Operating Instructions

Micropilot M FMR250

Level–Radar

FOUNDATION

Endress+Hauser

People for Process Automation

Brief operating instructions

KA235F/00/a2/08.06
52025245

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

⚠ Contrast: [E] + [+] or [E] + [−]

| 000 measured value |
| Group selection |

| 00 basic setup |
| 01 safety settings |
| 04 linearisation |
| 05 extended calibr. |
| 06 output (HART, FF) profibus param. (PA) |
| 09 display |
| 0E envelope curve |
| 0A diagnostics |
| 0C system parameter |

008 dist./ meas value

| 001 media type | 002 **tank shape** | 003 medium cond. | 004 process cond. | 005 empty calibr. | 006 full calibr. | 007 pipe diameter | 008 dist./ meas value | 051 check distance | 052 range of mapping | 053 start mapping |

- liquid
- solid

002 tank shape
- dome ceiling
- horizontal cyl.
- bypass
...

003 medium cond.
- unknown
- DC: <1.9
- DC: 1.9 … 4
- DC: 4 … 10
- DC: >10
...

004 process cond.
- standard
- calm surface
- add. agitator
...

005 empty calibr.
input E (see sketch)

006 full calibr.
input F (see sketch)

007 pipe diameter
only for bypass + stilling well

008 dist./meas value
D and L are displayed (see sketch)

051 check distance
- ok
- too small
- too big
- unknown
- manual

052 range of mapping
confirm suggestion or specify range

| 00A vessel / silo | 00B medium cond. | 00C proscess cond. | 005 empty calibr. | 006 full calibr. |

00A vessel / silo
- unknown
- metal silo
- concrete silo
- bin / bunker
...

00B medium cond.
- unknown
- DC: 1.6…1.9
- DC: 1.9 …2.5
- DC: 2.5 …4
...

00C proscess cond.
- standard
- fast change
- slow change
- test: no filter

005 empty calibr.
input E (see sketch)

006 full calibr.
input F (see sketch)

| 092 language |

| 0E1 plot settings | 0E2 recording curve |

25dB   09C
−0.01 2.461m 5.00

0E1 plot settings
- envel. curve
- incl. FAC
- incl. cust. map

0E2 recording curve
- single curve
- cyclic

| 0A0 present error | 0A1 previous error |

| 0A4 unlock parameter |
= 100: unlocked
≠ 100: locked } HART
= 2457: unlocked
≠ 2457: locked } PA, FF

flange: reference point of measurement

threaded connection 1 ½" BSPT (R 1½") or 1½ NPT: reference point of measurement

20 mA 100%
D
E
F
L
4 mA 0%
Solid | Liquid

52025245

L00-FMR250xx-19-00-00-en-020

✎ 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 → 📄 100.

The operating manual BA291F/00/EN "Description of Instrument Functions" 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 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 1 mW (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 and process safety

Alternative monitoring measures must be taken to ensure operational safety and process safety during configuration, testing and maintenance work on the device.

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	
⟨Ex⟩	**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.
⟨Ex⟩	**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.
⟨Ex⟩	**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.
(t>85°C)	**Temperature resistance of the connection cables** States, that the connection cables must be resistant to a temperature of at least 85 °C (185 °F).

2   Identification

2.1   Device designation

2.1.1   Nameplate

The following technical data are given on the instrument nameplate:

Information on the nameplate of the Micropilot M

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 e.g. 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

This overview does not mark options which are mutually exclusive.

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				
	I	NEPSI Ex ia IIC T6				
	J	NEPSI Ex d (ia) ia IIC T6				
	Q	NEPSI DIP				
	L	TISS EEx d (ia) IIC T3				
	S	FM IS-Cl.I/II/III Div.1 Gr.A-G, zone 0, 1, 2				
	T	FM XP-Cl.I/II/III Div.1 Gr.A-G, zone 1, 2				
	N	CSA General Purpose				
	U	CSA IS Cl.I/II/III Div.1 Gr.A-G, zone 0, 1, 2				
	V	CSA XP Cl.I/II/III Div.1 Gr.A-G, zone 1, 2				
	Y	Special version				

20		Antenna:				
	D	Horn 80mm/3", increased near distance dynamics				
	E	Horn 100mm/4", 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 100mm/4"				
	6	Parabolic 200mm/8"				
	9	Special version				

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	

60						Output; Operation:
					A	4-20mA SIL HART; 4-line display VU331, envelope curve display on site

60						Output; Operation:	
					B	4-20mA SIL HART; w/o display, via communication	
					K	4-20mA SIL 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, 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 M20 (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	
					P	5-point, Air purge connection G1/4 5-point linearity protocol, see additional spec.	
					Q	5-point, Air purge connection NPT1/4 5-point linearity protocol, see additional spec.	
					Y	Special version	
995						**Marking:**	
					1	Tagging (TAG)	
					2	Bus address	
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", → 🗎 10!

The scope of delivery consists of:
- Assembled instrument
- Accessories (→ 🗎 71)
- Endress+Hauser oprating program on the enclosed CD-ROM
- Brief operating instructions KA1017F/00/EN for quick commissioning
- Brief operating instructions KA235F/00/A2 (basic setup/trouble-shooting), housed in the instrument
- Approval documentation: if this is not included in the operating manual
- CD-ROM with further documentation, e.g.
  – Technical Information
  – Operating Instruction
  – Description of Instrument Functions

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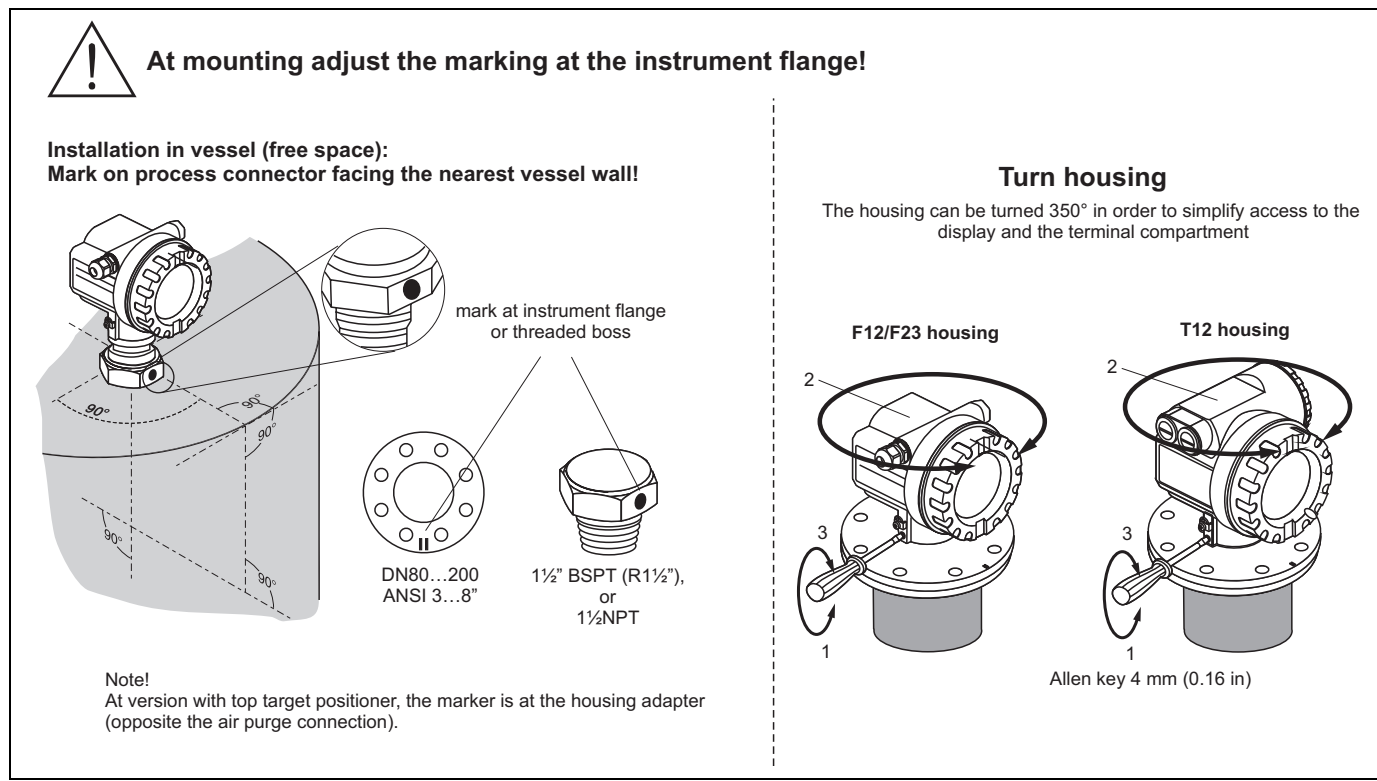
PulseMaster®
Registered trademark of the company Endress+Hauser GmbH+Co. KG, Maulburg, Germany

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 (R1½"),
or
1½NPT

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 (0.16 in)

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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 (39.69 lbs). 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 to +80 °C (–40 °F to +176 °F) or
–50 °C to +80 °C (–58 F to +176 °F).

3.3   Installation conditions

3.3.1   Dimensions

Housing dimensions

F12 housing (Aluminium)

max. 110 (4.33) — 65 (2.56) — 78 (3.07) — ø129 (ø5.08) — 150 (5.91) — 85 (3.35)

mm (in)

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

T12 housing (Aluminium)

max. 100 (4.33) — 94 (3.7) — 65 (2.56) — 78 (3.07) — ø129 (ø5.08) — 162 (6.38) — 85 (3.35)

mm (in)

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

F23 housing (316L)

max. 94 (3.7) — 93 (3.66) — 40 (1.57) — ø129 (ø5.08) — 150 (5.91)

mm (in)

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

Process connection and antenna (option "4, 5")

F12 / T12 / F23 housing

Threaded connection
1½" BSPT (R1½")
or 1½NPT

ø60
108
43
23

Flange DN80…100
or equivalent

ø60
108
b
øD

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

ø60
108
8
40
ø225 (DN100)
ø340 (DN200)
ø405 (DN250)

Horn antenna
Option "4, 5"

50
L1
ød

27
250/450
40
50
L1
ød

Horn antenna

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

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 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 JIS B2220

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

for 10K

a0011475-en

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

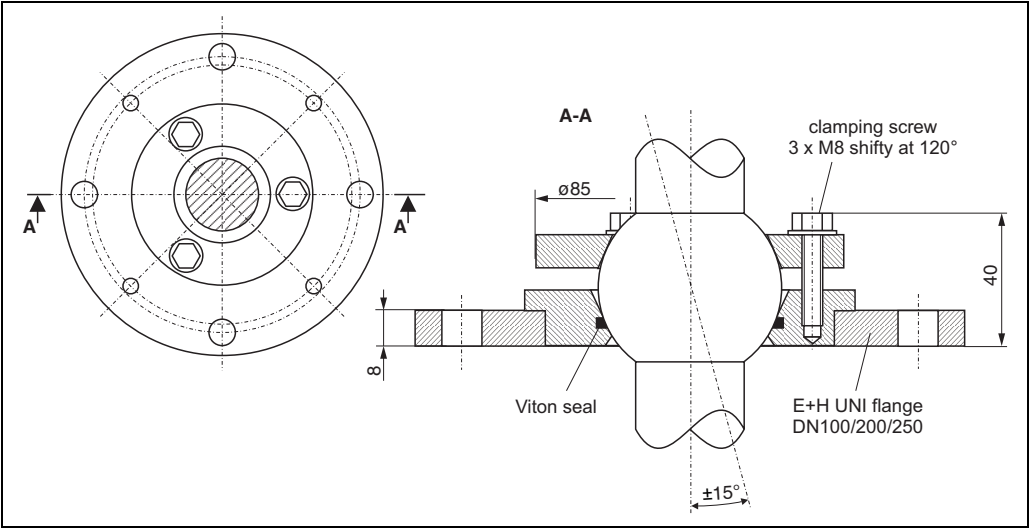| Flange	DN 80	DN 100
b [mm]	18	18
D [mm]	185	210
for 10K		

a0011476-en

Endress+Hauser 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.

A-A

ø80,3

8

Endress+Hauser UNI flange DN100
compatible with:
- DN100 PN10/16,
- ANSI 4" 150 lbs,
- JIS 10K 100A

4x90°

ø19

ø23

ø175

ø185.5

ø225

material: 316L (1.4404)

Endress+Hauser UNI flange DN200
compatible with:
- DN200 PN10/16,
- ANSI 8" 150 lbs,
- JIS 10K 200A

4x90°

6x60°

ø26

ø26

ø26

ø294.5

ø340

Endress+Hauser UNI flange DN250
compatible with:
- DN250 PN10/16,
- ANSI 10" 150 lbs,
- JIS 10K 250A

6x60°

ø29

ø358

ø405

a0011486-en

Top target positioner with Endress+Hauser UNI flange

A-A

ø85

clamping screw
3 x M8 shifty at 120°

40

8

Viton seal

E+H UNI flange
DN100/200/250

±15°

a0011477-en

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 (7.87 in) 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 (→ 🗎 71, "Accessories").
- In extremely dusty applications, the integrated air purge connection can prevent clogging of the antenna.
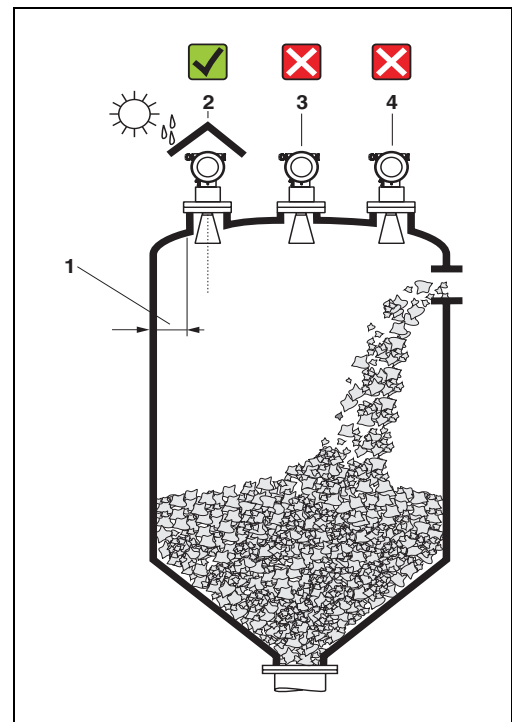
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Vessel installations

- Avoid any installations (1), like limit switches, struts, etc., inside the signal beam (→ 🗎 17, "Beam angle").
- 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", → 🗎 20.
- 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.
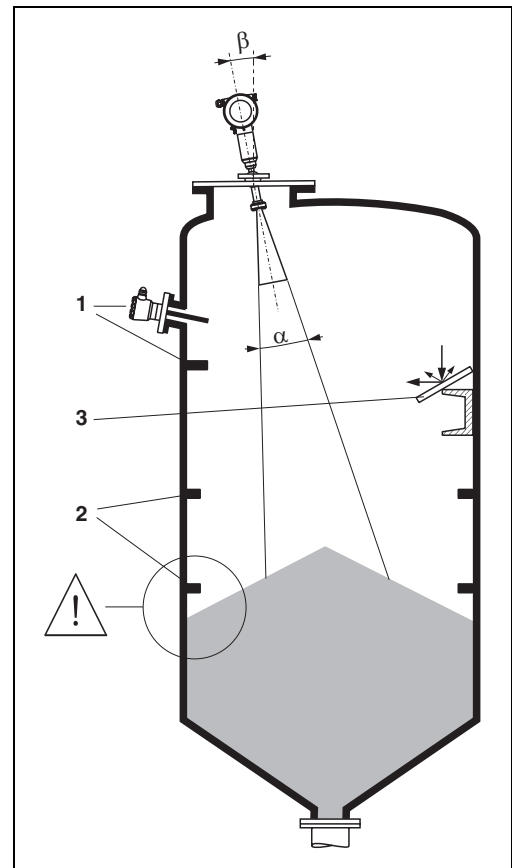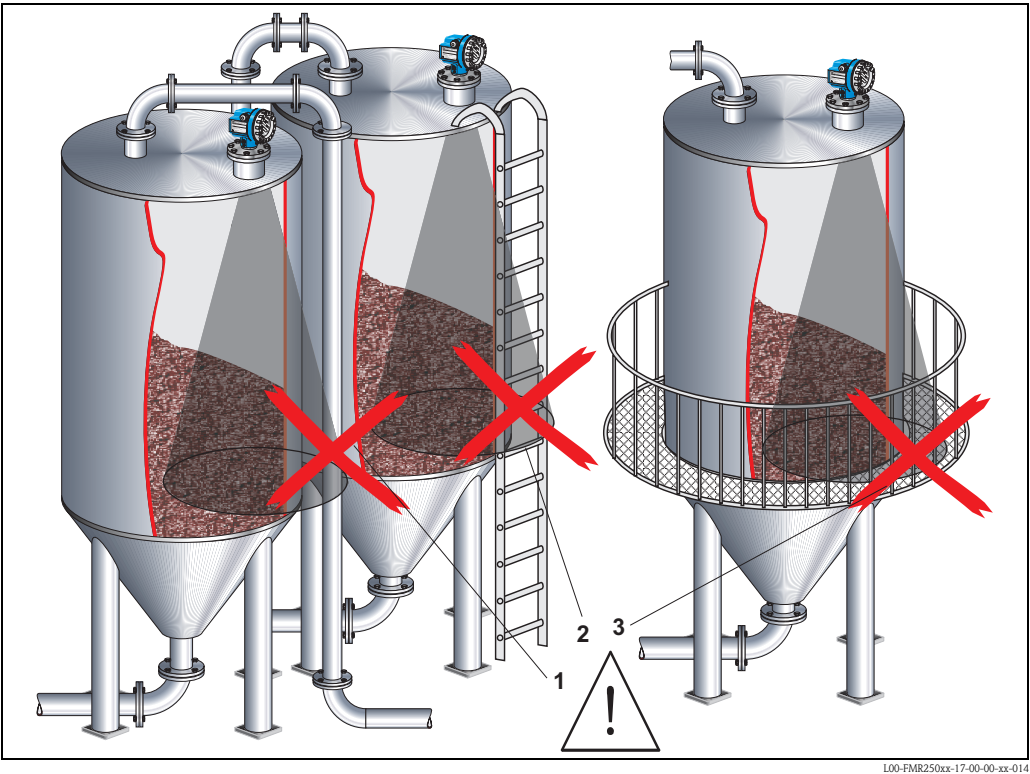

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Please contact Endress+Hauser for further information.

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. Please contact Endress+Hauser for further information.


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Beam angle

The beam angle is defined as the angle α 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	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 (2.9 ft)	0,70 m (2.3 ft)	0,35 m (1.1 ft)	0,3 m (1 ft)
10 m (33 ft)	1,75 m (5.7 ft)	1,40 m (4.6 ft)	0,70 m (2.3 ft)	0,61 m (2 ft)
15 m (49 ft)	2,62 m (8.6 ft)	2,10 m (6.9 ft)	1,05 m (3.4 ft)	0,92 m (3 ft)
20 m (66 ft)	3,50 m (11 ft)	2,80 m (9.2 ft)	1,40 m (4.6 ft)	1,22 m (4 ft)
30 m (98 ft)	5,25 m (17 ft)	4,20 m (14 ft)	2,10 m (6.9 ft)	1,83 m (6 ft)
40 m (131 ft)	7,00 m (23 ft)	5,59 m (18 ft)	2,79 m (9.2 ft)	2,44 m (8 ft)
50 m (164 ft)	8,75 m (29 ft)	6,99 m (23 ft)	3,50 m (11 ft)	3,06 m (10 ft)
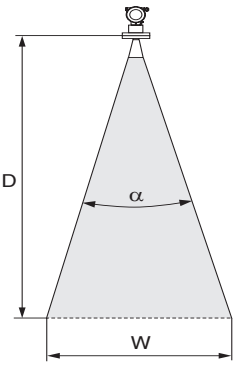
$$W = 2 \cdot D \cdot \tan\frac{\alpha}{2}$$

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Measuring conditions

- The measuring range begins, where the beam hits the bottom. Particularly with 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 (→ 🖹 16).
- In case of media with a low dielectric constant (groups A and B), the 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** above the 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 **A** (see Fig.). If required, and if some conditions (high DC value, flat angle of repose) are met, shorter distances can be achieved.
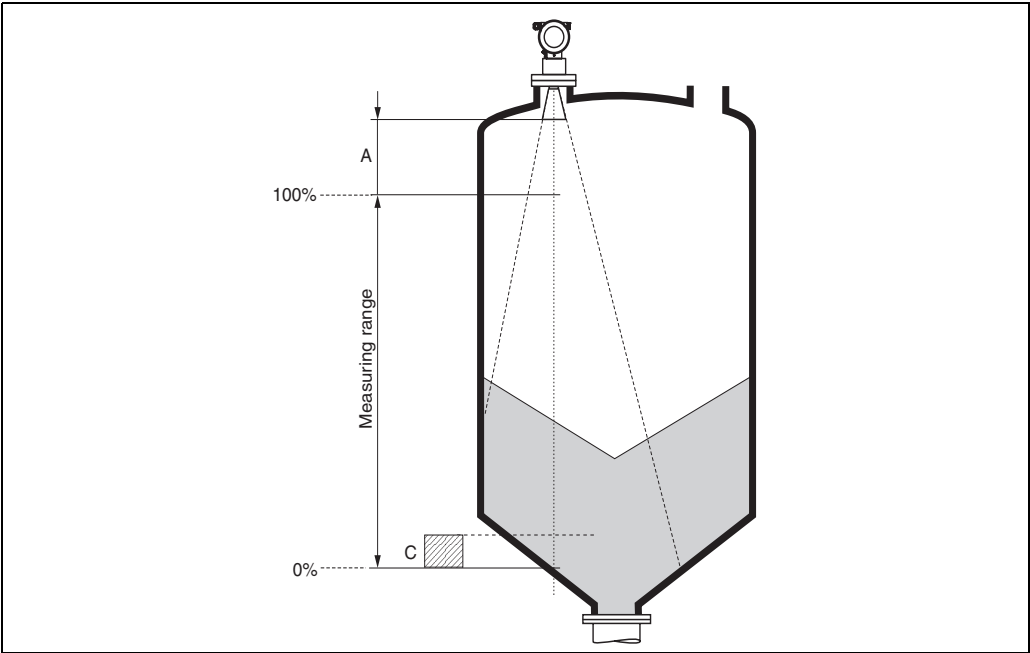
L00-FMR250xx-17-00-00-en-001

A [mm (in)]	C [mm (in)]
approx. 400 (15.7)	50...150 (1.97...5.91)

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 (230 ft).

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 below.
- 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.

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

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

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

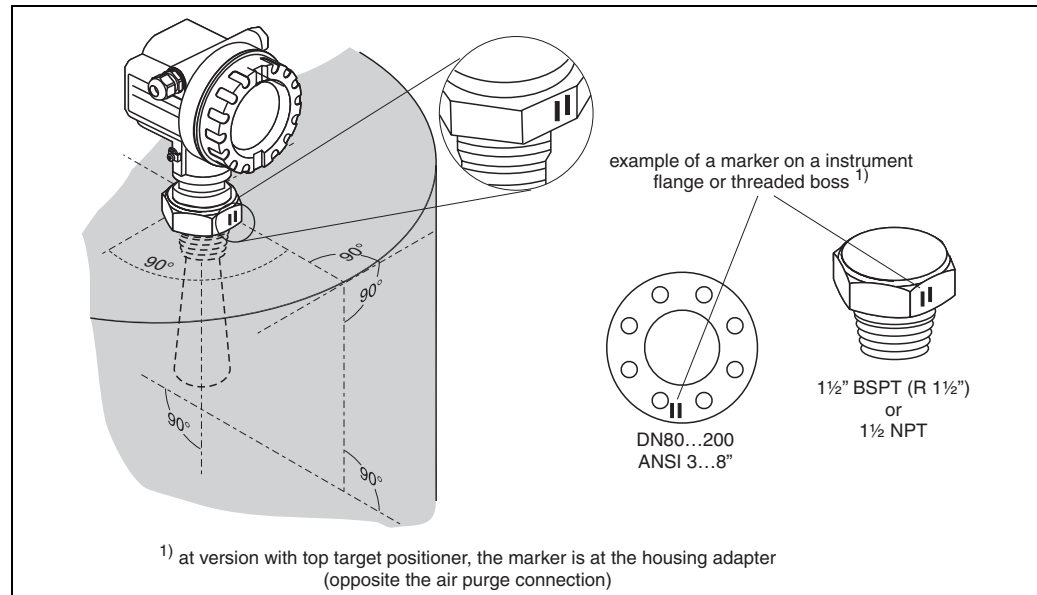# 3.4 Installation instructions

3.4.1 Mounting kit

In addition to the tool needed for flange mounting, you will require the following tool:
- A key AF60 for threaded boss
- 4 mm (0.16 in) Allen wrench for turning the housing

3.4.2 Installation in vessel (free space)

Optimum mounting position

example of a marker on a instrument flange or threaded boss [1]

1½" BSPT (R 1½")
or
1½ NPT

DN80…200
ANSI 3…8"

[1] at version with top target positioner, the marker is at the housing adapter (opposite the air purge connection)
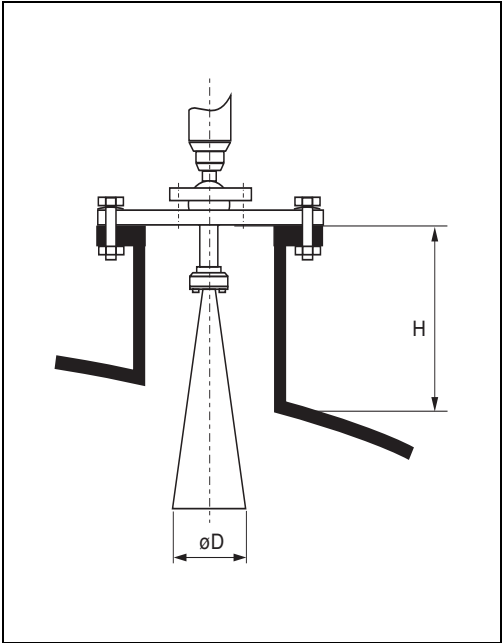
L00-FMR250xx-17-00-00-en-009

Standard installation FMR250 with horn antenna
- Observe installation instructions, → 🕮 16.
- 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 (in)]	75 (2.95)	95 (3.74)
H [mm (in)] (without antenna extension)	< 260 (< 10.2)	< 480 (< 18.9)

