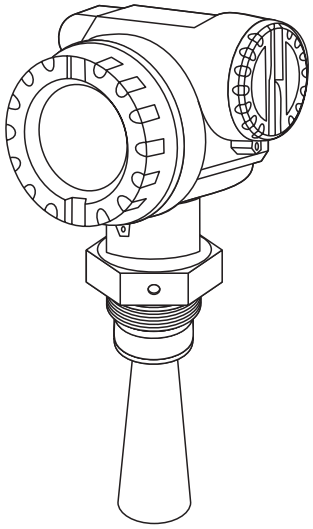
Level | Pressure | Flow | Temperature | Liquid Analysis | Registration | Systems Components | Services | Solutions

Operating Instructions

Micropilot M FMR240

Level-Radar

FOUNDATION



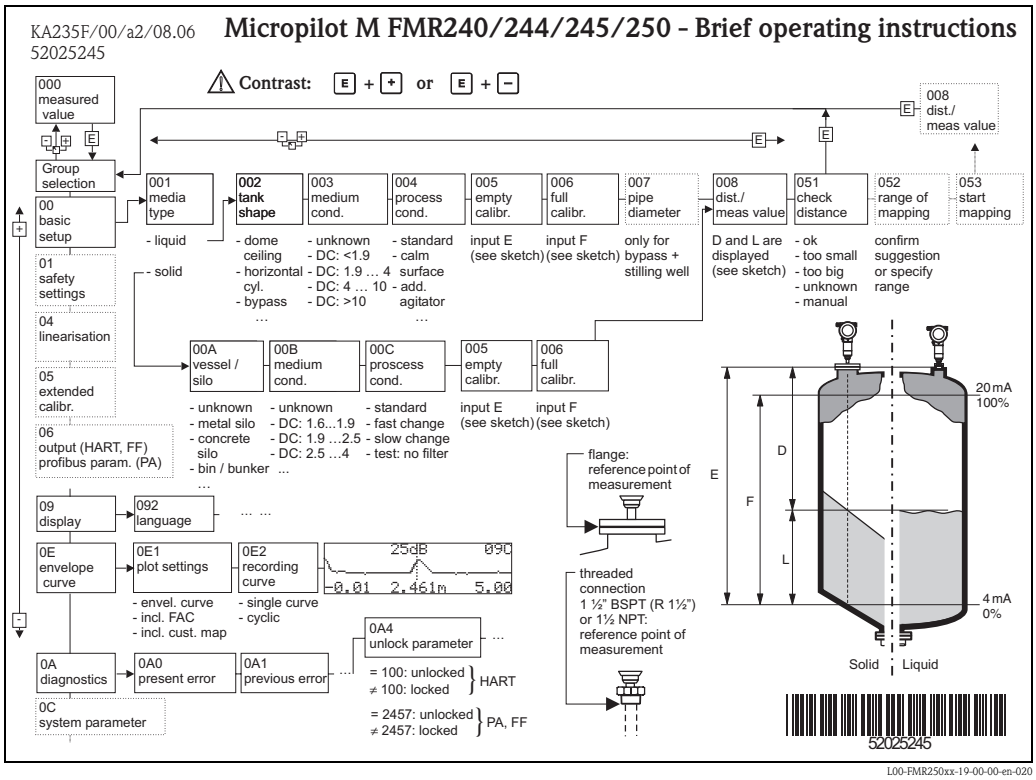
BA230F/00/EN/03.10
71112095

Valid as of software version:
01.05.00

Endress+Hauser

People for Process Automation

Brief operating instructions



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

An **overview of all device functions** can be found on → 102.

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 radar level transmitter for the continuous, contactless measurement of liquids, pastes, sludge and 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.

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 Additional documentation is mandatory.

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

1.3.1 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.
2. This device must accept any interference received, including interference that may cause undesired operation.

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

1.4 Notes on safety conventions and symbols

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

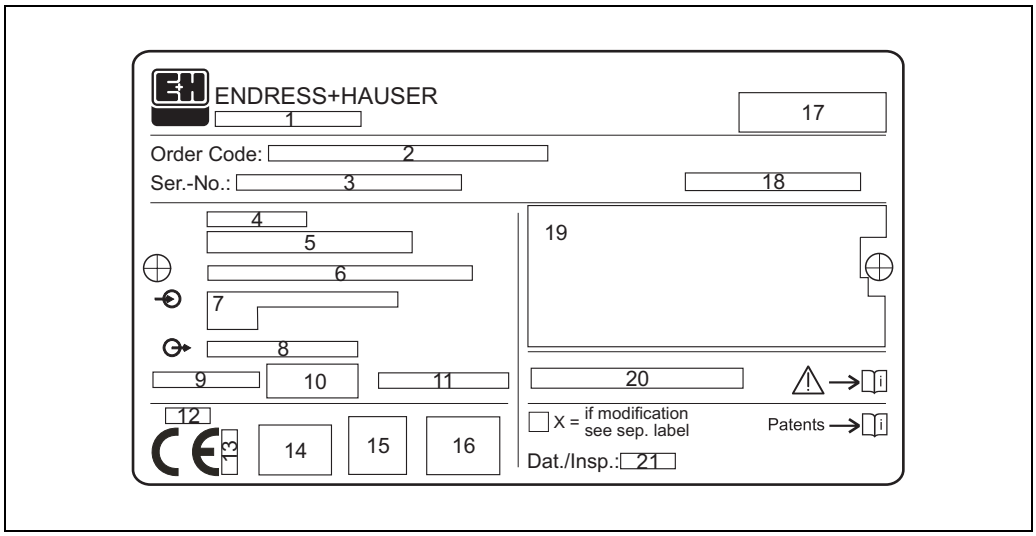
Safety conventions	
	**Warning!** A warning highlights actions or procedures which, if not performed correctly, will lead to personal injury, a safety hazard or destruction of the instrument.
	**Caution!** Caution highlights actions or procedures which, if not performed correctly, may lead to personal injury or incorrect functioning of the instrument.
	**Note!** A note highlights actions or procedures which, if not performed correctly, may indirectly affect operation or may lead to an instrument response which is not planned.
Explosion protection	
	**Device certified for use in explosion hazardous area** If the device has this symbol embossed on its name plate it can be installed in an explosion hazardous area.
	**Explosion hazardous area** Symbol used in drawings to indicate explosion hazardous areas. Devices located in and wiring entering areas with the designation “explosion hazardous areas” must conform with the stated type of protection.
	**Safe area (non-explosion hazardous area)** Symbol used in drawings to indicate, if necessary, non-explosion hazardous areas. Devices located in safe areas still require a certificate if their outputs run into explosion hazardous areas.
Electrical symbols	
	**Direct voltage** A terminal to which or from which a direct current or voltage may be applied or supplied.
	Alternating voltage A terminal to which or from which an alternating (sine-wave) current or voltage may be applied or supplied.
	**Grounded terminal** A grounded terminal, which as far as the operator is concerned, is already grounded by means of an earth grounding system.
	**Protective grounding (earth) terminal** A terminal which must be connected to earth ground prior to making any other connection to the equipment.
	**Equipotential connection (earth bonding)** A connection made to the plant grounding system which may be of type e. g. neutral star or equipotential line according to national or company practice.
	**Temperature resistance of the connection cables** States, that the connection cables must be resistant to a temperature of at least 85 °C (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
F	Non-hazardous area, WHG
1	ATEX II 1/2G EEx ia IIC T6
6	ATEX II 1/2G EEx ia IIC T6, WHG
3	ATEX II 1/2G EEx em (ia) IIC T6
8	ATEX II 1/2G EEx em (ia) IIC T6, WHG
4	ATEX II 1/2G EEx d (ia) IIC T6
B	ATEX II 1/2G, II 1/2D, Alu blind cover, ATEX II 1/2G EEx ia IIC T6, ATEX II 1/2D
H	ATEX II 1/2G EEx ia IIC T6, ATEX II 3D
G	ATEX II 3G EEx nA II T6
S	FM IS - Cl.I Div.1 Gr. A-D, zone 0, 1, 2
T	FM XP - Cl.I Div.1 Group A-D, zone 1, 2
N	CSA General Purpose
U	CSA IS - Cl.I Div.1 Group A-D, zone 0, 1, 2
V	CSA XP - Cl.I Div.1 Group A-D, zone 1, 2
L	TIIS EEx d (ia) IIC T4
D	IECEx Zone 0/1, Ex ia IIC T6
E	IECEx Zone 0/1, Ex d (ia) IIC T6
I	NEPSI Ex ia IIC T6
J	NEPSI Ex d (ia) ia IIC T6
R	NEPSI Ex nAL IIC T6
Y	Special version

20	Antenna:
E	40mm/1-1/2", gas-tight feed through
F	50mm/2", gas-tight feed through
G	80mm/3", gas-tight feed through
H	100mm/4", gas-tight feed through
2	40mm/1-1/2"
3	50mm/2"
4	80mm/3"
5	100mm/4"
9	Special version

30	Antenna Seal; Temperature:
V	FKM Viton; -20…150°C/-4…302°F
E	FKM Viton GLT; -40…150°C/-40…302°F
K	Kalrez; -20…150°C/-4…302°F
Y	Special version

40	Antenna Extension
1	Not selected
2	100 mm/4"
9	Special version

50	Process Connection:
GGJ	Thread EN10226 R1-1/2, 316L
GNJ	Thread ANSI NPT1-1/2, 316L
TDJ	Tri-Clamp ISO2852 DN40-51 (2"), 316L
TLJ	Tri-Clamp ISO2852 DN70-76.1 (3"), 316L
CFJ	DN50 PN10/16 B1, 316L flange EN1092-1 (DIN2527 C)
CGJ	DN50 PN25/40 B1, 316L flange EN1092-1 (DIN2527 C)
CFM	DN50 PN10/16, AlloyC22 > 316L flange EN1092-1 (DIN2527)
CGM	DN50 PN25/40, AlloyC22 > 316L flange EN1092-1 (DIN2527)
CMJ	DN80 PN10/16 B1, 316L flange EN1092-1 (DIN2527 C)
CNJ	DN80 PN25/40 B1, 316L flange EN1092-1 (DIN2527 C)
CMM	DN80 PN10/16, AlloyC22 > 316L flange EN1092-1 (DIN2527)
CNM	DN80 PN25/40, AlloyC22 > 316L flange EN1092-1 (DIN2527)
CQJ	DN100 PN10/16 B1, 316L flange EN1092-1 (DIN2527 C)
CRJ	DN100 PN25/40 B1, 316L flange EN1092-1 (DIN2527 C)
CQM	DN100 PN10/16, AlloyC22 > 316L flange EN1092-1 (DIN2527)
CRM	DN100 PN25/40, AlloyC22 > 316L flange EN1092-1 (DIN2527)
CWJ	DN150 PN10/16 B1, 316L flange EN1092-1 (DIN2527 C)
CWM	DN150 PN10/16, AlloyC22 > 316L flange EN1092-1 (DIN2527)
AEJ	2" 150lbs RF, 316/316L flange ANSI B16.5
AFJ	2" 300lbs RF, 316/316L flange ANSI B16.5
AEM	2" 150lbs, AlloyC22 > 316/316L flange ANSI B16.5

50	**Process Connection:**	
	AFM	2" 300lbs, AlloyC22 > 316/316L flange ANSI B16.5
	ALJ	3" 150lbs RF, 316/316L flange ANSI B16.5
	AMJ	3" 300lbs RF, 316/316L flange ANSI B16.5
	ALM	3" 150lbs, AlloyC22 > 316/316L flange ANSI B16.5
	AMM	3" 300lbs, AlloyC22 > 316/316L flange ANSI B16.5
	APJ	4" 150lbs RF, 316/316L flange ANSI B16.5
	AQJ	4" 300lbs RF, 316/316L flange ANSI B16.5
	APM	4" 150lbs, AlloyC22 > 316/316L flange ANSI B16.5
	AQM	4" 300lbs, AlloyC22 > 316/316L flange ANSI B16.5
	AWJ	6" 150lbs RF, 316/316L flange ANSI B16.5
	AWM	6" 150lbs, AlloyC22 > 316/316L flange ANSI B16.5
	KEJ	10K 50A RF, 316L flange JIS B2220
	KEM	10K 50A, AlloyC22 > 316L flange JIS B2220
	KLJ	10K 80A RF, 316L flange JIS B2220
	KLM	10K 80A, AlloyC22 > 316L flange JIS B2220
	KPJ	10K 100A RF, 316L flange JIS B2220
	KPM	10K 100A, AlloyC22 > 316L flange JIS B2220
	KWJ	10K 150A RF, 316L flange JIS B2220
	KWM	10K 150A, AlloyC22 > 316L flange JIS B2220
	YY9	Special version

60	**Output; Operation:**	
	A	4-20mA SIL HART; 4-line display VU331, envelope curve display on site
	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 conn. compartment
	D	T12 Alu, coated IP65 NEMA4X+OVP, separate conn. 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
	5	Plug M12
	6	Plug 7/8"
	9	Special version

90	**Additional Option:**	
	A	Basic version
	B	EN10204-3.1 material, wetted parts, (316L wetted parts) inspection certificate
	F	Advanced dynamics, max. MB=70m liquids, MB=measuring range
	G	Advanced dynamics, 3.1, NACE, max. MB=70m liquids, MB=measuring range EN10204-3.1 material, NACE MR0175 (316L wetted parts) inspection certificate
	H	5-point linearity protocol, see additional spec.
	J	5-point, 3.1, NACE, 5-point linearity protocol, see additional spec., EN10204-3.1 material, NACE MR0175 (316L wetted parts) inspection certificate
	L	5-point, advanced dynamics, 3.1, NACE, 5-point linearity protocol, see additional spec., Advanced dynamics, max MB=70m liquids, MB=measuring range EN10204-3.1 material, NACE MR0175, (316L wetted parts) inspection certificate
	N	EN10204-3.1 material, NACE MR0175 (316L wetted parts) inspection certificate
	S	GL/ABS/NK marine certificate
	Y	Special version

995	**Marking:**	
	1	Tagging (TAG)
	2	Bus address

FMR240-	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", → 11!

The scope of delivery consists of:

- Assembled instrument
- Accessories (→ 74)
- Endress+Hauser oprating program on the enclosed CD-ROM
- Brief operating instructions KA1008F/00/EN for quick commissioning
- Brief operating instructions KA235F/00/A2 (basic setup/troubleshooting), 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 Instructions
  - Description of Intrument 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

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

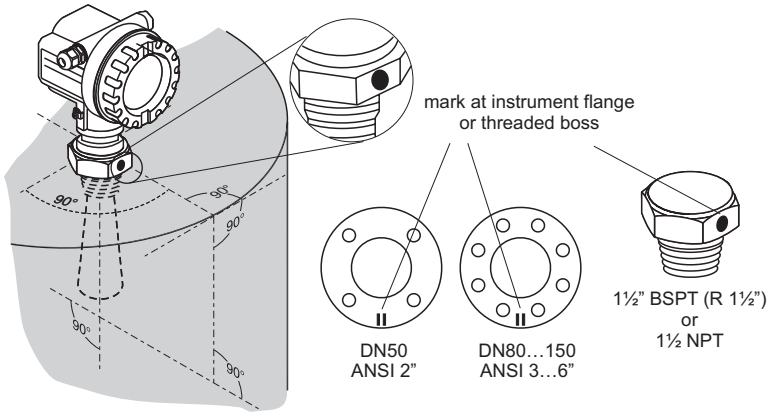
FOUNDATION™ Fieldbus
Registered trademark of Fieldbus Foundation Austin, Texas, USA

3 Mounting

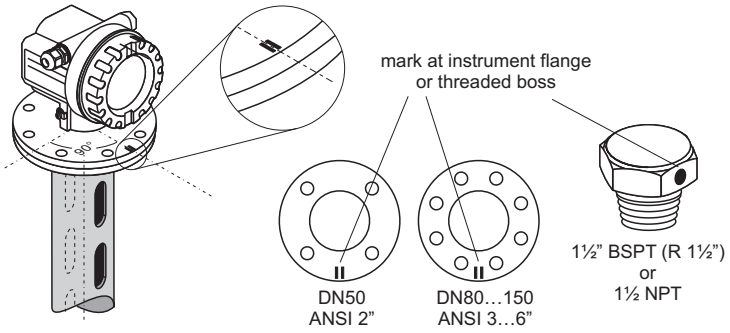
3.1 Quick installation guide

Observe orientation when installing!

