-19-00-00-en-014	Interference echo from installations, nozzle or extension on the antenna		1. Carry out tank mapping → basic setup 2. If necessary, clean antenna 3. If necessary, select better mounting position 4. If necessary due to wide interference echos set function detection window (0A7) to "off"

Error	Output	Possible cause		Remedy
If the surface is not calm (e.g. filling, emptying, agitator running), the measured value jumps sporadically to a higher level	100% / actual / expected / 0% / t → L00-FMR2xxxx-19-00-00-en-015 100% / actual / expected / 0% / t → L00-FMR2xxxx-19-00-00-en-016	Signal is weakened by the rough surface – the interference echoes are sometimes stronger		1. Carry out tank mapping → basic setup 2. Set the process cond. (004) to "turb. surface" or "agitator" 3. Increase the output damping (058) 4. Optimise the orientation (see Page 91) 5. If necessary, select a better mounting position and/or larger antenna
During filling/ emptying the measured value jumps ownwards	100% / expected / actual / 0% / t → L00-FMR2xxxx-19-00-00-en-017	Multiple echoes	yes →	1. Check the tank shape (002), e.g. "dome ceiling" or "horizontal cyl" 2. In the range of the blocking dist. (059) there is no echo evaluation → Adapt the value 3. If possible, do not select central installation position 4. Perhaps use a stilling well
E 641 (loss of echo)	100% / eingetreten / E 641 / erwartet / 0% / t → L00-FMR2xxxx-19-00-00-en-018	Level echo is too weak. Possible causes: ■ Rough surface due to filling/ emptying ■ Agitator running ■ Foam	yes →	1. Check application arameters (002), (003) and (004) 2. Optimise alignment (see Page 91) 3. If necessary, select a better installation position and/or larger antenna

9.4 Application errors in solids

Error	Output		Possible cause		Remedy
A warning or alarm has occurred.	Depending on the configuration		See table of error messages (see Page 85)		1. See table of error messages (see Page 85)
Measured value (00) is incorrect	 L00-FMR250xx-19-00-00-en-019		Measured distance (008) OK?	yes →	1. Check empty calibr. (005) and full calibr. (006). 2. Check linearisation: → level/ullage (040) → max. scale (046) → Check table
			no ↓		
			An interference echo may have been evaluated.	yes →	1. Carry out tank mapping → basic setup
No change off measured value on filling/emptying	 L00-FMR250xx-19-00-00-en-014		Interference echo from installations, nozzle or build up on the antenna		1. Carry out tank mapping → basic setup 2. If necessary, use top target positioner to aim antenna better to product surface (avoidance of interference echo) (see Page 91) 3. If necessary, clean antenna (air purge) 4. If necessary, select better mounting position 5. If necessary due to wide interference echos set function detection window (0A7) to "off"
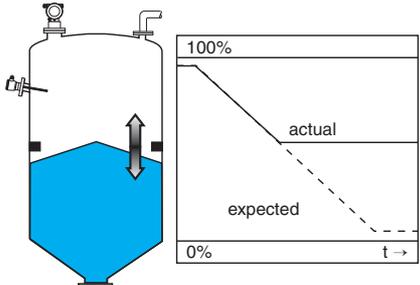
Error	Output	Possible cause	Remedy
During filling/ emptying or measumement the measured value jumps sporadically to a higher level	L00-FMR250xx-19-00-00-en-015	Signal is weakened (e.g. by fluidisation of the surface, extreme dust formation) – the interference echoes are sometimes stronger. Strong build-up, filling stream in path of beam.	1. Carry out tank mapping → basic setup 2. Increase the output damping (058) 3. Optimise the orientation (see Page 91) 4. If necessary, select a better mounting position and/or larger antenna 5. If necessary, clear antenna
E 641 (loss of echo)	L00-FMR250xx-19-00-00-en-018	Level echo is too weak. Possible causes: ■ fluidisation of the surface ■ extreme dust formation ■ angle of repose	yes → 1. Check application arameters (00A), (00B) and (00C) 2. Optimise alignment (see Page 91) 3. If necessary, select a better installation position and/or larger antenna
Measured value jumps to higher levels and remains there	L00-FMR250xx-19-00-00-en-039	Possible causes: ■ build-up at container ■ build-up at antenna ■ strong condensate formation at antenna	1. Periodic cleaning 2. Carry out tank mapping → basic setup 3. Increase the output damping (058) 4. Optimise the orientation (see Page 91) 5. If necessary, select a better mounting position and/or larger antenna
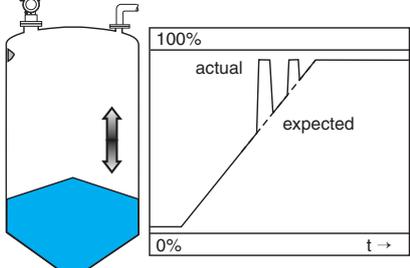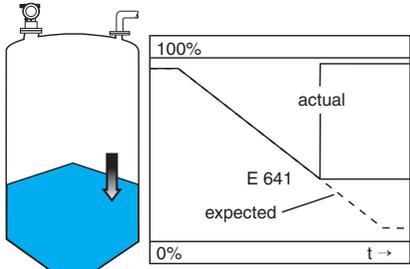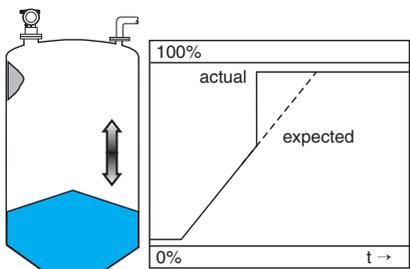
9.5   Orientation of the Micropilot

For orientation a marker is found on the flange or threaded boss of the Micropilot. During installation this must be oriented as follows (see Page 12):
- In tanks: to the vessel wall
- In stilling wells: to the slots
- In bypass pipes: vertical to the tank connectors
- When using the Wave Guide antenna **no** orientation is required!

After commissioning the Micropilot, the echo quality indicates whether a sufficiently large measuring signal is obtained. If necessary, the quality can be optimised later. Vice versa, the presence of an interference echo can be used to minimise this by optimum orientation. The advantage of this is that the subsequent tank mapping uses a somewhat lower level that causes an increase in the strength of the measuring signal.
Proceed as follows:

⚠ Warning!
Subsequent alignment can lead to personal injury. Before you unscrew or loosen the process connection, make sure that the vessel is not under pressure and does not contain any injurious substances.

1.   It is best to empty the container so that the bottom is just covered. However, alignment can be carried out even if the vessel is empty.

2.   Optimisation is best carried out with the aid of the envelope graph in the display or the ToF Tool.

3.   Unscrew the flange or loosen the threaded boss by a half a turn.

4.   Turn the flange by one hole or screw the threaded boss by one eighth of a turn. Note the echo quality.

5.   Continue to turn until 360° is reached.

6.   Optimum alignment:

L00-FMRxxxxx-19-00-00-en-002
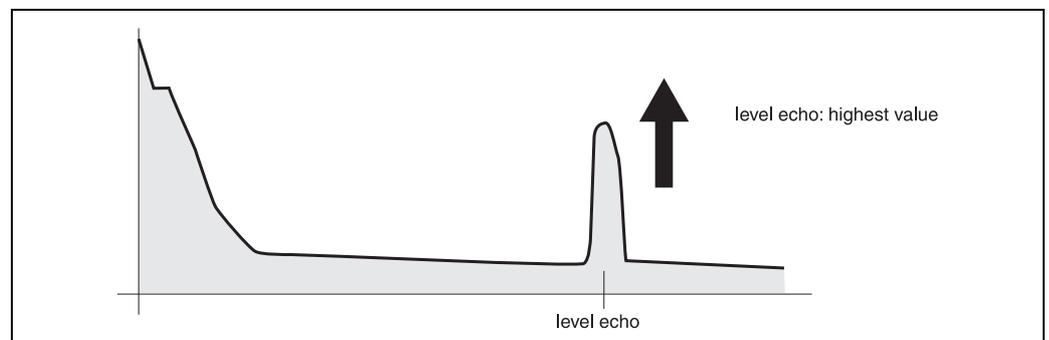
Fig. 4:   Vessel partly full, no interference echo obtained