Standard installation FMR250 with parabolic antenna

- Observe installation instructions, → 🖹 16.
- 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). The maximum height of the nozzle (H_{max}) to the parabolic mirror (option "G, H") should not exceed 500 mm (19.7 in). 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 "G"	Option "H"
Antenna size	200 mm (8")	250 mm (10")
D [mm (in)]	173 (6.81)	236 (9.29)
H [mm (in)] (without antenna extension)	< 50 (< 1.96)	< 50 (< 1.96)
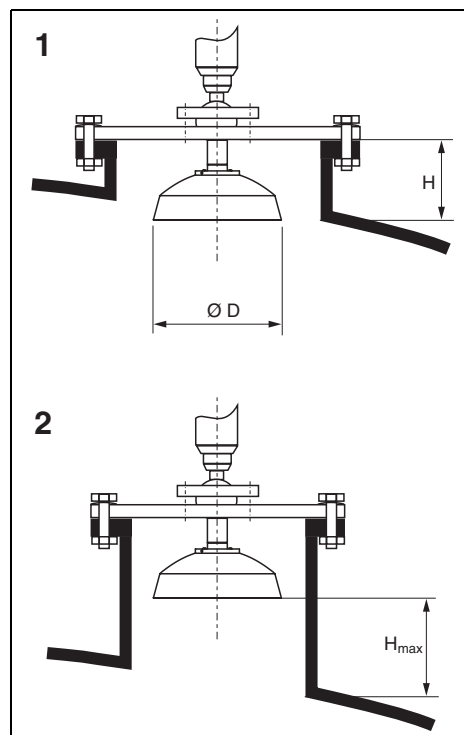
L00-FMR250xx-17-00-00-en-004

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

standard installation

nozzle

H

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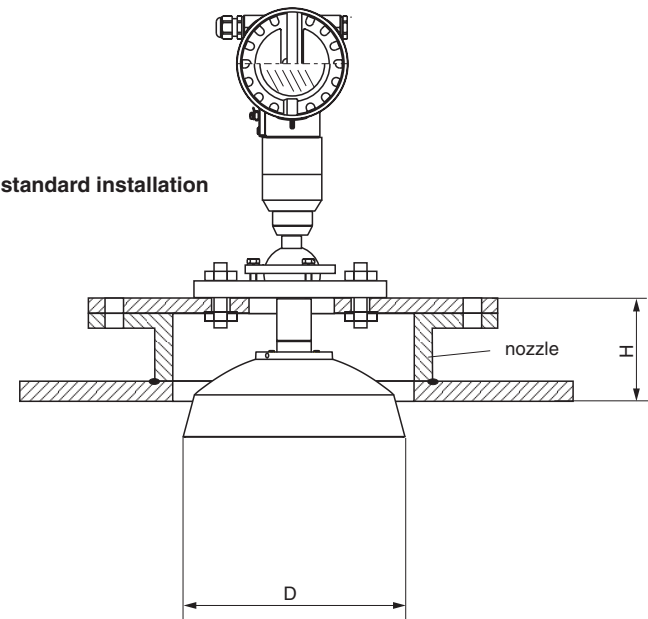
Antenna size	200 mm (8")	250 mm (10")
D [mm (inch)]	173 (6.81)	236 (9.29)
H [mm (inch)] [1]	< 50 (< 1.96)	< 50 (< 1.96)

[1] without antenna extension

for installation
in nozzle
you can dismantle
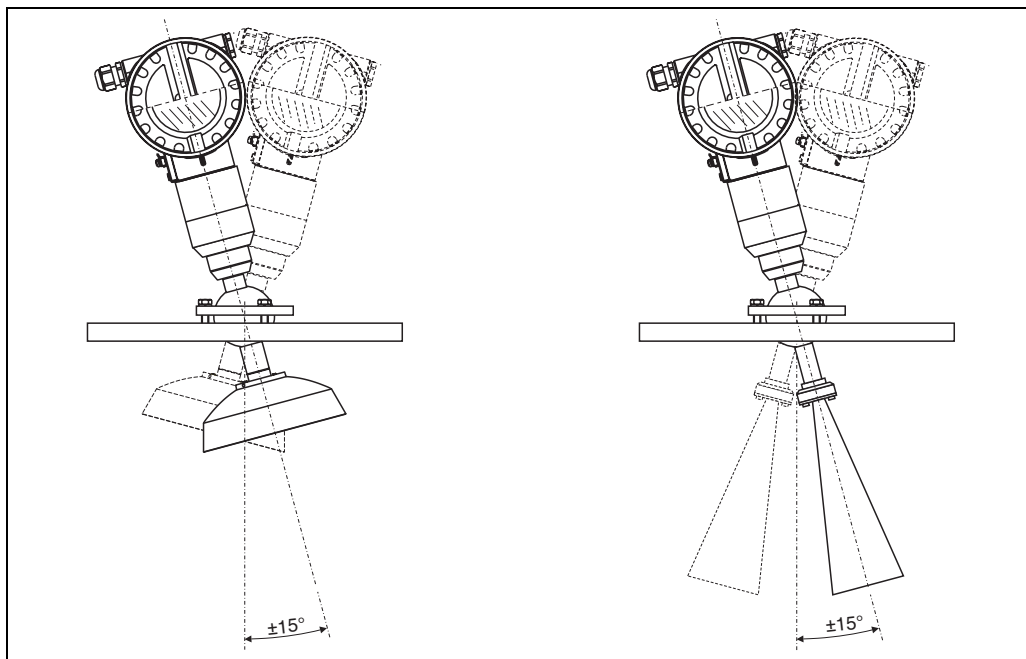the parabolic reflector

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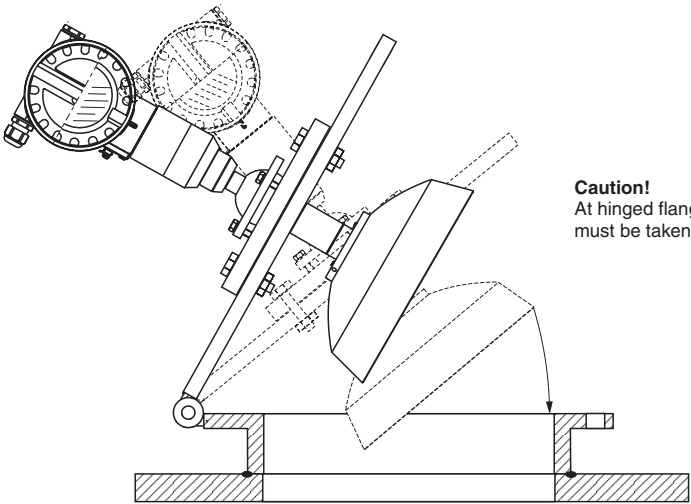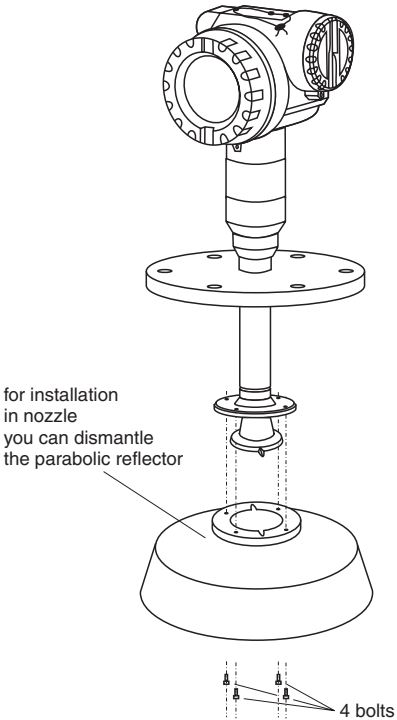
Caution!
At hinged flanges, the length of the antenna
must be taken into account!

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 (87 psi).
- Permanent operation:
  recommended pressure range of the purge air: 200 mbar to 500 mbar (3 psi to 7.25 psi).

Caution!
Make sure to use dry purge air.

air purge connection:
NPT¼ or G¼
(max. torque 3.5 Nm (2.58 lbf ft))
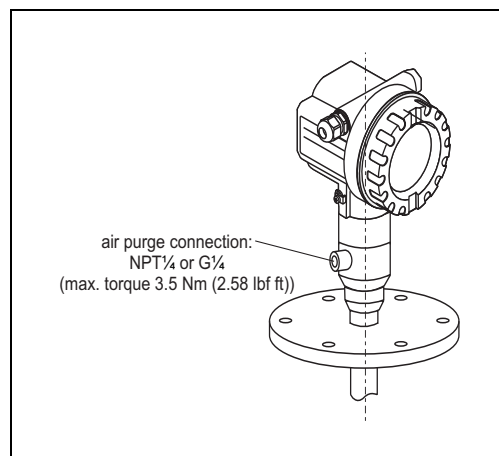
L00-FMR250xx-17-00-00-en-010

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
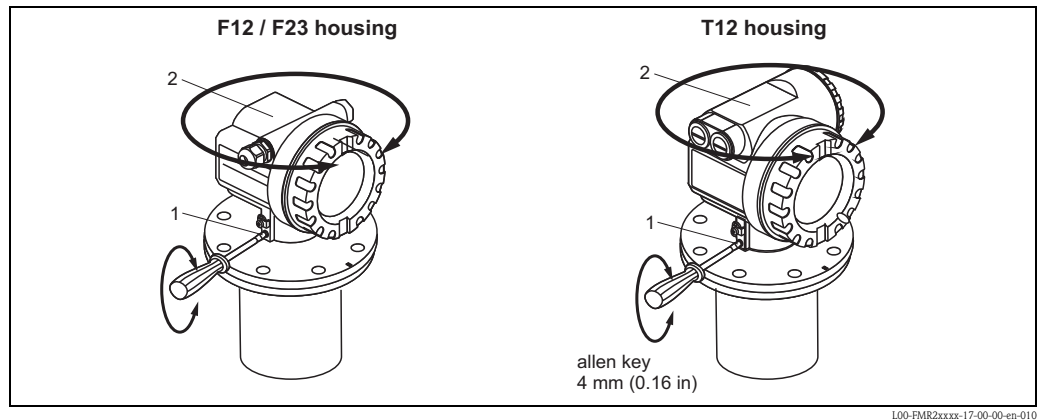
3.5   Post-installation check

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 (→ 🗎 10)?
- 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 (→ 🗎 71)?
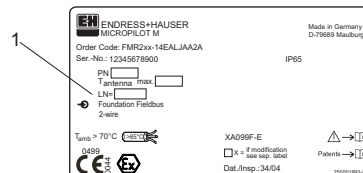
4   Wiring

4.1   Quick wiring guide

Wiring in F12/F23 housing

Before connection please note the following:

Caution!
- Foundation Fieldbus devices are marked on the nameplate (1). The voltage is determined by the Foundation Fieldbus 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 - Ex ia:
  Power supply must be intrinsically safe.
- The electronics and the current output are galvanically separated from the antenna circuit.
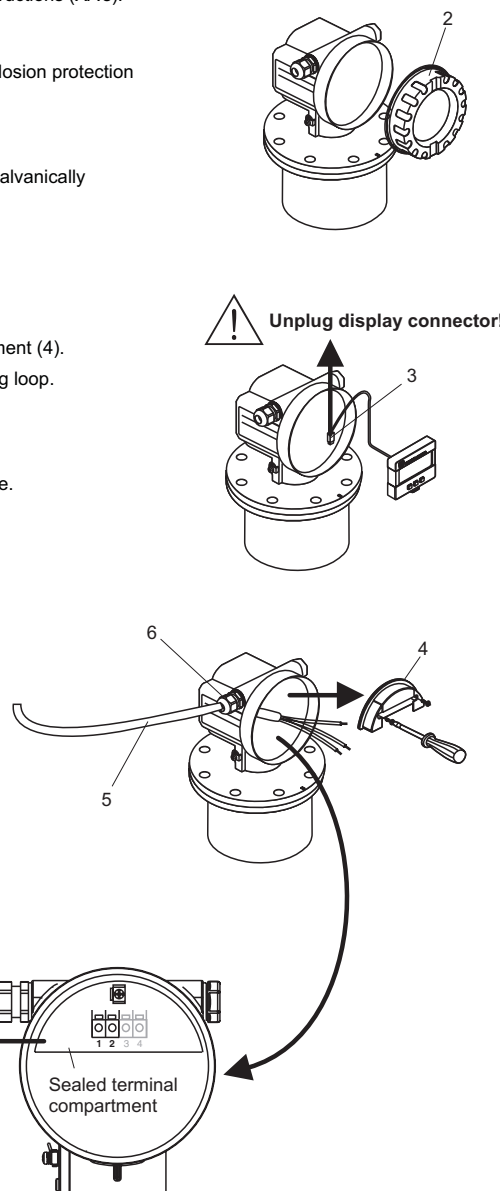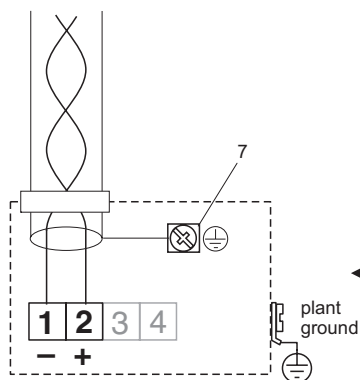
Connect up the Micropilot M as follows:
- Unscrew housing cover (2).
- Remove any display (3) if fitted.
- Remove cover plate from terminal compartment (4).
- Pull out terminal module slightly using pulling loop.
- Insert cable (5) through gland (6).
  Use screened, twisted wire pair.

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!

ENDRESS+HAUSER
MICROPILOT M
Made in Germany
D-79689 Maulburg
Order Code: FMR2xx-14EALJAA2A
Ser.-No.: 12345678900
IP65
PN
T antenna max.
LN
Foundation Fieldbus
2-wire
T amb > 70°C
XA099F-E
0499
X = if modification see sep. label
Patents
Dat./Insp.:34/04

plant ground

1 2 3 4
− +

Sealed terminal compartment

L00-FMR2xxxx-04-00-00-en-018

Wiring in T12 housing

Caution!

Before connection please note the following:

- Foundation Fieldbus devices are marked on the nameplate (1). The voltage is determined by the Foundation Fieldbus 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.
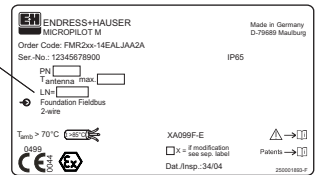
When you use the measuring system in hazardous areas, make sure you comply with national standards and the specifications in the safety instructions (XA's).
Make sure you use the specific cable gland.

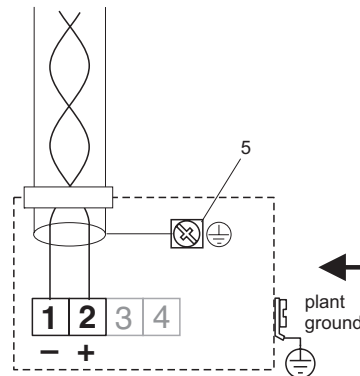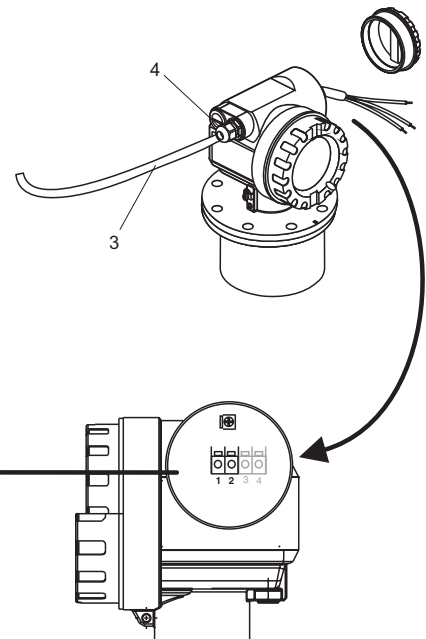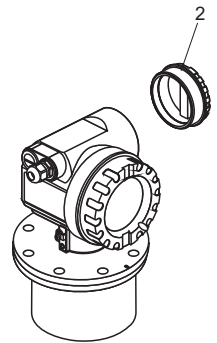Connect up the Micropilot M as follows:

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.

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.
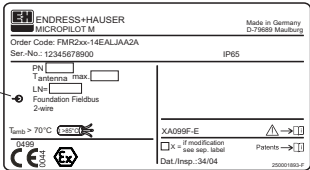
L00-FMR2xxxx-04-00-00-en-020

Wiring with Foundation Fieldbus connector

Before connection please note the following:

Caution!

- FOUNDATION Fieldbus devices are marked on the nameplate (1). The voltage is determined by the FOUNDATION Fieldbus 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.

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

- Housing F12/F23 - Ex ia:
  Power supply must be intrinsically safe.
- The electronics and the current output are galvanically separated from the antenna circuit.

The Micropilot M is connected as follows:

- Insert plug (2) into bushing (3).
- Screw firmly.
- Ground the device according to the desired safety concept.

L00-FMR230xx-04-00-00-en-006

Cable specification Foundation Fieldbus

Twisted, shielded pairs must be used. The cable specifications can be taken from the FF specification or IEC61158-2. The following have been found suitable:

Non-Ex-area:
- Siemens 6XV1 830-5BH10
- Belden 3076F
- Kerpen CEL-PE/OSCR/PVC/FRLA FB-02YS(ST)YFL
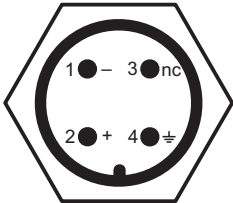
Ex-area:
- Siemens 6XV1 830-5AH10
- Belden 3076F
- Kerpen CEL-PE/OSCR/PVC/FRLA FB-02YS(ST)YFL

Fieldbus plug connectors

For the versions with fieldbus plug connector, the signal line can be connected without opening the housing.

Pin assignment of the 7/8" plug connector (FOUNDATION Fieldbus plug)

Pin	Meaning
1	Signal –
2	Signal +
3	not connected
4	ground

L00-FMxxxxxx-04-00-00-yy-017

4.2   Connecting the measuring unit

4.2.1   Cable entry

- Cable gland: M20x1.5 (for Ex d: cable entry)
- Cable entry: G½ or ½NPT

4.2.2   Supply voltage

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

Supply voltage	9 V to 30 V (Ex) [1] 9 V to 32 V (non Ex) max. voltage 35 V
Device (Lift off) minimum voltage	9 V
Polarity sensitive	No
FISCO / FNICO compliant	Yes

1)   There may be additional restrictions for devices with an explosion protection certificate. Refer to the notes in the appropriate safety instructions (XA).

4.2.3   Current consumption

- Device basic current: 15 mA
- Device In-rush current: ≤ 15 mA
- Error current FDE (Fault Disconnection Electronic): 0 mA

4.2.4   Overvoltage protection

The level transmitter Micropilot M with T12-housing (housing version "D", → 🖹 6) is equipped with an internal overvoltage protection (600 V surge arrester) according to DIN EN 60079-14 or IEC 60060-1 (impulse current test 8/20 µs, Î = 10 kA, 10 pulses). Connect the metallic housing of the Micropilot M to the vessel wall or screen directly with an electrically conductive lead to ensure reliable potential matching.

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 EN60079-14.

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 (→ 📄 26 and → 📄 28)?
- Is the cable gland tight?
- If available: Is the FOUNDATION Fieldbus connector screwed 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

This chapter gives an overview of the different operating options for the device. The different methods of parameter access are described and the preconditions for each method are stated. The meaning of the parameters is not described in this chapter. Instead, refer to:

- Chapter 6: "Commissioning"
- Operating Instructions BA291F/00/EN: "Description of Instrument Functions"

5.1   Operating options
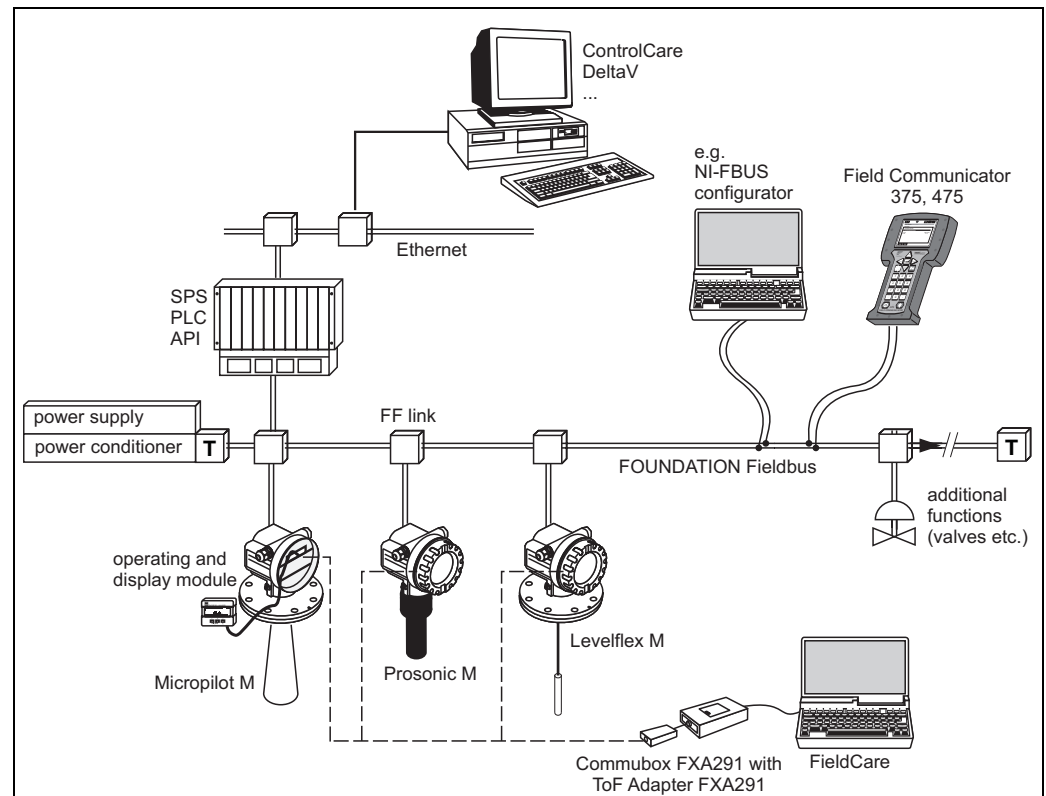
L00-FMxxxxxx-14-00-06-de-011

5.1.1 On-site operation

Options for on-site operation

- Display and operating module
- Endress+Hauser operating software "FieldCare"

Parameter access by on-site operation

The following parameters can be accessed by on-site operation:

- Parameters of the device specific blocks (Sensor Block, Diagnostic Block, Display Block)
- Endress+Hauser service parameters
- in the Resource Block: "Device Tag", "Device ID", "Device Revision", "DD Revision" (read only)

L00-FMU4XXXX-02-00-00-YY-005
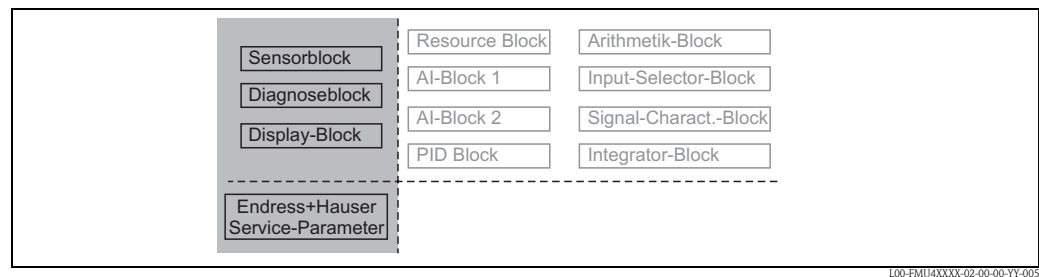
The highlighted parameters can be edited by on-site operation.

5.1.2 Remote operation

Options for remote operation

- FOUNDATION Fieldbus configuration tool (e.g. DeltaV or ControlCare)
- Field Communicator 375, 475

Parameter access by remote operation

The following parameters can be accessed by remote operation:

- Parameters of the device specific blocks (Sensor Block, Diagnostic Block, Display Block)
- Parameters of the FOUNDATION Fieldbus function blocks

L00-FMU4XXXX-02-00-00-YY-006
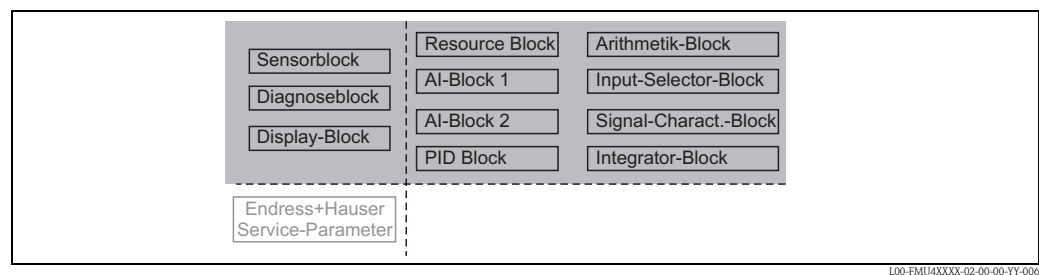
The highlighted parameters can be edited by remote operation.