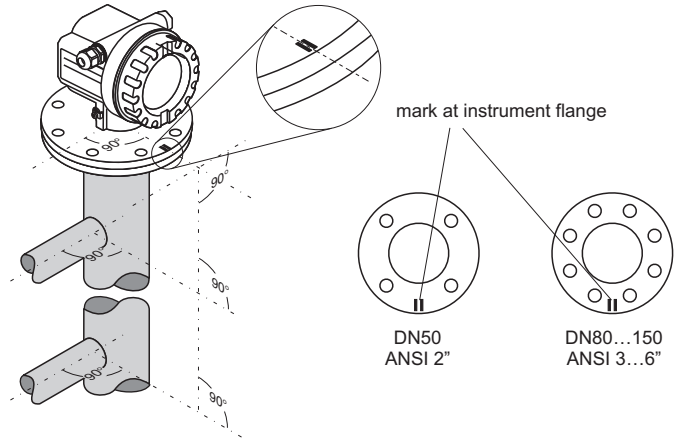
Installation in tank (free space):
Mark on process connector facing the nearest tank wall!



Installation in stilling well:
Mark on process connector pointed towards the slots or vent holes!



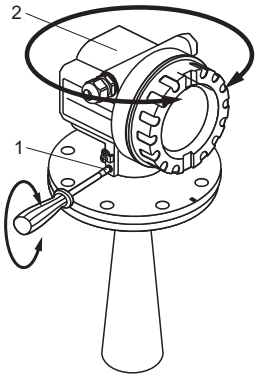
Installation in bypass:
Mark on process connector 90° offset from the tank connections!



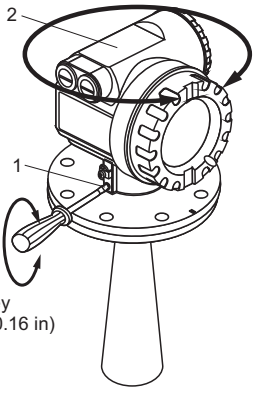
Turn housing

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 (39.69 lbs) kg. Do not lift the measuring instrument by its housing in order to transport it.

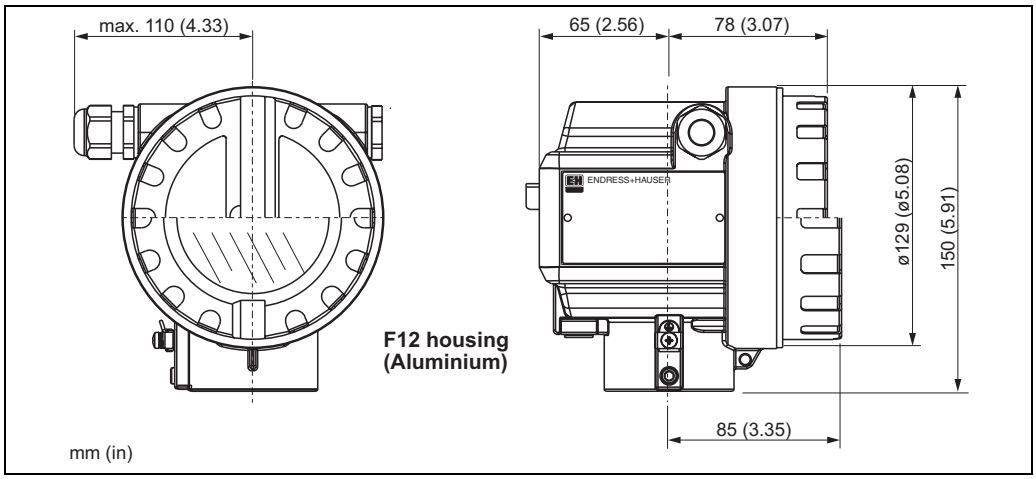
3.2.3 Storage

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



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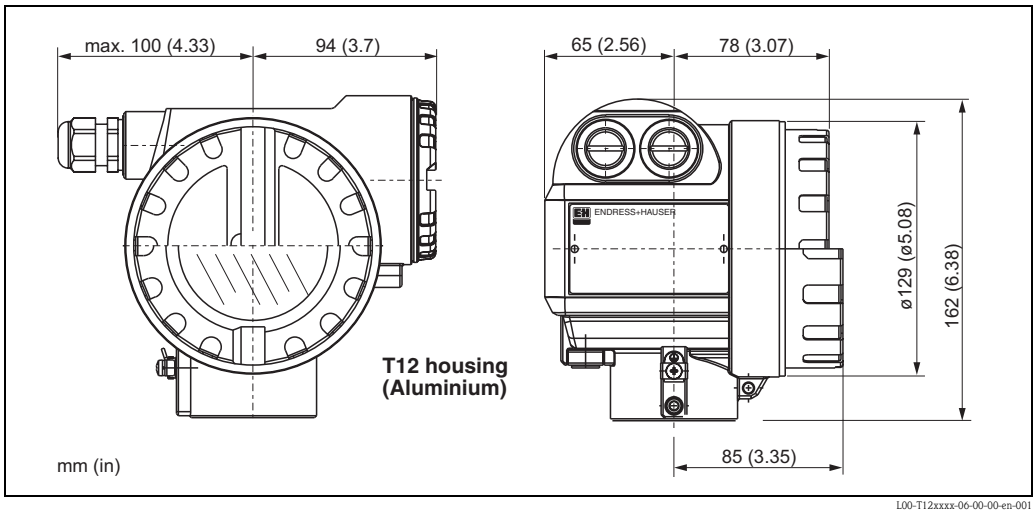

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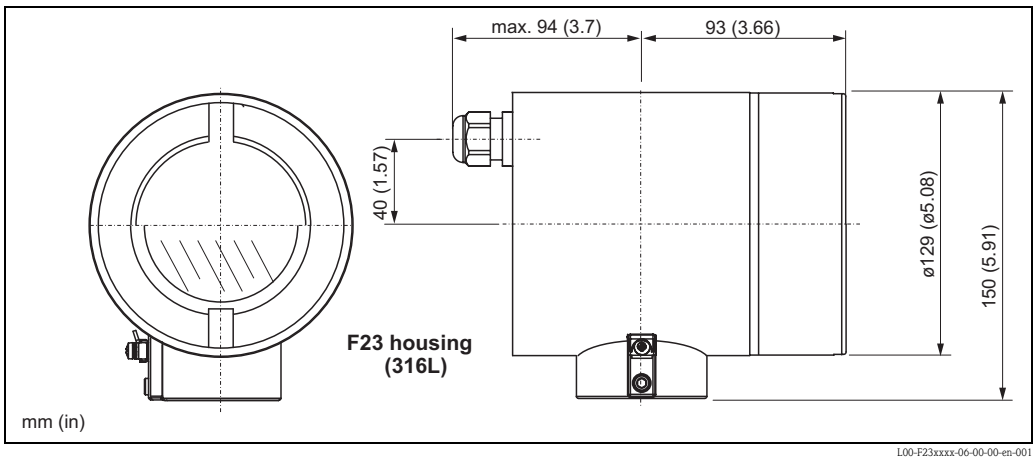

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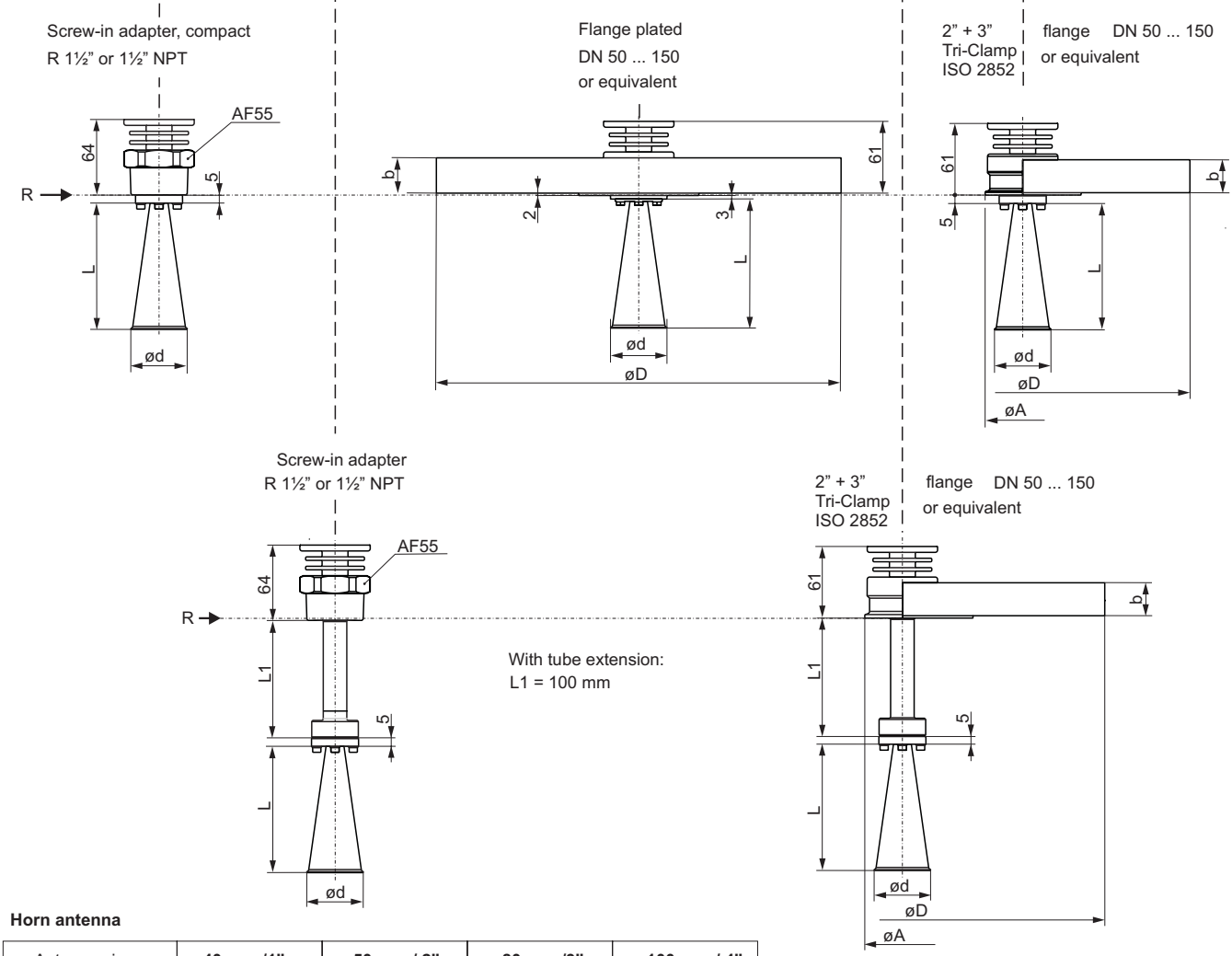
Process connection

F12 / T12 / F23 housing

R = reference point of measurement



Horn antenna

Antenna size	**40 mm /1"**	**50 mm / 2"**	**80 mm /3"**	**100 mm / 4"**
L [mm]	86	115	211	282
d [mm]	40	48	75	95

Note!
material process connection = material horn antenna, resp. wetted parts of the process connection

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

Flange	**DN 50**	**DN 80**	**DN 100**	**DN 150**
b [mm]	18 (20)	20 (24)	20 (24)	22
D [mm]	165 (165)	200 (200)	220 (235)	285

for PN 16 (for PN 40)

Flange to JIS B2220

Flange	**DN 50**	**DN 80**	**DN 100**	**DN 150**
b [mm]	16	18	18	22
D [mm]	155	185	210	280

for 10K

Flange to ANSI B16.5

Flange	**2"**	**3"**	**4"**	**6"**
b [mm]	19.1 (22.4)	23.9 (28.4)	23.9 (31.8)	25.4
D [mm]	152.4 (165.1)	190.5 (209.5)	228.6 (254)	279.4

for 150 lbs (for 300 lbs)

Tri - Clamp to ISO 2852

Clamp	**2"**	**3"**
A	64	91

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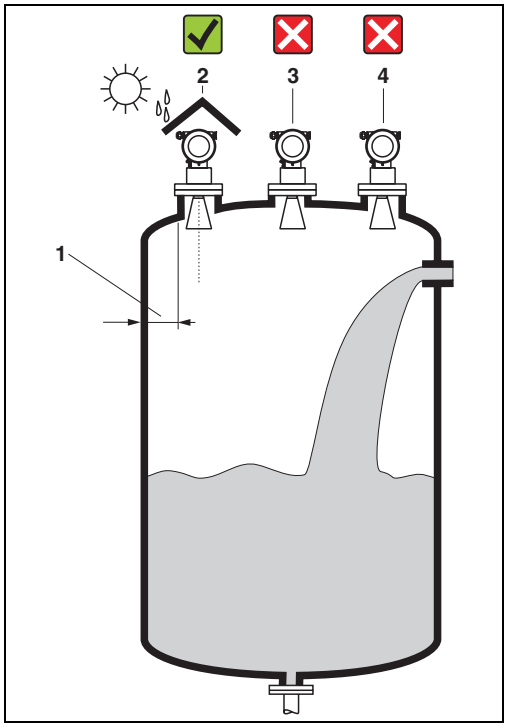
3.3.2 Engineering hints

Orientation

- Recommended distance (1) wall – **outer edge** of nozzle: ~1/6 of tank diameter. Nevertheless the device should not be installed closer than 15 cm (5.91 in) to the tankwall.
- 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 (→ 74, "Accessories").



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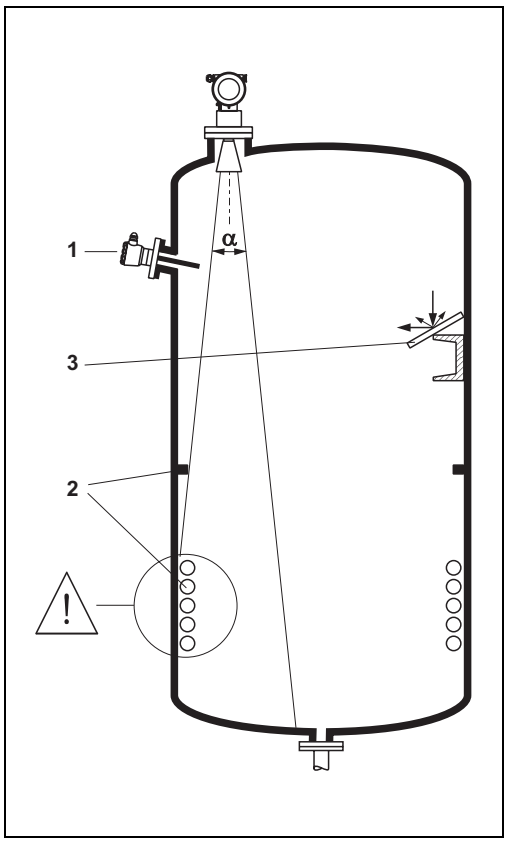
Tank installations

- Avoid any installations (1), like limit switches, temperature sensors, etc., inside the signal beam (→ 16, "Beam angle").
- Symmetrical installations (2), i. e. vacuum rings, heating coils, baffles, 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: "Installation in tank (free space)", → 22
- Stilling well: a stilling well can always be used to avoid interference.
- Metallic screens (3) mounted at a slope spread the radar signals and can, therefore, reduce interference echoes.

Please contact Endress+Hauser for further information.