L00-FMRxxxxx-19-00-00-en-003
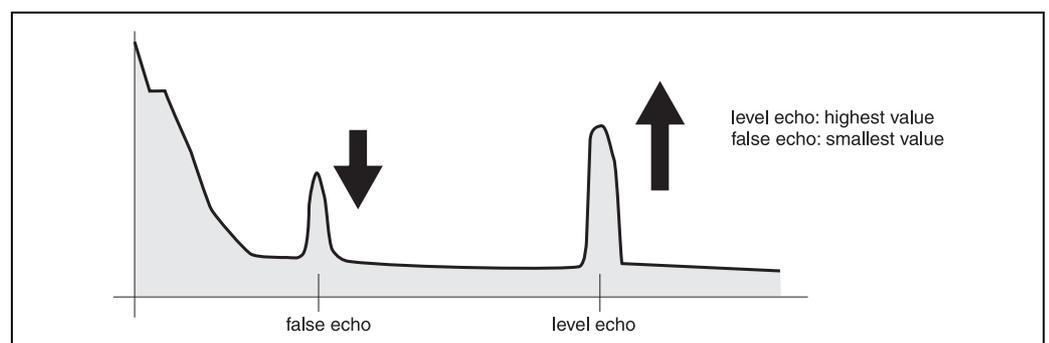
Fig. 5:   Vessel partly full, interference echo obtained:

L00-FMRxxxxx-19-00-00-en-004
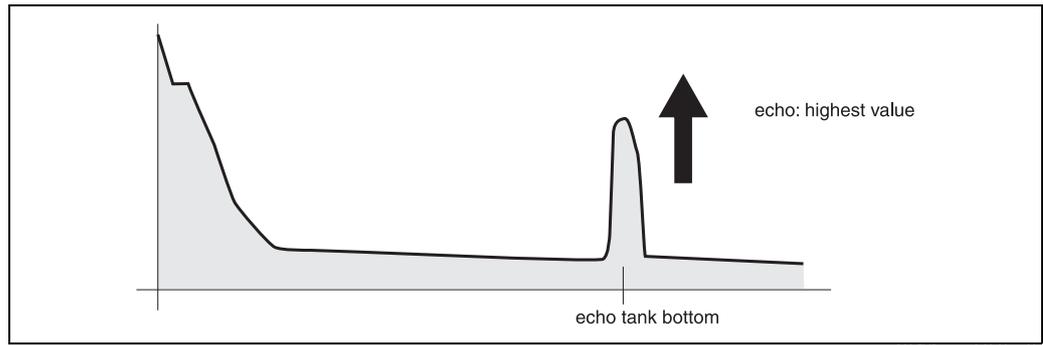
Fig. 6:   Vessel empty, no interference echo

L00-FMRxxxxx-19-00-00-en-005
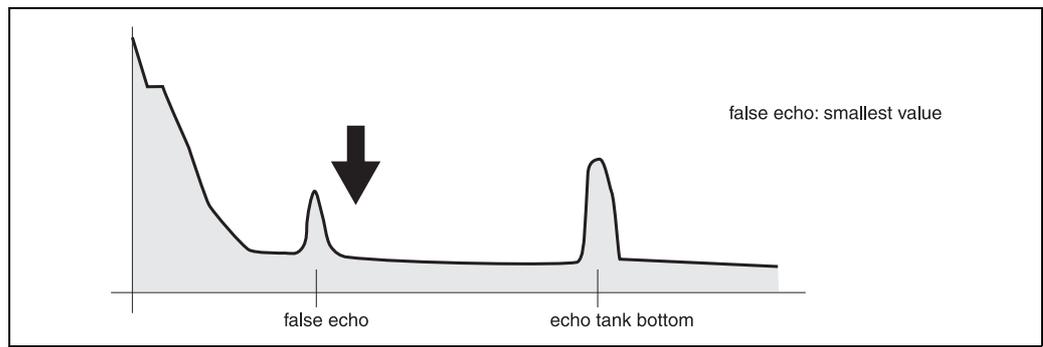
Fig. 7:   Vessel empty, interference echo obtained

7.   Fix the flange or threaded boss in this position.
      If necessary, replace the seal.

8.   Carry out tank mapping, see Page 70.

Top target positioner – optional
Using top target positioner it is possible to tilt the antenna axis by up to 15° in all directions. The top target positioner is used for the optimum alignment of the radar beam with the bulk solids surface.

9.6   Spare parts

✎ Note!
You can order spare parts directly from your E+H service organization by giving the serial number which is printed on the measuring transducer nameplate (see Page 8s. Seite 8 ff.). The corresponding spare part number also appears on each spare part. Installation instructions are given on the instruction card that is also delivered.

Spare parts Micropilot M FMR250, F12 housing with combined wiring and electronics compartment
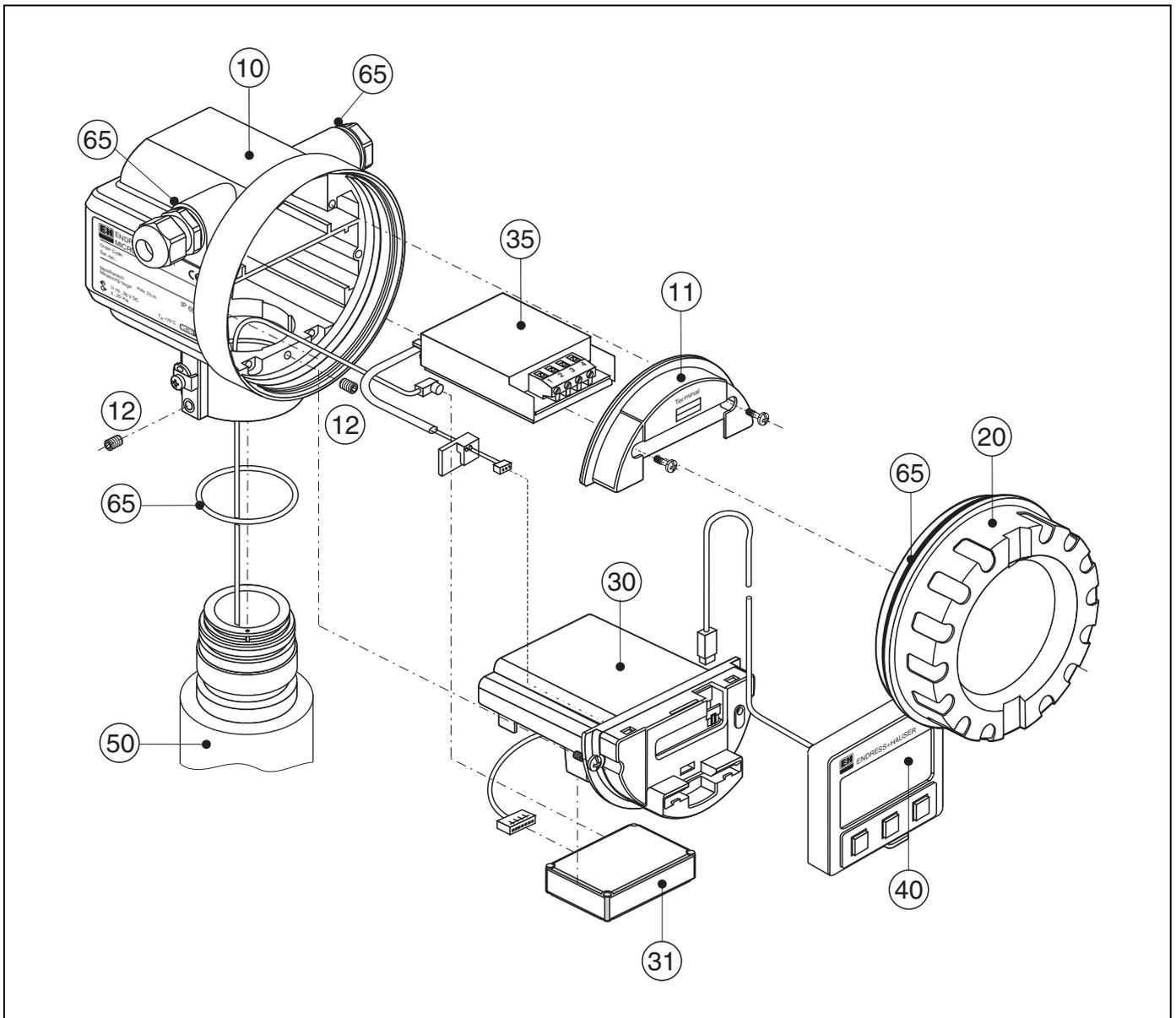
L00-FMR250xx-00-00-06-xx-001

10 Housing – for E+H service only!

11 Hood for terminal compartment

52006026	Cover terminal compartment F12
52019062	Hood terminal compartment F12, FHX40

12 Screw set
    535720-9020   Set of screws housing F12/T12

20 Cover
    52005936   Cover F12/T12 Aluminium, window, gasket
    517391-0011   Cover F12/T12 Aluminium, coated, gasket