5.2 Operation with the display and operating module

L00-FMxxxxxx-07-00-00-en-001
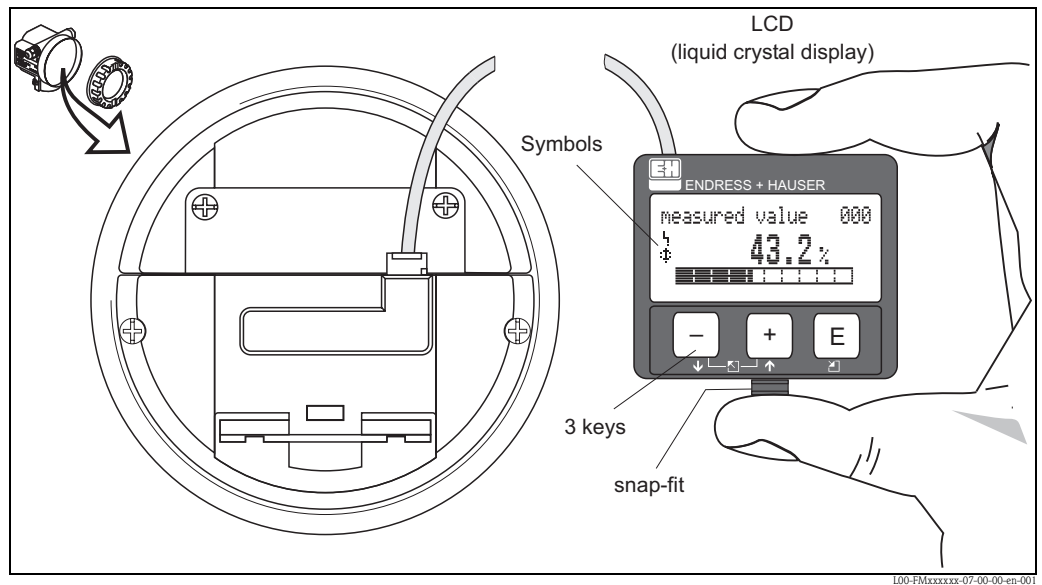
Layout of the display and operating elements

The 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 (19.7 in) 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.
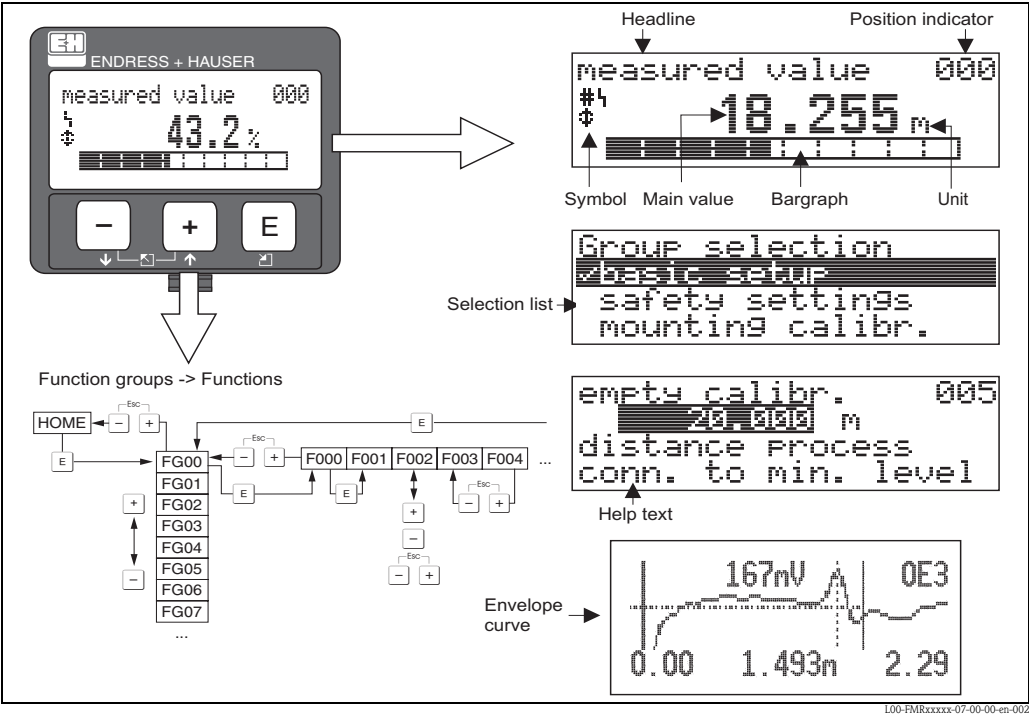
Display

In the measured value display, the bargraph corresponds to the output. The bargraph is segmented in 10 bars. Each completely filled bar represents a change of 10 % of the adjusted span.

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.
	SIMULATION_SWITCH_ENABLE This communication symbol appears when simulation in FOUNDATION Fieldbus is enabled via the DIP switch.

5.2.3   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.
Esc $-$ $+$ 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.

5.2.4   The operating menu

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.: "**media type**" **(001)**, "**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 "**media type**" **(001)** function group.

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

Identifying the functions

For simple orientation within the function menus (→ 🖹 100), for each function a position is shown on the display.

L00-FMRxxxxx-07-00-00-en-005
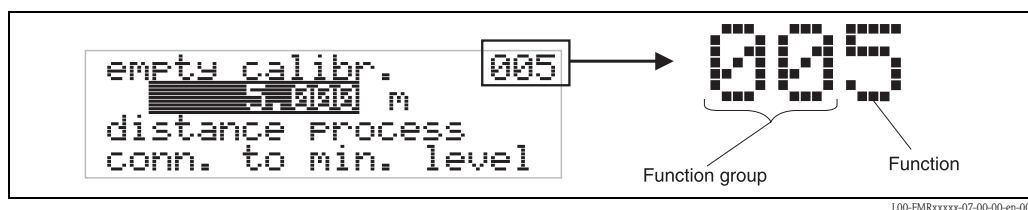
The first two digits identify the function group:
- **basic setup**   00
- **safety settings**   01
- **linearisation**   04

. . .

The third digit numbers the individual functions within the function group:
- **basic setup**   00   →   ■ **media type**   001
                                        ■ **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.

Navigation within the menu
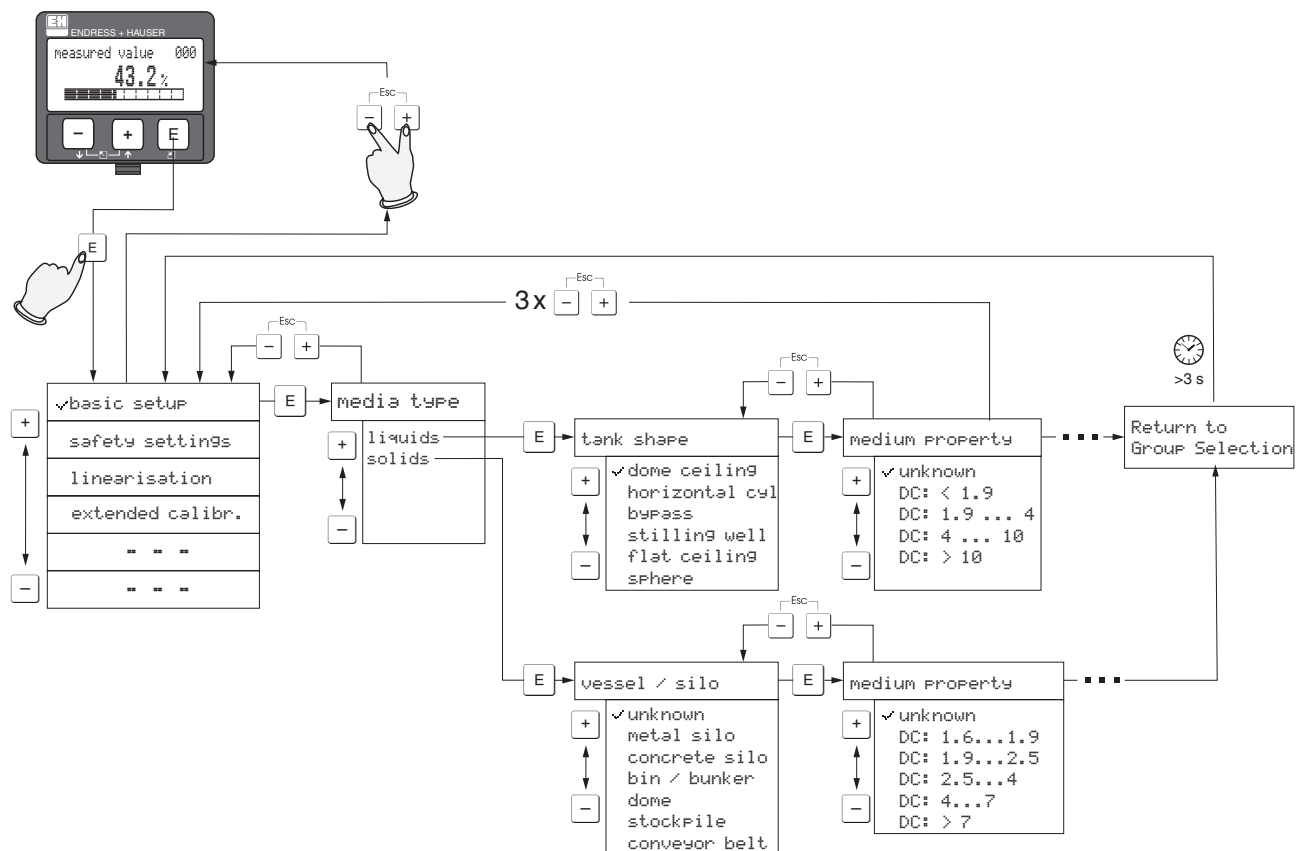
Example - Selection and configuration in Operation menu:

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) $+$ + $-$ (= ⌐⌐) 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) $+$ + $-$ (= ⌐⌐) interrupts the input, system quits Edit mode

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

5) Press $+$ + $-$ (= ⌐⌐) once ➜ return to previous **function** (e.g. "tank shape (002)")

Press $+$ + $-$ (= ⌐⌐) twice ➜ return to **Group selection**

6) Press $+$ + $-$ (= ⌐⌐) to return to **Measured value display**

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

5.3   Operation with an Endress+Hauser operating program

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. Hardware and software requirements you can find on the internet: www.endress.com → select your country → search: FieldCare → FieldCare → Technical Data.

Functions

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 with FXA291 (USB)

L00-FMxxxxxx-04-00-00-yy-024
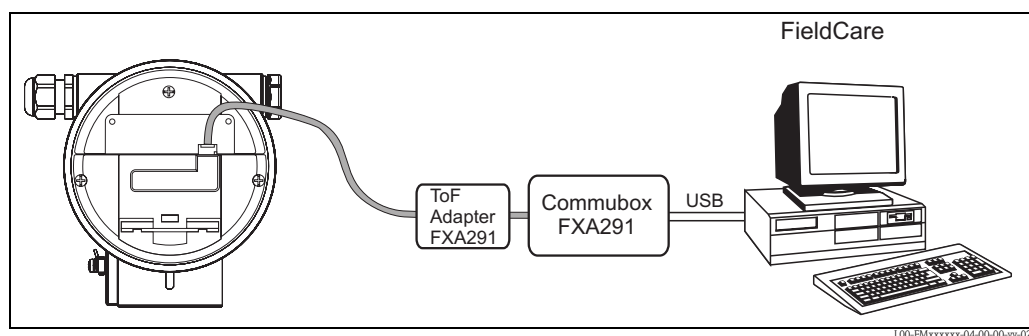
For details refer to:
Technical Information TI405C/07/EN (Commubox FXA291)
Operating Instructions KA271F/00/A2 (ToF Adapter FXA291)

Menu-guided commissioning
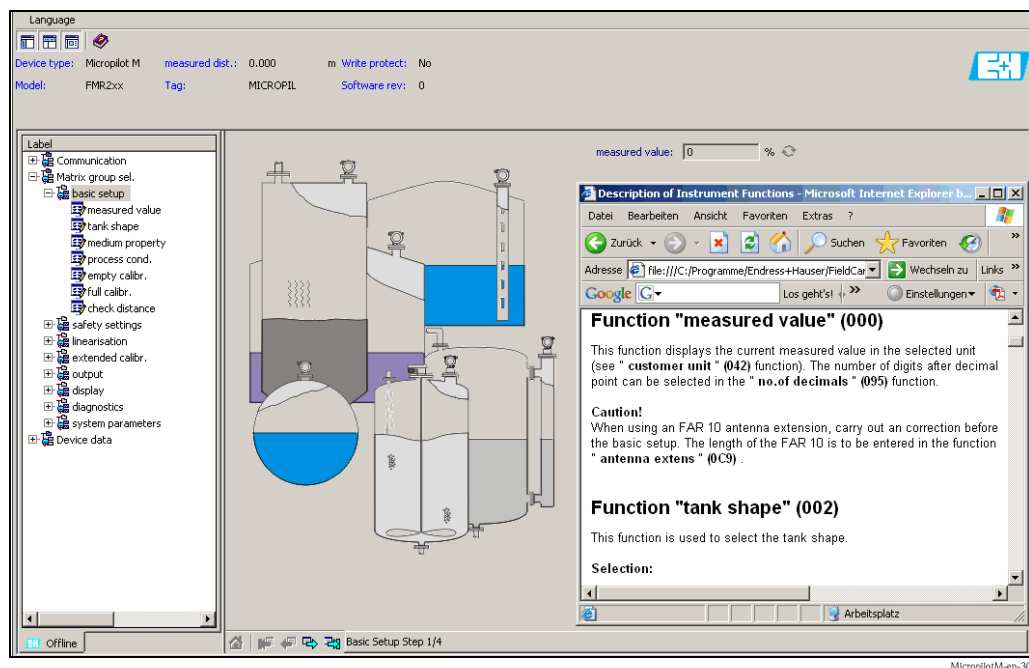
MicropilotM-en-305

Signal analysis via envelope curve
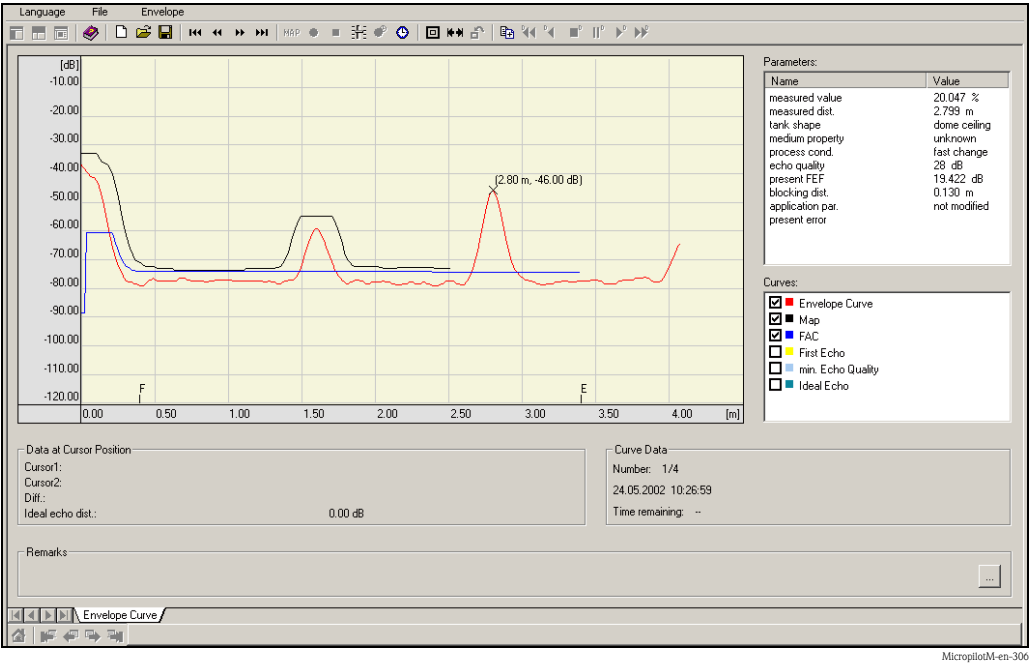
MicropilotM-en-306

Tank linearisation
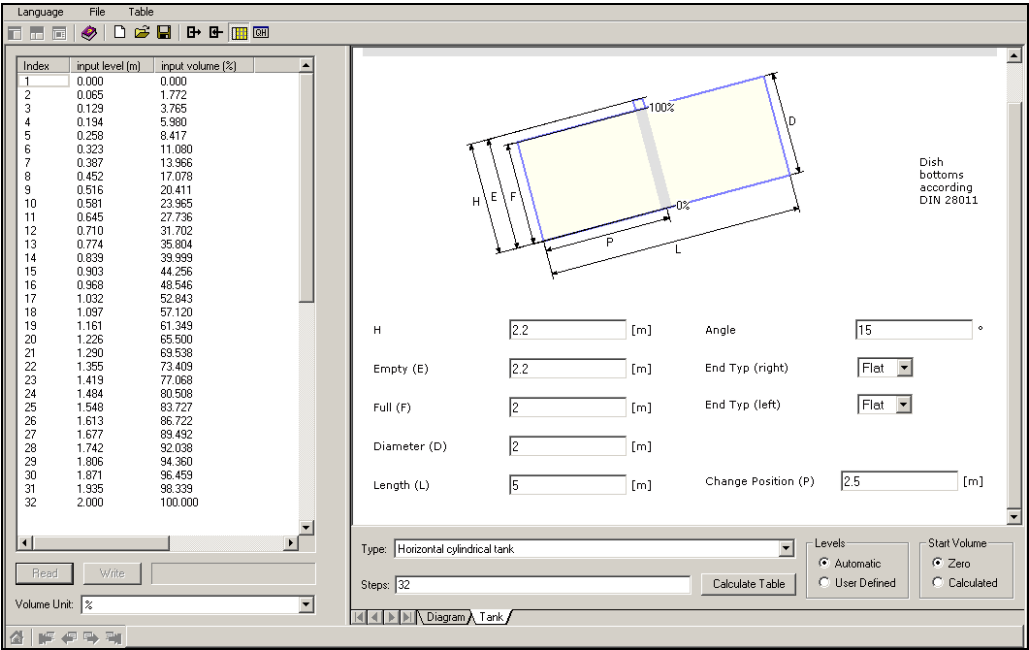
MicropilotM-en-307

5.4 Operation with a FOUNDATION Fieldbus configuration program

5.4.1 FOUNDATION Fieldbus configuration programs

The user can obtain special configuration and operating programs offered by different manufacturers for use in configuration. These can be used for configuring both the FOUNDATION Fieldbus functions and all the device-specific parameters. The predefined function blocks allow uniform access to all the network and fieldbus device data.

5.4.2 Device Description files

File names

You will need the following files for commissioning and network configuration:
- **Device Description files**: *.sym, *.ffo
  These files describe the structure of the blocks and their parameters. They offer guided setups with the help of menus and methods.
- **Capability file**: *.cff
  This file enables offline configuration and describes the device capability in terms of communication stack and function blocks.

The file names consist of the following parts:
- Device Revision (0C3)[1]
- DD Revision (0C4)[1] (use the most current version)
- CFF Revision (use the most current version)

Example:

- Device Revision (0C3) = 03
- DD Revision (0C4) = 01
- CFF Revision = 02
- → files to be used: "0301.sym", "0301.ffo", "030102.cff"

Directory structure

The files are normally stored in the following directory structure:

- /452B48/100F/*.sym
                       *.ffo
                       *.cff

The directory names have the following meaning:

- 452B48: manufacturer ID of Endress+Hauser
- 100F: device ID of Micropilot M

---

[1]   "Device Revision" (0C3) and "DD Revision" (0C4) can be obtained through the display and operating module.
       For details refer to → 🖺 33: "Operation with the display and operating module"

Source of supply

Host System	Source of supply for the Device Description and Network Configuration files
ABB (Field Controller 800) Allen Bradley (Control Logix) Endress+Hauser (ControlCare) Honeywell (Experion PKS) Invensys SMAR (System 302)	■ www.endress.de (→ Download → Media type = "Software", "Device Drivers") ■ CD-ROM (Endress+Hauser order code: 56003896) ■ www.fieldbus.org
Emerson (Delta V)	■ www.easydeltav.com
Yokogawa (CENTUM CS 3000)	■ www.yokogawa.com

5.4.3   Representation of parameters

A FOUNDATION Fieldbus configuration tool offers two types of parameter representation:

- **Representation by parameter name**
  Examples: "PAROPERATIONCODE", "PARRESET"
- **Representation by parameter label**
  (identical to the labels on the display module and in an Endress+Hauser operation tool)
  Examples: "unlock parameter", "reset"

5.5   Operation with the Field Communicator 375, 475

5.5.1   Connection

The handheld terminal is directly connected to the FOUNDATION Fieldbus communication line. An additonal communication resistor is not required.

5.5.2   Device Descriptions

Make sure you have loaded the valid Device Description files (DDs). DDs can be downloaded from the internet at "www.fieldcommunicator.com". The DDs can also be updated by the update functionality of the Field Communicator 375, 475.

5.5.3   User interface

The device parameters are arranged in blocks. The Field Communicator 375, 475 uses this block structure to access the parameters. You can navigate within the structure by the arrow keys and the "Enter" key. Alternatively, you can use the touch-screen functionality of the handheld terminal for navigation. (Double-click on a name opens the respective block or parameter).

5.5.4   Example
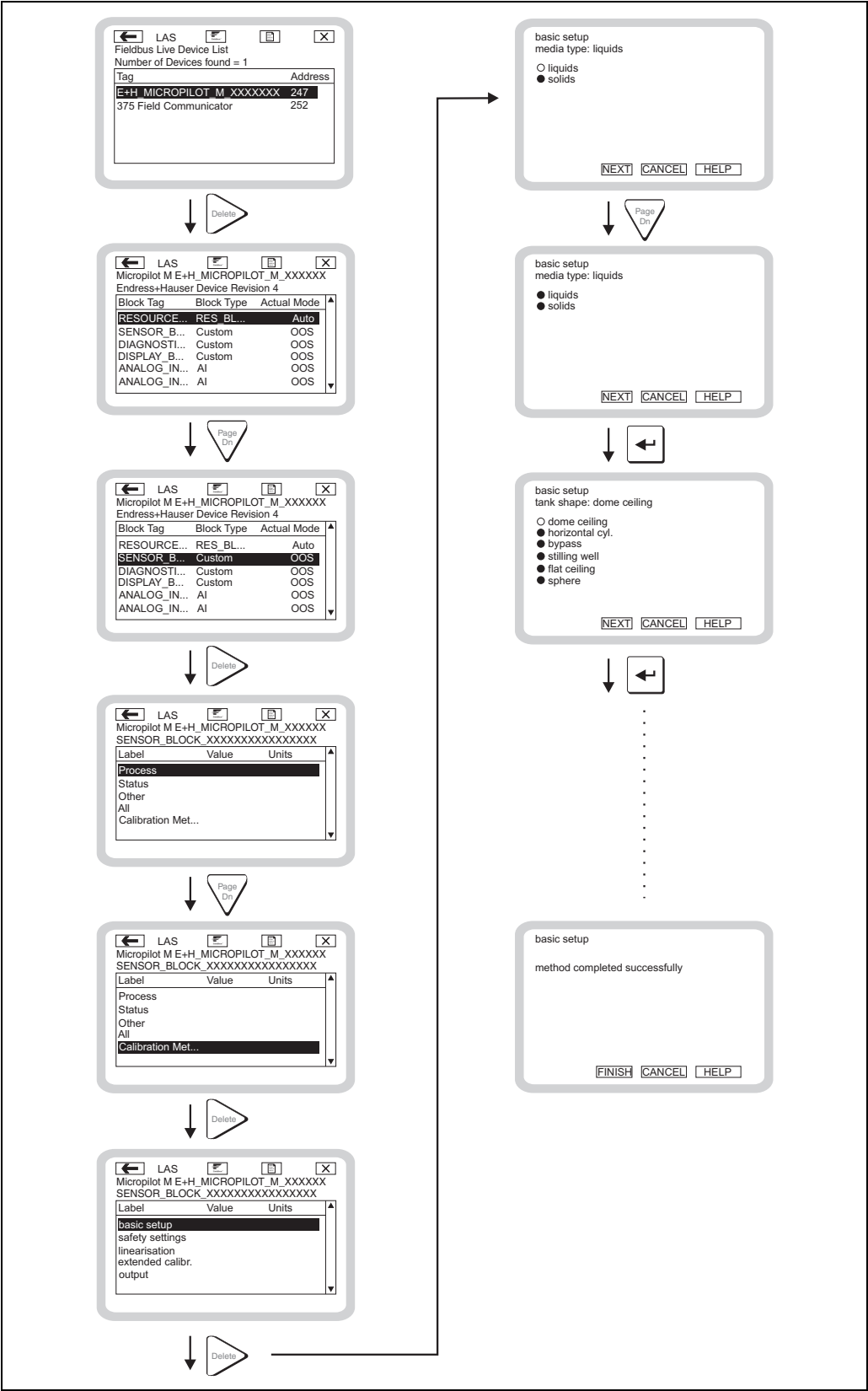
L00-FMR2xxxx-07-00-00-yy-011

6 Commissioning

This chapter consists of the following sections:

- "Function check", → 🗐 43
- "Unlocking the device", → 🗐 43
- "Resetting the device", → 🗐 45
- "Commissioning by the display and operatig module", → 🗐 47
- "Basic Setup with the Endress+Hauser operating program", → 🗐 60
- "Commissioning with a FOUNDATION Fieldbus configuration tool", → 🗐 64
- "Commissioning with the Field Communicator 375, 475", → 🗐 69

6.1 Function check

Make sure that all final checks have been completed before you start up your measuring point:
- Checklist "Post installation check", → 🗐 25.
- Checklist "Post connection check", → 🗐 30.

6.2 Unlocking the device

Before commissioning, make sure that the device is not locked against parameter changes.
On delivery, the device is unlocked. In other cases, however, it may have been locked in one of the following ways:

6.2.1 DIP switch (under the housing cover)

Locking and unlocking

default settings:
write protection OFF
simulation OFF

write protection

simulation

L00-FMxxxxxx-19-00-00-en-002
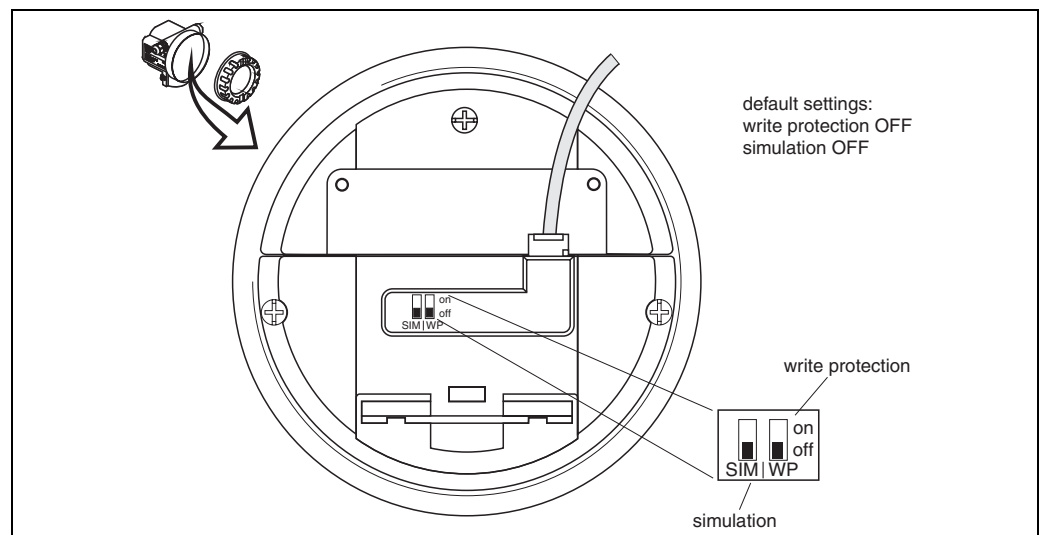
WP = on: parametrization locked
WP = off: parametrization unlocked
SIM = on: simulation possible in Analog Input Block by configuration tool
SIM = off: simulation not possible in Analog Input Block by configuration tool

Parameters affected

Locking by the DIP switch affects **all** parameters.

6.2.2 Key combination (display and operating module)

Locking

Press ⊟, ⊞ and ⊑ simultaneously.

Unlocking

If you try to change a parameter, the following appears:

```
unlock parameter 0A4
£ Hardware locked
```

<p align="right"><small>L00-fmrxf0a4-20-00-00-de-001</small></p>
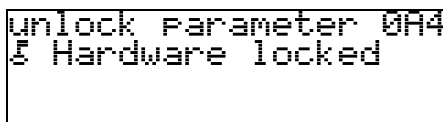
Press ⊟, ⊞ and ⊑ simultaneously. The **"unlock parameter" (0A4)** function appears.
Enter "2457". Now parameters can be changed.