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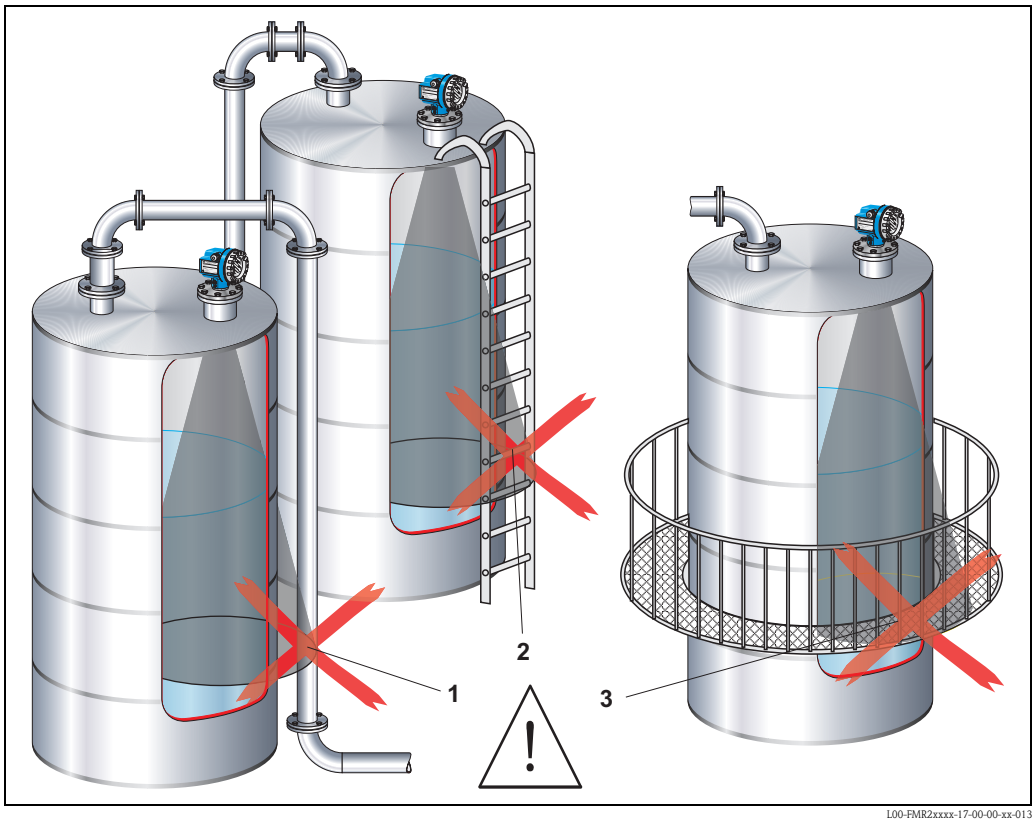
Measurement in a plastic tank

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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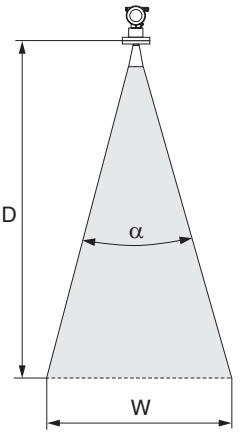
Beam angle

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**:

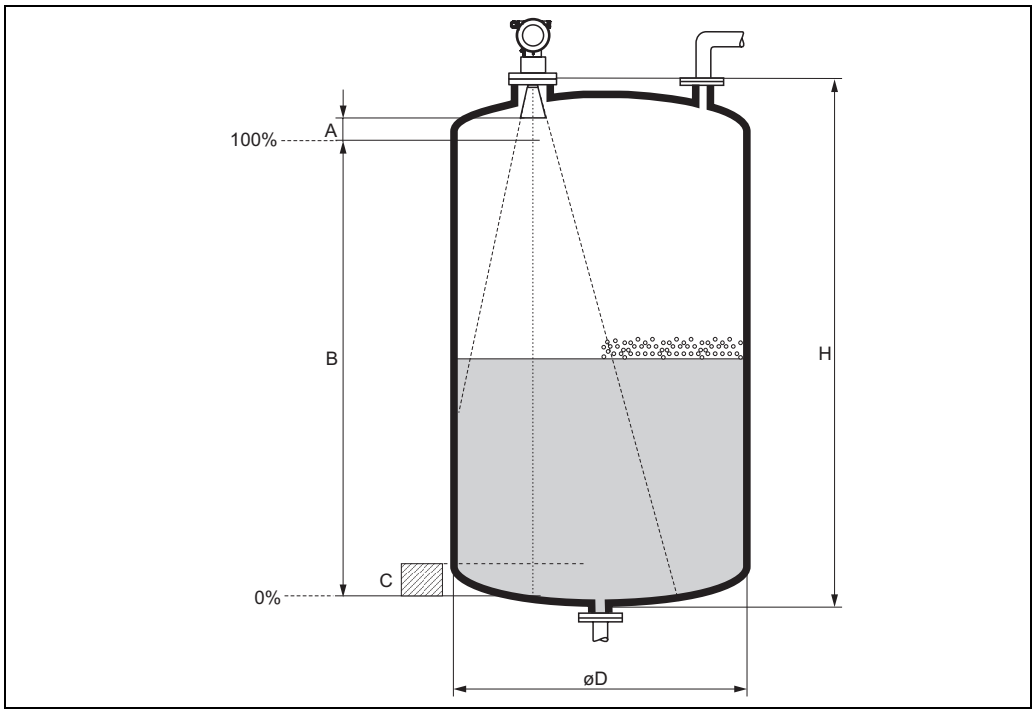
Antenna size (horn diameter)	40 mm (1½")	50 mm (2")	80 mm (3")	100 mm (4")
Beam angle α	23°	18°	10°	8°
Measuring distance (D)	**Beam diameter (W)**			
	40 mm (1½")	50 mm (2")	80 mm (3")	100 mm (4")
3 m (9.8 ft)	1,22 m (4 ft)	0,95 m (3.1 ft)	0,53 m (1.7 ft)	0,42 m (1.4 ft)
6 m (20 ft)	2,44 m (8 ft)	1,90 m (6.2 ft)	1,05 m (3.4 ft)	0,84 m (2.8 ft)
9 m (30 ft)	3,66 m (12 ft)	2,85 m (9.4 ft)	1,58 m (5.2 ft)	1,26 m (4.1 ft)
12 m (39 ft)	4,88 m (16 ft)	3,80 m (12.0 ft)	2,10 m (6.9 ft)	1,68 m (5.5 ft)
15 m (49 ft)	6,10 m (20 ft)	4,75 m (16 ft)	2,63 m (8.63 ft)	2,10 m (6.9 ft)
20 m (66 ft)	8,14 m (27 ft)	6,34 m (21 ft)	3,50 m (11 ft)	2,80 m (9.2 ft)
25 m (82 ft)	10,17 m (33 ft)	7,92 m (26 ft)	4,37 m (14 ft)	3,50 m (11 ft)
30 m (98 ft)	—	9,50 m (31 ft)	5,25 m (17 ft)	4,20 m (14 ft)
35 m (115 ft)	—	11,09 m (36 ft)	6,12 m (20 ft)	4,89 m (16 ft)
40 m (131 ft)	—	12,67 m (42 ft)	7,00 m (23 ft)	5,59 m (18 ft)
45 m (148 ft)	—	—	7,87 m (26 ft)	6,29 m (21 ft)
60 m (197 ft)	—	—	10,50 m (34 ft)	8,39 m (28 ft)
70 m (230 ft)	—	—	—	9,79 m (32 ft)



Measuring conditions in liquids

Note!

- In case of **boiling surfaces, bubbling** or tendency for **foaming,** use FMR230 or FMR231. Depending on its consistence, foam can either absorb microwaves or reflect them off the foam surface. Measurement is possible under certain conditions.
- In case of heavy **steam development** or **condensate** the max. measuring range of FMR240 may decrease depending on density, temperature and composition of the steam → use FMR230 or FMR231.
- For the measurement of absorbing gases such as **ammonia NH_3** or some **fluorocarbons** [1], please use FMR230 in a stilling well.



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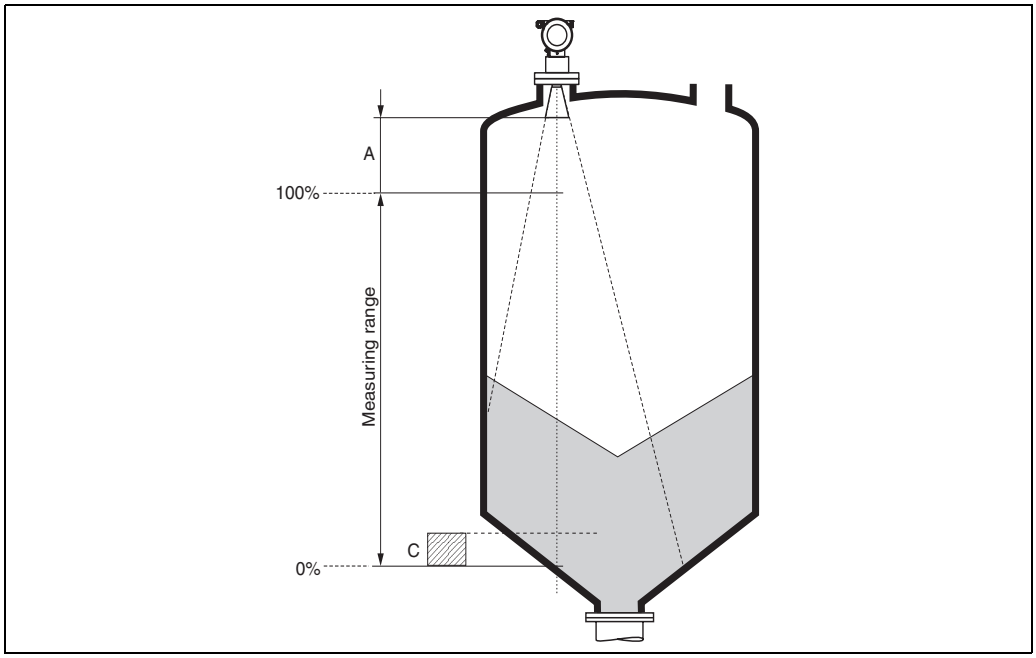
- The measuring range begins, where the beam hits the tank bottom. Particularly with dish bottoms or conical outlets the level cannot be detected below this point.
- In case of media with a low dielectric constant (groups A and B), the tank bottom can be visible through the medium at low levels (low height **C**). Reduced accuracy has to be expected in this range. If this is not acceptable, we recommend positioning the zero point at a distance **C** (see Fig.) above the tank bottom in these applications.
- In principle it is possible to measure up to the tip of the antenna with FMR230/231/240. However, due to considerations regarding corrosion and build-up, the end of the measuring range should not be chosen any closer than **A** (see Fig.) to the tip of the antenna.
  For FMR244/245, the end of measuring range should not be chosen closer than **A** (see Fig.) to the tip of the antenna, especially if there is development of condensate.
- The smallest possible measuring range **B** depends on the antenna version (see Fig.).
- The tank diameter should be greater than **D** (see Fig.), the tank height at least **H** (see Fig.).

A [mm (in)]	B [m (ft)]	C [mm (in)]	D [m (ft)]	H [m (ft)]
50 (1.97)	> 0,2 (> 0.7)	50 to 250 (1.97 to 9.84)	> 0,2 (> 0.7)	> 0,3 (> 1.0)

1) Affected compounds are e.g. R134a, R227, Dymel 152a.

Measuring conditions in solids

- 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 (see Technical Information TI345F/00/EN).
- 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 Figure).
- In principle it is possible to measure up to the tip of the antenna with the Micropilot M. 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 Figure). If required, and if some conditions (high DC value, flat angle of repose) are met, shorter distances can be achieved.



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

Measuring range in liquids

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:
- 40 m (131 ft) for basic version
- 70 m (230 ft) with additional option F (G), → 📄 7, "ordering information"

The following tables describe the groups of media as well as the achievable measuring range as a function of application and media group. If the dielectric constant of a medium is unknown, it is recommended to assume media group B to ensure a reliable measurement.

Media group	DC (εr)	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 NH_3 as a medium of group A, i. e. use FMR230 in a stilling well.

Measuring range in solids

The FMR244 with 80 mm (3") antenna or FMR240 with 100 mm (4") horn antenna and additional option F (= advanced dynamics) is also suited for solid applications. The usable measuring range depends on the reflection properties of the medium, the mounting position and interference reflections which may be present. The maximum configurable measuring range for the Micropilot M FMR240 with 100 mm (4") horn antenna and additional option F (= advanced dynamics) is 30 m (98 ft) in solid applications. It is recommended to use the variable flange seal for alignment (see Technical Information TI345F/00/EN).

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.

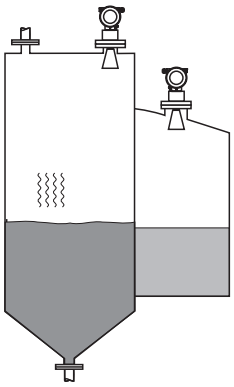
Media group	DC (εr)	Examples	Signal attenuation
A	1.6 to 1.9	– Plastic granulate – White lime, special cement – Sugar	19 to 16 dB
B	1.9 to 2.5	– Portland cement, plaster	16 to 13 dB
C	2.5 to 4	– Grain, seeds – Ground stones – Sand	13 to 10 dB
D	4 to 7	– Naturally moist (ground) stones, ores – Salt	10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

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

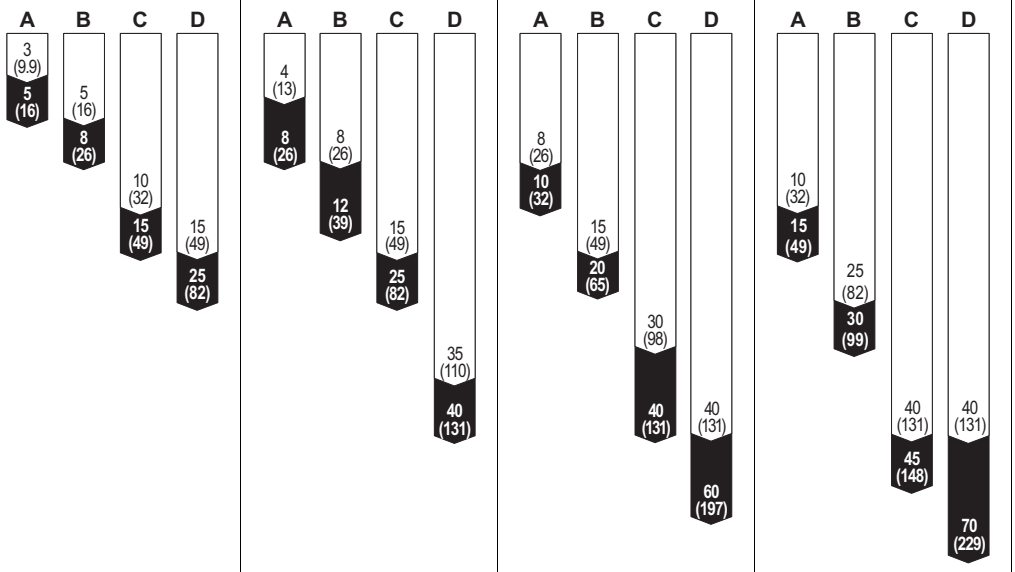
Measuring range depending on vessel type, conditions and product

Standard: max. measuring range = 40 m (131 ft)	With additional option F (G): max. measuring range = 70 m (230 ft) min. measuring range = 5 m (16 ft)
The recommended measuring range for 100 mm (4") horn antenna in solids is 30 m (98 ft).	

Storage tank

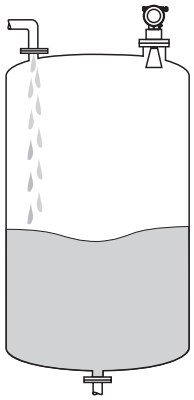


Calm product surface (e. g. intermittent filling, filling from bottom, immersion tubes).