30 Electronics
    71026754   Electronics FMR24x/FMR250, Ex, HART, v5.0
    71026819   Electronics FMR24x/FMR250, Ex, PA, v5.0
    71026820   Electronics FMR24x/FMR250, Ex, FF, v5.0

31 HF module
    52024953   HF module FMR24x, FMR259, 26 GHz
                      version: uP III.3
                      for electronics from software version 1.0
                      Micropilot M FMR250
                      for electronics from software version 5.0
                      Micropilot M FMR24x, advanced dynamics

35 Terminal module / power supply board
    52006197   Terminal module 4pole, HART, 2-wire with cable connection
    52012156   Terminal module 4pole, PROFIBUS PA, FOUNDATION Fieldbus

40 Display
    52026443   Display VU331, version 2

50 Antenna assembly with process connection on request!

65 Sealing kit
    535720-9010   consists of:
                      2 x gasket Pg13.5 FA
                      2 x O-ring 17.0x2.0 EPDM
                      1 x O-ring 49.21x3.53 EPDM
                      2 x O-ring 17.12x2.62 FKM
                      1 x O-ring 113.9x3.63 EPDM
                      1 x O-ring 72.0x3.0 EPDM

Spare parts Micropilot M FMR250, T12 housing with separate wiring and electronics compartment
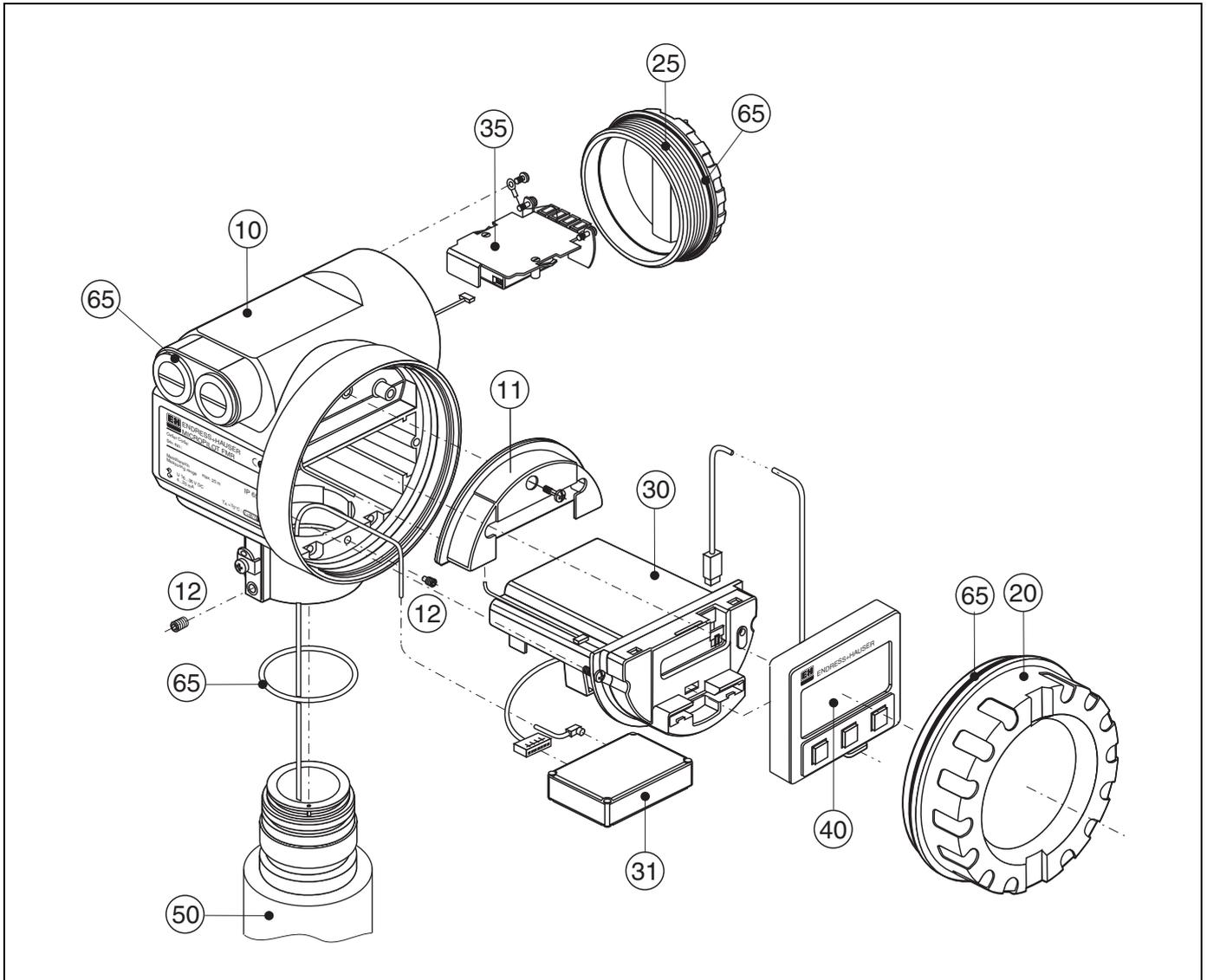
L00-FMR250xx-00-00-06-xx-002

10 Housing – for E+H service only!

11 Hood for terminal compartment
52005643   Hood T12

12 Screw set
535720-9020   Set of screws housing F12/T12

20 Cover
52005936   Cover F12/T12 Aluminium, window, gasket
517391-0011   Cover F12/T12 Aluminium, coated, gasket

25 Cover for terminal compartment
518710-0020   Cover T3/T12, Aluminium, coated, gasket

30 Electronics

71026754	Electronics FMR24x/FMR250, Ex, HART, v5.0
71026819	Electronics FMR24x/FMR250, Ex, PA, v5.0
71026820	Electronics FMR24x/FMR250, Ex, FF, v5.0

31 HF module

52024953   HF module FMR24x, FMR259, 26 GHz
             version: uP III.3
             for electronics from software version 1.0
             Micropilot M FMR250
             for electronics from software version 5.0
             Micropilot M FMR24x, advanced dynamics

35 Terminal module / power supply board

52013302	Terminal module 4pole, 2-wire, HART, EEx d
52018949	Terminal module 4pole, 2-wire, HART, EEx ia, overvoltage protection
52013303	Terminal module 2pole, 2-wire, PROFIBUS PA / FOUNDATION Fieldbus, EEx ia
52018950	Terminal module 4pole, 2-wire, PROFIBUS PA / FOUNDATION Fieldbus, EEx ia, overvoltage protection

40 Display

52026443   Display VU331, version 2

50 Antenna assembly with process connection on request!

65 Sealing kit

535720-9010   consists of:
                2 x gasket Pg13.5 FA
                2 x O-ring 17.0x2.0 EPDM
                1 x O-ring 49.21x3.53 EPDM
                2 x O-ring 17.12x2.62 FKM
                1 x O-ring 113.9x3.63 EPDM
                1 x O-ring 72.0x3.0 EPDM