Parameters affected

Locking by the key combination affects the following parameters:

- Parameters of the device specific blocks (Sensor Block, Diagnostic Block, Display Block)
- Endress+Hauser service parameters

6.2.3 Locking parameter

Locking

Enter a number other than "2457" into the **"unlock parameter" (0A4)** function.
(FOUNDATION Fieldbus: Diagnsotic Block, parameter PAROPERATIONMODE)

Unlocking

Enter **"2457"** into the **"unlock parameter" (0A4)** function.
(FOUNDATION Fieldbus: Diagnostic Block, parameter PAROPERATIONMODE)

Parameters affected

Locking by the locking parameter affects the following parameters:

- Parameters of the device specific blocks (Sensor Block, Diagnostic Block, Display Block)
- Endress+Hauser service parameters

6.3 Resetting the device

It is advisable to reset the device parameters before the commissioning if you want to use a device with an unknown history.

6.3.1 Resetting the parameters of the FOUNDATION Fieldbus function blocks

Parameters affected

- all parameters of the FOUNDATION Fieldbus function blocks
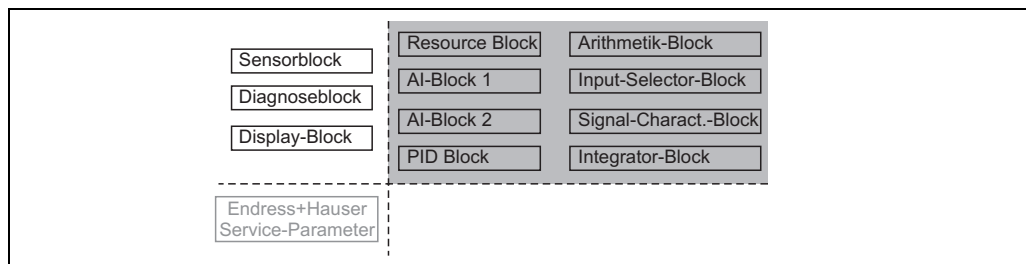
L00-FMU4XXXX-02-00-00-YY-007

Performing the reset

Resource Block, parameter RESTART; select the option "defaults".

6.3.2 Resetting the parameters of the transducer blocks

Caution!
A reset may lead to impairment of the measurement. As a rule, a basic calibration is required after a reset.

Note!
The default values of each parameter are shown in bold in the menu overview in the appendix.

In order to carry out the reset, enter the number **"33333"** in the **"reset" (0A3)** function in the **"diagnostics" (0A)** function group.
(FOUNDATION Fieldbus: **Diagnostic Block**, Parameter **PARRESET (reset)**)

Parameters affected

- All parameters of the device specific blocks (Sensor Block, Diagnostic Block, Display Block)
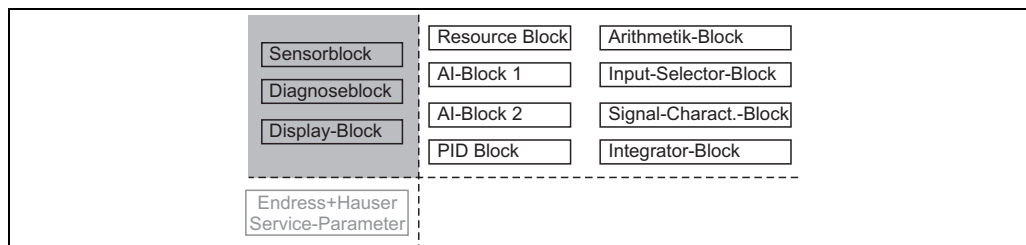
L00-FMU4XXXX-02-00-00-YY-008

Effects of the reset

- All customer parameters are reset to their default values.
- Customer interference echo suppression is **not** deleted.
- Linearisation is switched to **"linear"**, but the table values are kept. The table can be switched back on in the **"linearisation" (04)** function group in the **"linearisation" (041)** function.
  (FOUNDATION Fieldbus: Sensor Block, Parameter PARLINEARISATION (linearisation))

Performing the reset

"diagnostics" (0A) function group, "reset" (0A3) function; enter "33333"
(FOUNDATION Fieldbus: Diagnostic Block, parameter PARRESET)

6.3.3   Resetting an interference echo suppression (tank map)

It is always adivable to reset the interference echo suppression (tank mapping) when:

- A device with an unknown history is used
- An incorrect suppression was input

Resetting the tank map with the device display

1. In the **"extended calibr." (05)** function group select the **"selection" (050)** function.

2. Select **"extended map."**

3. Go to the **"cust. tank map" (055)** function and select the required option:
    – **"reset"**: deletes the existing tank map.
    – **"inactive"**: deactivates the tank map but does not delete it. It can be re-activated when required.
    – **"active"**: activates the tank map.

Resetting the tank map with an Endress+Hauser operating program

1. In the function group **"extended calibr."** select the **"cust. tank map" (055)** function.

2. Select the required option (**"reset"**, **"inactive"** or **"active"**)

Resetting the tank map with a FOUNDATION Fieldbus configuration tool

1. In the **Sensor Block** select the parameter **PARCUSTTANKMAP (cust tank map)**.

2. Select the required option (**"reset"**, **"inactive"** or **"active"**).

6.4   Commissioning by the display and operatig module

6.4.1   Power up instrument

After switching on the supply voltage, the
instrument is first initialised.

```
initialization      /


VU 331 01.01.02
```
L00-fmp-fxxx-20-00-00-en-003
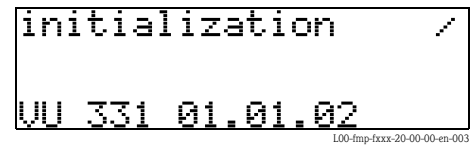
Then the following appear for approximately
five seconds:
- Device type
- Software version
- Type of digital communication signal

```
FMR2XX
V01.05.00  FF        [EH]
```
L00-fmr-fxxx-20-00-00-en-103

Press ⌷ to exit this display.
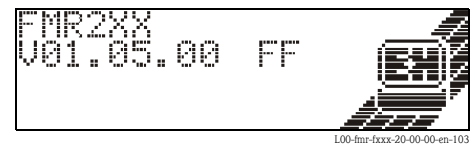
On first power-up, you are requested to select
the language for the display texts.

```
language            092
✓English
 Deutsch
 Français
```
L00-fmrxf092-20-00-00-en-001

Then you are requested to select the unit of
length for your measurements.

```
distance unit       0C5
✓m
 ft
 mm
```
L00-fmrxf0c5-20-00-00-en-001
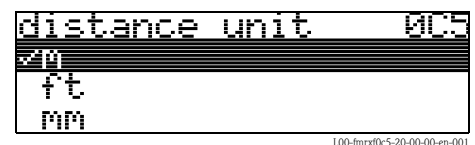
A measured value is displayed. This is NOT
equivalent to the level in your tank. Firstly carry
out a basic calibration.

```
measured value      000
    63.460 ·

■■■■■■■■□□□□
```
L00-fmrxf000-20-00-00-en-001
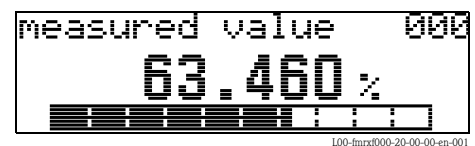
Press ⌷ to switch to the group selection.
Press ⌷ again to start the basic calibration.

```
Group selection     00→
✓basic setup
 safety settings
 linearisation
```
L00-fmrxfg00-20-00-00-en-001

The **"Basic setup" (00)** function group lists all the functions which are required for a standard
measurement task to commission the Micropilot M. When you have completed your input for a
function, the next function appears automatically. In this way, you are guided through the complete
calibration.

6.4.2 Application parameters

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:
- tank shape 002
- medium property 003
- process cond. 004
- empty calibr. 005
- full calibr. 006
- pipe diameter 007
- check distance 051
- range of mapping 052
- start mapping 053
- . . .

With the selection "solids" only the following functions can be adjusted:
- vessel / silo 00A
- medium property 00B
- process cond. 00C
- empty calibr. 005
- full calibr. 006
- check distance 051
- range of mapping 052
- start mapping 053
- . . .

Function "tank shape" (002), liquids only

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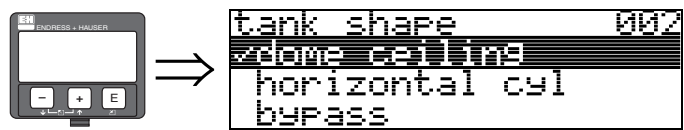
This function is used to select the tank shape.

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

dome ceiling   horizontal cyl

bypass   stilling well

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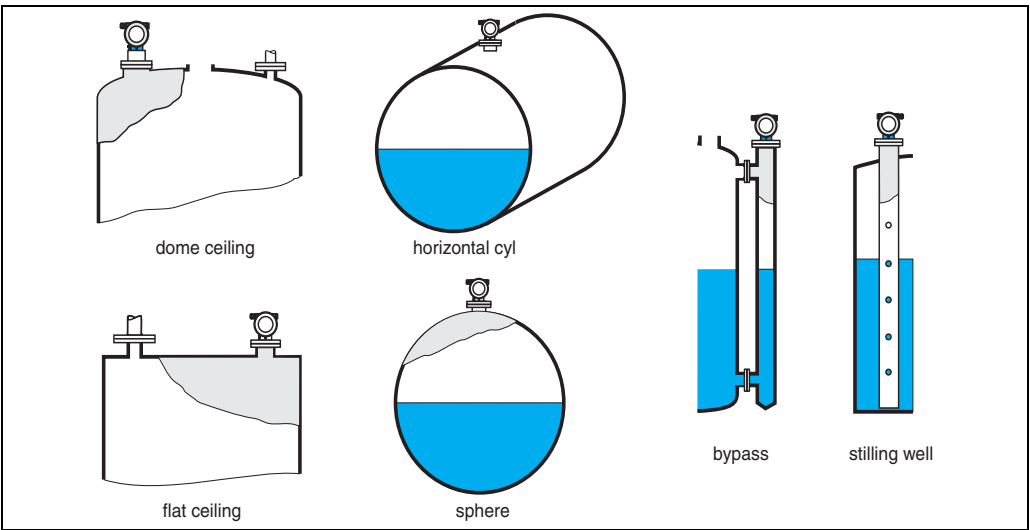
L00-FMR2xxxx-14-00-06-en-007

Function "medium property" (003), liquids only

```
medium property   003
↗unknown
 DC: < 1.9
 DC: 1.9 ... 4
```
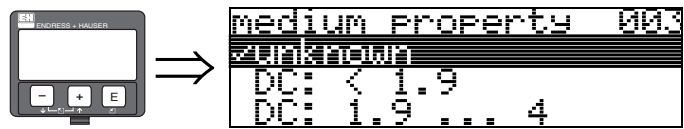
This function is used to select the dielectric constant.

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

Product class	DC (ε_r)	Examples
A	1.4 to 1.9	non–conducting liquids, e.g. liquefied gas [1]
B	1.9 to 4	non–conducting liquids, e.g. benzene, oil, toluene, …
C	4 to 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 FMR230 in a stilling well.
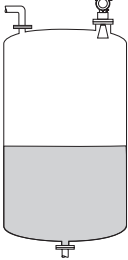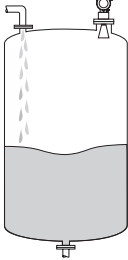
Function "process cond." (004) , liquids only

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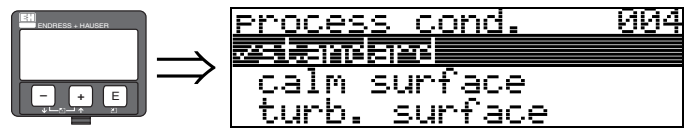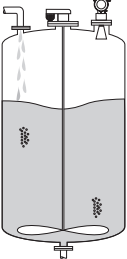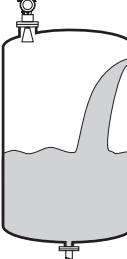
This function is used to select the process conditions.

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
```
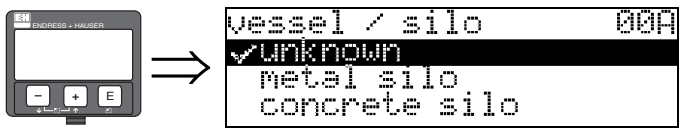
This function is used to select the vessel / silo.

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
```
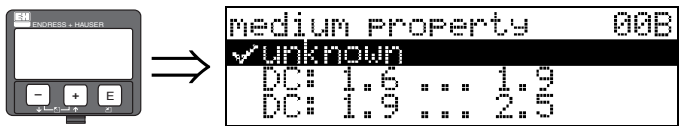
This function is used to select the dielectric constant.

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

Media group	DC (εr)	Examples
A	1.6 to 1.9	– Plastic granulate – White lime, special cement – Sugar
B	1.9 to 2.5	– Portland cement, plaster
C	2.5 to 4	– Grain, seeds – Ground stones – Sand
D	4 to 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
```
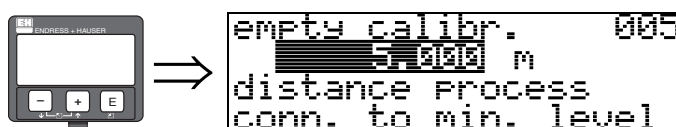
This function is used to enter the distance from the flange (reference point of the measurement) to the minimum level (=zero).

E = empty calibration (= zero)

0%
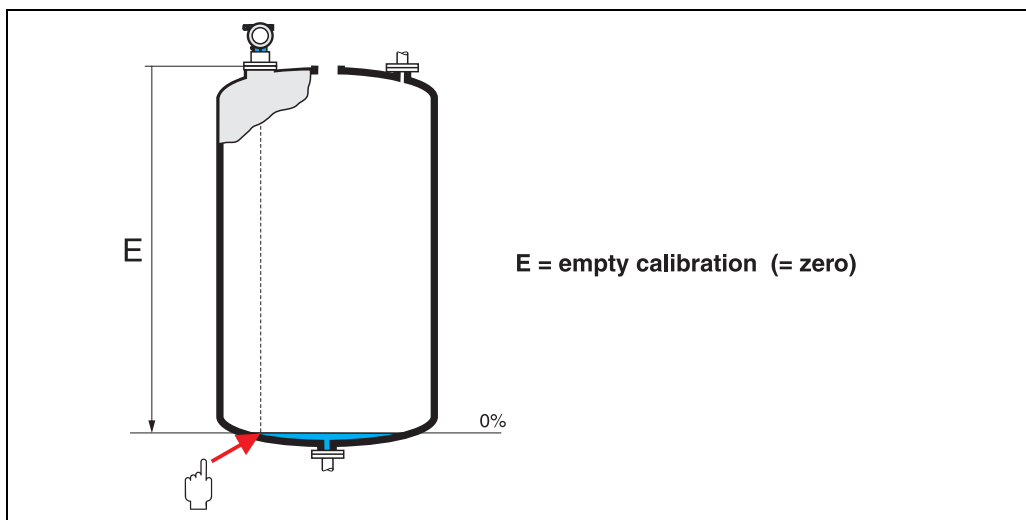
L00-FMR2xxxx-14-00-06-en-008

☞ 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 tank.

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). 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 (1.97 in) to the tip of the antenna.

F = full calibration (= span)
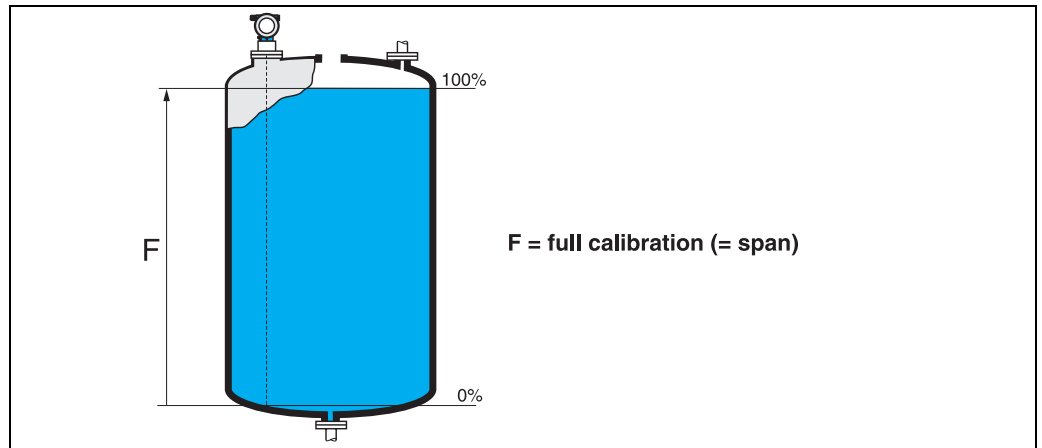
L00-FMR2xxxx-14-00-06-en-009

✎ 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)
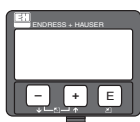
```
Pipe diameter       007
      201.225  mm
inner diameter of
bypass/stilling well
```

This function is used to enter the pipe diameter of the stilling well or bypass pipe.
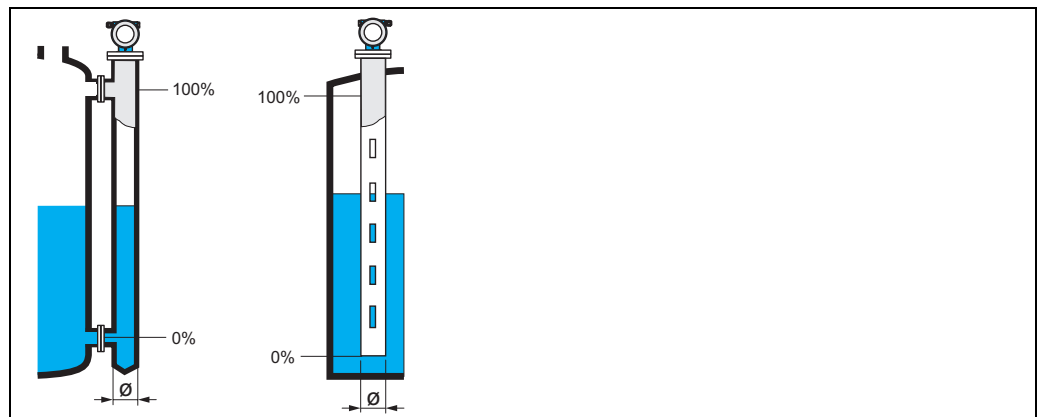
L00-FMR2xxxx-14-00-00-en-011

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.

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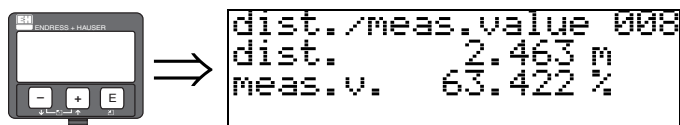
```
dist./meas.value 008
dist.        2.463 m
meas.v.   63.422 %
```

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
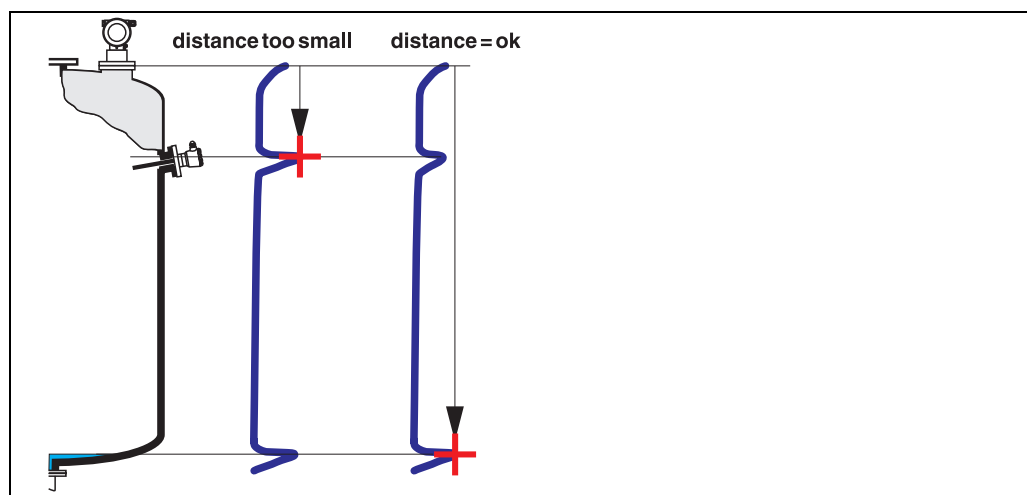
L00_FMR2xxxxx-14-00-06-en-010

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 (1.6 ft) before the echo of the actual level. For an empty tank, do not enter E, but E – 0,5 m (1.6 ft). If a mapping already exists, it is overwriten 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. 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.

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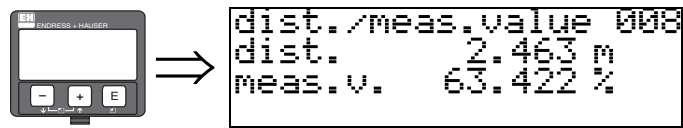
```
dist./meas.value 008
dist.       2.463 m
meas.v.    63.422 %
```

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
```

After 3 s, the following message appears

```
Group selection  00→
 basic setup
 safety settings
 linearisation
```
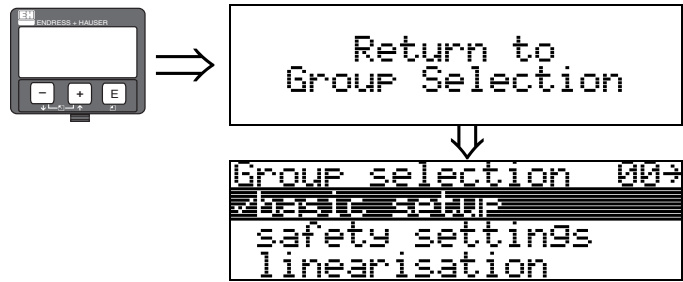
6.4.3 Envelope curve

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
envelope 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/00/EN)
- 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
single 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.
- 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", → 📄 84).

Function "envelope curve display" (0E3)

The envelope curve is displayed in this function. You can use it to obtain the following information:

L00-FMU4xxxxx-07-00-00-en-003
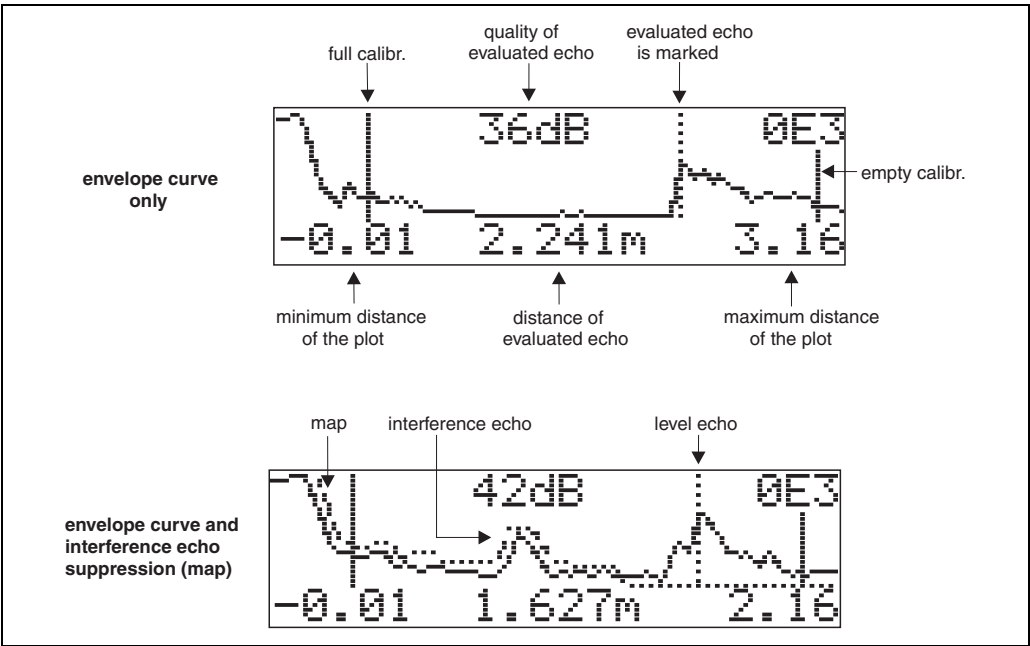
Navigating in the envelope curve display

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
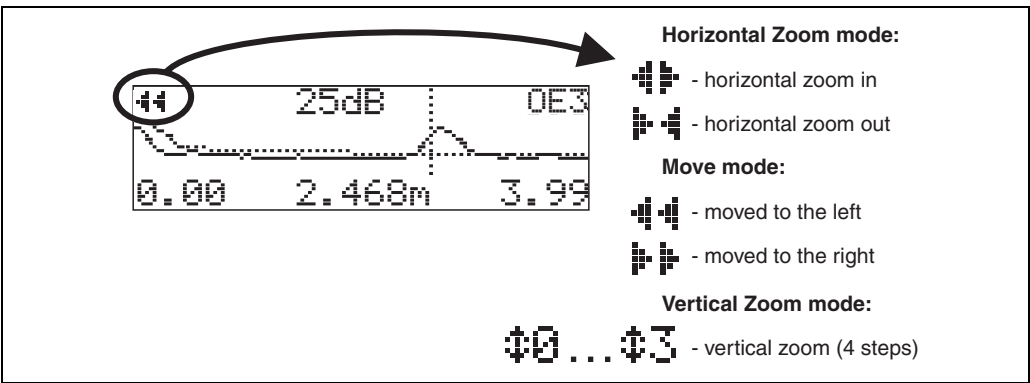
Horizontal Zoom mode

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
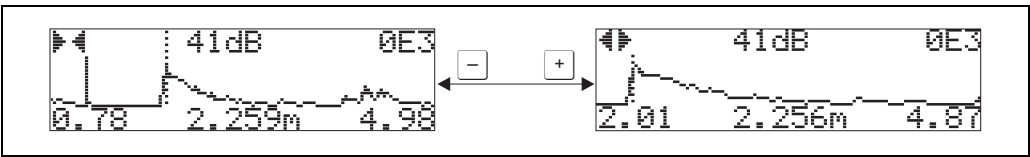
Move mode

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
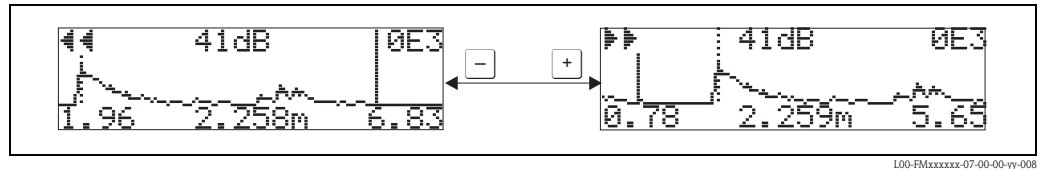
Vertical Zoom mode

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
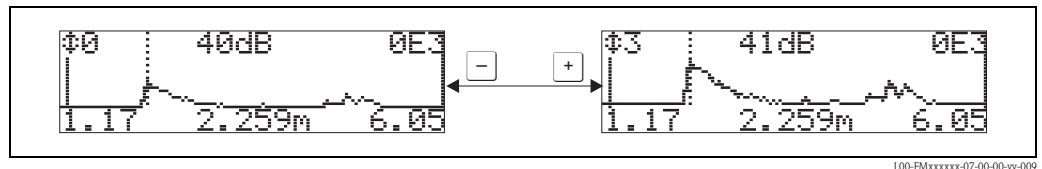
Exiting the navigation

- 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 the Micropilot uses the standard display again.


```
        Return to
     Group Selection
```

After 3 s, the following message appears
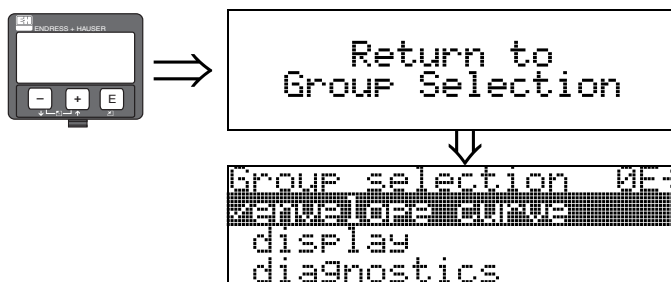
```
Group selection   0E
 envelope curve
 display
 diagnostics
```

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.[2]
- 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
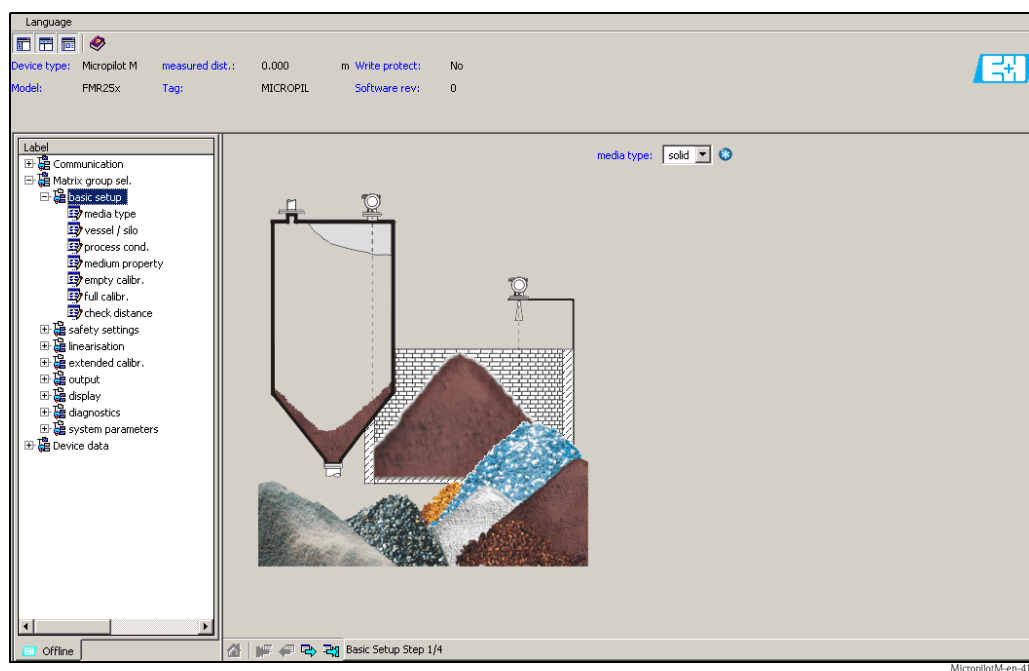
- The "**Next**" button moves you to the next screen display:

---

2)   If the connection can not be established, make sure that you use the latest versin of the operating program.