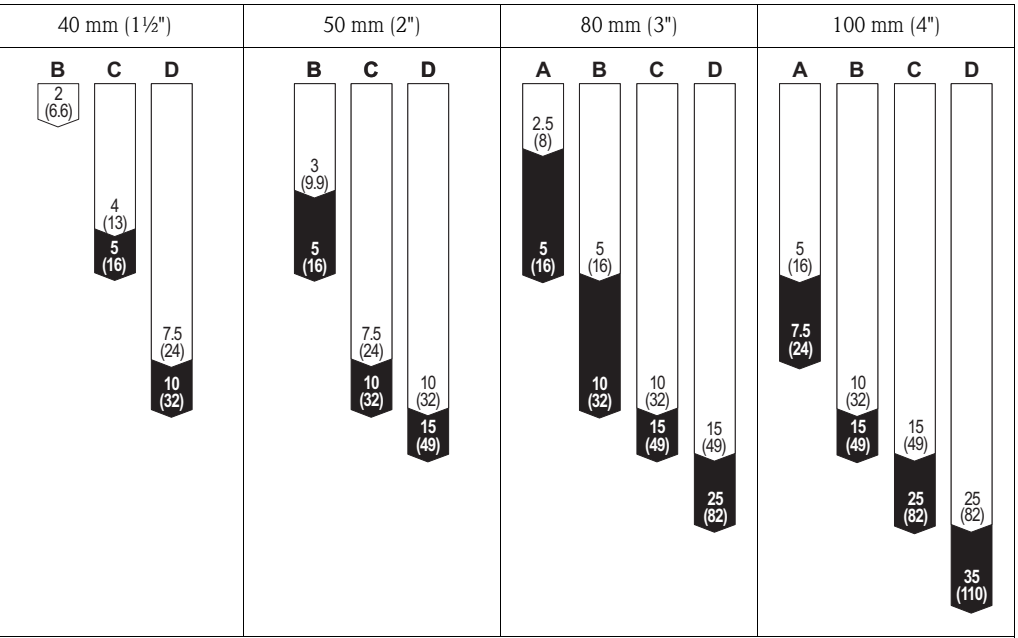


Measuring range [m (ft)]

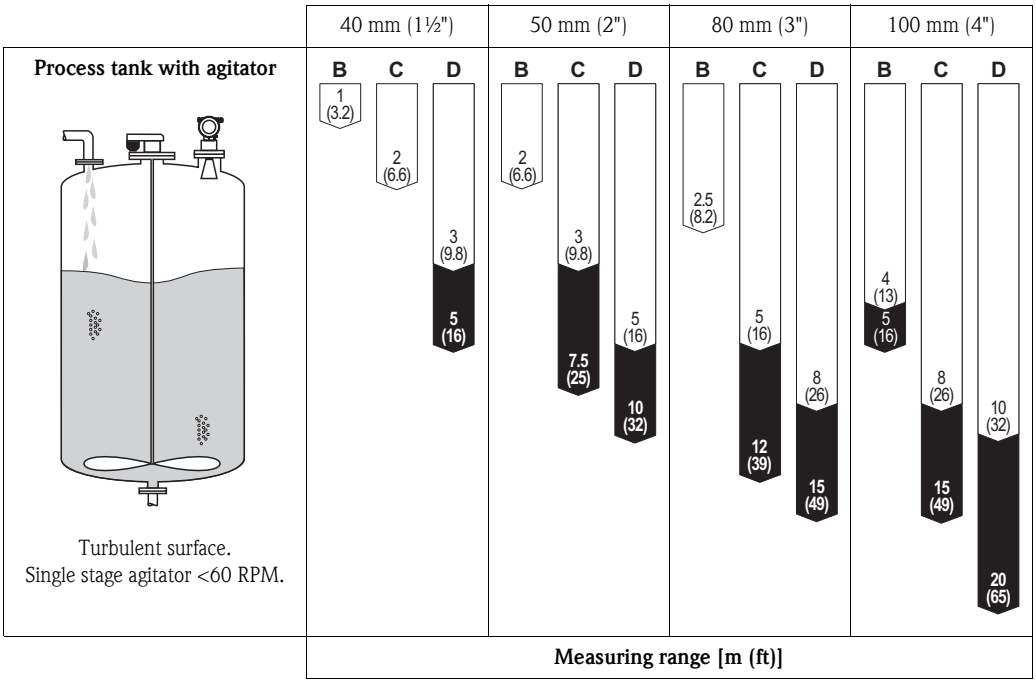
Buffer tank

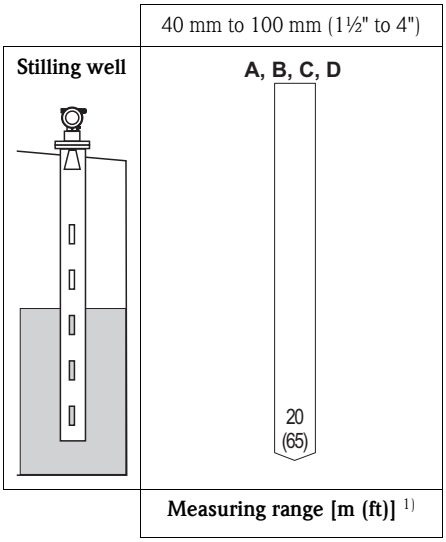


Moving surfaces (e. g. continuous filling, from above, mixing jets).

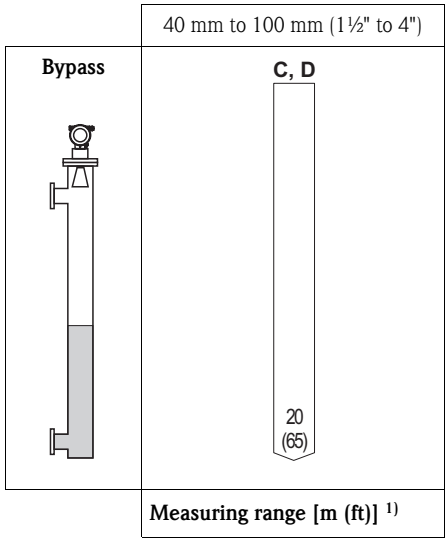


Measuring range [m (ft)]





1) Larger measuring range on request



1) For media group A and B to use a Levelflex M with koax probe

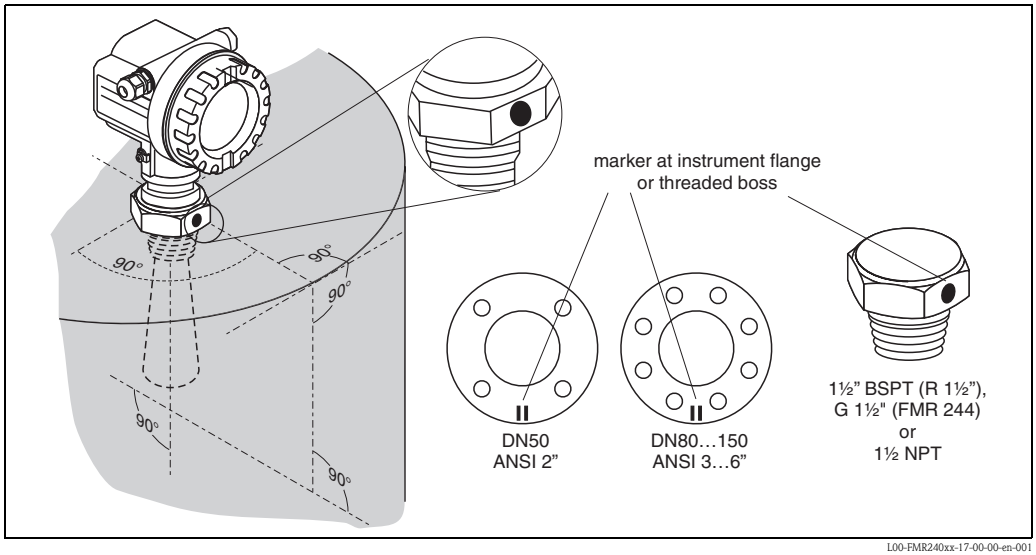
3.4 Installation instructions

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 tank (free space)

Optimum mounting position



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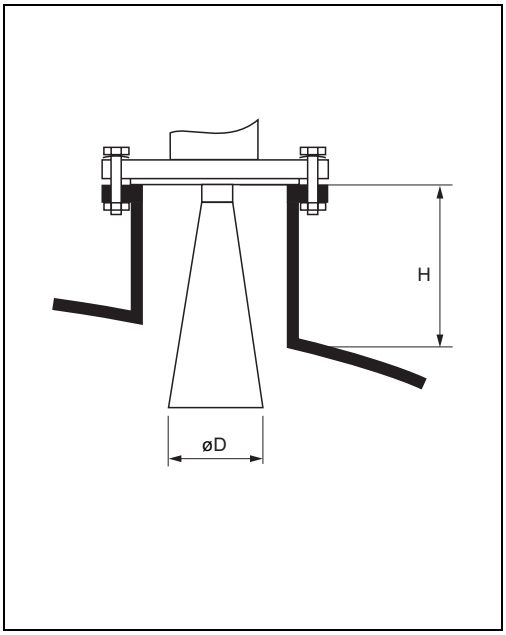
Standard installation

When mounting in a tank, please observe engineering hints (→ 14) and the following points:
- Marker is aligned towards tank 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.
- For optimum measurement, the horn antenna should extend below the nozzle. Select version with 100 mm (4") antenna extension if necessary, → 12. Nozzle heights up to 500 mm (19.7 in) can be accepted if this should not be possible due to mechanical reasons (→ 12).

  Note!
  Please contact Endress+Hauser for application with higher nozzle.



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- **The horn antenna must be aligned vertically.**

  Caution!
  At not vertically aligned horn antenna can be reduced the maximum range.

- For mounting in solid applications use the variable flange seal to align the device towards the product surface (see Technical Information TI345F/00/EN).

Antenna size	40 mm (1½")	50 mm (2")	80 mm (3")	100 mm (4")
D [mm (in)]	40 (1.57)	48 (1.89)	75 (2.95)	95 (3.74)
H [mm (in)]	< 85 (< 3.35)	< 115 (< 4.53)	< 210 (< 8.27)	< 280 (< 11)

Measurement from the outside through plastic walls

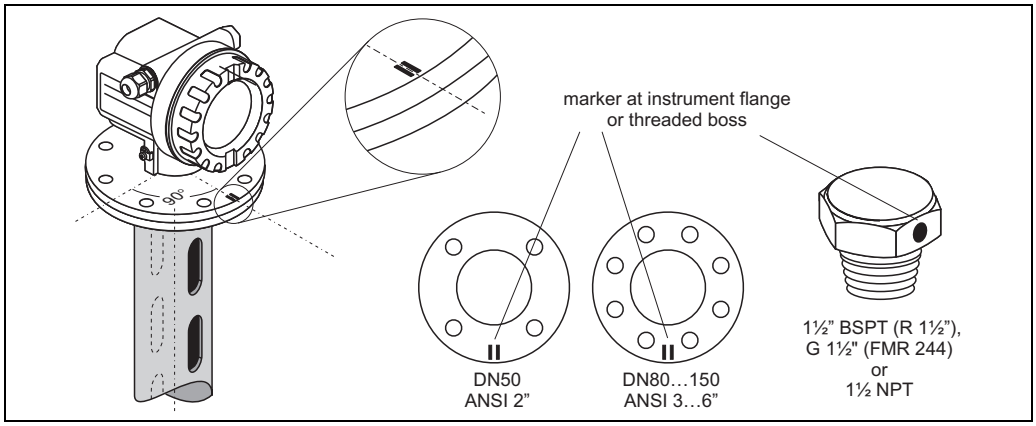
- Observe engineering hints, → 14.
- If possible, use an antenna 100 mm (4").

Penetrated material	PE	PTFE	PP	Perspex
DK / εr	2.3	2.1	2.3	3.1
Optimum thickness [mm (in)][1)]	3.8 (0.15)	4.0 (0.16)	3.8 (0.15)	3.3 (0.13)

1) Other possible values for the thickness are multiples of the values listed (i. e. PE: 7.6 mm (0.3 in), 11.4 mm (0.45 in), ...)

3.4.3 Installation in stilling well

Optimum mounting position



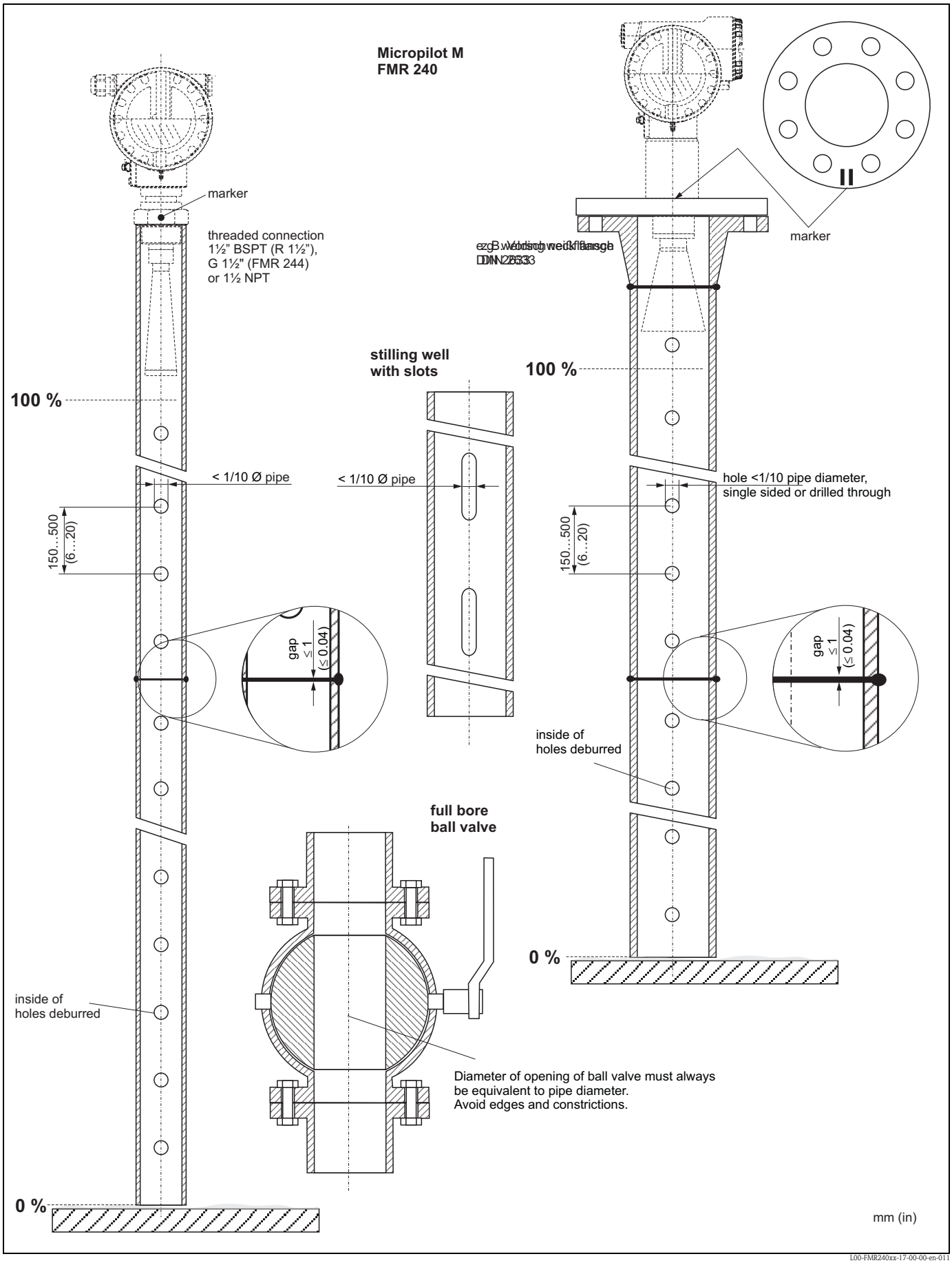
Standard installation

For installations in a stilling well, follow the engineering hints on (→ 14) and note the following points:
- Marker is aligned toward slots.
- 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.
- Measurements can be performed through an open full bore ball valve without any problems.