Spare parts Micropilot M FMR250, F23 housing with combined wiring and electrinics compartment
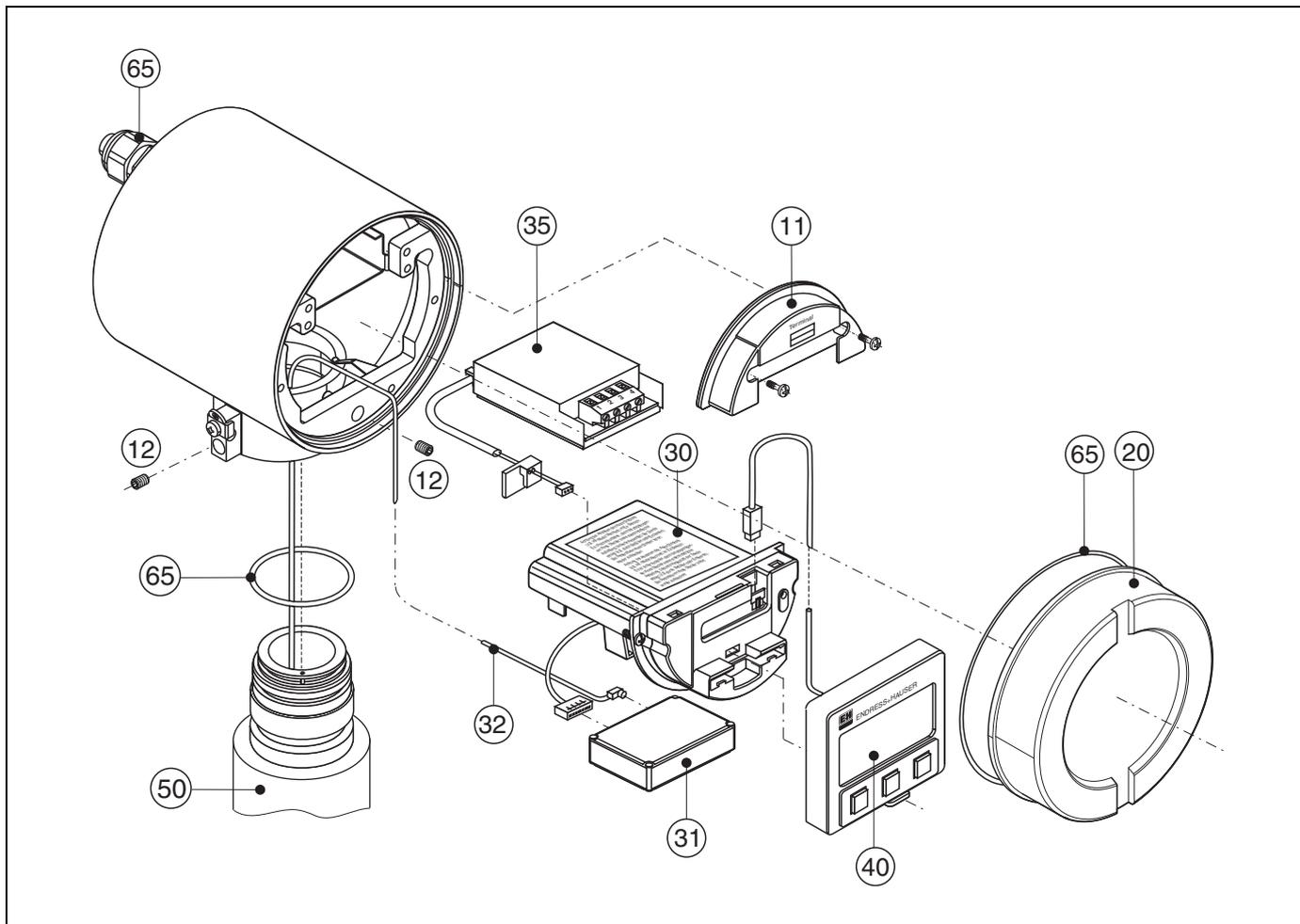
L00-FMR250xx-00-00-06-xx-003

**Stainless steel housing on request!**

20 Cover
52018670   Cover F23, 316L, sight glass, gasket
52018671   DeCoverckel F23, 316L, gasket

50 Antenna assembly with process connection on request!

65 Sealing kit
535720-9010   consists of:
                2 x gasket Pg13.5 FA
                2 x O-ring 17.0x2.0 EPDM
                1 x O-ring 49.21x3.53 EPDM
                2 x O-ring 17.12x2.62 FKM
                1 x O-ring 113.9x3.63 EPDM
                1 x O-ring 72.0x3.0 EPDM

Spare parts Micropilot M FMR250, horn/parabolic antenna
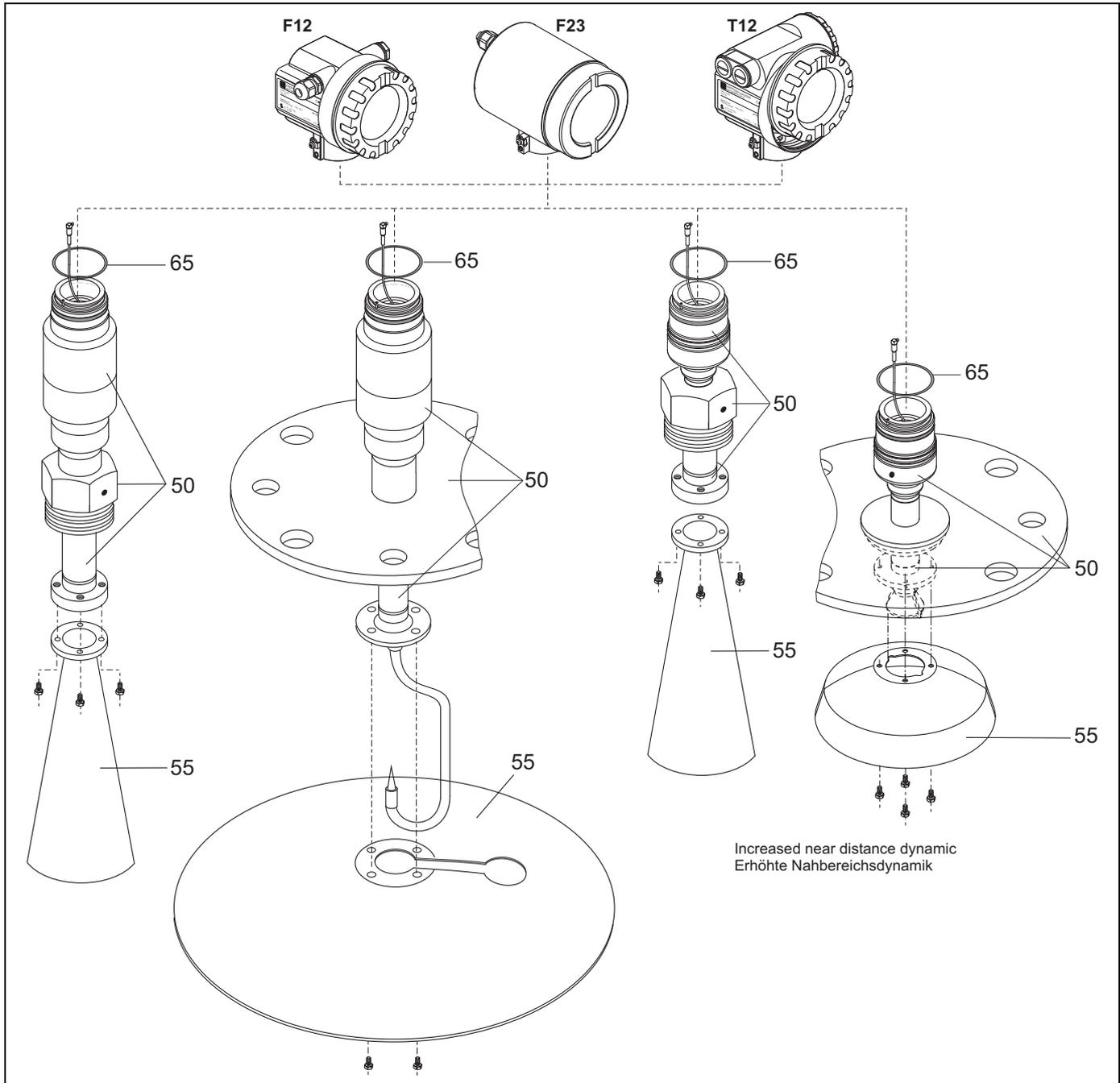
L00-FMR250xx-00-00-06-xx-004

50 Antenna assembly with process connection on request!

55 Horn antenna

52025230	Horn FMR250 80mm/3", SS
71020169	Horn FMR250 100mm/4", length 430mm, SS

55 Parabolic antenna

52025233	Parabolic reflector 197x25, 316L
71079160	Parabolic reflector DN200_173x60_1.4404
71079156	Parabolic reflector DN250_236x88_1.4404

9.7   Return

The following procedures must be carried out before a transmitter is sent to Endress+Hauser e.g. for repair or calibration:

- Remove all residue which may be present. Pay special attention to the gasket grooves and crevices where fluid may be present. This is especially important if the fluid is dangerous to health, e.g. corrosive, poisonous, carcinogenic, radioactive, etc.
- Always enclose a duly completed "Declaration of contamination" form (a copy of the "Declaration of contamination" is included at the end of this operating manual). Only then can Endress+Hauser transport, examine and repair a returned device.
- Enclose special handling instructions if necessary, for example a safety data sheet as per EN 91/155/EEC.

Additionally specify:

- An exact description of the application.
- The chemical and physical characteristics of the product.
- A short description of the error that occurred (specify error code if possible)
- Operating time of the device.

9.8   Disposal

In case of disposal please seperate the different components according to their material consistence.

9.9   Software history

Date	Software version	Changes to software	Documentation
09.2004	01.01.00	Original software. Operated via: – ToF Tool from version 2.0 – HART communicator DXR375 with Rev. 1, DD 1.	BA291F/00/en/08.04
11.2005	01.04.00	■ Function: detection window ■ Communication: PROFIBUS PA Operated via: – ToF Tool from version 4.2 – FieldCare from version 2.02.00 – HART communicator DXR375 with Rev. 1, DD 1.	BA291F/00/en/01.06
10.2006	01.05.00	Support of additional HF modules integrated. ■ Communication: FOUNDATION Fieldbus	BA291F/00/en/08.06 71030727

9.10   Contact addresses of Endress+Hauser

Contact addresses can be found on our homepage "www.endress.com/worldwide". If you have any questions, please do not hesitate to contact your Endress+Hauser representative.