Basic Setup step 2/4:

■ Enter the application parameters:
  – Vessel / silo
  – Medium property
  – Process cond.
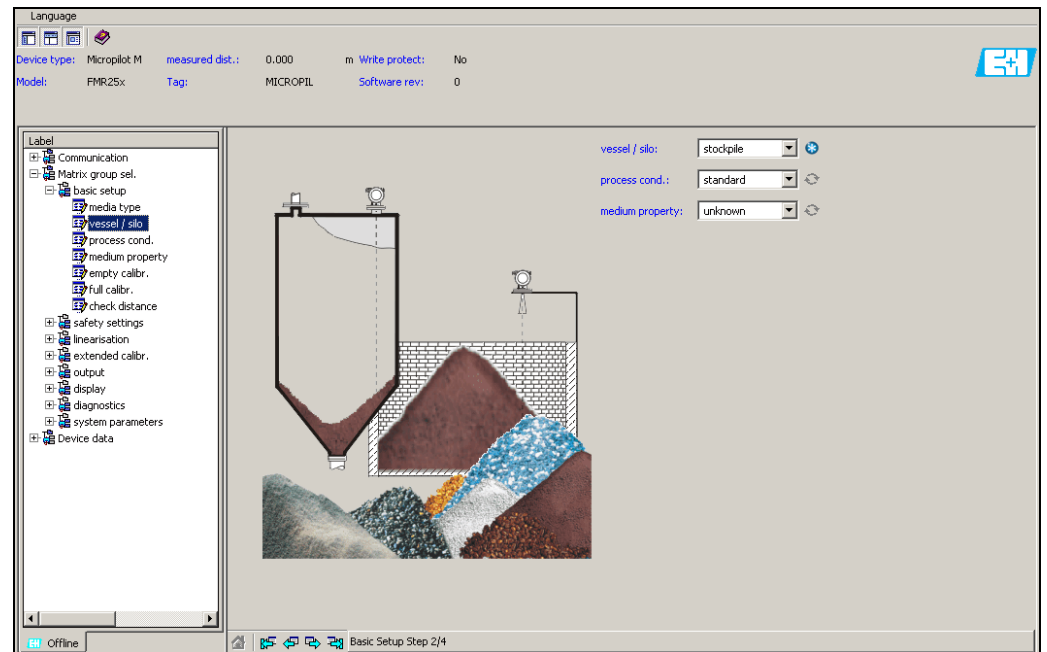
MicropilotM-en-412

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.
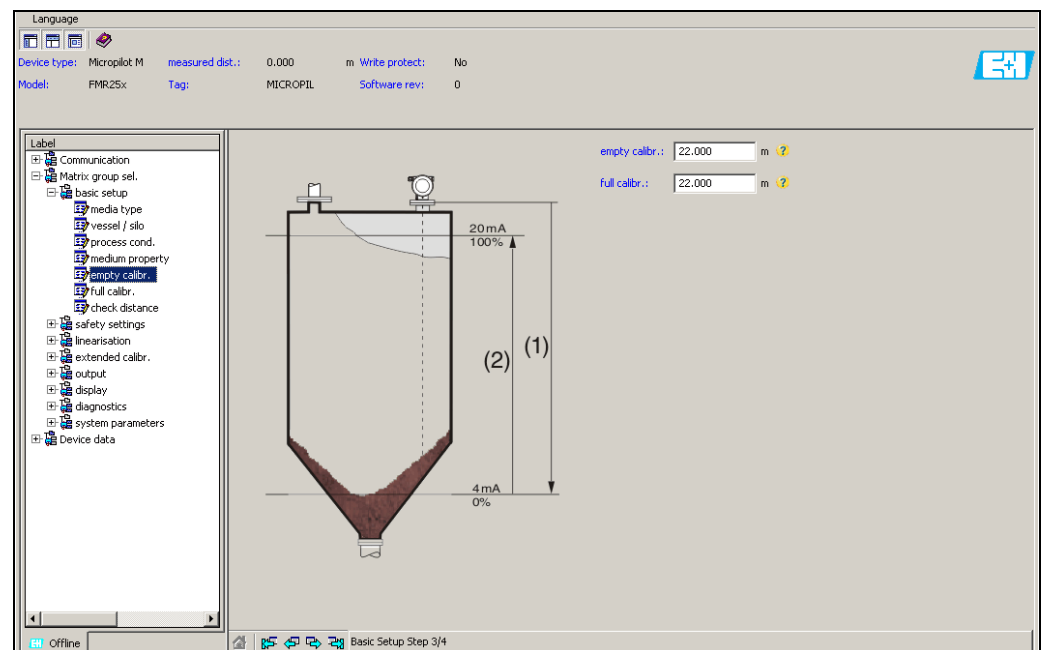
MicropilotM-en-413

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
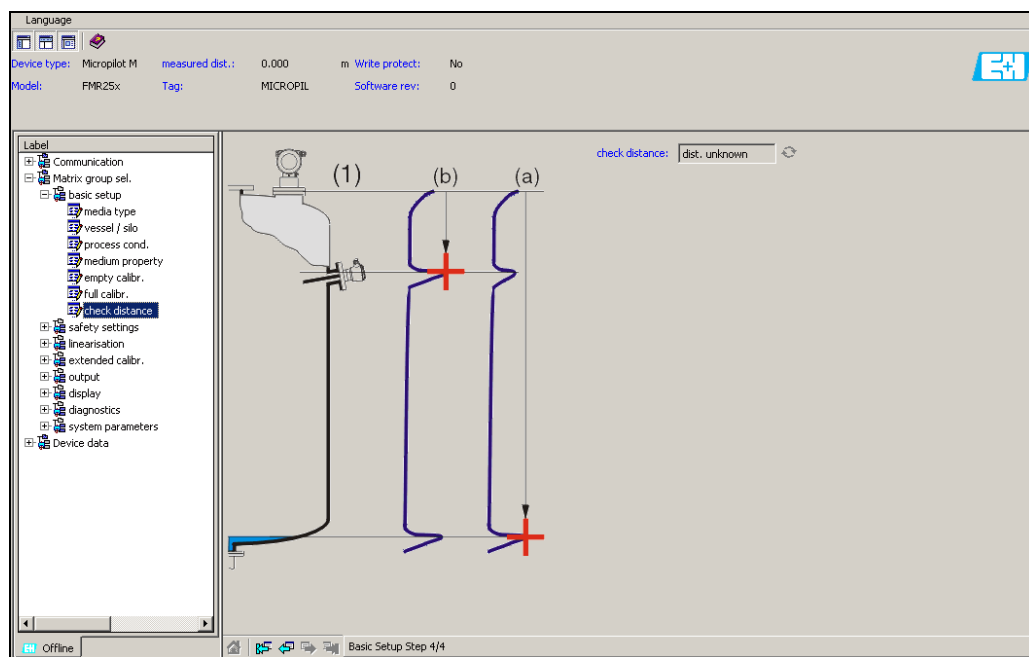
MicropilotM-en-404

6.5.1 Signal analysis via envelope curve

After the basic setup, an evaluation of the measurement using the envelope curve is recommended.
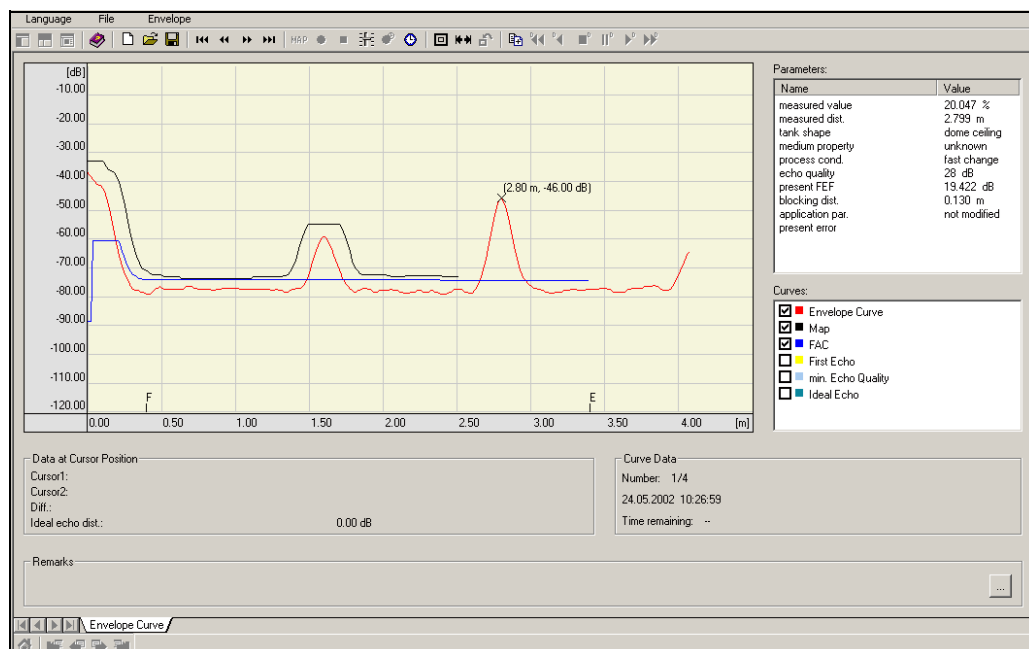
MicropilotM-en-306

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 Instrument Functions" on the enclosed CD-ROM.

6.6 Commissioning with a FOUNDATION Fieldbus configuration tool

✎ Note!

For commissioning of the device with a FOUNDATION Fieldbus configuration tool you need to know the DEVICE_ID, which consists of the following parts:

Device_ID = 452B48100F–XXXXXXXX

whereby:

452B48	ID code for Endress+Hauser
100F	ID code for Micropilot M
XXXXXXXX	Device serial number, as printed on the nameplate

6.6.1 Fist setup

1. Open the configuration tool and load the Device Descriptions (*.ffo, *.sym and – if required by the tool – *.cff). Ensure you use the correct files (→ 📖 40).

2. The first time it is connected, the device reports as follows:

FMR24x-FF-DevRev5-in-NIConfig
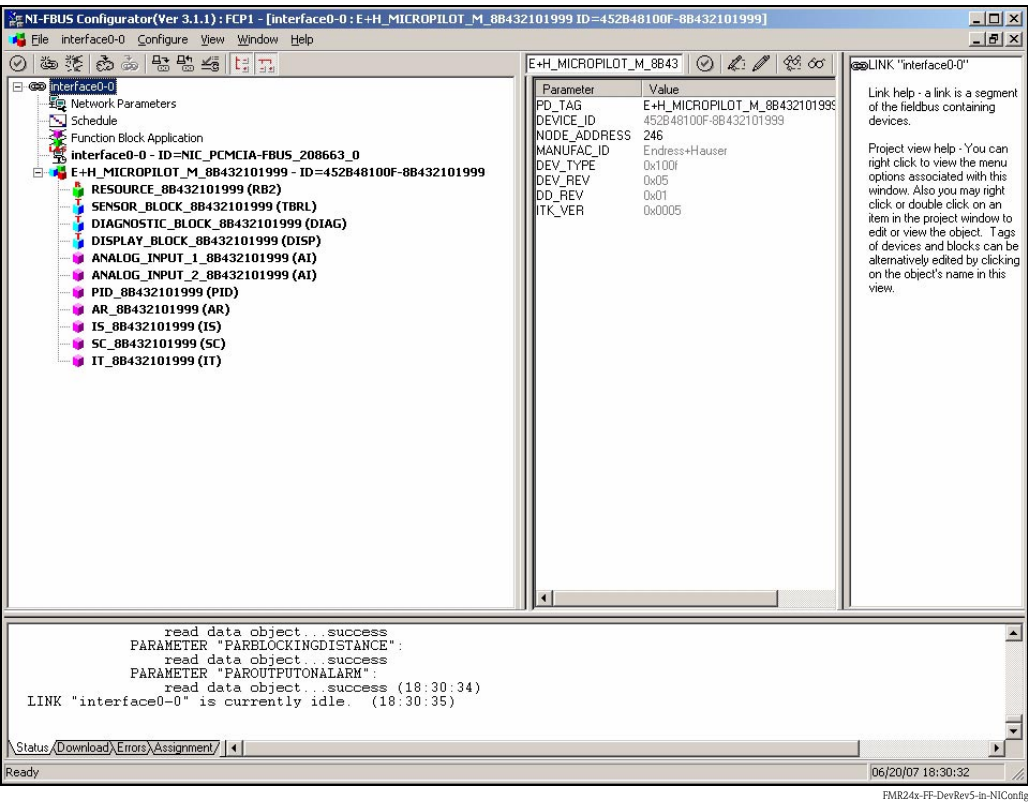
3. Identify the device using the DEVICE_ID and assign the desired field device tag name (PD_TAG).
    Factory setting: PD_TAG = E+H_MICROPILOT_M_XXXXXXXX

6.6.2   Parametrization of the Resource Block (Start Index: 400)

1. Enter the desired block name (optional).
   Factory setting: RESOURCE_XXXXXXXX

2. Opern the Resource Block

3. On delivery, write protection is disabled so that you can access the write parameters via
   FOUNDATION Fieldbus. Check this status by the parameter WRITE_LOCK:
   – Write protectin activated: WRITE_LOCK = LOCKED
   – Write protection deactivated: WRITE_LOCK = NOT LOCKED
   Deactivate the write protection if necessary, → 🗎 43.

4. Set the operating mode to AUTO in the parameter group MODE_BLK (parameter TARGET).

6.6.3   Parametrization of the Sensor Block (Start Index: 2000)

1. Enter the desired block name (optional)
   Factory setting: SENSOR_BLOCK_XXXXXXXX

2. Open the Sensor Block. The following display appears:
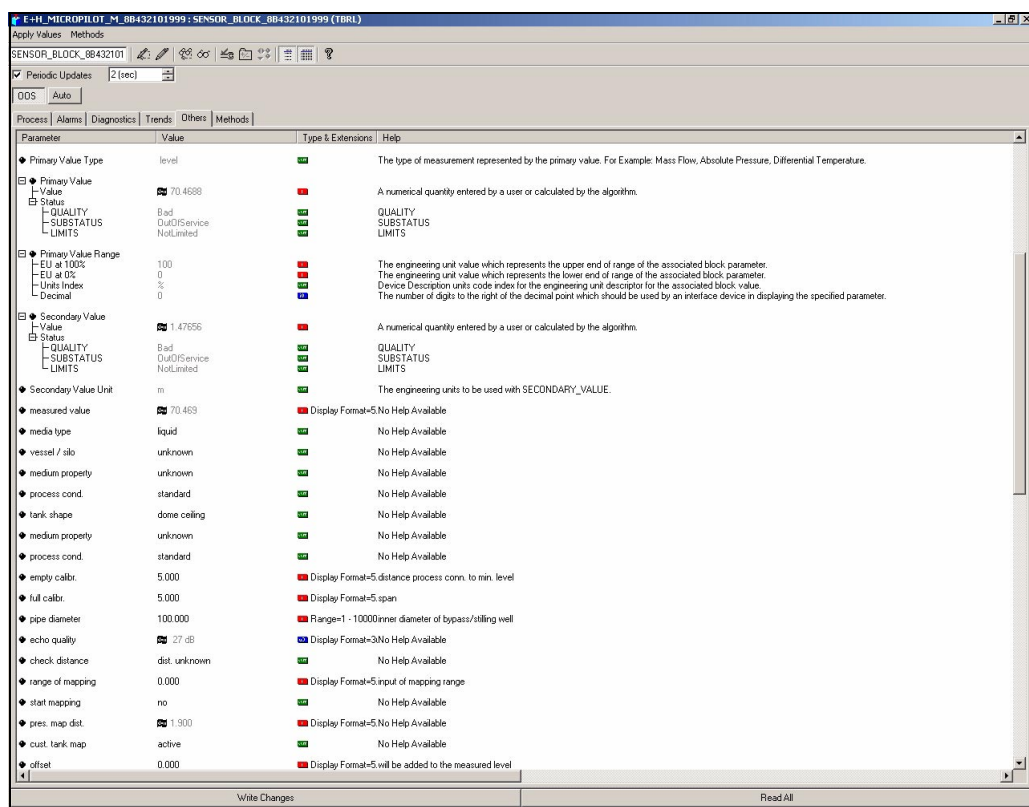
FMR24x-FF-DevRev5-Sensorblock-in-NIConfig

✎ Note!
There are two possibilities to edit the parameters of the block:
- A parameter from the list can be opened for editing by a double click.
- You can open one of the FOUNDATION Fieldbus methods. Each method guides you
  automatically through a number of parameters which are required for a specific configuration
  task. The following sections describe the parametrization by the "basic setup" method.

3.   Open the FOUNDATION Fieldbus method "basic setup":

FMR2xx-FF-Methode-in-NIConfig
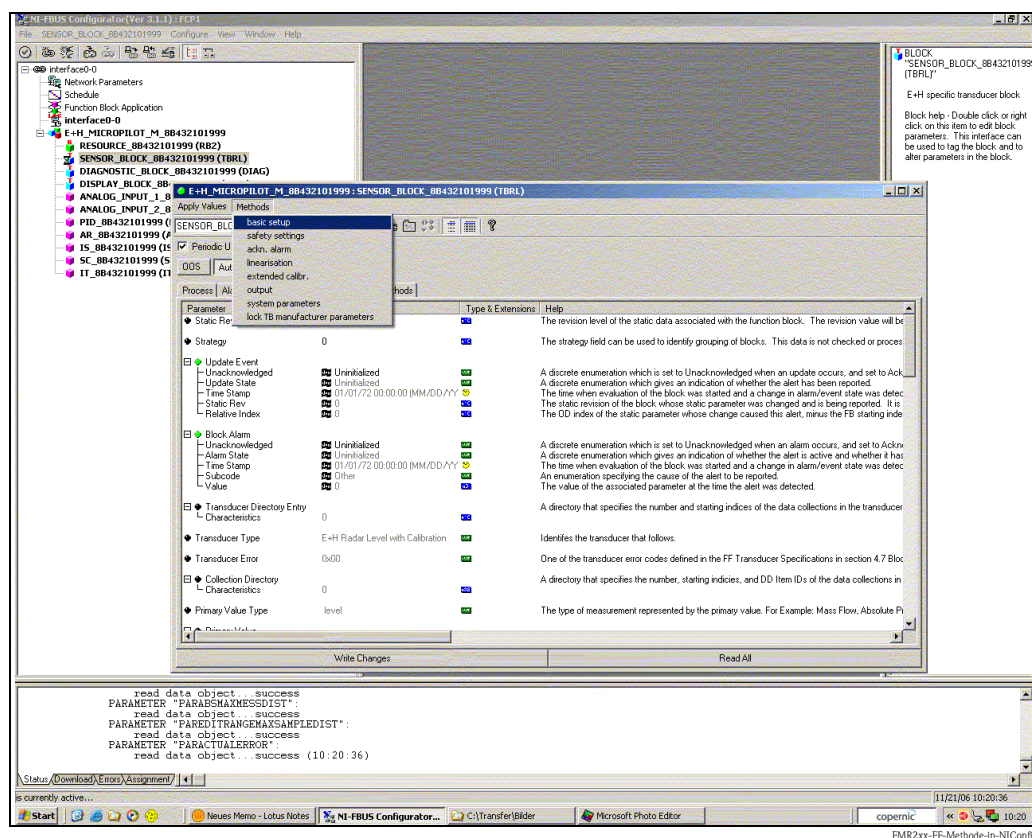
4.   The method contains the following parameters[3]:
      a. Application parameters ($\to$ 🖹 48)
          – PARMEDIATYPE (media type)
          With the selection "liquid" only the following application parameters can be adjusted:
          – PARTANKSHAPE (tank shape)
          – PARDIELECTRICCONSTANT (medium property)
          – PARPROCESSCONDITION (process cond.)
          With the selection "solid" only the following application parameters can be adjusted:
          – PARVESSELSILO (vessel / silo)
          – PARDIELECTRICCONSTANT (medium property)
          – PARPROCESSPROPERTIES (process propert.)

      b. Empty and full calibration ($\to$ 🖹 52)
          – PAREMPTYCALIBRATION (empty calibration)
          – PARFULlCALIBRATION (full calibration)

      c. Interference echo suppression ($\to$ 🖹 54)
          – PARCHECKDISTANCE (check distance)
          – PARSUPPRESSIONDISTANCE (range of mapping)
          – PARSTARTMAPPINGRECORD (start maping)
          – PARPRESMAPRANGE (pres. map. dist.)
          – PARCUSTTANKMAP (cust. tank map)

---

3)   In the FOUNDATION Fieldbus configuration tool you can select from two types of parameter display:
      – parameter names (e.g. "PARTANKSHAPE")
      – label texts (e.g. "tank shape")

5. Set the operating mode to AUTO in the parameter group MODE_BLK (parameter TARGET). Otherwise the measured value can not be processed correctly by the connected Analog Input Block.

6. If measuring errors occur or if the measuring value seems unreliable, it is advisable to check the quality of the measurement by the envelope curve display. This can be done in two different ways:
    – by the display and operating module ($\rightarrow$ 📄 57)
    – by an Endress+Hauser operating program ($\rightarrow$ 📄 62)

6.6.4 Parametrization of the Analog Input Blocks

Prosonic M has two Analog Input Blocks that can be assigned to the various process variables. The following descripiton provides an example for the Analog Input Block 1 (Start Index 500).

1. Enter the desired block name (optional).
    Factory setting: ANALOG_INPUT_1_XXXXXXXX

2. Open the Analog Input Block.

3. Set the operating mode to OOS (Out of Service) in the parameter group MODE_BLK (parameter TARGET).

4. Using the parameter CHANNEL select the process variable that is to be used as the input value for the function block algorithm (scaling and limit value monitoring). The following settings are possible:
    – CHANNEL = 1: level
    – CHANNEL = 2: distance

5. In the parameter gorup XD_SCALE select the desired engineering unit and the block input range (measuring range) for the process variable in question (see the example below).

    👆 Caution!
    Make sure that the selected unit is suitable for the measurement variable of the selected process variable. Otherwies the parameter BLOCK_ERROR will display the error message "Block Configuration Error" and the block operating mode cannot be set to AUTO.

6. In the L_TYPE prameter, select the mode of linearization for the input variable (Direct, Indirect, Indirect Sq Root). For details, $\rightarrow$ 📄 109.

    👆 Caution!
    Note that with the type of linearization "Direct" the configuration of the parameter group OUT_SCALE must agree with the configuration of the parameter group XD_SCALE. Otherwise the block operating mode cannot be set to AUTO. Such incorrect configuration is indicated in the parameter BLOCK_ERROR by the "Block Configuration Error" message.

Example:

- The measuring range of the sensor is 0 to 10 m (0 to 33 ft).
- The output range to the automation system should be 0 to 10 m (0 to 33 ft), too.