Recommendations for the stilling well

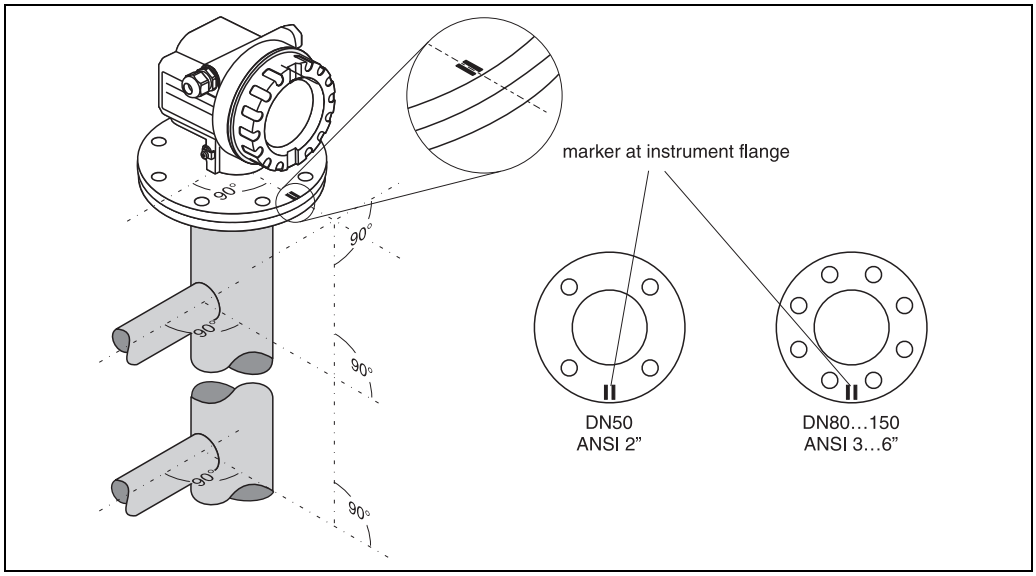
At the construction of a stilling well, please note the following points:
- Metal (no enamel coating, plastic coating on request).
- Constant diameter.
- Weld seam as smooth as possible and on the same axis as the slots.
- Slots offset 180° (not 90°).
- Slot width respectively diameter of holes max. 1/10 of pipe diameter, de-burred. Length and number do not have any influence on the measurement.
- Select horn antenna as big as possible. For intermediate sizes (i. e. 180 mm (7")) select next larger antenna and adapt it mechanically.
- At any transition (i. e. when using a ball valve or mending pipe segments), no gap may be created exceeding 1 mm (0.04 in) .
- The stilling well must be smooth on the inside (average roughness Rz ≤ 6.3 µm(≤ 248 µin)). Use extruded or parallel welded stainless steel pipe. An extension of the pipe is possible with welded flanges or pipe sleeves. Flange and pipe have to be properly aligned at the inside.
- Do not weld through the pipe wall. The inside of the stilling well must remain smooth. In case of unintentional welding through the pipe, the weld seam and any unevenness on the inside need to be carefully removed and smoothened. Otherwise, strong interference echoes will be generated and material build-up will be promoted.
- Particularly on smaller nominal widths it needs to be observed that flanges are welded to the pipe such that they allow for a correct orientation (marker aligned toward slots).

Examples for the construction of stilling wells



3.4.4 Installation in bypass

Optimum mounting position



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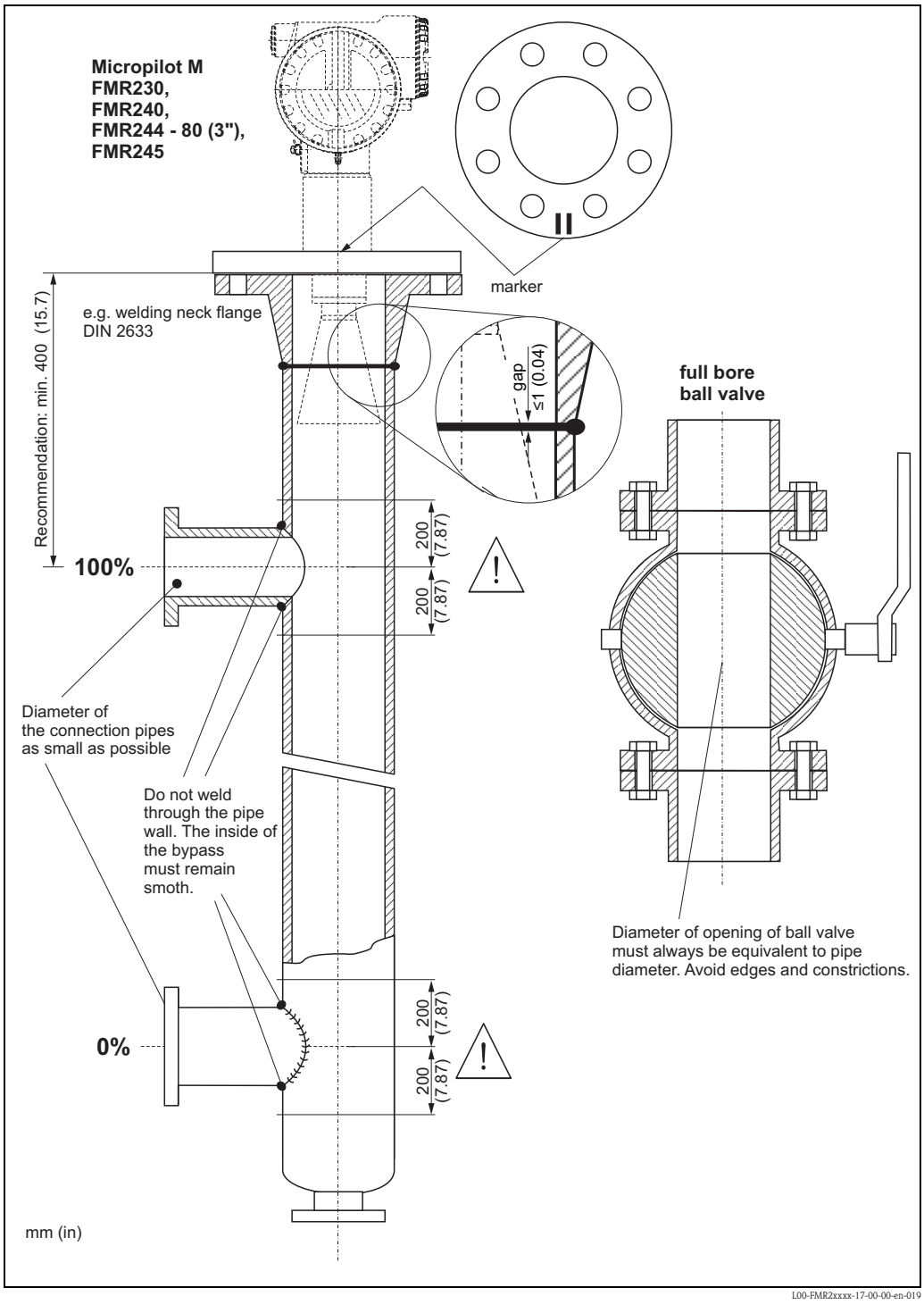
Standard installation

For installations in a bypass, follow the engineering hints on (→ 14) and note the following points:
- Marker is aligned perpendicular (90°) to tank connectors.
- 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 must be aligned vertically.
- Measurements can be performed through an open full bore ball valve without any problems.

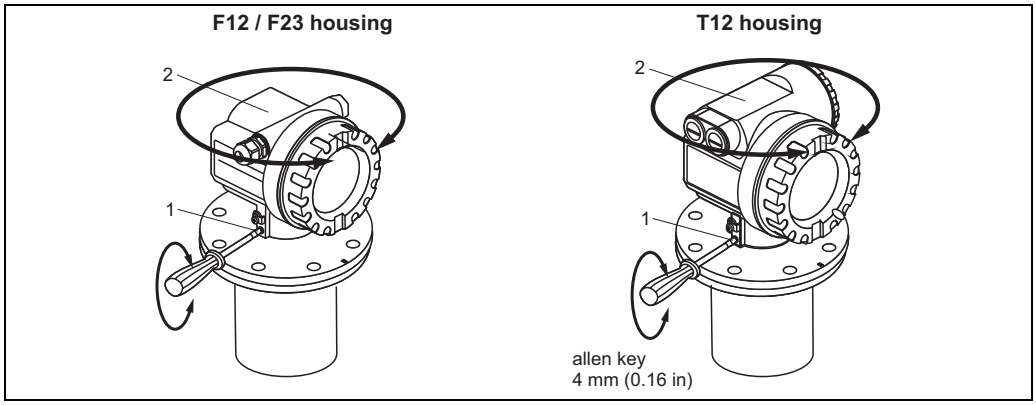
Recommendations for the bypass pipe
- Metal (no plastic or enamel coating).
- Constant diameter.
- Select horn antenna as big as possible. For intermediate sizes (i. e. 95 mm (3.5")) select next larger antenna and adapt it mechanically (FMR230/FMR240 only).
- At any transition (i. e. when using a ball valve or mending pipe segments), no gap may be created exceeding 1 mm (0.04").
- In the area of the tank connections (~ ±20 cm (±7.87 in)) a reduced accuracy of the measurement has to be expected.

Example for the construction of a bypass



3.4.5 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)



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 (→ 🖹 74)?

4 Wiring

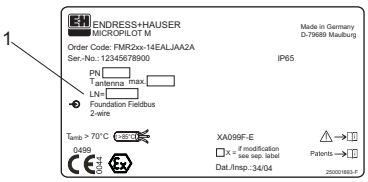
4.1 Quick wiring guide

Wiring in F12/F23 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.

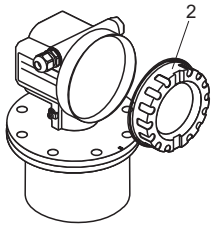


When you use the measuring system in hazardous areas, make sure you comply with national standards and the specifications in the safety instructions (XA's).
Make sure you use the specific cable gland.

EX

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

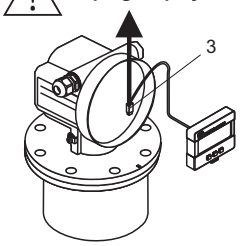
- Housing F12/F23 - Ex ia:
  Power supply must be intrinsically safe.
- The electronics and the current output are galvanically separated from the antenna circuit.



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.

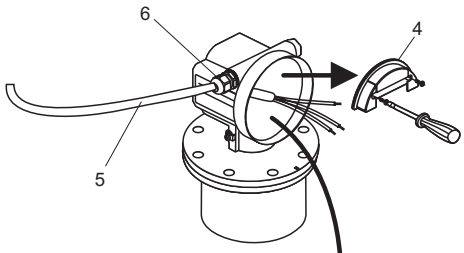
Unplug display connector!

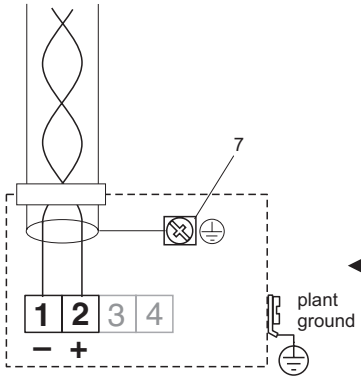


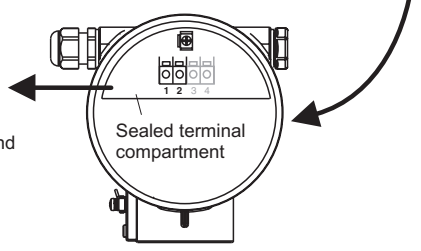
EX

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).







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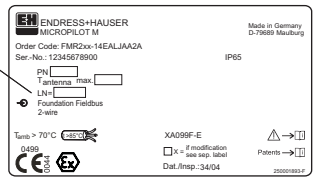
Wiring in T12 housing

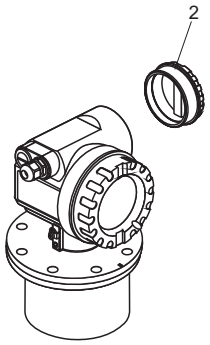
Caution!

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.



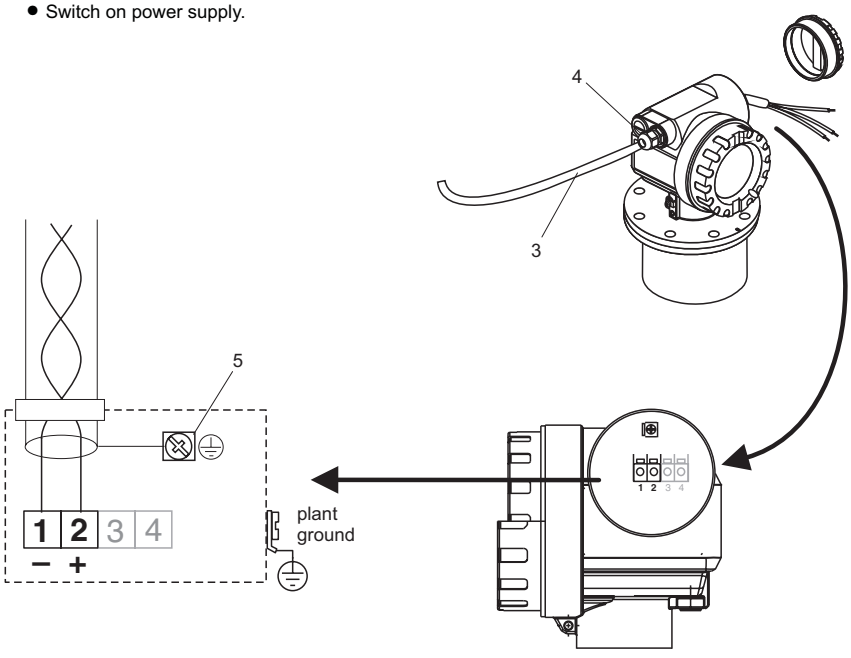
Connect up the Micropilot M as follows:

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.



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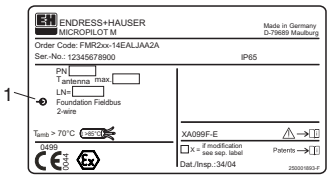
Wiring with FOUNDATION Fieldbus connector

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.

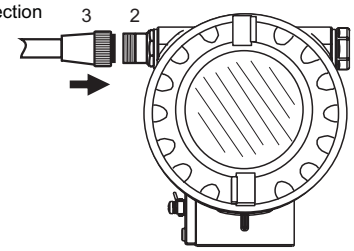


When you use the measuring system in hazardous areas, make sure you comply with national standards and the specifications in the safety instructions (XA's). Make sure you use the specific cable gland.

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.



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 IEC 61158-2. The following have been found suitable:

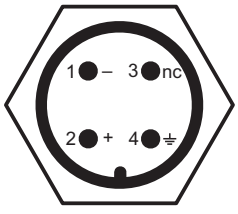
Non-Ex-area:
- Siemens 6XV1 830-5BH10
- Belden 3076F
- Kerpen CEL-PE/OSCR/PVC/FRLA FB-02YS(ST)YFL

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)



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

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

4.2 Connecting the measuring unit

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).