10 Technical data

10.1 Additional technical data

10.1.1 Input

Measured variable	The measured variable is the distance between a reference point and a reflective surface (i.e. medium surface). The level is calculated based on the tank height entered. The level can be converted into other units (volume, mass) by means of a linearization (32 points).

Operating frequency	▪ FMR250: K–band

Transmitting power	Average energy density in beam direction:

Distance	Average energy density measuring range = 70 m (229 ft)
1 m	< 64 nW/cm^2
5 m	< 2.5 nW/cm^2

10.1.2 Output

Output signal	PROFIBUS PA

Signal on alarm	Error information can be accessed via the following interfaces:
	▪ Local display:
	  – Error symbol (see Page 37)
	  – Plain text display
	▪ Current output
	▪ Digital interface

Linearization	The linearization function of the Micropilot M allows the conversion of the measured value into any unit of length or volume. Linearization tables for calculating the volume in cylindrical tanks are pre-programmed. Other tables of up to 32 value pairs can be entered manually or semi-automatically.

10.1.3 Performance characteristics

Reference operating conditions	▪ temperature = +20 °C (68 °F) ±5 °C (9 °F) ▪ pressure = 1013 mbar abs. (14.7 psia) ±20 mbar (0.3 psi) ▪ relative humidity (air) = 65 % ±20% ▪ ideal reflector ▪ no major interference reflections inside the signal beam

Maximum measured error	Typical statements for reference conditions, include linearity, repeatability, and hysteresis: ▪ up to 1 m: ±30 mm ▪ ex 1 m: ±15 mm (or 0.04% of measuring range, whatever is larger)

Resolution	Digital / analog in % 4…20 mA ▪ FMR250: 1mm / 0.03 % of measuring range

Reaction time	The reaction time depends on the parameter settings (min. 1 s). In case of fast level changes, the instrument needs the reaction time to indicate the new value.

Influence of ambiente temperature	The measurements are carried out in accordance with EN 61298-3:
	■ digital output (HART, PROFIBUS PA):
	  – **FMR250**
	    average T_K: 5 mm/10 K, max. 15 mm over the entire temperature range -40 °C...+80 °C
	■ Current output (additional error, in reference to the span of 16 mA):
	  – **Zero point (4 mA)**
	    average T_K: 0,03 %/10 K, max. 0,45 % over the entire temperature range -40 °C...+80 °C
	  – **Span (20 mA)**
	    average T_K: 0,09 %/10 K, max. 0,95 % over the entire temperature range -40 °C...+80 °C

10.1.4 Operating conditions: Environment

Ambient temperature range	Ambient temperature for the transmitter: -40 °C ... +80 °C (-40 °F ... +176 °F), -50 °C (-58 °F) on request. The functionality of the LCD display may be limited for temperatures Ta<-20 °C and Ta>+60 °C. A weather protection cover should be used for outdoor operation if the instrument is exposed to direct sunlight.

Storage temperature	-40 °C … +80 °C (-40 °F … +176°F), -50 °C (-58 °F) on request.

Climate class	DIN EN 60068-2-38 (test Z/AD)

Vibration resistance	DIN EN 60068-2-64 / IEC 68-2-64: 20...2000 Hz, 1 $(m/s^2)^2$/Hz

Cleaning of the antenna	The antenna can get contaminated, depending on the application. The emission and reception of microwaves can thus eventually be hindered. The degree of contamination leading to an error depends on the medium and the reflectivity, mainly determined by the dielectric constant εr. If the medium tends to cause contamination and deposits, cleaning on a regular basis is recommended. Care has to be taken not to damage the antenna in the process of a mechanical or hose-down cleaning (eventually air purge connection). The material compatibility has to be considered if cleaning agents are used! The maximum permitted temperature at the flange should not be exceeded.

Electromagnetic compatibility	■ Interference Emission to EN 61326, Electrical Equipment Class B ■ Interference Immunity to EN 61326, Annex A (Industrial) and NAMUR Recommendation NE 21 (EMC) ■ A standard installation cable is sufficient if only the analogue signal is used. Use a screened cable when working with a superimposed communications signal (HART).

10.1.5   Operating conditions: Process

Process temperature range /
Process pressure limits

Feature "20 Antenna:"			Seal	Temperature	Pressure [1]	Wetted parts
Type	Option	Size				
Parabolic	6	200 mm (8")	FKM Viton GLT	–40 °C ... +200 °C (–40 °F ... +392 °F)	–1 ... 16 bar (...232 psi)	PEEK, seal, 316L/1.4404/1.4435
Horn	4 5 D E	80 mm (3") 100 mm (4") 80 mm (3") 100 mm (4")	FKM Viton GLT	–40 °C ... +200 °C (–40 °F ... +392 °F)	–1 ... 16 bar (...232 psi)	PEEK, seal, 316L/1.4404/1.4435
Parabolic	G H	200 mm (8") 250 mm (10")	FKM Viton GLT	–40 °C ... +200 °C (–40 °F ... +392 °F)	–1 ... 16 bar (...232 psi)	PTFE, seal, 316L/1.4404/1.4435

↑

Ordering information see Page 9-10

1)   E+H UNI flange: –1...1 bar (...14.5 psi)

Optional top target positioner: ±15°, seal: FMK Viton GLT

Dielectric constant

- in free space: $\varepsilon r \geq 1.6$ (for horizontal, even product surfaces: $\varepsilon r \geq 1.4$)

10.1.6   Mechanical construction

Weight

- F12/T12 housing: approx 6 kg + weight of flange
- F23 housing: approx 9.4 kg + weight of flange

10.1.7   Certificates and approvals

CE approval

The measuring system meets the legal requirements of the EC-guidelines. Endress+Hauser confirms the instrument passing the required tests by attaching the CE-mark.

RF approvals

R&TTE, FCC

External standards and
guidelines

EN 60529
Protection class of housing (IP-code)

EN 61010
Safety regulations for electrical devices for measurement, control, regulation and laboratory use.

EN 61326
Emissions (equipment class B), compatibility (appendix A – industrial area)

NAMUR
Standards committee for measurement and control in the chemical industry

Ex approval   Correlation of safety instructions (XA) and certificates (ZE) to the instrument:

Instrument	Certificate	Explosion protection	Output	Communication	Housing	PTB 04 ATEX	XA
FMR250	A	Non-hazardous area	A, B, C, D, K, L E, F, M	HART, PROFIBUS PA FOUNDATION Fieldbus	—	—	—
	1	ATEX II 1/2G EEx ia IIC T6	A, B, K	HART	A, B, D	2108	XA313F
			C, D, L E, F, M	PROFIBUS PA FOUNDATION Fieldbus	A, B, D	2108	XA343F
	4	ATEX II 1/2G EEx d [ia] IIC T6	A, B, K	HART	C	2108	XA314F
			C, D, L E, F, M	PROFIBUS PA FOUNDATION Fieldbus	C	2108	XA344F
	G	ATEX II 3G EEx nA II T6	A, B, C, D, K, L E, F, M	HART, PROFIBUS PA FOUNDATION Fieldbus	—	2108	XA233F
	B	ATEX II 1/2GD EEx ia IIC T6, Alu blind cover	A, B, K	HART	A, B	2108	XA312F
			A, B	HART	D	2108	XA312F
			C, D, L E, F, M	PROFIBUS PA FOUNDATION Fieldbus	A, B	2108	XA342F
			C, D E, F	PROFIBUS PA FOUNDATION Fieldbus	D	2108	XA342F
	C	ATEX II 1/2G EEx ia IIC T6 ATEX II 1/3D	A, B, K	HART	A, B	2108	XA312F
			A, B	HART	D	2108	XA312F
			C, D, L E, F, M	PROFIBUS PA FOUNDATION Fieldbus	A, B	2108	XA342F
			C, D E, F	PROFIBUS PA FOUNDATION Fieldbus	D	2108	XA342F
	D	ATEX II 1/2D, Alu blind cover	A, B, K	HART	C	2108	XA315F
			A, B	HART	A, B, D	2108	XA315F
			C, D, L E, F, M	PROFIBUS PA FOUNDATION Fieldbus	C	2108	XA345F
			C, D E, F	PROFIBUS PA FOUNDATION Fieldbus	A, B, D	2108	XA345F
	E	ATEX II 1/3D	A, B, K	HART	A, D, C	2108	XA315F
			A, B	HART	B	2108	XA315F
			C, D, L E, F, M	PROFIBUS PA FOUNDATION Fieldbus	A, D, C	2108	XA345F
			C, D E, F	PROFIBUS PA FOUNDATION Fieldbus	B	2108	XA345F