The following settings are to be made:

- Analog Input Block 1, Parameter CHANNEL -> "1" (measured level)
- Parameter L_TYPE -> DIRECT
- Parameter group XD_SCALE
  XD_SCALE 0% -> 0
  XD_SCALE 100% -> 10
  XD_SCALE_UNIT -> m
- Parameter group OUT_SCALE
  OUT_SCALE 0% -> 0
  OUT_SCALE 100% -> 10
  OUT_SCALE_UNIT -> m

7. If required, use the following parameters to define the limit values for alarm and warning messages:
   – HI_HI_LIM -> Limit value for the upper alarm
   – HI_LIM -> Limit value for the upper warning
   – LO_LIM -> Limit value for the lower warning
   – LO_LO_LIM -> Limit value for the lower alarm
   The limit values entered must be within the value range specified in the parameter group OUT_SCALE.

8. In addition to the limit values you must also specify the action taken if a limit value is exceeded using the alarm priorities (parameters HI_HI_PRI, HI_PRI, LO_PRI, LO_LO_PRI). Reporting to the the fieldbus host system only takes place if the alarm priority is higher than 2.
   For details, → 📄 109.

6.6.5   Connection of the function blocks

1. A concluding overall system configuration is essential so that the operating mode of the Analog Input Block can be set to AUTO and so that the field device is integrated into the system application. To do this, a configuration software (e.g. you host system software) is used to connect the function blocks – normally graphically – to the desired control strategy and then the sequence of the individual process control functions is specified.
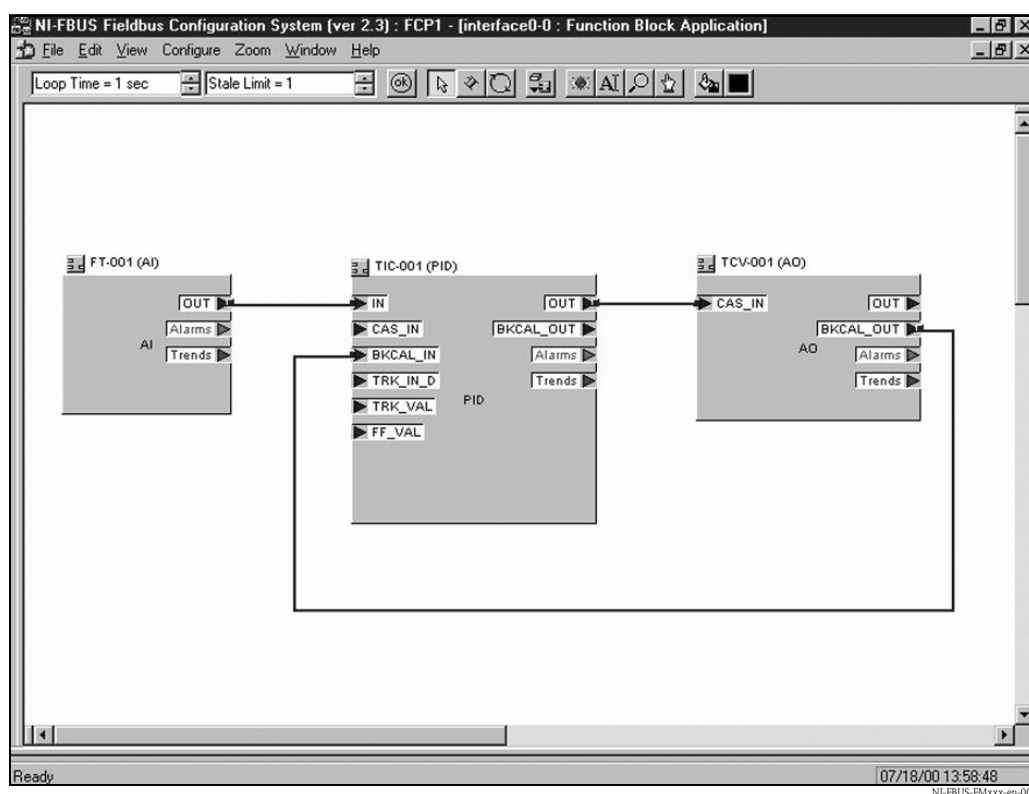
Example: Connection of the function blocks with the NI-FBUS Configurator

2. Download the configuration data into the field devices by the download function of the FOUNDATION Fieldbus configuration tool.

3. Set the oerating mode of the AI Block to AUTO (parameter group MODE_BLK, parameter TARGET). However, this is only possible under the following conditions:
   – The function blocks are correctly connected with each other.
   – The parametrization of the AI Block is correct (→ 📄 67, steps 5 and 6).
   – The Resource Block is in operating mode AUTO.

6.7   Commissioning with the Field Communicator 375, 475

The steps of the commissioning procedure are the same as with a FOUNDATION Fieldbus configuration tool (→ 🖹 64).

The blocks should be parametrized in the following order:

- The RESOURCE BLOCK
- The SENSOR BLOCK (the "basic setup" method can be used for this, → 🖹 42)
- The ANALOG INPUT BLOCKS

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 (→ 🗎 86, "Spare Parts"). 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 FieldCare.
Measurement can continue without having to carry out a new setup.

- You may have to activate linearisation (see BA291F/00/EN 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.

8.1 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.
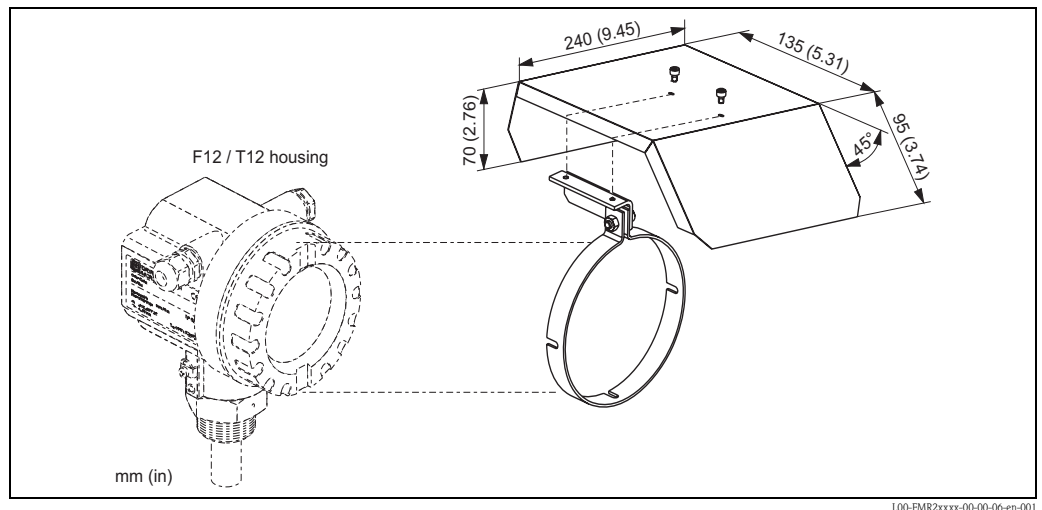
L00-FMR2xxxx-00-00-06-en-001

8.2 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 instrument you need the "ToF Adapter FXA291" as an additional accessory.

8.3 ToF Adapter FXA291

The ToF Adapter FXA291 connects the Commubox FXA291 via the USB interface of a personal computer or a notebook to the instrument. For details refer to KA271F/00/A2.

8.4   Remote display FHX40

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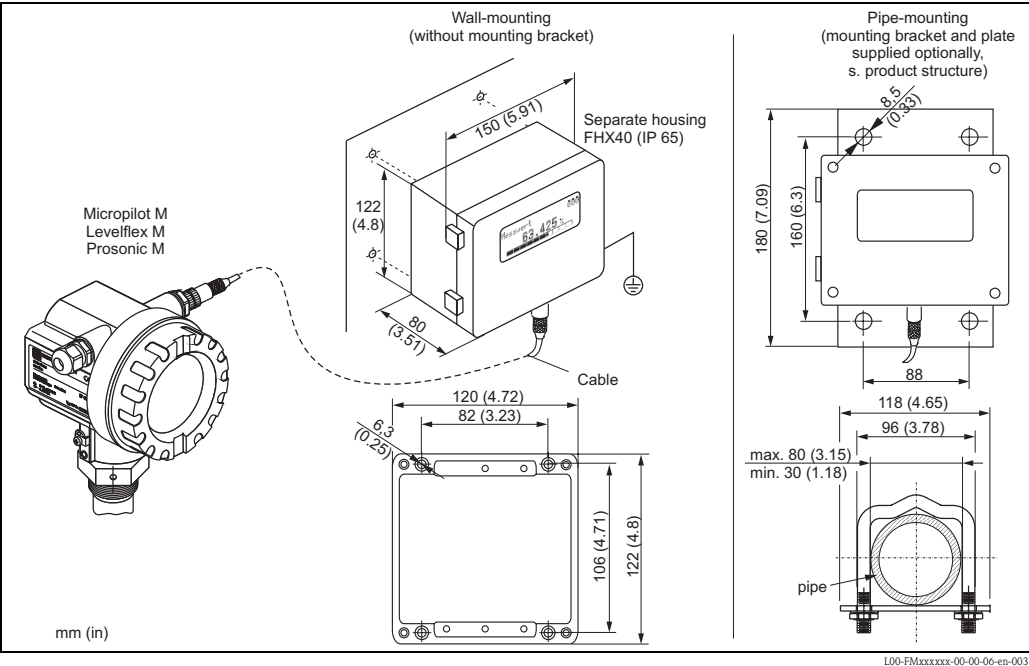
Technical data (cable and housing) and product structure:

Max. cable length	20 m (66 ft)
Temperature range	–30 °C to +70 °C (–22 °F to +158 °F)
Degree of protection	IP65/67 (housing); IP68 (cable) acc. to IEC60529
Materials	Housing: AlSi12; cable glands: nickle plated brass
Dimensions [mm (in)]	122x150x80 (4.8x5.91x3.15) /HxWxD

Approval:					
A	Non-hazardous area				
1	ATEX II 2 G EEx ia IIC T6, ATEX II 3D				
S	FM IS Cl.I Div.1 Gr.A-D, zone 0				
U	CSA IS Cl.I Div.1 Gr.A-D, zone 0				
N	CSA General Purpose				
K	TIIS Ex ia IIC T6				
C	NEPSI Ex ia IIC T6/T5				
G	IECEx zone1 Ex ia IIC T6/T5				
Y	Special version				
	Cable:				
	1	20m/65ft; for HART			
	5	20m/65ft; for PROFIBUS PA/FOUNDATION Fieldbus			
	9	Special version			
		Additional option:			
		A	Basic version		
		B	Mounting bracket, pipe 1"/ 2"		
		Y	Special version		
			Marking:		
			1	Tagging (TAG)	
FHX40 –				Complete product designation	

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

8.5 Horn cover for 80 mm (3") and 100 mm (4") horn antenna

8.5.1 Technical data

Materials	
Horn cover	PTFE
Screws	316L
Holding ring	316L
Contact ring	316L
O-ring seal	Silicone
Flat seal	PTFE

Process conditions	
Vessel pressure max.	0,5 bar (7.252 psi)
Process temperature max.	130 °C (266 °F)

8.5.2 Dimensions

L00-FMR2xxxx-06-00-00-xx-002
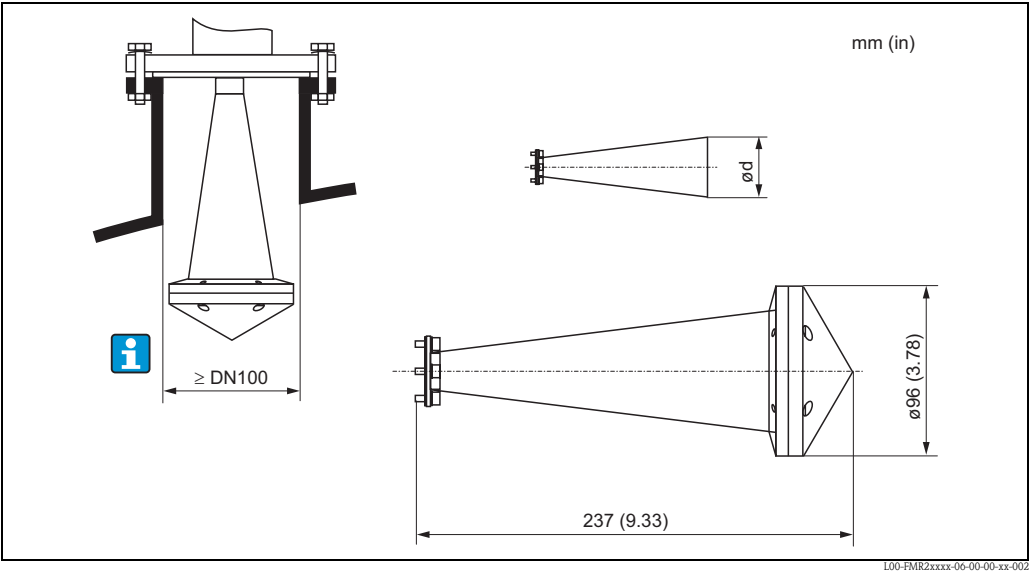
Horn cover for horn antenna 80 mm (3")
– for antenna diameter d = 75 mm (2.95 in)
– for FMR240: antenna variant G, 4
– for FMR250: antenna variant D

Note!
The horn cover is not allowed to use in areas, where explosion proofed equipment is necessary.
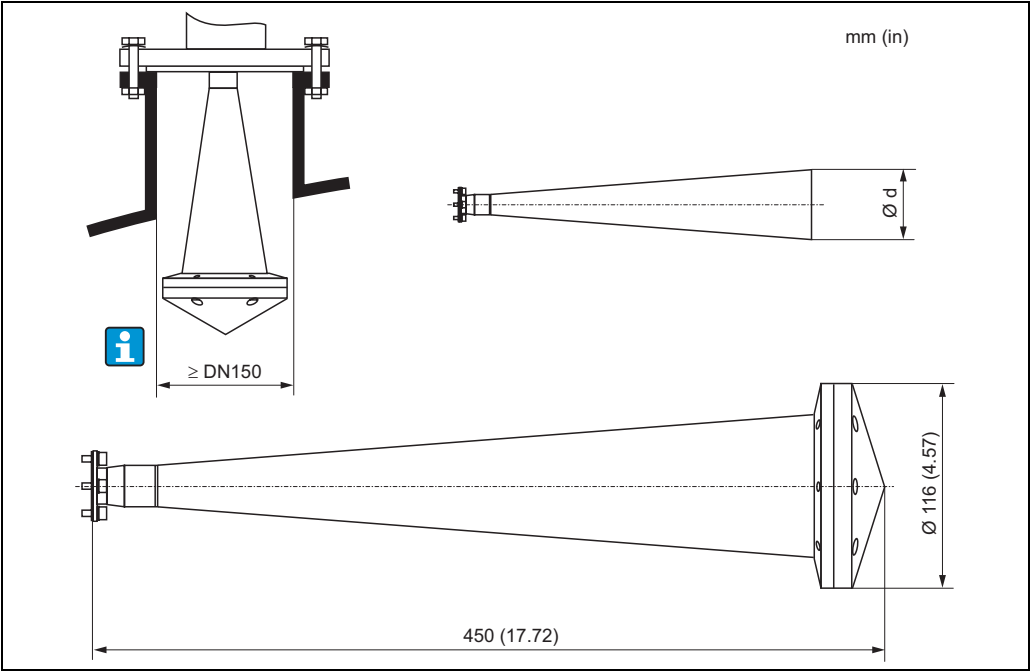
Horn cover for horn antenna 100 mm (4")
– for antenna diameter d = 95 mm (3.74 in)
– for FMR240: antenna variant H, 5
– for FMR250: antenna variant E

Note!
The horn cover is not allowed to use in areas, where explosion proofed equipment is necessary.

8.5.3   Ordering information

Horn antenna	80 mm (3")	100 mm (4")
Order code	71105890	71105889

9   Trouble-shooting

9.1   Trouble-shooting instructions

Micropilot M FMR 250 -Trouble Shooting

Instrument does not respond	→	Check voltage and compare it with the specifications on the nameplate.	Not ok →	Connect the correct voltage	→	Instrument works?	Yes → Ready
		ok ↓				No ↓	
		Check the polarity of the voltage.	Not ok →	Correct the polarity	→	Instrument works?	Yes → Ready
		ok ↓				No ↓	
		Check power connection to electronic board	Not ok →	Connect plug	→	Instrument works?	Yes → Ready
		ok ↓				No ↓	

Values on display invisible — Yes → Contrast: $\boxed{E}$ + $\boxed{+}$ — ok → Ready

No ↓ / Not ok ↓

Check plug contact of the display. — Not ok → Connect the plug correctly → Display works? — Yes → Ready
ok ↓ / No ↓

Output current between 3.6 …22mA ? — Yes → The display is possibly defective. Contact E+H Service
No ↓

Output current < 3,6 mA ? — Yes → Check cabling — Not ok → Correct the cabling → Current is ok? — Yes → Ready
ok ↓ / No ↓

Possibly defective electronics
Contact E+H Service

HART communication does not function — Yes → Is the communication resistor installed according to the OM? — Not ok → Install the resistor (see the OM) → Communication ok? — Yes → Ready
ok ↓ / No ↓

Is the Commubox connected according to the OM? — Not ok → Connect the Commubox (see the OM) → Communication ok? — Yes → Ready
ok ↓ / No ↓

Is the switch on the Commubox for selecting HART/Intensor in the correct position? — Not ok → Set the switch correctly → Communication ok? — Yes → Ready
ok ↓ / No ↓

Contact E+H Service

Communication via Service adapter FXA 193 does not function — Yes → Check configuration of COM port on PC — Not ok → Correct configuration → Communication ok? — Yes → Ready
No ↓

Contact E+H Service

Instrument measures incorrectly — Yes → Check basic setup — Not ok → Repeat basic setup → Measurement ok? — Yes → Ready
ok ↓ / No ↓

Proceed according to section 'Trouble shooting' in OM

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

9.2   System error messages

9.2.1   Current error

Errors which the Micropilot M detects during commissioning or operation are displayed:

- **Device display:**
  error symbol in the **"measured value" (000)** function
- **Device display or Endress+Hauser operating program:**
  in the **"diagnostics" (0A)** function group in the **"present error" (0A0)** function
  Only the highest priority error is displayed; in the case of multiple errors, you can scroll between the different error messages by pressing ⊕ or ⊖.
- **FOUNDATION Fieldbus:**
  – by the status of the main value in the cyclic data telegram
  – Diagnostic Block, parameter PARACTUALERROR (present error)

FMR2xx-FF-Diagnosticblock-in-NIConfig
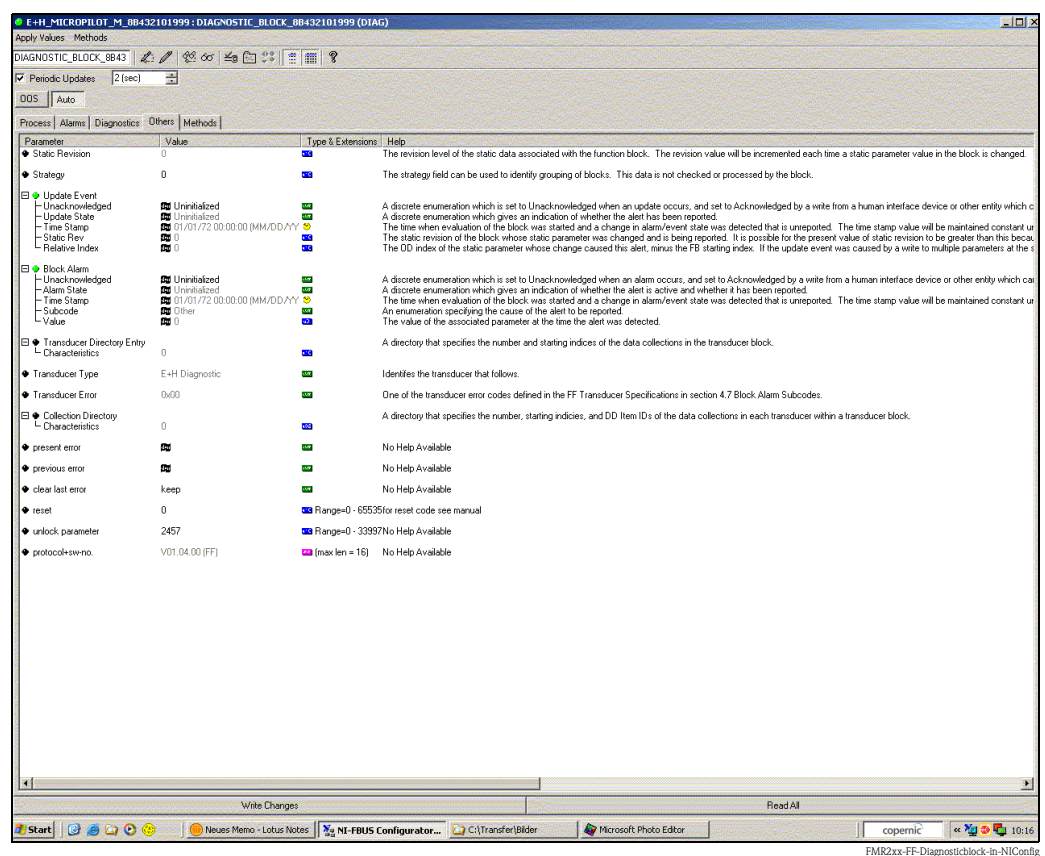
9.2.2   Last error

The last error is displayed in the **"diagnostics" (0A)** function group in the **"previous error" (0A1)** function. This display can be deleted in the **"clear last error" (0A2)** function.

9.2.3   Types of error

Type of error	Symbol	Meaning
Alarm (A)	continuous	The output signal assumes a value which can be set using the **"output on alarm" (010)** function: ■ MAX: 110% ■ MIN: –10% ■ Hold: last value is on hold ■ User-specific value
Warning (W)	flashing	The device continues measurement. An error message is displayed.
Alarm/Warning (E)	You can define whether the error should behave as an alarm or as a warning.	

9.2.4   Error codes

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; EEPROM defect	reset; avoid emc problem; if alarm prevails after reset, exchange electronics
W103	initialising – please wait	EEPROM 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; EEPROM 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	EEPROM defect	reset; if alarm prevails after reset, exchange electronics
A115	electronics defect	general hardware problem	reset; if alarm prevails after reset, exchange electronics
A116	download error repeat download	checksum of stored data not correct	restart download of data
A121	electronics defect	no factory calibration existant; EEPROM 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; EEPROM defect	reset; avoid emc problem; if alarm prevails after reset, exchange electronics

Code	Description	Possible cause	Remedy
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
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;
E671	linearisation ch1 not complete, not usable	linearisation table is in edit mode	activate linearisation table

9.2.5   Influence of the error codes on the output signal
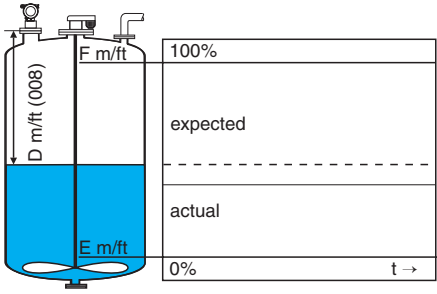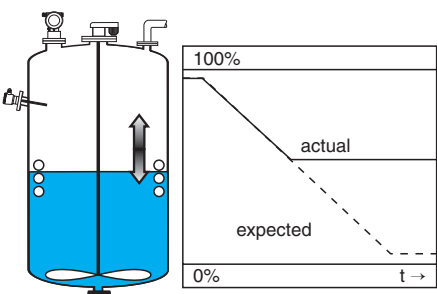
The following table describes the influence of the error codes on the status of the cyclic output values as well as on the parameters BLOCK_ERR and XD_ERROR in the Sensor Block.
The output values are linked to the following measuring values:

- Primary Value (PV): level/volume
- Secondary Value (SV): distance between sensor membrane and surface of the material measured
- Third Value (TV): sensor temperature
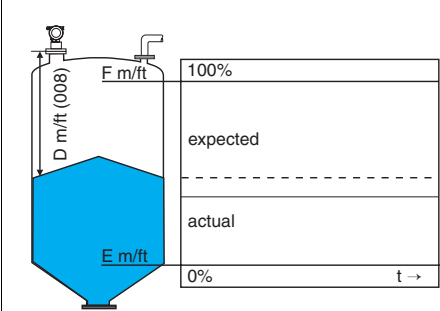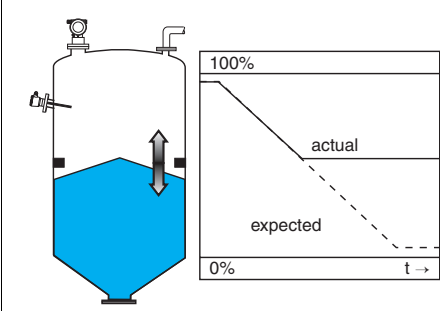
Code	PV Status SV Status	PV Substatus SV Substatus	TV Status	TV Substatus	BLOCK_ER	XD_ERROR
A102	BAD	Device Failure	BAD	Device Failure	Memory Failure/ Device needs maintenance now	Electronic Failure
W103	Uncertain	Non specific	GOOD	Non specific	Other	Unspecified Err
A106	BAD	Device Failure	BAD	Device Failure	Other	Unspecified Err
A110	BAD	Device Failure	BAD	Device Failure	Memory Failure/ Device needs maintenance	Electronic Failure
A111	BAD	Device Failure	BAD	Device Failure	Memory Failure/ Device needs maintenance now	Electronic Failure
A113	BAD	Device Failure	BAD	Device Failure	Memory Failure/ Device needs maintenance now	Electronic Failure
A114	BAD	Device Failure	BAD	Device Failure	Memory Failure/ Device needs maintenance now	Electronic Failure
A115	BAD	Device Failure	BAD	Device Failure	Device needs maintenance now	Unspecified Err
A116	BAD	Device Failure	BAD	Device Failure	Device needs maintenance now	Unspecified Err
A121	BAD	Device Failure	BAD	Device Failure	Memory Failure/ Device needs maintenance now	Electronic Failure
W153	Uncertain	Non specific	GOOD	Non specific	Power up	No Error
A155	BAD	Device Failure	BAD	Device Failure	Device needs maintenace now	Electronic Failure
A160	BAD	Device Failure	BAD	Device Failure	Memory Failure/ Device needs maintenance now	Electronic Failure
A164	BAD	Device Failure	BAD	Device Failure	Memory Failure/ Device needs maintenance now	Electronic Failure
A171	BAD	Device Failure	BAD	Device Failure	Memory Failure/ Device needs maintenance now	Electronic Failure
A231	BAD	Device Failure	BAD	Device Failure	Device needs maintenance now	Unspecified Err
A511	Uncertain	configuration error	GOOD	Non specific	Other	Configuration Error
A512	Uncertain	Non specific	GOOD	Non specific	Other	Unspecified Err
W601	Uncertain	configuration error	GOOD	Non specific	Other	Configuration Error
W611	Uncertain	configuration error	GOOD	Non specific	Other	Configuration Error
W621	Uncertain	Non specific	GOOD	Non specific	simulation active	No Error
E641 (Alarm)	BAD	Device Failure	GOOD	Non specific	Device needs maintenance now	Unspecified Err
E641 (Warning)	Uncertain	Non specific	GOOD	Non specific	Device needs maintenance now	Unspecified Err
E651 (Alarm)	BAD	Device Failure	GOOD	Non specific	Other	Unspecified Err
E651 (Warning)	Uncertain	Non specific	GOOD	Non specific	Other	Unspecified Err
A671	BAD	Device Failure	GOOD	Non specific	Configuration Error	No Error

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 (→ ▤ 76)		1. See table of error messages (→ ▤ 76)
Measured value (000) 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		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 (→ 📄 84) 5. If necessary, select a better mounting position and/or larger antenna (→ 📄 16)
During filling/ emptying the measured value jumps ownwards		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 (→ 📄 16) 4. Perhaps use a stilling well
E641 (loss of echo)		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 (→ 📄 84) 3. If necessary, select a better installation position and/or larger antenna (→ 📄 16).