Current consumption

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

Overvoltage protector

The level transmitter Micropilot M with T12-housing (housing version "D", → 🖹 7, "Ordering structure") is equipped with an internal overvoltage protector (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 tank 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

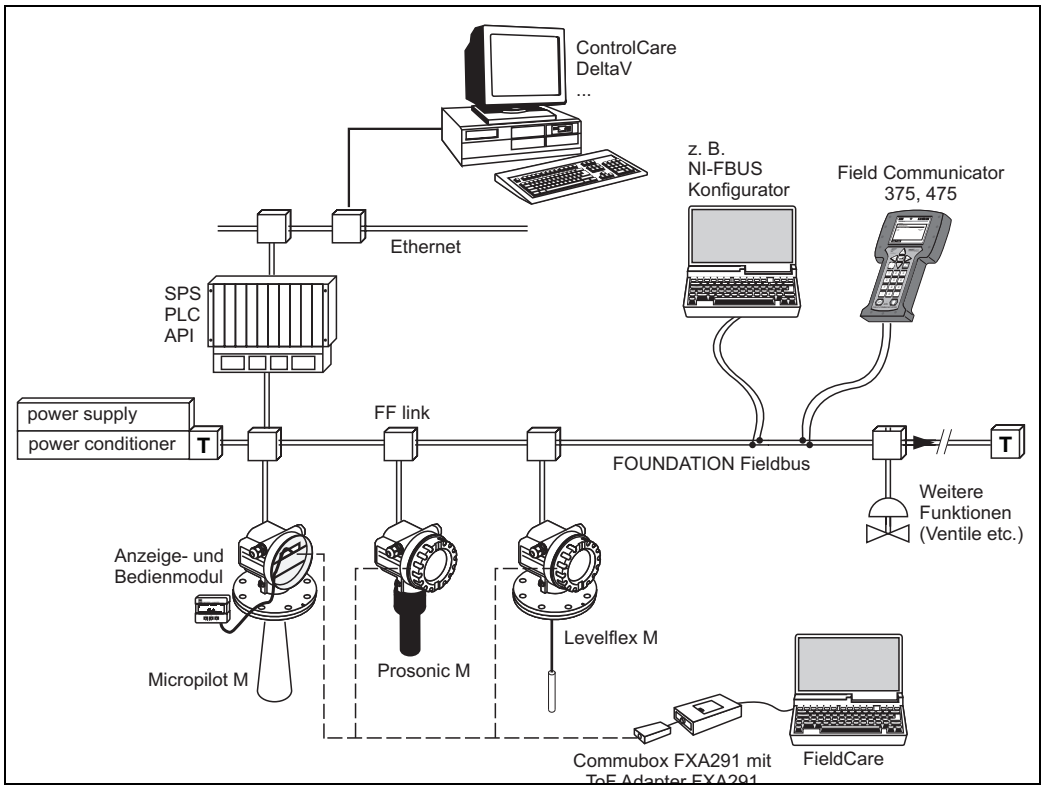
After wiring the measuring instrument, perform the following checks:
- Is the terminal allocation correct (→ 29 and → 31)?
- Is the cable gland tight?
- If available: Is the FOUNDATION Fieldbus connector screwed tight?
- Is the housing cover screwed tight?
- If auxiliary power is available:
  Is the 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



5.1.1 On-site operation

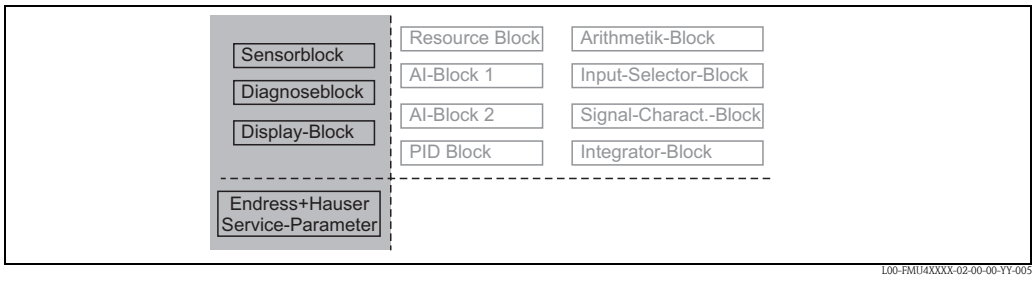
Options for on-site operation

- 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)



The highlighted parameters can be edited by on-site operation.

5.1.2 Remote operation

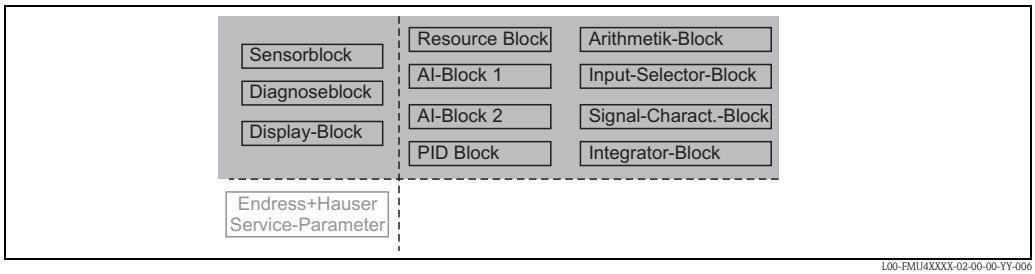
Options for remote operation

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

Parameter access by remote operation

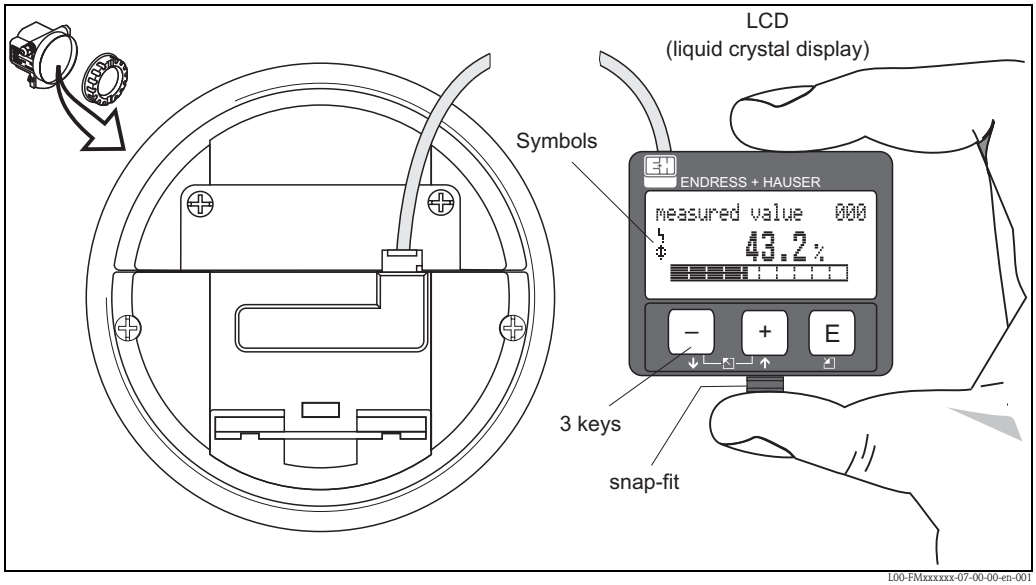
The following parameters can be accessed by remote operation:

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



The highlighted parameters can be edited by remote operation.

5.2 Operation with the display and operating module



Layout of the display and operating elements

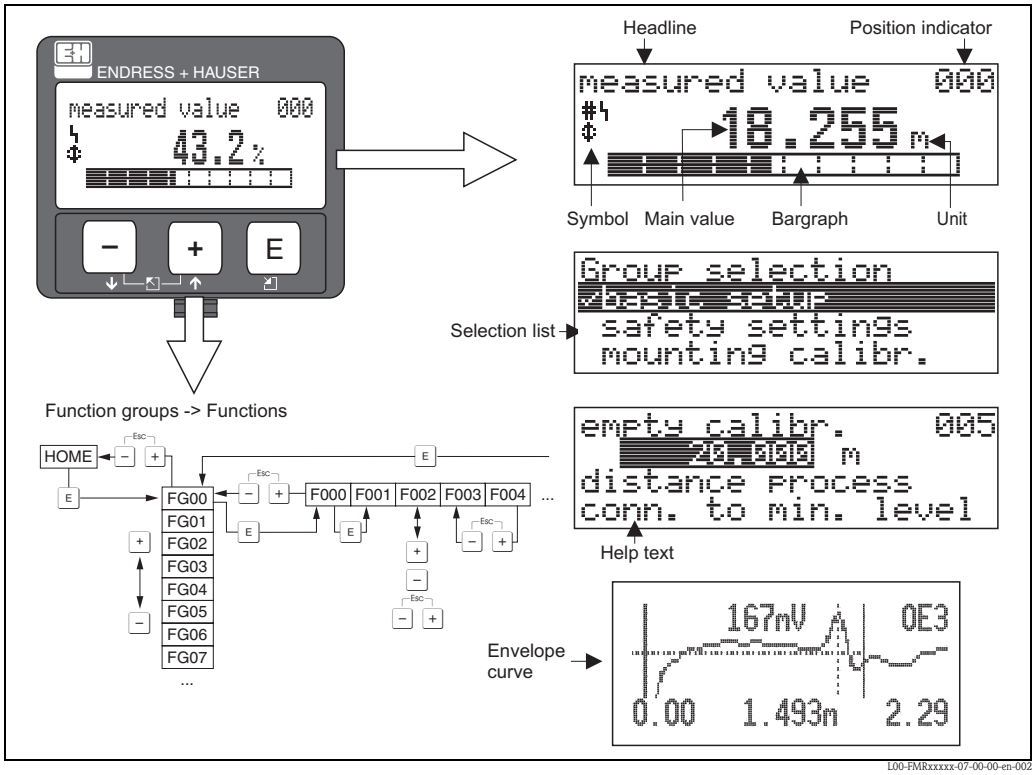
The LCD display can be removed to ease operation by simply pressing the snap-fit (see graphic above). It is connected to the device by means of a 500 mm (19.7 in) cable.

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

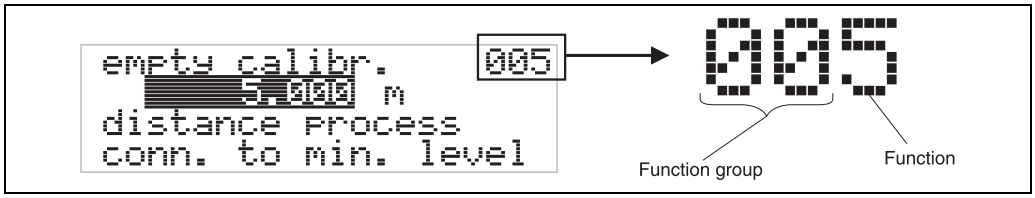
The operating menu is made up of two levels:
- **Function groups (00, 01, 03, …, 0C, 0D):** The individual operating options of the instrument are split up roughly into different function groups. The function groups that are available include, e. g.: "**basic setup**", "**safety settings**", "**output**", "**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 (→ 102), 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**

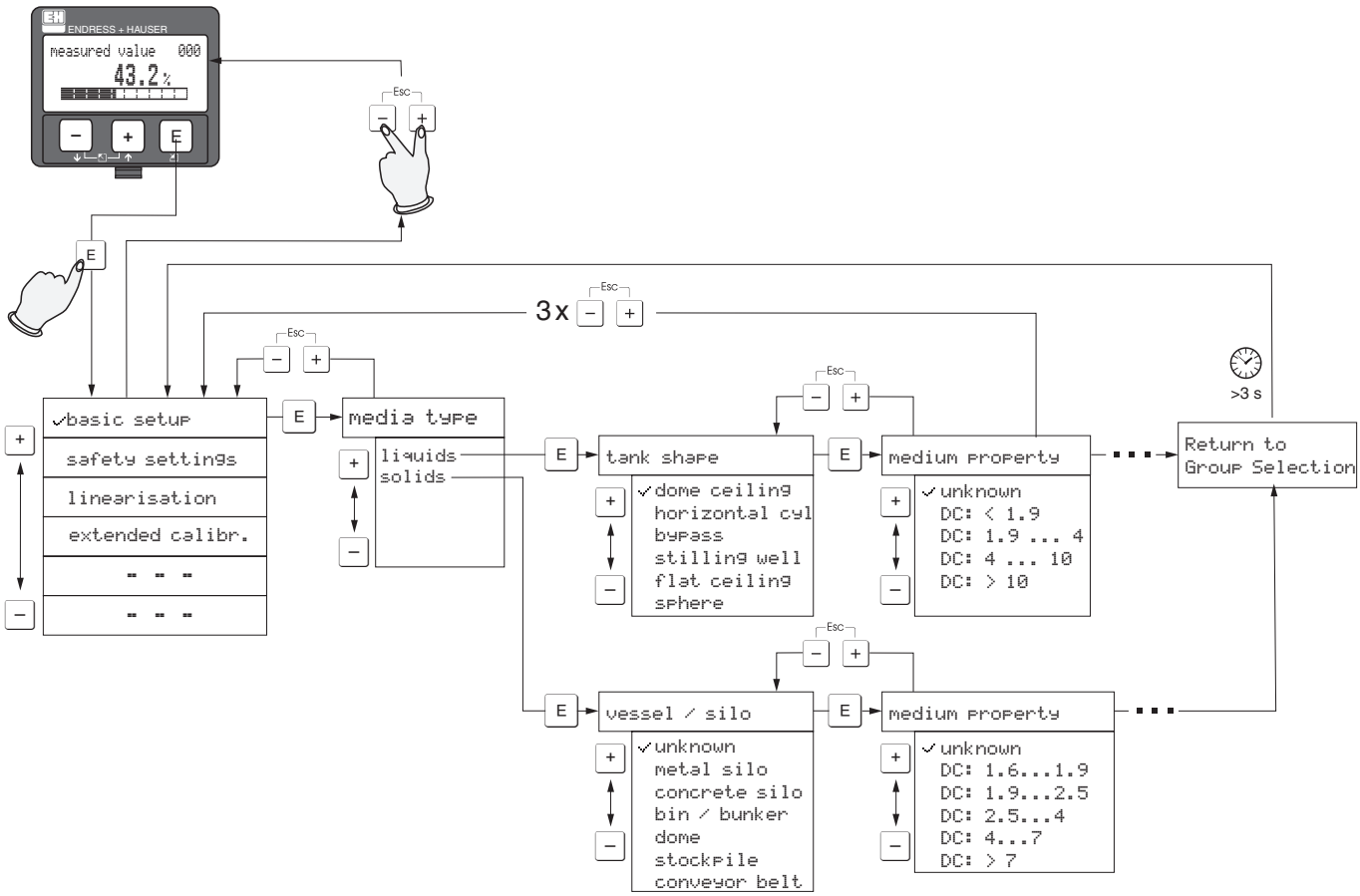
. . .

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) + + − (= Esc) interrupts selection ➜ system quits Edit mode

Typing in numerals and text:

a) Press + or − to edit the first character of the **numeral / text** (e.g. "empty calibr. (005)")
b) E positions the cursor at the next character ➜ continue with (a) until you have completed your input
c) if a ⏎ symbol appears at the cursor, press E to accept the value entered ➜ system quits Edit mode
d) + + − (= Esc) interrupts the input, system quits Edit mode

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

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

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

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

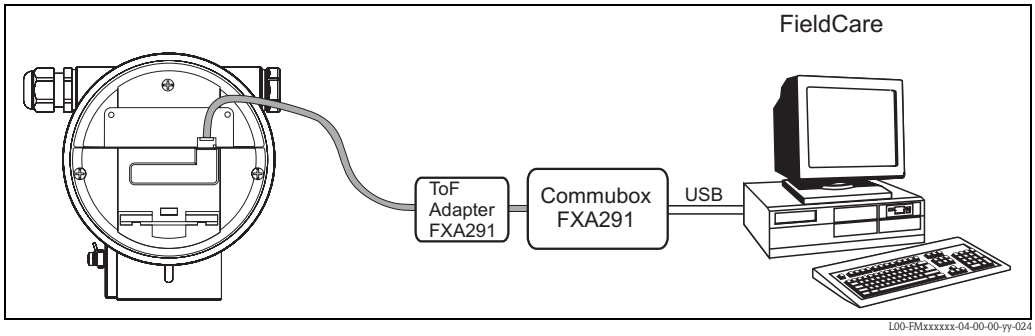
5.3 Operation with an Endress+Hauser operating program

The operating program FieldCare is an Endress+Hauser Plant Asset Management Tool based on FDT technology. You can use FieldCare to configure all your 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.