Instrument	Certificate	Explosion protection	Output	Communication	Housing	NEPSI GYJ...	XA
FMR250	I	Ex ia IIC T6...T1	A, B, K	HART	A, B, C, D	...081023	XA445F
FMR250	I	Ex ia IIC T1...T6	D, E, F, K, L, M	PROFIBUS PA, FOUNDATION Fieldbus	A, B, C, D	...081023	XA447F
FMR250	J	Ex d [ia] IIC T1...T6	A, B, C, D, E, F, K, L, M	HART, PROFIBUS PA, FOUNDATION Fieldbus	C	...081024	XA448F
FMR250	Q	DIP A20/21 T_A, T* IP65 DIP A21 T_A, T* IP65 DIP A20/22 T_A, T* IP65	A, B, K	HART	A, B, C, D	...081025	XA446F

Control Drawings

Correlation of Control Drawings (ZD) to the instrument:

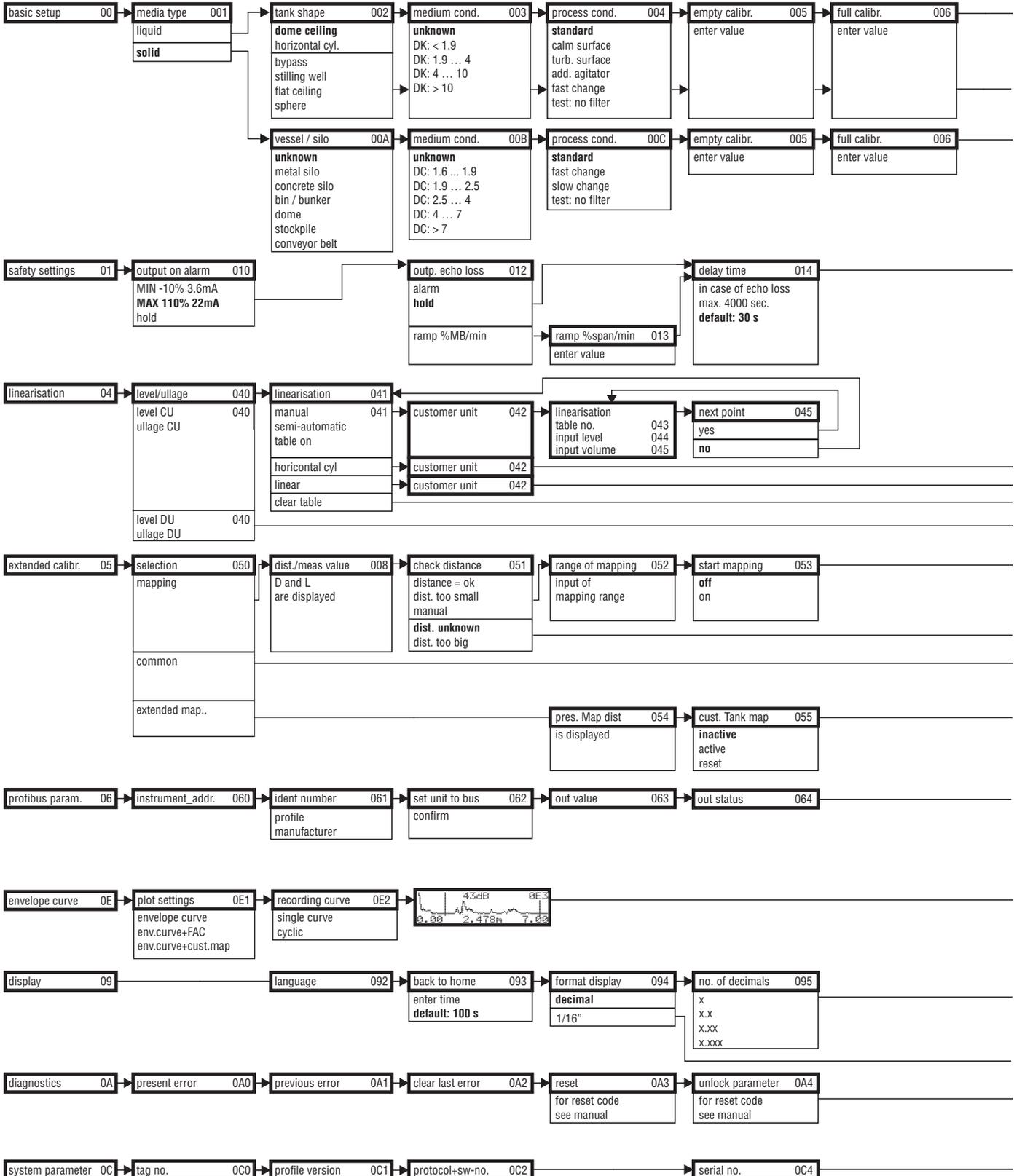| Instrument	Certificate	Explosion protection	Output	Communication	Housing	ZD
FMR250	S	FM IS	A, B, K	HART	A, B	ZD168F/00/en
			A, B	HART	D	ZD168F/00/en
			C, D, L	PROFIBUS PA	A, B	in preparation
			C, D	PROFIBUS PA	D	in preparation
	T	FM XP	A, B, K C, D, L	HART PROFIBUS PA	C	ZD169F/00/en
	U	CSA IS	A, B, K	HART	A, B	ZD170F/00/en
			A, B	HART	D	ZD170F/00/en
			C, D, L	PROFIBUS PA	A, B	in preparation
			C, D	PROFIBUS PA	D	in preparation
	V	CSA XP	A, B, K C, D, L	HART PROFIBUS PA	C	ZD171F/00/en

10.1.8 Supplementary Documentation
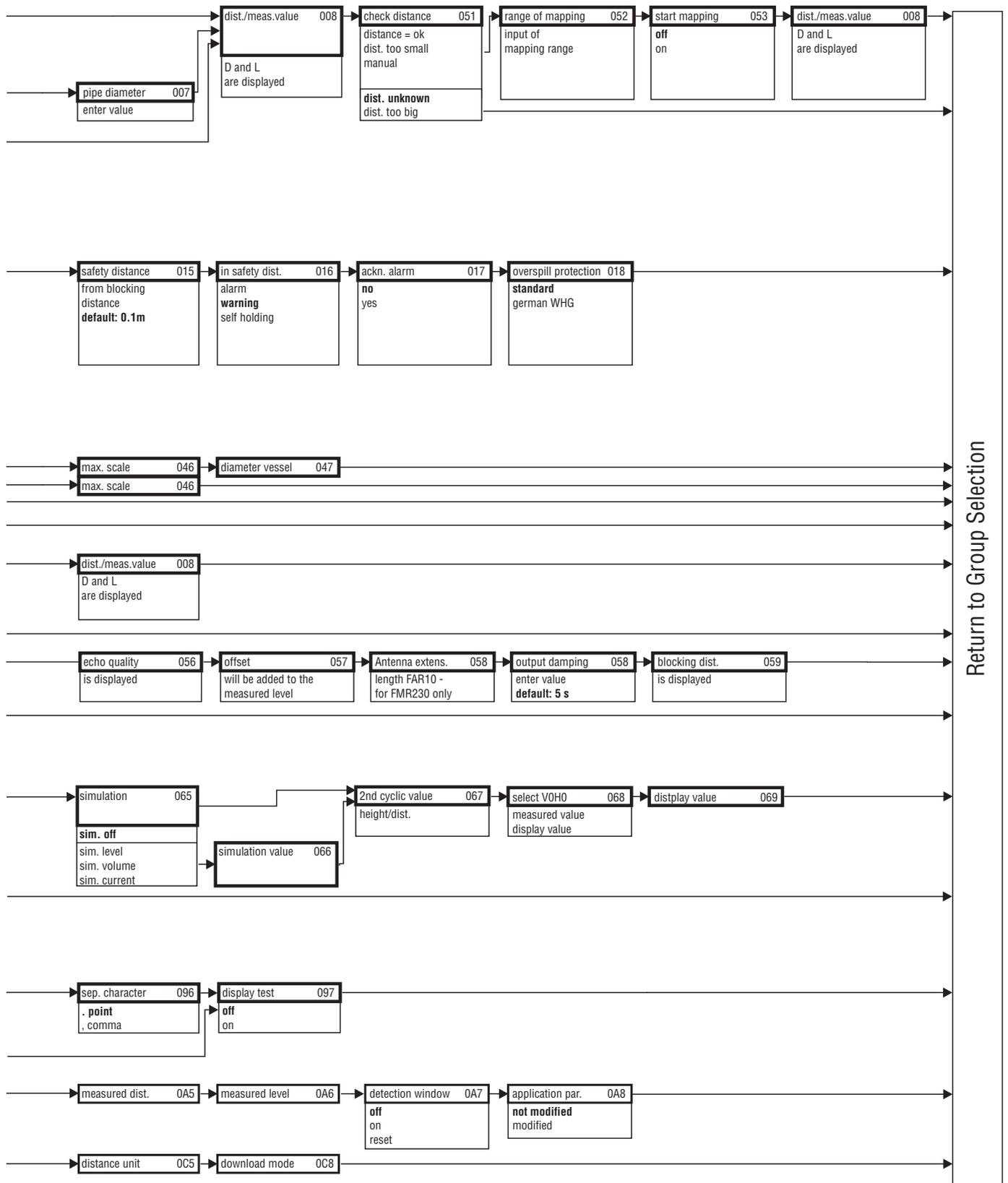
Supplementary Documentation

- Technical Information (TI390F/00/en)
- Operating Instructions "Description of instrument functions" (BA291F/00/en)