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 (→ 📄 76)		1. See table of error messages (→ 📄 76)
Measured value (000) is incorrect	 L00-FMR250xx-19-00-00-en-019	Measured distance (008) OK? no ↓	yes →	1. Check empty calibr. (005) and full calibr. (006). 2. Check linearisation: → level/ullage (040) → max. scale (046) → Check table
		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) (→ 📄 84) 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 (→ 📄 84) 4. If necessary, select a better mounting position and/or larger antenna 5. If necessary, clear antenna
E641 (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 (→ 📄 84) 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 (→ 📄 84) 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 ($\rightarrow$ 🖹 10):

- 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 FieldCare.

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:
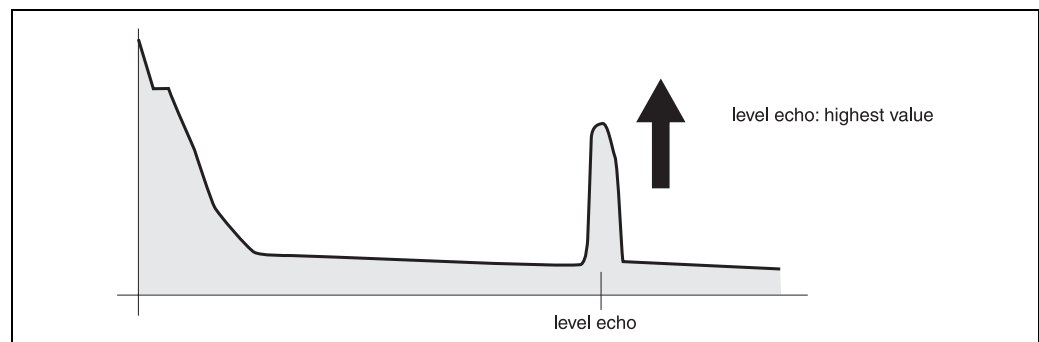
Vessel partly full, no interference echo obtained
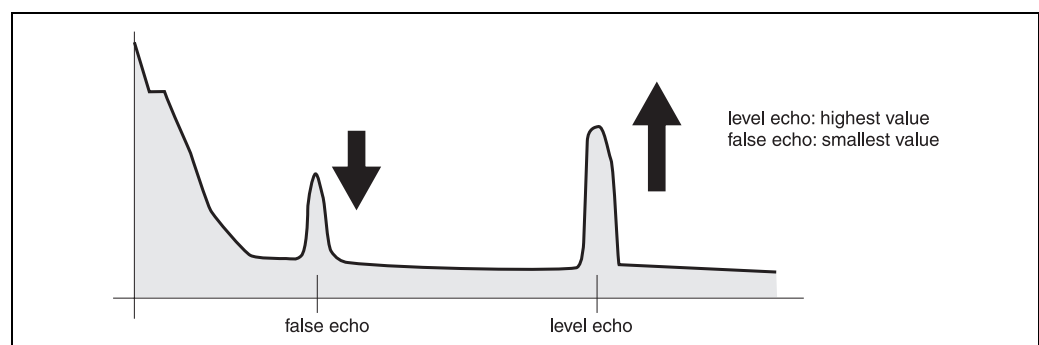
Vessel partly full, interference echo obtained:

echo: highest value

echo tank bottom

L00-FMRxxxxx-19-00-00-en-004
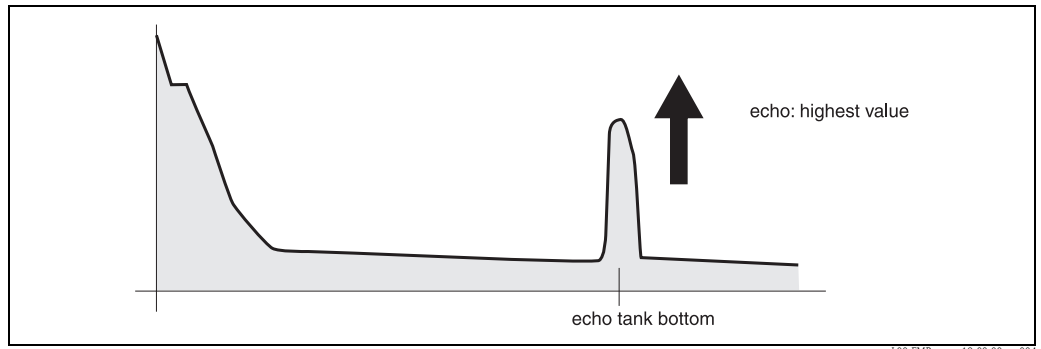
Vessel empty, no interference echo

false echo: smallest value

false echo   echo tank bottom

L00-FMRxxxxx-19-00-00-en-005
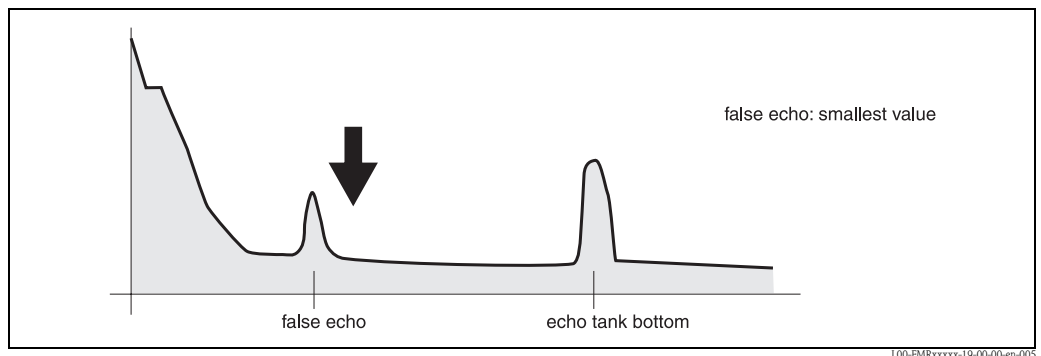
Vessel empty, interference echo obtained

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

8. Carry out tank mapping, → ▤ 54.

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

An overview of the spare parts for your device is available in the internet at www.endress.com. To obtain information on the spare parts, proceed as follows:

1. Go to "www.endress.com" and select your country.

2. Click "Instruments".
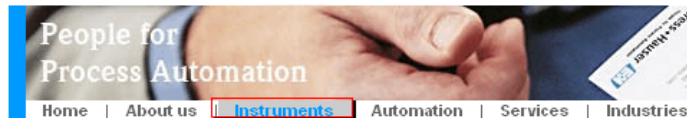
3. Enter the product name into the "product name" field.

4. Select the device.

5. Click the "Accessories/Spare parts" tab.

6. Select the required spare parts (You may also use the overview drawing on the right side of the screen.)

When ordering spare parts, always quote the serial number indicated on the nameplate. As far as necessary, the spare parts also include replacement instructions.

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 EN91/155/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	■ K-band

Transmitting power	

Distance	Average energy density in beam direction measuring range = 70 m (230 ft)
1 m (3.3 ft)	< 64 nW/cm^2
5 m (16 ft)	< 2.5 nW/cm^2

10.1.2 Output

Output signal	FOUNDATION Fieldbus

Signal Coding	Manchester Bus Powered (MBP)

Data transmission rate	31.25 KBit/s, voltage mode

Galvanic isolation	Yes (IO-Module)

Signal on alarm	Error information can be accessed via the following interfaces:
	■ Local display
	  – Error symbol
	  – Plain text display
	■ Current output, signal on error can be selected (e.g. according to NAMUR recommendation NE43)
	■ Digital interface

10.1.3   Data of the FOUNDATION Fieldbus interface

Basic Data

Device Type	100F (hex)
Device Revision	05 (hex)
DD Revision	01 (hex)
CFF Revision	01 (hex)
ITK Version	5.0
ITK–Certification Driver–No.	IT042000
Link Master (LAS) cabable	yes
Link Master / Basic Device selectable	yes; Default: Basic Device
Number VCRs	24
Number of Link–Objects in VFD	24

Virtual communication references (VCRs)

Permanent Entries	1
Client VCRs	0
Server VCRs	24
Source VCRs	23
Sink VCRs	0
Subscriber VCRs	23
Publisher VCRs	23

Link Settings

Slot time	4
Min. Inter PDU delay	4
Max. response delay	10

Transducer Blocks

Block	Content	Output values
Sensor Block	contains all parameters related to the mesurement	■ level or volume[1] (channel 1) ■ distance (channel 2)
Diagnsotic Block	contains diagnostic information	no output values
Display Block	contains parameters to configure the local display	no output values

1)   je nach Konfiguration des Sensor–Blocks

Function Blocks

Block	Content	Execution time	Functionality
Resource Block	The Resource Block contains all the data that uniquely identifies the field device. It is an electronic version of a nameplate of the device.		enhanced
Analog Input Block 1 Analog Input Block 2	The AI block takes the manufacturer's input data, selected by channel number, and makes it available to other function blocks at its output.	30 ms	standard
PID Block	The PID block serves as proportional-integral-derivative controller and is used almost universally to do closed-loop-control in the field including cascade and feedforward.	80 ms	standard
Arithmetic Block	This block is designed to permit simple use of popular measurement math functions. The user does not have to know how to write equations. The math algorithm is selected by name, chosen by the user for the function to be done.	50 ms	standard
Input Selector Block	The input selector block provides selection of up to four inputs and generates an output based on the configured action. This block normally receives its inputs from AI blocks. The block performs maximum, minimum, middle, average and 'first good' signal selection.	30 ms	standard
Signal Characterizer Block	The signal characterizer block has two sections, each with an output that is a non-linear function of the respective input. The non-linear function is determined by a single look-up table with 21 arbitrary x-y pairs.	40 ms	standard
Integrator Block	The Integrator Function Block integrates a variable as a function of the time or accumulates the counts from a Pulse Input block. The block may be used as a totalizer that counts up until reset or as a batch totalizer that has a setpoint, where the integrated or accumulated value is compared to pre-trip and trip settings, generating discrete signals when these settings are reached.	60 ms	standard

10.1.4   Auxiliary energy

Terminals	Cable cross-section: 0.5 to 2.5 mm² (20 to 14 AWG)

Cable entry	■ Cable gland M20x1.5 (recommended cable diameter 6 to 10 mm (0.24 to 0.39 in)) ■ Cable entry G½ or ½NPT ■ 7/8" Foundation Fieldbus plug

Supply voltage	9 V to 32 V (Ex) [4] 9 V to 30 V (non Ex) max. voltage 35 V

Lift-off voltage	9 V

Polarity sensitive	No

FISCO

U_i	17,5 V
I_i	500 mA; with surge arrester 273 mA
P_i	5,5 W; with surge arrester 1,2 W
C_i	5 nF
L_i	0,01 mH

FNICO compliant	Yes

Basic current	15 mA

In-rush current	≤ 15 mA

Error current	0 mA

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[4]   There may be additional restrictions for devices with an explosion protection certificate. Refer to the notes in the appropriate safety instructions (XA).

10.1.5   Performance characteristics

Reference operating conditions	■ temperature = +20 °C ±5 °C (+68 °F ±41 °F) ■ pressure = 1013 mbar abs. ±20 mbar (15 psi ±0.29 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 (3.3 ft): ±30 mm (1.18 in) ■ ex 1 m (3.3 ft): ±15 mm (0.59 in) (or 0.04% of measuring range, whatever is larger)
Resolution	Digital: 1 mm (0.04 in) / 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 EN61298-3: ■ digital output FOUNDATION Fieldbus: – average T_K: 5 mm (0.2 in) /10 K, max. 15 mm (0.59 in) over the entire temperature range –40 °C to +80 °C (-40 °F to +176 °F).

10.1.6   Operating conditions: Environment

Ambient temperature range	Ambient temperature for the transmitter: -40 °C to +80 °C (-40 °F to +176 °F) or –50 °C to +80 °C (-58 °F to +176 °F). The functionality of the LCD display may be limited for temperatures Ta < -20 °C (-4°F) and Ta > +60 °C (140 °F). A weather protection cover should be used for outdoor operation if the instrument is exposed to direct sunlight.
Storage temperature	–40 °C to +80 °C (-40 °F to +176 °F) or –50 °C to +80 °C (-58 °F to +176 °F).
Climate class	DIN EN 60068-2-38 (test Z/AD)
Vibration resistance	DIN EN 60068-2-64 / IEC 68-2-64: 20 to 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	Electromagnetic compatibility in accordance with all the relevant requirements of the EN61326 series and NAMUR recommendation (NE21). For details refer to the Declaration of Conformity. Maximum deviation < 0.5 % of the span.

10.1.7 Operating conditions: Process

Process temperature range / Process pressure limits

Note!
The specific range may be reduced by the selected process condition. The pressure rating (PN) specified on the flanges refers to a reference temperature of 20 °C (68 °F), for ASME flanges to 100 °F. Observe pressure temperature dependency.
The pressure values permitted at higher temperatures can be found in the following standards:

- EN1092-1: 2001 Tab.18
  With regard to their temperature stability properties, the materials 1.4404 and 1.4435 are grouped under 13E0 in EN1092-1 Tab.18. The chemical composition of the two materials can be identical.
- ASME B16.5a – 1998 Tab. 2–2.2 F316
- ASME B16.5a – 1998 Tab. 2.3.8 N10276
- JIS B 2220

Feature "20 Antenna:"			Seal	Temperature	Pressure [1]	Wetted parts
Type	Option	Size				
Horn	**4** **5** **D** **E**	80 mm (3") 100 mm (4") 80 mm (3") 100 mm (4")	FKM Viton GLT	–40 °C to +200 °C (–40 °F to +392 °F)	–1 bar to 16 bar (–14.5 psi to 232 psi)	PEEK, seal, 316L/1.4404/1.4435
Parabolic	**G** **H**	200 mm (8") 250 mm (10")	FKM Viton GLT	–40 °C to +200 °C (–40 °F to +392 °F)	–1 bar to 16 bar (–14.5 psi to 232 psi)	PTFE, seal, 316L/1.4404/1.4435

↑   Ordering information, → 🖹 6

1)   Endress+Hauser UNI flange: –1 bar to +1 bar (–14.5 psi to +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: $\varepsilon r \geq 1.4$)

10.1.8 Mechanical construction

Weight	▪ F12/T12 housing: approx 6 kg (13.32 lbs) + weight of flange ▪ F23 housing: approx 9,4 kg (20.73 lbs) + weight of flange

Material (not in contact with process)	*Materials of T12 and F12 housing (seawater-resistant, powder-coated)*

L00-x12xxxx-16-00-00-en-001
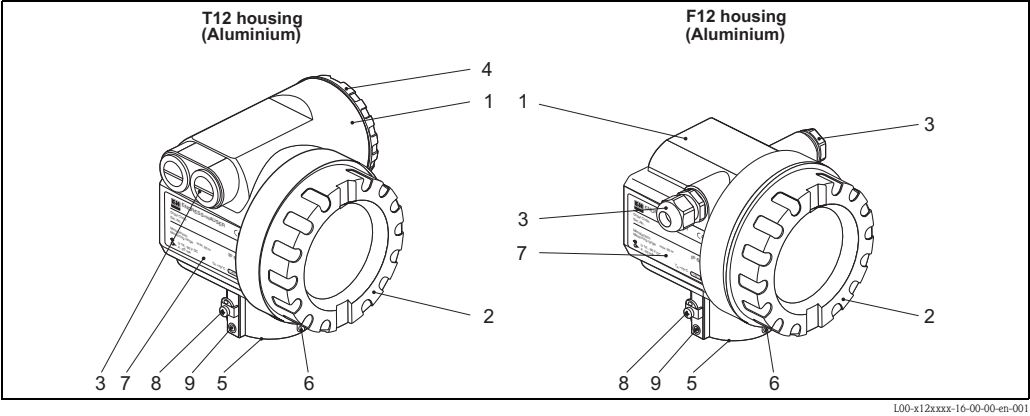
Pos.	Part	Material	
1	T12 and F12 housing	AlSi10Mg	
2	Cover (Display)	AlSi10Mg	
	Sealing	Fa. SHS: EPDM 70pW FKN	
	Window	ESG–K–Glass (Toughened safety glass)	
	Sealing of the glass	Silicone sealing compound Gomastit 402	
3	Sealing	Fa. SHS: EPDM 70 pW FKN	Trelleborg: EPDM E7502
	Cable gland	Polyamid (PA), CuZn nickel–plated	
	Plug	PBT–GF30	1.0718 galvanized
		PE	3.1655
	Adapter	316L (1.4435)	AlMgSiPb (anodized)
4	Cover (Connection compartment)	AlSi10Mg	
	Sealing	Fa. SHS: EPDM 70pW FKN	Trelleborg: EPDM E7502/E7515
	Clamp	Screws: A4; Clamp: Ms nickel-plated; Spring washer: A4	
5	Sealing ring	Fa. SHS: EPDM 70pW FKN	Trelleborg: EPDM E7502/E7515
6	Retaining ring for tag	VA	
	Rope	VA	
	Crimp sleeve	Aluminium	
7	Nameplate	1.4301	
	Groove pin	A2	
8	Ground terminal:	Screws: A2; Spring washer: A4; Clamp: 1.4301 Holder: 1.4310	
9	Screws	A2-70	

Materials of F23 housing (corrosion-resistant)
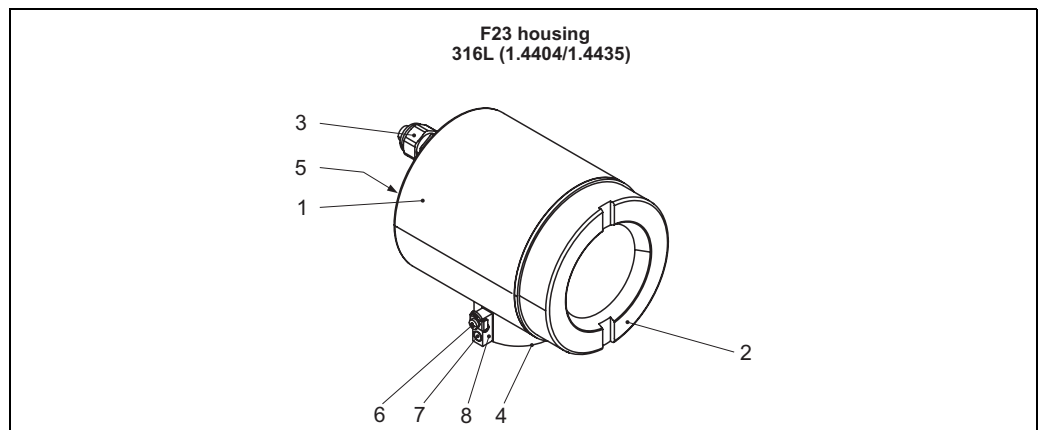
L00-x12xxxx-16-00-00-en-001

Pos.	Part	Material	
1	F23 housing	Housing body: 1.4404; Sensor neck: 1.4435; earth connection block: 1.4435	
2	Cover	1.4404	
	Sealing	Fa. SHS: EPDM 70pW FKN	
	Window	ESG–K–Glass (Toughened safety glass)	
	Sealing of the glass	Silicone sealing compound Gomastit 402	
3	Sealing	Fa. SHS: EPDM 70pW FKN	Trelleborg: EPDM E7502
	Cable gland	Polyamid (PA), CuZn nickel-plated	
	Plug	PBT–GF30	1.0718 galvanized
		PE	3.1655
	Adapter	316L (1.4435)	
4	Sealing ring	Fa. SHS: EPDM 70pW FKN	Trelleborg: EPDM E7502
5	Nameplate	1.4301	
6	Grounding terminal:	Screws: A2; Spring washer: A4; Clamp: 1.4301; Holder: 1.4310	
7	Screw	A2-70	
8	Retaining ring for tag	VA	
	Rope	VA	
	Crimp sleeve	Aluminium	

Material
(in contact with process)

L00-FMR250xx-16-00-00-en-001
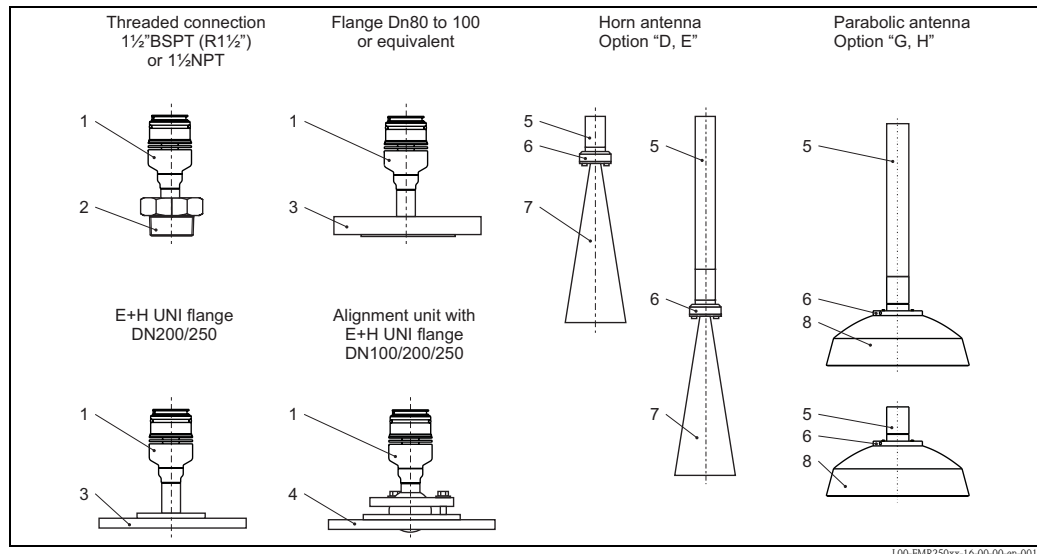
Pos.	Part	Material	
1	Adapter	316L (1.4404)	
	Plug	A4	316L (1.4404)
	Adapter (G → NPT)	316L (1.4404)	
	Sealing	Viton	
2	Process connection	R1½": 316L (1.4404)	1½" NPT: 316L (1.4404/1.4435)
3	Flange	316L (1.4404 / 1.4435)	
	Adapter	316L (1.4404)	
4	Flange	316L (1.4404)	
	Ball	316L (1.4404)	
	Screws	A2	
	Spring washer	1.4310	
	Jammes flange	316L (1.4404)	
	Adapter	316L (1.4404)	
	Sealing	Viton	
5	Pipe	316L (1.4404)	
6	Parts for process separation	316L (1.4404)	
	Adapter Horn/Parabolic	316L (1.4404)	
7	Horn	316L (1.4404)	
	Screws	A4	
8	Parabolic reflector	316L (1.4404)	
	Screws	A4	

Flange

Endress+Hauser supplies DIN/EN flanges made of stainless steel according to AISI 316L (DIN/EN material number 1.4404 or 1.4435). With regard to their temperature stability properties, the materials 1.4404 and 1.4435 are grouped under 13E0 in EN1092-1 Tab. 18. The chemical composition of the two materials can be identical.

10.1.9 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-X** EMC product family standard for electrical equipment for measurement, control and laboratory use. **NAMUR** User Association for Automation in Process Industries.

Ex approval

Correlation of safety instructions (XA) and certificates (ZD, ZE) to the instrument:

Feature		Variant	ZD021F	ZD209F	ZD208F	ZD171F	ZD170F	ZD169F	ZD168F	XA448F	XA447F	XA446F	XA445F	XA345F	XA344F	XA343F	XA342F	XA315F	XA314F	XA313F	XA312F	XA233F
10 Approval:	Non-hazardous area	A																				
	ATEX II 1/2GD Ex ia IIC T6, Alu blind cover	B														X				X		
	ATEX II 1/2G Ex ia IIC T6, ATEX II 1/3D	C														X				X		
	ATEX II 1/2D, Alu blind cover	D													X				X			
	ATEX II 1/3D	E													X				X			
	ATEX II 3G Ex nA II T6	G																				X
	NEPSI Ex ia IIC T6	I									X	X										
	NEPSI Ex d(ia)ia IIC T6	J								X												
	TIIS Ex d (ia) IIC T3	L																				
	CSA General Purpose	N																				
	NEPSI DIP	Q											X									
	FM IS Cl.I,II,III Div.1 Gr.A-G, zone 0, 1, 2	S	X		X				X													
	FM XP Cl.I,II,III Div.1 Gr.A-G, zone 1, 2	T					X															
	CSA IS Cl.I,II,III Div.1 Gr.A-G, zone 0, 1, 2	U		X		X																
	CSA XP Cl.I,II,III Div.1 Gr.A-G, zone 1, 2	V			X																	
	Special version	Y																				
	ATEX II 1/2G Ex ia IIC T6	1															X				X	
	ATEX II 1/2G Ex d (ia) IIC T6	4														X				X		
60 Output; Operation:	4-20mA SIL HART, 4-line display VU331[1]	A			X	X	X	X	X			X	X					X	X	X	X	X
	4-20mA SIL HART, w/o display[2]	B			X	X	X	X	X			X	X					X	X	X	X	X
	PROFIBUS PA, 4-line display VU331[1]	C	X	X	X	X		X			X	X	X		X	X	X					X
	PROFIBUS PA, w/o display[2]	D	X	X	X	X		X			X	X	X		X	X	X					X
	FOUNDATION Fieldbus, 4-line display[1]	E	X	X	X	X		X			X	X	X		X	X	X					X
	FOUNDATION Fieldbus, w/o display[2]	F	X	X	X	X		X			X	X	X		X	X	X					X
	4-20mA SIL HART, prepared for FHX40	K				X		X				X	X					X		X	X	X
	PROFIBUS PA, prepared for FHX40	L	X	X	X							X	X		X		X	X				X
	FOUNDATION Fieldbus, prepared for FHX40	M	X	X	X							X	X		X		X	X				
	Special version	Y																				
70 Housing:	F12 Alu, coated IP65 NEMA4X	A	X	X	X		X		X	X	X	X	X	X	X	X				X	X	X
	F23 316L IP65 NEMA4X	B	X	X	X		X		X	X	X	X	X	X	X	X				X	X	X
	T12 Alu, coated IP65 NEMA4X[3]	C				X		X		X		X		X	X			X	X			
	T12 Alu, coated IP65 NEMA4X + OVP[3,4]	D	X	X	X		X		X	X	X	X	X	X	X	X				X	X	X
	Special version	Y																				

1) Envelope curve display on site.
2) Via communication.
3) Separate conn. compartment.
4) OVP = overvoltage protection.