5.3.1 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

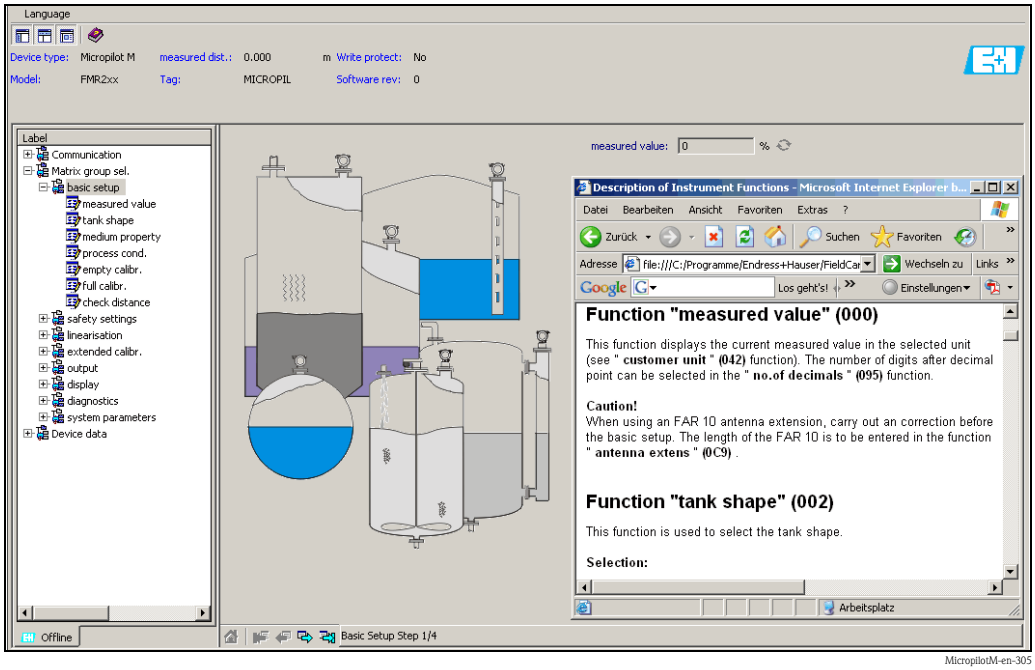
5.3.2 Connection with FXA291 (USB)



L00-FMxxxxxx-04-00-00-yy-024

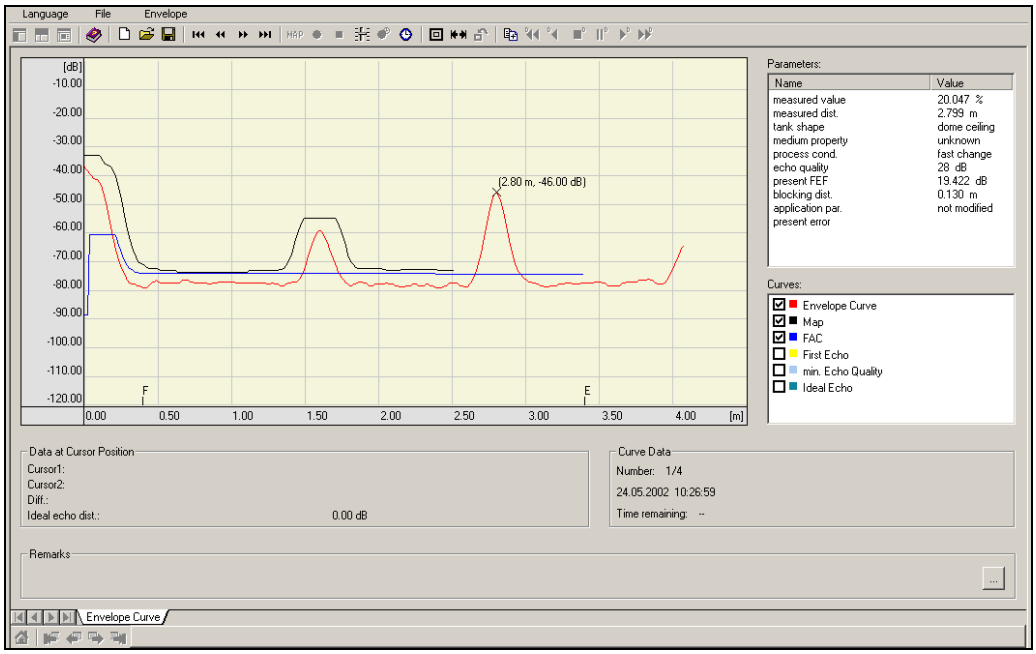
For details refer to:
Technical Information TI405C/07/EN (Commubox FXA291)
Operating Instructions KA271/00/A2 (ToF Adapter FXA291)

5.3.3 Menu-guided commissioning



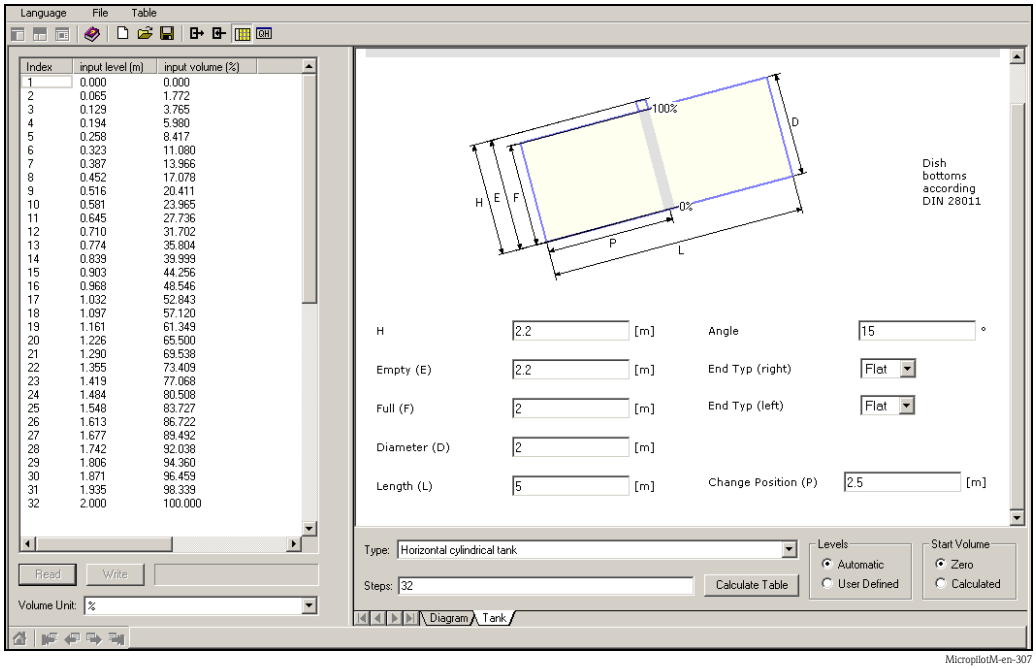
MicropilotM-en-305

5.3.4 Signal analysis via envelope curve



MicropilotM-en-306

5.3.5 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) [2)]
- DD Revision (0C4) [2)] (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

2) "Device Revision" (0C3) and "DD Revision" (0C4) can be obtained through the display and operating module. For details → 36, "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 handheld 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.

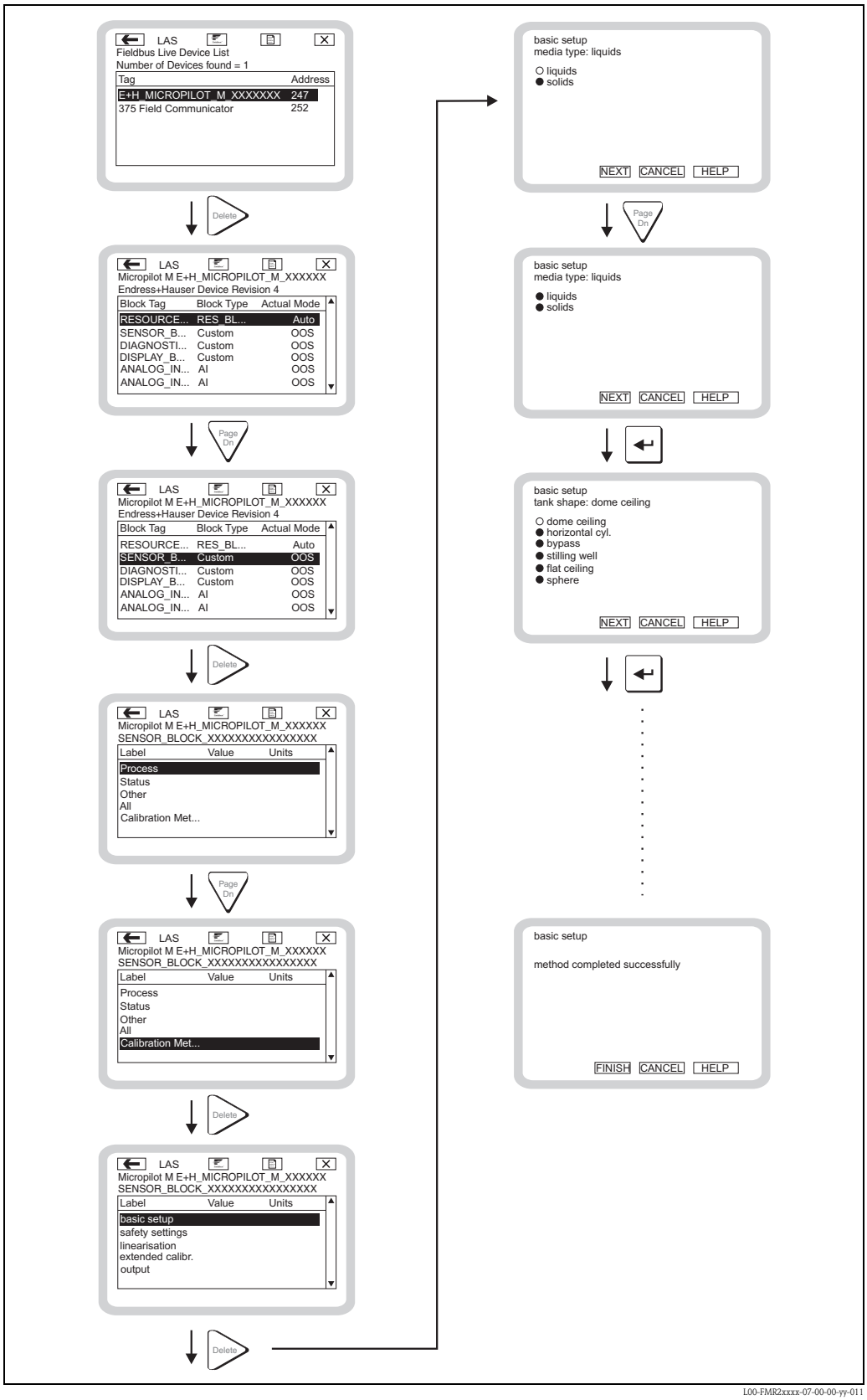
5.5.2 Device Descriptions

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 handheld terminal 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:

6.1 Function check

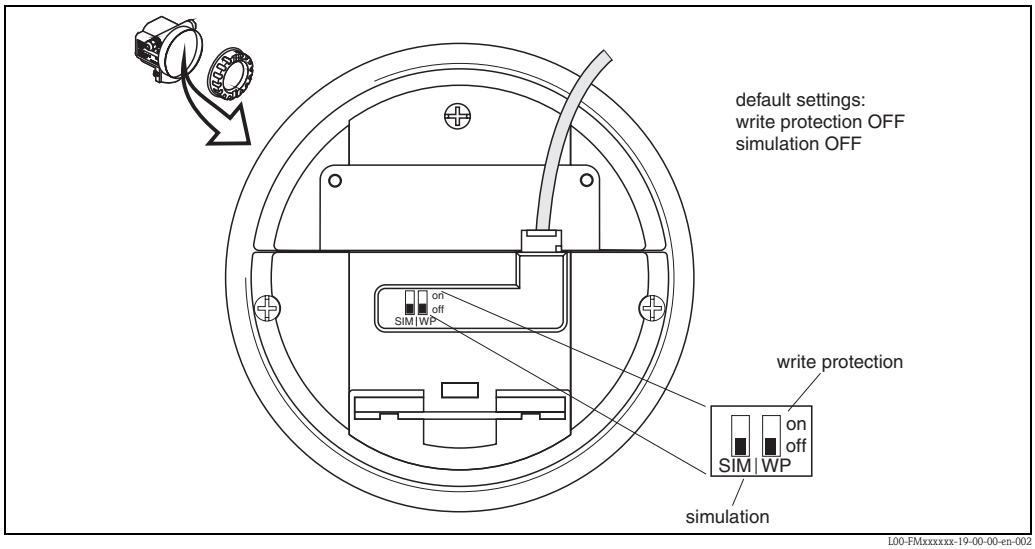
Make sure that all final checks have been completed before you start up your measuring point:
- Checklist "Post installation check", → 28.
- Checklist "Post connection check", → 33.

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



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.

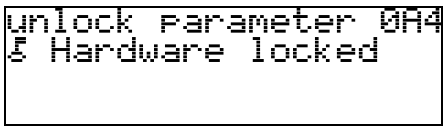
6.2.2 Key combination (display and operating module)

Locking

Press −, + and E simultaneously.

Unlocking

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



Press −, + and E 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

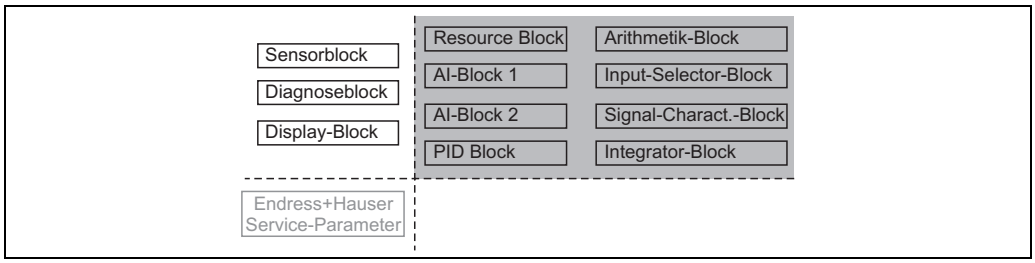
6.3 Resetting the device

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



Performing the reset

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

6.3.2 Resetting the parameters of the transducer blocks

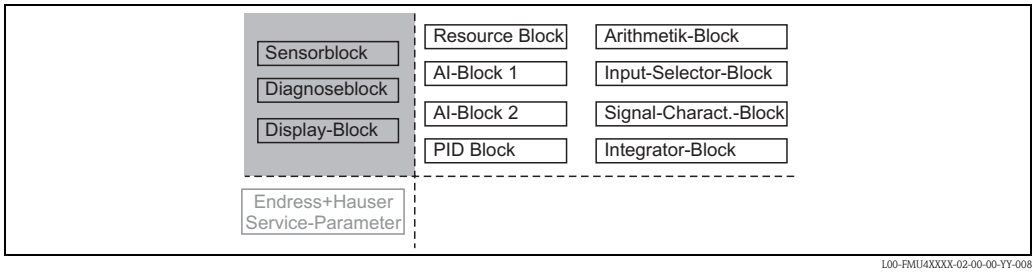
Caution!
A reset may lead to impairment of the measurement. As a rule, a basic calibration is required after a reset.

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)



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"**)

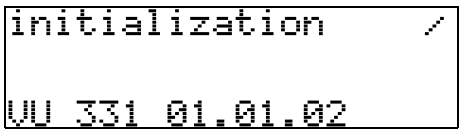
Resetting the tank map with a FOUNDATION Fieldbus configuration tool

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

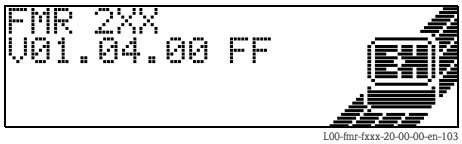
6.4.1 Power up instrument

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



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



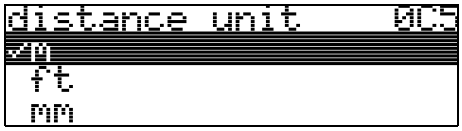
L00-fmr-fxxx-20-00-00-en-103

Press E to exit this display.

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

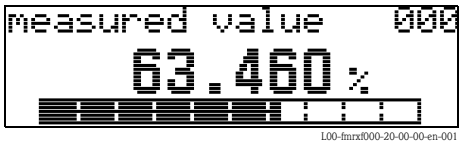
L00-fmrxf092-20-00-00-en-001

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



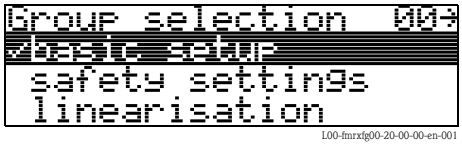
L00-fmrxf0c5-20-00-00-en-001

A measured value is displayed. This is NOT equivalent to the level in your tank. Firstly carry out a basic calibration.



L00-fmrxf000-20-00-00-en-001

Press E to switch to the group selection.
Press E again to start the basic calibration.



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)

This function is used to select the media type.