11 Appendix

11.1 Operating menu PROFIBUS PA

basic setup 00	media type 001	tank shape 002	medium cond. 003	process cond. 004	empty calibr. 005	full calibr. 006
	liquid	**dome ceiling**	**unknown**	**standard**	enter value	enter value
	solid	horizontal cyl.	DK: < 1.9	calm surface		
		bypass	DK: 1.9 … 4	turb. surface		
		stilling well	DK: 4 … 10	add. agitator		
		flat ceiling	DK: > 10	fast change		
		sphere		test: no filter		

		vessel / silo 00A	medium cond. 00B	process cond. 00C	empty calibr. 005	full calibr. 006
		unknown	**unknown**	**standard**	enter value	enter value
		metal silo	DC: 1.6 ... 1.9	fast change		
		concrete silo	DC: 1.9 ... 2.5	slow change		
		bin / bunker	DC: 2.5 ... 4	test: no filter		
		dome	DC: 4 ... 7			
		stockpile	DC: > 7			
		conveyor belt				

safety settings 01	output on alarm 010	outp. echo loss 012	delay time 014
	MIN -10% 3.6mA	alarm	in case of echo loss
	MAX 110% 22mA	**hold**	max. 4000 sec.
	hold		**default: 30 s**
		ramp %MB/min	ramp %span/min 013
			enter value

linearisation 04	level/ullage 040	linearisation 041	customer unit 042	linearisation 043 / input level 044 / input volume 045	next point 045
	level CU 040	manual 041		table no. 043	yes
	ullage CU	semi-automatic		input level 044	**no**
		table on		input volume 045	
		horicontal cyl	customer unit 042		
		linear	customer unit 042		
		clear table			
	level DU 040				
	ullage DU 040				

extended calibr. 05	selection 050	dist./meas value 008	check distance 051	range of mapping 052	start mapping 053
	mapping	D and L	distance = ok	input of	**off**
		are displayed	dist. too small	mapping range	on
			manual		
			dist. unknown		
			dist. too big		
	common				
	extended map..			pres. Map dist 054	cust. Tank map 055
				is displayed	**inactive**
					active
					reset

profibus param. 06	instrument_addr. 060	ident number 061	set unit to bus 062	out value 063	out status 064
		profile	confirm		
		manufacturer			

envelope curve 0E	plot settings 0E1	recording curve 0E2	0E3
	envelope curve	single curve	43dB
	env.curve+FAC	cyclic	0.00 2.478m 7.00
	env.curve+cust.map		

display 09		language 092	back to home 093	format display 094	no. of decimals 095
			enter time	**decimal**	x
			default: 100 s	1/16"	x.x
					x.xx
					x.xxx

diagnostics 0A	present error 0A0	previous error 0A1	clear last error 0A2	reset 0A3	unlock parameter 0A4
				for reset code	for reset code
				see manual	see manual

system parameter 0C	tag no. 0C0	profile version 0C1	protocol+sw-no. 0C2	serial no. 0C4

Note! The default values of the parameters are typed in boldface.

L00-FMR250xx-19-00-01-en-037

dist./meas.value 008	→	check distance 051	→	range of mapping 052	→	start mapping 053	→	dist./meas.value 008
		distance = ok		input of		**off**		D and L
D and L		dist. too small		mapping range		on		are displayed
are displayed		manual						
		dist. unknown						
		dist. too big						

pipe diameter 007
enter value

safety distance 015	→	in safety dist. 016	→	ackn. alarm 017	→	overspill protection 018
from blocking		alarm		**no**		**standard**
distance		**warning**		yes		german WHG
default: 0.1m		self holding				

max. scale 046	→	diameter vessel 047
max. scale 046		

dist./meas.value 008
D and L
are displayed

echo quality 056	→	offset 057	→	Antenna extens. 058	→	output damping 058	→	blocking dist. 059
is displayed		will be added to the		length FAR10 -		enter value		is displayed
		measured level		for FMR230 only		**default: 5 s**		

simulation 065			2nd cyclic value 067	→	select V0H0 068	→	distplay value 069
			height/dist.		measured value		
sim. off					display value		
sim. level		simulation value 066					
sim. volume							
sim. current							

sep. character 096	→	display test 097
. point		**off**
, comma		on

measured dist. 0A5	→	measured level 0A6	→	detection window 0A7	→	application par. 0A8
				off		**not modified**
				on		modified
				reset		

distance unit 0C5	→	download mode 0C8

Return to Group Selection

L00-FMR250xx-19-00-02-en-037

11.2   Description of functions

✎ Note!
A detailed description of the function groups, functions and parameters is given in the documentation BA291F/00/en "Description of the instrument functions of the Micropilot M" on the enclosed CD-ROM.

11.3   Function and system design

11.3.1   Function (Measuring principle)

The Micropilot is a "downward–looking" measuring system, operating based on the time–of–flight method. It measures the distance from the reference point (process connection) to the product surface. Radar impulses are emitted by an antenna, reflected off the product surface and received again by the radar system.

L00-FMR250xx-15-00-00-en-001
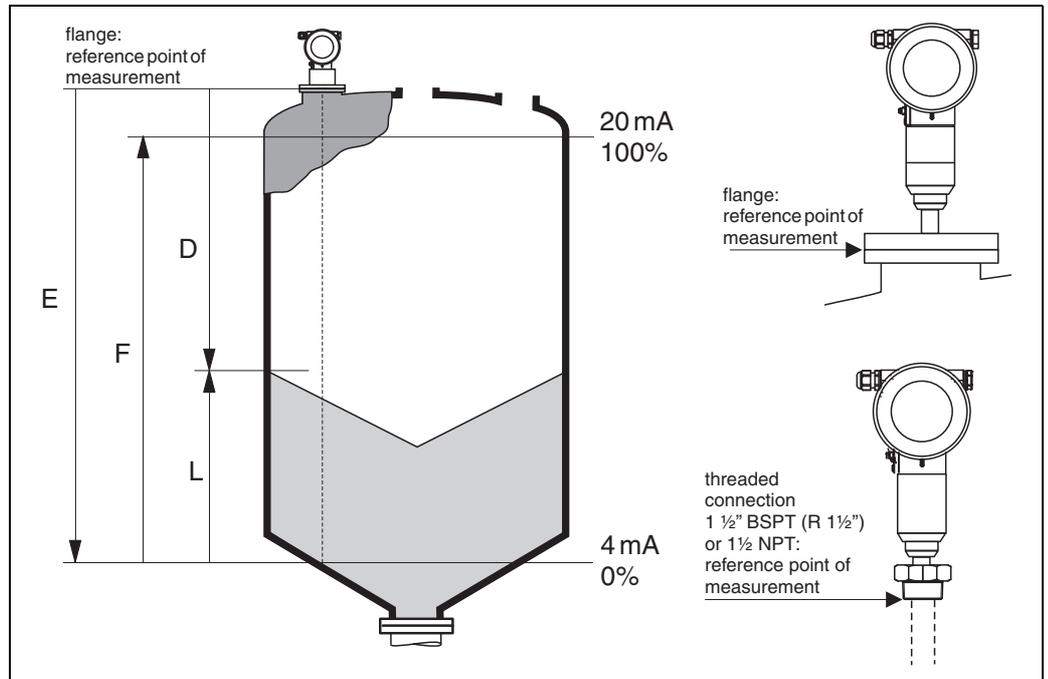
Input

The reflected radar impulses are received by the antenna and transmitted into the electronics. A microprocessor evaluates the signal and identifies the level echo caused by the reflection of the radar impulse at the product surface. The unambiguous signal identification is accomplished by the PulseMaster® software, based on many years of experience with time–of–flight technology. The distance D to the product surface is proportional to the time of flight t of the impulse:

$D = c \cdot t/2$,
with c being the speed of light.