10.1.10 Supplementary Documentation

Supplementary
Documentation

This supplementary documentation can be found on our product pages on www.endress.com.
- Technical Information (TI390F/00/EN)
- Operating Instructions "Description of instrument functions" (BA291F/00/EN)
- Brief operating instructions (KA1017F/00/EN)

11 Appendix

11.1 Operating menu FOUNDATION Fieldbus

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	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		
	level DU 040	clear table			
	ullage DU				

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		
	common		dist. too big		
	extended map..			pres. Map dist 054	cust. Tank map 055
				is displayed	**inactive**
					active
					reset

output 06

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	device tag 0C0	device id 0C1	protocol+sw-no. 0C2	dev. rev. 0C3	dd rev. 0C4

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

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

pipe diameter 007
enter value

safety distance 015	in safety dist. 016	ackn. alarm 017
from blocking distance **default: 0.1m**	alarm **warning** self holding	**no** yes

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 measured level	length FAR10 - for FMR230 only	enter value **default: 5 s**	is displayed

simulation 065
sim. off sim. level sim. volume sim. current

simulation value 066

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

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

distance unit 0C5	download mode 0C8

Return to Group Selection

L00-FMR250xx-19-00-02-en-038

11.2   Block model of the Micropilot M

The Micropilot M contains the follwoing blocks:

- **Resource Block (RB2)**
  see Operating Instructions BA013S/04/EN: "FOUNDATION Fieldbus – Overview"
- **Sensor Block (TBRL)**
  contains the parameters relevant to the measurement
- **Diagnostic Block (DIAG)**
  contains the diagnostic parameters of the Micropilot M
- **Display Block (DISP)**
  contains the configuration parameters for the display module
- **Analog-Input-Block 1 bzw. 2 (AI)**
  scale the signal of the Transducer Block and transmit them to the PLCS
- **PID Block (PID)**
  see Operating Instructions BA013S/04/EN: "FOUNDATION Fieldbus – Overview"
- **Arithmetic Block (AR)**
  see Operating Instructions BA013S/04/EN: "FOUNDATION Fieldbus – Overview"
- **Input Selector Block (IS)**
 see Operating Instructions BA013S/04/EN: "FOUNDATION Fieldbus – Overview"
- **Signal Characterizer Block (SC)**
  see Operating Instructions BA013S/04/EN: "FOUNDATION Fieldbus – Overview"
- **Integrator Block (IT)**
  see Operating Instructions BA013S/04/EN: "FOUNDATION Fieldbus – Overview"

11.2.1   Default Block configuration

The input and output variables of the blocks can be interconnected by a configuration tool (e.g. NI-Fieldbus configurator). The figure below shows, how these connections are set by default.

L00-FMxxxxxx-02-00-00-en-002
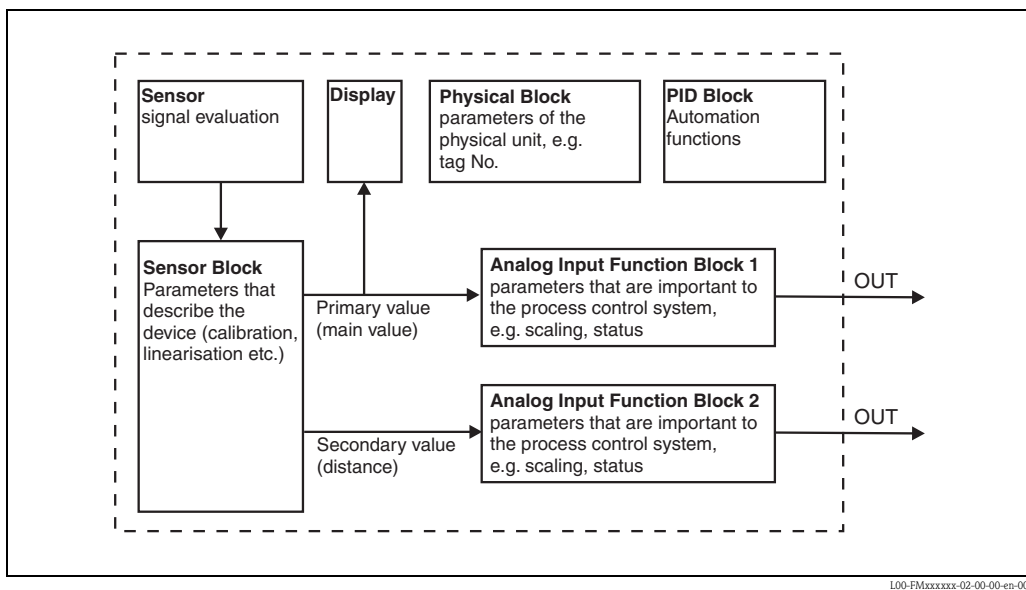
11.3 Resource block

The resource block contains the parameters used to describe physical resources of the device. It has no linkable inputs or outputs.

11.3.1 Operation

The resource block is opened by a click on the resource line.
If the NI-FBUS Configurator is being used, a series of file tabs appears on the screen. The files can be opened to view and/or edit the parameters in the following table. A short description of the parameter function appears on the side of the screen. A change in the parameter is stored by pressing the WRITE CHANGES button when the block is out of service. Press the READ ALL button to check the values stored in the device.

11.3.2 Parameters

Parameter	Description
TAG_DESC	User description of the intended application of the block.
MODE_BLK	Lists the actual, target, permitted and normal operating modes of the block. – Target: changes the operating mode of the block – Actual: indicates the current operating mode of the block – Permitted: states which operating modes are allowed – Normal: indicates the normal operating mode of the block The possible operating modes of the resources block are: – AUTO: the block is operating as normal – OOS: the block is out of service. If the resource block is out of service, then all blocks within the device (resource) are forced into the same status.
RS_STATE	Indicates the state of the resource block application state machine – On-line: block in AUTO mode – Standby: block in OOS mode
WRITE_LOCK	Indicates the status of DIP-switch WP – LOCKED: device data can be modified – NOT LOCKED: device data can be modified
RESTART	Allows a manual restart: – UNINITIALISED: no status – RUN: normal operational status – RESOURCE: resets the resource block parameters – **DEFAULTS: Resets all FOUNDATION Fieldbus parameters within the device, but not the manufacturer specific parameters.** – PROCESSOR: make a warm start of the processor
BLOCK_ERROR	Shows error status of software and hardware components – Out-of-Service: the block is in OOS mode – Simulation active: shows the setting of DIP-switch SIM
BLOCK_ALM	Shows any configuration, hardware, connection and system problems in the lock. The cause of the alert is to be seen in the subcode field.

The function of the resource block parameters not described here can can be taken from the FOUNDATION Fieldbus specification, see "**www.fieldbus.org**".

11.4   Sensor block

The Sensor block contains the parameters required to calibrate the device. These parameters can also be addressed by using the display module. The calibration of the device, → 🗎 43ff..

11.4.1   Operation

Parameter changes from the tool are made off-line while the device is operating. The changes are downloaded by first setting MODE_BLK = OOS then pressing the WRITE CHANGES button. Press the READ ALL button to check the values stored in the device. Normally operation is resumed as soon as MODE–BLK is set to AUTO.

11.4.2   Block administration parameters

Parameter	Description
MODE_BLK	See description in Resource block. The possible operating modes of the Sensor block are: – AUTO: the block is operating as normal – OOS: the block is out of service.
TAG_DESC	User description of the intended application of the block.
BLOCK_ERROR	Shows error status of software and hardware components – Out-of-Service: the block is in OOS mode

11.4.3   Output values

Parameter	Description
PRIMARY_VALUE	Main value (level or volume).
SECONDARY_VALUE	Measured distance.

11.4.4   Configuration parameters

The Sensor block also contains the configuration parameters, which are used to commission and calibrate the instrument. They are identical to the functions of the operating menu, except for the service parameters which are not accessible on the bus. Thus, the calibration procedure via the display module (→ 🗎 47) is equally valid for a calibration via a network configuration tool.
A complete list of the configuration parameters can be found in the "BA291F – Description of Instrument Functions".

11.4.5   Methods

The FOUNDATION Fieldbus specification provides for the use of so-called methods to simplify the operation of the device. A method is an interactive sequence of steps that must be followed in order to obtain a particular function from the device.

The Micropilot M has got the following methods:
- Basic setup
- Safety settings
- Acknowledge alarm
- Linearisation
- Extended calibration
- Output
- System parameters
- Lock TB Manufacturer parameters

Most of these methods are identical to the respective function group in the operating menu. A detailed description of them can be found in the "BA291F – Description of Instrument Functions".

11.4.6   Parameter list of the Micropilot M Sensor Block

Parameter	Position Indicator	rel. Index	Variable Name	Size [bytes]	Type	Access	Storage Class	Changeable in Mode
measured value	000	18	PARMEASUREDVALUE	4	FloatingPoint	RO	dynamic	Auto, OOS
media type	001	19	PARMEDIATYPE	1	Unsigned8	RW	static	OOS
vessel / silo	00A	20	PARVESSELSILO	1	Unsigned8	RW	static	OOS
medium property	00B	21	PARDIELECTRICCONSTANT	1	Unsigned8	RW	static	OOS
process prpert.	00C	22	PARPROCESSPROPERTIES	1	Unsigned8	RW	static	OOS
tank shape	002	23	PARTANKSHAPE	1	Unsigned8	RW	static	OOS
medium property	003	24	PARDIELECTRICCONSTANT	1	Unsigned8	RW	static	OOS
process cond.	004	25	PARPROCESSCONDITION	1	Unsigned8	RW	static	OOS
empty calibr.	005	26	PAREMPTYCALIBRATION	4	FloatingPoint	RW	static	OOS
full calibr.	006	27	PARFULLCALIBRATION	4	FloatingPoint	RW	static	OOS
pipe diameter	007	28	PARTUBEDIAMETER	4	FloatingPoint	RW	static	OOS
echo quality	056	29	PARECHOQUALITY	1	Unsigned8	RO	dynamic	Auto, OOS
check distance	051	30	PARCHECKDISTANCE	1	Unsigned8	RW	dynamic	OOS
range of mapping	052	31	PARSUPPRESSIONDISTANCE	4	FloatingPoint	RW	dynamic	OOS
start mapping	053	32	PARSTARTMAPPINGRECORD	1	Unsigned8	RW	dynamic	OOS
pres. map dist.	054	33	PARPRESMAPRANGE	4	FloatingPoint	RO	dynamic	Auto, OOS
cust. tank map	055	34	PARCUSTTANKMAP	1	Unsigned8	RW	dynamic	OOS
offset	057	35	PAROFFSETOFMEASUREDDISTANCE	4	FloatingPoint	RW	static	OOS
antenna extens.	0C9	36	PARANTENNAEXTENSIONLENGTH	4	FloatingPoint	RW	static	OOS
output damping	058	37	PAROUTPUTDAMPING	4	FloatingPoint	RW	static	Auto, OOS
blocking dist.	059	38	PARBLOCKINGDISTANCE	4	FloatingPoint	RW	static	OOS
output on alarm	010	39	PAROUTPUTONALARM	1	Unsigned8	RW	static	OOS
outp. echo loss	012	40	PARREACTIONLOSTECHO	1	Unsigned8	RW	static	OOS
ramp %span/min	013	41	PARRAMPINPERCENTPERMIN	4	FloatingPoint	RW	static	OOS
delay time	014	42	PARDELAYTIMEONLOSTECHO	2	Unsigned16	RW	static	OOS
safety distance	015	43	PARLEVELWITHINSAFETYDISTANCE	4	FloatingPoint	RW	static	OOS
in safety dist.	016	44	PARINSAFETYDISTANCE	1	Unsigned8	RW	static	OOS

Parameter	Position Indicator	rel. Index	Variable Name	Size [bytes]	Type	Access	Storage Class	Changeable in Mode
ackn. alarm	017	45	PARACKNOWLEDGEALARM	1	Unsigned8	RW	dynamic	Auto, OOS
level/ullage	040	46	PARLEVELULLAGEMODE	1	Unsigned8	RW	static	OOS
linearisation	041	47	PARLINEARISATION	1	Unsigned8	RW	static	OOS
customer unit	042	48	PARCUSTOMERUNIT	2	Unsigned16	RW	static	OOS
table no.	043	49	PARTABLENUMBER	1	Unsigned8	RW	non-vol.	Auto, OOS
input level	044	50	PARINPUTLEVELHALFAUTOMATIC	4	FloatingPoint	RO	dynamic	Auto, OOS
input level	044	51	PARINPUTLEVELMANUAL	4	FloatingPoint	RW	dynamic	OOS
input volume	045	52	PARINPUTVOLUME	4	FloatingPoint	RW	dynamic	OOS
max. scale	046	53	PARMAXVOLUME	4	FloatingPoint	RW	static	OOS
diameter vessel	047	54	PARCYLINDERVESSEL	4	FloatingPoint	RW	static	OOS
simulation	065	55	PARSIMULATION	1	Unsigned8	RW	dynamic	OOS
simulation value	066	56	PARSIMULATIONVALUELEVEL	4	FloatingPoint	RW	dynamic	Auto, OOS
simulation value	066	57	PARSIMULATIONVALUEVOLUME	4	FloatingPoint	RW	dynamic	Auto, OOS
unlock parameter	0A4	58	PAROPERATIONCODE	2	Unsigned16	RW	non-vol.	OOS
measured dist.	0A5	59	PARMEASUREDDISTANCE	4	FloatingPoint	RO	dynamic	Auto, OOS
measured level	0A6	60	PARMEASUREDLEVEL	4	FloatingPoint	RO	dynamic	Auto, OOS
detection window	0A7	61	PARDETECTIONWINDOW	1	Unsigned8	RW	dynamic	OOS
application par.	0A8	62	PARAPPLICATIONPARAMETER	1	Unsigned8	RO	dynamic	Auto, OOS
distance unit	0C5	63	PARDISTANCEUNIT	2	Unsigned16	RW	static	OOS
download mode	0C8	64	PARDOWNLOADMODE	1	Unsigned8	RW	static	OOS
max meas dist	0D84	65	PARABSMAXMESSDIST	4	FloatingPoint	RO	dynamic	Auto, OOS
max sample dist.	0D88	66	PAREDITRANGEMAXSAMPLEDIST	4	FloatingPoint	RO	dynamic	Auto, OOS

11.5   Diagnostic Block

11.5.1   Operation

The diagnostic block contains the error messages of the instrument. These parameters can also be addressed by using the display module. The diagnostic block is opened by clicking on the "diagnostic" line. Parameter changes from the tool are made off-line while the device is operating. The changes are downloaded by first setting MODE_BLK = OOS then pressing the WRITE CHANGES button. Press the READ ALL button to check the values stored in the device. In order to resume operation, change MODE_BLK to AUTO[5].

11.5.2   Block administration parameters

Parameter	Description
MODE_BLK	See description in Resource block. The possible operating modes of the Sensor block are: – AUTO: the block is operating as normal. – OOS: the block is out of service.
TAG_DESC	User description of the intended application of the block.
BLOCK_ERROR	Shows the error status associated with the block components – Out-of-Service: the block is in OOS mode.

11.5.3   Methods

The FOUNDATION Fieldbus specification provides for the use of so-called methods to simplify the operation of the device. A method is an interactive sequence of steps that must be followed in order to obtain a particular function from the device.

The Micropilot M has got the following methods:
- Set to customer default
- Diagnostics

Most of these methods are identical to the respective function group in the operating menu. A detailed description of them can be found in the "BA291F – Description of Instrument Functions".

11.5.4   Instrument specific parameters

Parameter	Position Indicator	rel. Index	Variable Name	Size [bytes]	Type	Access	Storage Class	Changeable in Mode
present error	0A0	13	PARACTUALERROR	2	Unsigned16	RO	dynamic	Auto, OOS
previous error	0A1	14	PARLASTERROR	2	Unsigned16	RO	non-vol.	Auto, OOS
clear last error	0A2	15	PARCLEARLASTERROR	1	Unsigned8	RW	dynamic	Auto, OOS
reset	0A3	16	PARRESET	2	Unsigned16	RW	dynamic	OOS
protocol+sw-no.	0C2	18	PARPROTSOFTVERSIONSTRING	16	VisibleString	RO	const	Auto, OOS

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5)   If MODE_BLK refuses to be changed to AUTO, an error is present. Control all parameters, perform the required changes and try again to change MODE_BLK to AUTO.

11.6 Display Block

11.6.1 Operation

The display block contains the parameters required to parametrise the display module (which is contained in the remote display and operating unit FHX40). These parameters can also be addressed by using the display module. The display block is opened by clicking on the "display" line. Parameter changes from the tool are made off-line while the device is operating. The changes are downloaded by first setting MODE_BLK = OOS then pressing the WRITE CHANGES button. Press the READ ALL button to check the values stored in the device. In order to resume operation, change MODE_BLK to AUTO [6].

11.6.2 Block administration parameters

Parameter	Description
MODE_BLK	See description in Resource block. The possible operating modes of the sensor block are: – AUTO: the block is operating as normal. – OOS: the block is out of service.
TAG_DESC	User description of the intended application of the block.
BLOCK_ERROR	Shows the error status associated with the block components – Out-of-Service: the block is in OOS mode.

11.6.3 Methods

The FOUNDATION Fieldbus specification provides for the use of so–called methods to simplify the operation of the device. A method is an interactive sequence of steps that must be followed in order to obtain a particular function from the device.

The Micropilot M has got the following methods:
▪ Display

Most of these methods are identical to the respective function group in the operating menu. A detailed description of them can be found in the "BA291F – Description of Instrument Functions".

11.6.4 Instrument specific parameters

Parameter	Position Indicator	rel. Index	Variable Name	Size [bytes]	Type	Access	Storage Class	Changeable in Mode
language	092	13	PARLANGUAGE	1	Unsigned8	RW	non-vol.	Auto, OOS
back to home	093	14	PARBACKTOHOME	2	Integer16	RW	non-vol.	Auto, OOS
format display	094	15	PARFORMATDISPLAY_FT	1	Unsigned8	RW	non-vol.	Auto, OOS
no.of decimals	095	16	PARNOOFDECIMALS	1	Unsigned8	RW	non-vol.	Auto, OOS
sep. character	096	17	PARSEPARATIONCHARACTER	1	Unsigned8	RW	non-vol.	Auto, OOS

---

[6] If MODE_BLK refuses to be changed to AUTO, an error is present. Control all parameters, perform the required changes and try again to change MODE_BLK to AUTO.

11.7 Analog input block

The analog input block conditons the signal output by the Sensor block andoutputs signal to the PCL or other function blocks.

L00-FMR2xxxx-05-00-00-en-008
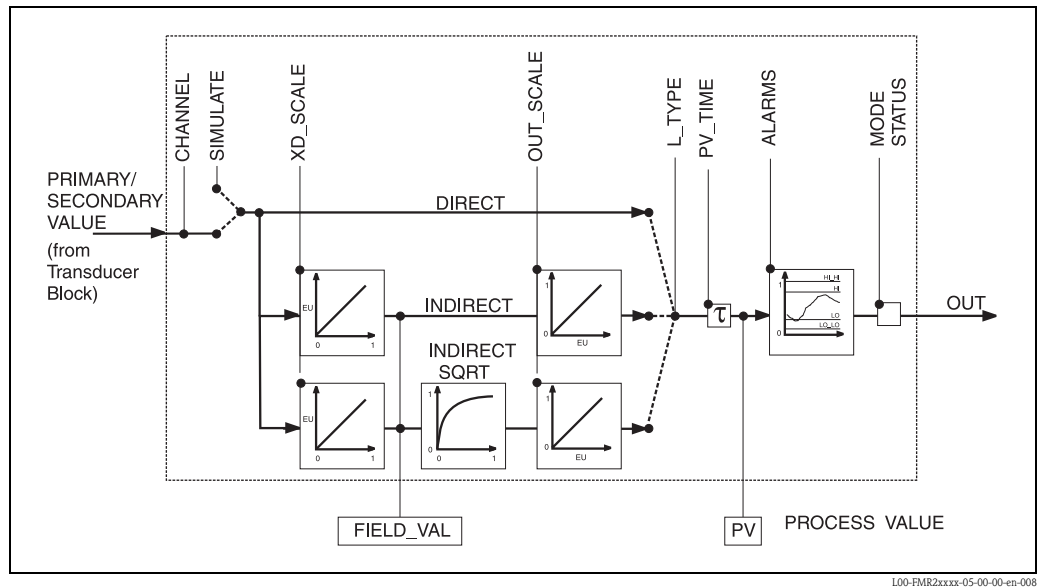
11.7.1 Operation

The resource block is opened by a click on the resource line. Parameter changes from the tool are made off-line while the device is operating. The changes are downloaded by first setting MODE_BLK = OOS then pressing the WRITE CHANGES button. Press the READ ALL button to check the values stored in the device. Normally operation is resumed as soon as MODE-BLK is set to AUTO.

11.7.2 Block administration parameters

Parameter	Description
MODE_BLK	See description in Resource block. The possible operating modes of the Sensor block are: – AUTO: the block is operating as normal – MAN: the block is operated with a manually entered primary value. – OOS: the block is out of service.
TAG_DESC	User description of the intended application of the block.
BLOCK_ERROR	Shows error status of software and hardware components – Out-of-Service: the block is in OOS mode – Simulation active: shows the setting of DIP-switch SIM. Input failure/process variable has BAD status. – configuration error

11.7.3   Output values

Parameter	Description
PV	Either the primary/secondary Sensor block value used to execute the block or a process value associated with it. Comprises value and status.
OUT	The primary value output as a result of executing the analog input block. Comprises value and status.
FIELD_VALUE	Raw value of field device in % of PV range with a status reflecting the Sensor condition before signal characterisation L_Type or filtering V_TIME. Comprises value and status.

11.7.4   Scaling parameters

Parameter	Description
CHANNEL	Selects the measured value to be input to the analogue input block – 0 = no channel defined – 1 = primary value: measured level/volume – 2 = secondary value: measured distance
XD_SCALE	Scales the Sensor block value in the required engineering units (EU).
OUT_SCALE	Scales the output value in the required engineering units (EU).
L_TYPE	Sets the linearization type: – DIRECT: the Sensor block value bypasses the scaling functions – INDIRECT:the Sensor block value is fed through the linear scaling functions – INDIRECT SQRT: the Sensor block value is fed through the square root scaling functions

The relationship between the output values and scaling paramaters for the Micropilot M is as follows:

$$\text{FIELD\_VAL} = 100 \times \frac{\text{CHANNEL\_VALUE - XD\_SCALE\_MIN}}{\text{XD\_SCALE\_MAX - XD\_SCALE\_MIN}}$$

The L_TYPE parameter influences the signal conversion:
- Direct:

$$\text{PV = CHANNEL\_VALUE}$$

- Indirect:

$$\text{PV} = \frac{\text{FIELD\_VALUE}}{100} \times (\text{OUT\_SCALE\_MAX - OUT\_SCALE\_MIN}) + \text{OUT\_SCALE\_MIN}$$

- Indirect square root:

$$\text{PV} = \sqrt{\frac{\text{FIELD\_VALUE}}{100}} \times (\text{OUT\_SCALE\_MAX - OUT\_SCALE\_MIN}) + \text{OUT\_SCALE\_MIN}$$

11.7.5   Output response parameters

Parameter	Description
LOW_CUT	Not relevant to level measurement! Determines a threshold for square root linearization below which the output value is set to zero.
PV_FTIME	Sets the time constant for the output value.

11.7.6   Alarm parameters

Parameter	Description
ACK_OPTION	Sets the way in which alarms and warnings are to be acknowledged.
ALARM_HYS	Sets the hysteresis (in output engineering units) for all configured alarms. A hysteresis of e.g. 2 % on a HI_HI_LIMIT of 95 % would cause the alarm to activate when the level reaches 95% and to deactivate when the level drops below 93 %. A hysteresis of e.g. 2 % on a LO_LO_LIMIT of 5 % would cause the alarm to activate when the level drops below 5% and to deactivate when the level rises to 7 %.
HI_HI_PRI	The priority (1 – 15) of the HI_HI alarm
HI_HI_LIM	Sets the HI_HI alarm limit in output engineering units
HI_PRI	The priority (1 – 15) of the HI alarm
HI_LIM	Sets the HI warning limit in output engineering units
LO_PRI	The priority (1 – 15) of the LO alarm
LO_LIM	Sets the LO warning limit in output engineering units
LO_LO_PRI	The priority (1 – 15) of the LO_LO alarm
LO_LO_LIM	Sets the LO_LO alarm limit in output engineering units

11.7.7   Alarm priorities

Parameter	Description
0	Alarm is suppressed
1	Recognised by the system but not reported
2	Reported to the operator, but does not require his attention
3 - 7	Advisroy alarms of increasing priority
8 - 15	Critical alarms of increasing priority

11.7.8   Alarm status

Parameter	Description
HI_HI_ALM	The status of the HI_HI alarm
HI_ALM	The status of the HI alarm
LO_ALM	The status of the LO alarm
LO_LO_ALM	The status of the LO_LO alarm

11.7.9   Simulation

The SIMULATE parameter allows the Sensor block output value to be simulated, provided simulation has also been enabled at the device DIP switch. The simulation must be enabled, a value and/or status entered and the block must be in AUTO mode. During simulation the Sensor output value is substituted by the simulated value.
A simulation is also possible by switching MODE_BLK to "MAN" and entering a value for OUT.

Parameter	Description
SIMULATE	Enables, sets and displays a simulated value, options: – enable/disable – simulated value – output value

11.8   List of start indices

The following list indicates the start indices for all blocks and objects:

Object	Start Index
Object Dictionary	298

Object	Start Index
Resource Block	400
Analog Input 1 Function Block	500
Analog Input 2 Function Block	600
PID Function Block	700
Arithmetic Function Block	800
Input Selector Function Block	900
Signal Characterizer Function Block	1000
Integrator Function Block	1100
Sensor Block	2000
Diagnostic Block	2200
Display Block	2400

Object	Start Index
View Objects Resource Block	3000
View Objects Analog Input 1 Function Block	3010
View Objects Analog Input 2 Function Block	3020
View Objects PID Function Block	3030
View Objects Arithmetic Function Block	3040
View Objects Input Selector Function Block	3050
View Objects Signal Characterizer Function Block	3060
View Objects Integrator Function Block	3070
View Objects Sensor Block	4000
View Object Diagnostic Block	4100
View Object Display Block	4200

11.9   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] _____ [mm^2/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* _____
_____

Address / *Adresse*
_____
_____

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

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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