Based on the known empty distance E, the level L is calculated:

$L = E - D$

Refer to the above figure for the reference point for "E".

The Micropilot is equipped with functions to suppress interference echoes. The user can activate these functions. They ensure that interference echoes (i.e. from internals and struts seams) are not interpreted as level echo.

Output

The Micropilot is commissioned by entering an empty distance E (=zero), a full distance F (=span) and an application parameter. The application parameter automatically adapts the instrument to the process cond.. The data points "E" and "F" correspond with 4mA and 20mA for instruments with current output. They correspond with 0 % and
100 % for digital outputs and the display module.
A linearization with max. 32 points, based on a table entered either manually or
semi-automatically, can be activated locally or remotely. This function provides a measurement in engineering units and a linear output signal for spheres, horizontal cylindrical tanks and vessels with conical outlet.

11.3.2 Equipment architecture

System integration via PROFIBUS PA

A maximum of 32 transmitters (8 if mounted in an explosion hazardous location EEx ia IIC according to FISCO-model) can be connected to the bus. The segment coupler provides the operating voltage to the bus. Both on-site as well as remote operation are possible.The complete measuring system consists of:

L00-FMxxxxxx-14-00-06-en-001
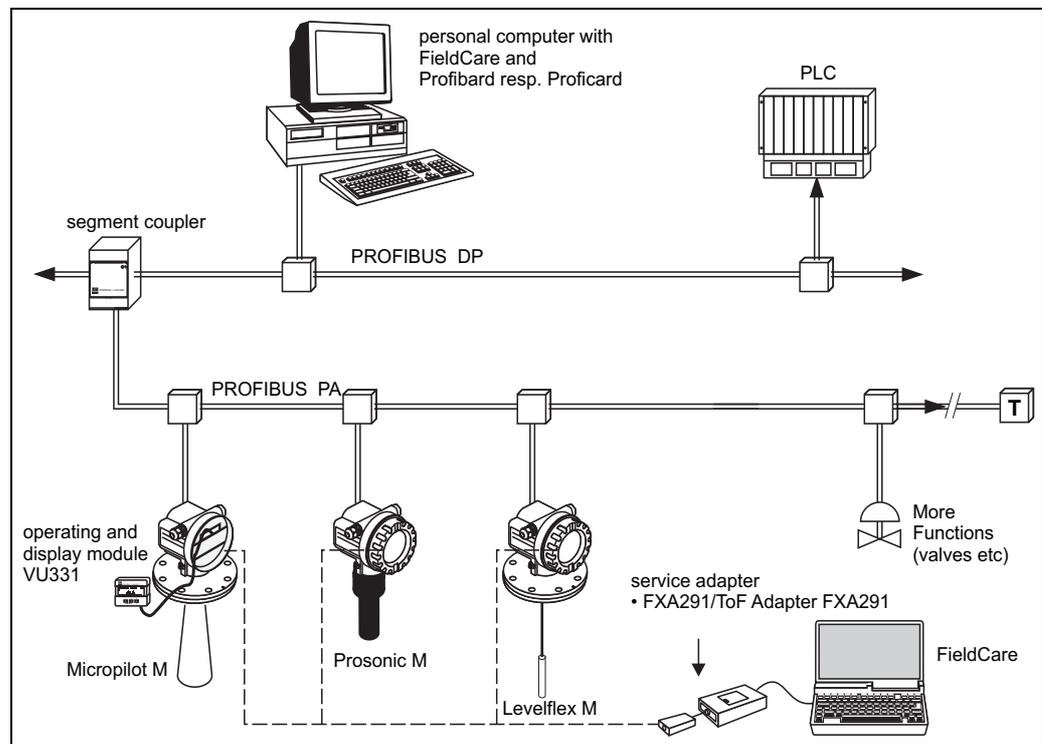
On-site operation

- with display and operating module VU331,
- with a Personal Computer, FXA193 and the operating software "ToF Tool – FieldTool Package" respectively "FieldCare".
  The ToF Tool is a graphical operating software for instruments from Endress+Hauser that operate based on the time-of-flight principle (radar, ultrasonic, guided micro-impulse). It assists with commissioning, securing data, signal analysis and documentation of the measuring point.

Remote operation

- with a Personal Computer, Profiboard resp. Proficard and the operating software COMMUWIN II respectively ToF Tool.

11.3.3 Patents

This product may be protected by at least one of the following patents.
Further patents are pending.

- US 5,387,918 ≅ EP 0 535 196
- US 5,689,265 ≅ EP 0 626 063
- US 5,659,321
- US 5,614,911 ≅ EP 0 670 048
- US 5,594,449 ≅ EP 0 676 037
- US 6,047,598
- US 5,880,698
- US 5,926,152
- US 5,969,666
- US 5,948,979
- US 6,054,946
- US 6,087,978
- US 6,014,100

Index

Declaration of Hazardous Material and De-Contamination
Erklärung zur Kontamination und Reinigung

RA No. ☐☐☐☐☐☐☐

Please reference the Return Authorization Number (RA#), obtained from Endress+Hauser, on all paperwork and mark the RA# clearly on the outside of the box. If this procedure is not followed, it may result in the refusal of the package at our facility.
Bitte geben Sie die von E+H mitgeteilte Rücklieferungsnummer (RA#) auf allen Lieferpapieren an und vermerken Sie diese auch außen auf der Verpackung. Nichtbeachtung dieser Anweisung führt zur Ablehnung ihrer Lieferung.

Because of legal regulations and for the safety of our employees and operating equipment, we need the "Declaration of Hazardous Material and De-Contamination", with your signature, before your order can be handled. Please make absolutely sure to attach it to the outside of the packaging.
Aufgrund der gesetzlichen Vorschriften und zum Schutz unserer Mitarbeiter und Betriebseinrichtungen, benötigen wir die unterschriebene "Erklärung zur Kontamination und Reinigung", bevor Ihr Auftrag bearbeitet werden kann. Bringen Sie diese unbedingt außen an der Verpackung an.

Type of instrument / sensor
Geräte-/Sensortyp _____

Serial number
Seriennummer _____

☐ **Used as SIL device in a Safety Instrumented System /** *Einsatz als SIL Gerät in Schutzeinrichtungen*

Process data/*Prozessdaten*
Temperature / *Temperatur*_____ [°F] _____ [°C]   Pressure / *Druck* _____ [psi] _____ [Pa]
Conductivity / *Leitfähigkeit* _____ [µS/cm]   Viscosity / *Viskosität* _____ [cp] _____ [mm²/s]

Medium and warnings
Warnhinweise zum Medium

	Medium /concentration *Medium /Konzentration*	Identification CAS No.	flammable *entzündlich*	toxic *giftig*	corrosive *ätzend*	harmful/ irritant *gesundheits- schädlich/ reizend*	other * *sonstiges**	harmless *unbedenklich*
Process medium *Medium im Prozess*								
Medium for process cleaning *Medium zur Prozessreinigung*								
Returned part cleaned with *Medium zur Endreinigung*								

* explosive; oxidising; dangerous for the environment; biological risk; radioactive
* explosiv; brandfördernd; umweltgefährlich; biogefährlich; radioaktiv

Please tick should one of the above be applicable, include safety data sheet and, if necessary, special handling instructions.
Zutreffendes ankreuzen; trifft einer der Warnhinweise zu, Sicherheitsdatenblatt und ggf. spezielle Handhabungsvorschriften beilegen.

Description of failure / *Fehlerbeschreibung* _____
_____
_____

Company data /*Angaben zum Absender*

Company / *Firma* _____
_____

Phone number of contact person / *Telefon-Nr. Ansprechpartner:*
_____

Address / *Adresse*
_____
_____

Fax / E-Mail _____

Your order No. / *Ihre Auftragsnr.* _____

"We hereby certify that this declaration is filled out truthfully and completely to the best of our knowledge.We further certify that the returned parts have been carefully cleaned. To the best of our knowledge they are free of any residues in dangerous quantities."
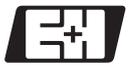*"Wir bestätigen, die vorliegende Erklärung nach unserem besten Wissen wahrheitsgetreu und vollständig ausgefüllt zu haben. Wir bestätigen weiter, dass die zurückgesandten Teile sorgfältig gereinigt wurden und nach unserem besten Wissen frei von Rückständen in gefahrbringender Menge sind."*

_____   _____   _____
(place, date / *Ort, Datum*)   Name, dept./*Abt.* (please print / *bitte Druckschrift*)   Signature / *Unterschrift*

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