Selection:
- liquid
- **solid**

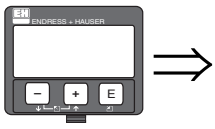
With the selection "liquid" the following functions can be adjusted:

■ 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" the following functions can be adjusted:

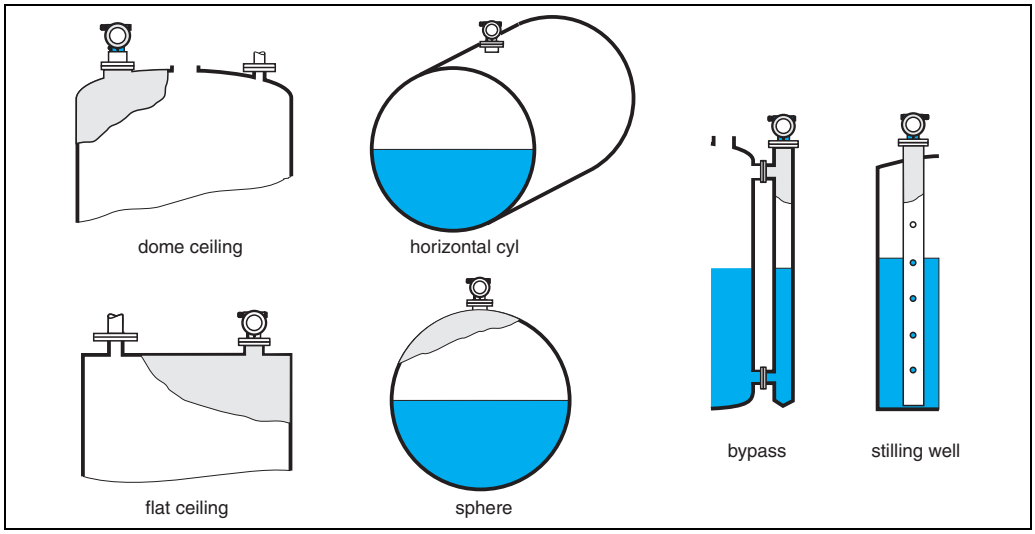
■ vessel / silo	00A
■ medium property	00B
■ process cond.	00C
■ empty calibr.	005
■ full calibr.	006
■ check distance	051
■ range of mapping	052
■ start mapping	053
■ . . .	

Function "tank shape" (002), liquids only



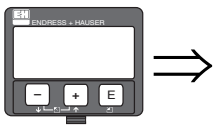
This function is used to select the tank shape.

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



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

Function "medium property" (003), liquids only



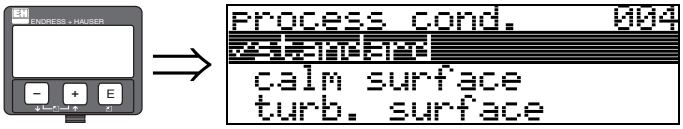
This function is used to select the dielectric constant.

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

Product class	DC (εr)	Examples
A	1.4 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

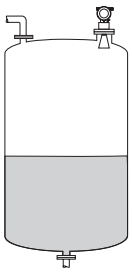
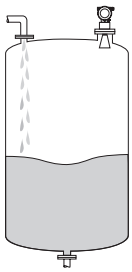
1) Treat Ammonia NH3 as a medium of group A, i. e. use FMR230 in a stilling well.

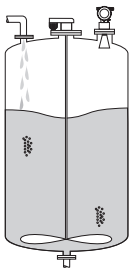
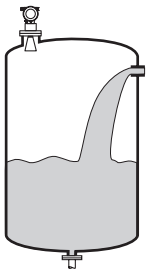
Function "process cond." (004) , liquids only



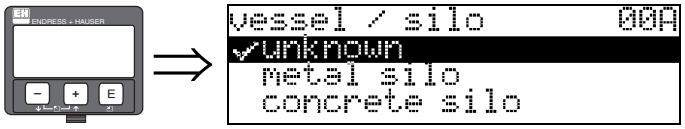
This function is used to select the process conditions.

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.

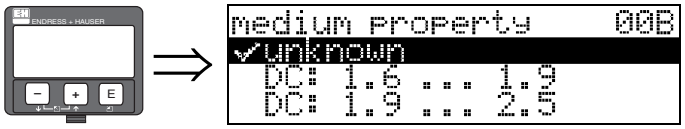
Function "vessel / silo" (00A), solids only



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



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 (Er)	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

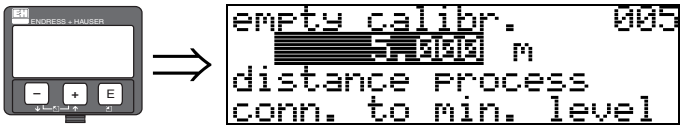
The respective lower group applies for very loose or loosened bulk solids.

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

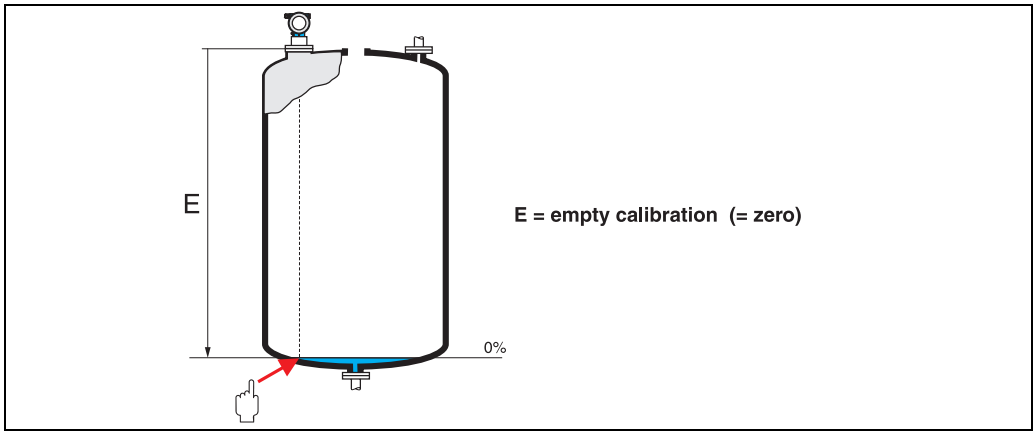
This function is used to select the process conditions.

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

Function "empty calibr." (005)



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



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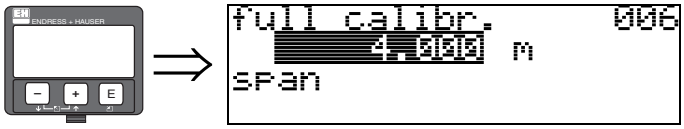
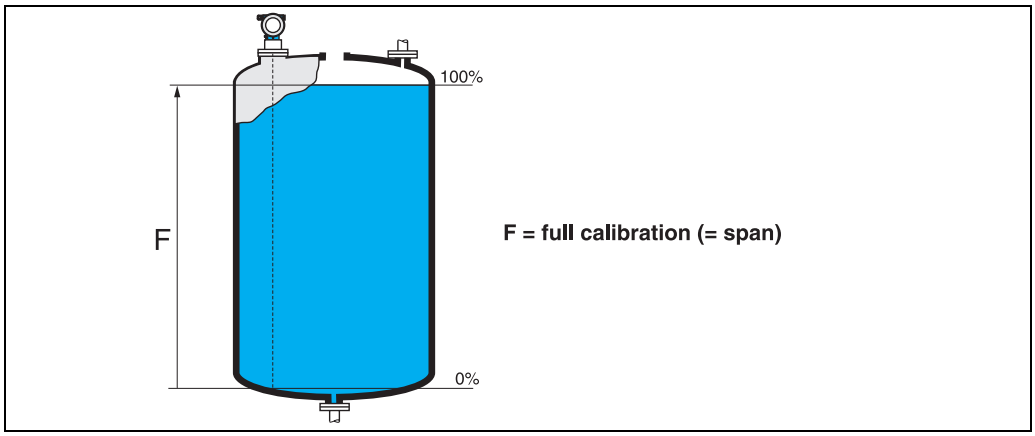
Caution!
For dish bottoms or conical outlets, the zero point should be no lower than the point at which the radar beam hits the bottom of the tank.

Function "full calibr." (006)



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



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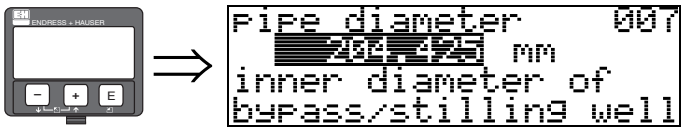
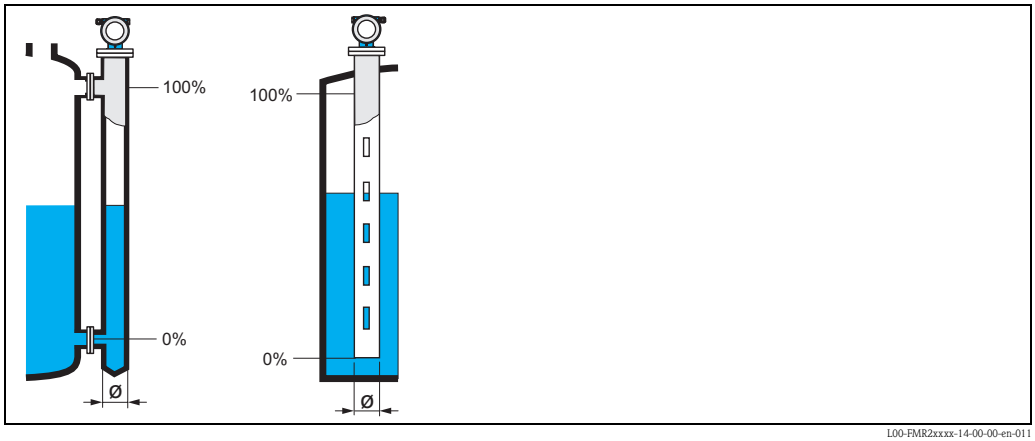
Note!
If **bypass** or **stilling well** was selected in the "**tank shape**" **(002)** function, the pipe diameter is requested in the following step.

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.

Function "pipe diameter" (007)



This function is used to enter the pipe diameter of the stilling well or bypass pipe.



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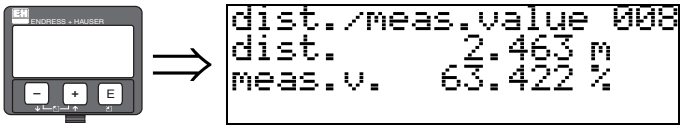
Microwaves propagate more slowly in pipes than in free space. This effect depends on the inside diameter of the pipe and is automatically taken into account by the Micropilot. It is only necessary to enter the pipe diameter for applications in a bypass or stilling well.

Function "Dist./meas.value" (008)

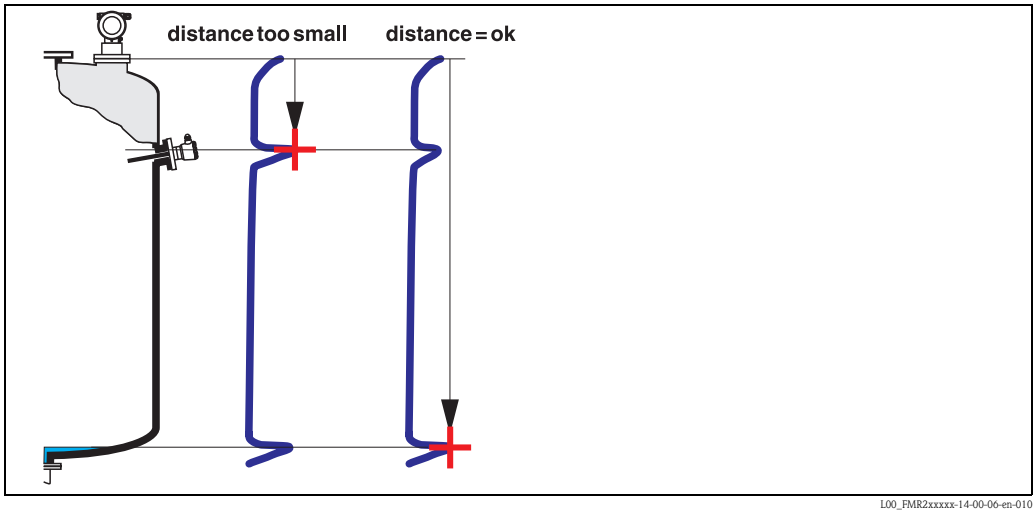


The **distance** measured from the reference point to the product surface and the **level** calculated with the aid of the empty adjustment are displayed. Check whether the values correspond to the actual level or the actual distance. The following cases can occur:
- Distance correct – level correct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

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



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.

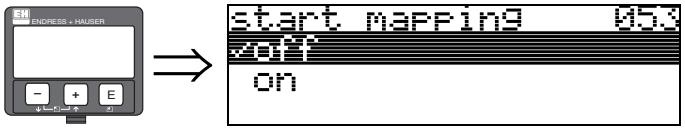
manual
A mapping is also possible by manual entry of the range to be suppressed. This entry is made in the "**range of mapping**" **(052)** function.

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)

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)



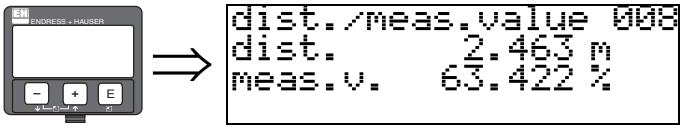
This function is used to start the interference echo mapping up to the distance given in "**range of mapping**" **(052)**.

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

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

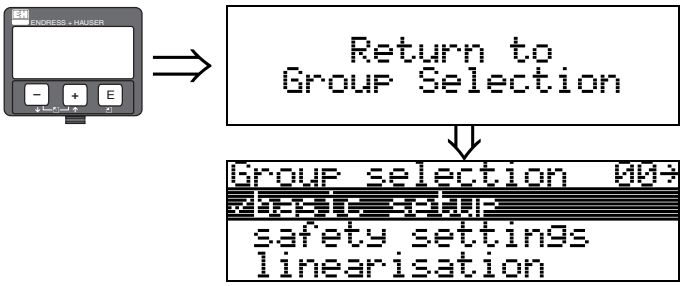
Caution!
A mapping will be recorded only, if the device is not in alarm-state.

Function "Dist./meas.value" (008)



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)**

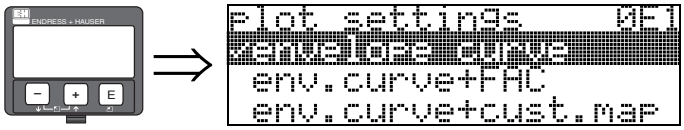


After 3 s, the following message appears

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)



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)

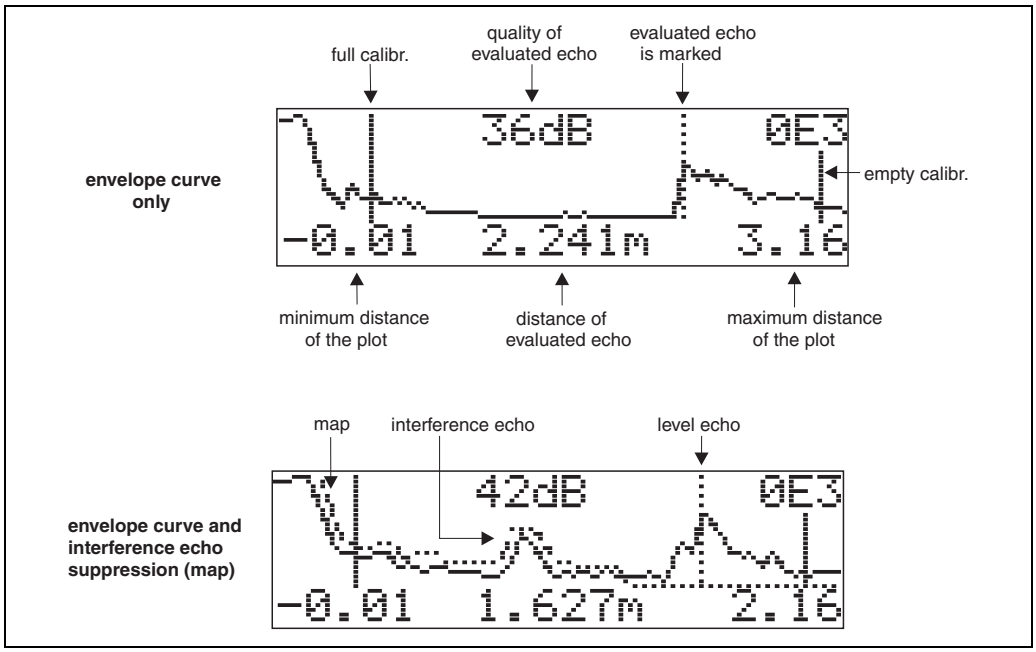
Function "recording curve" (0E2)

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

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 ("Orientation of the Micropilot", → 86).

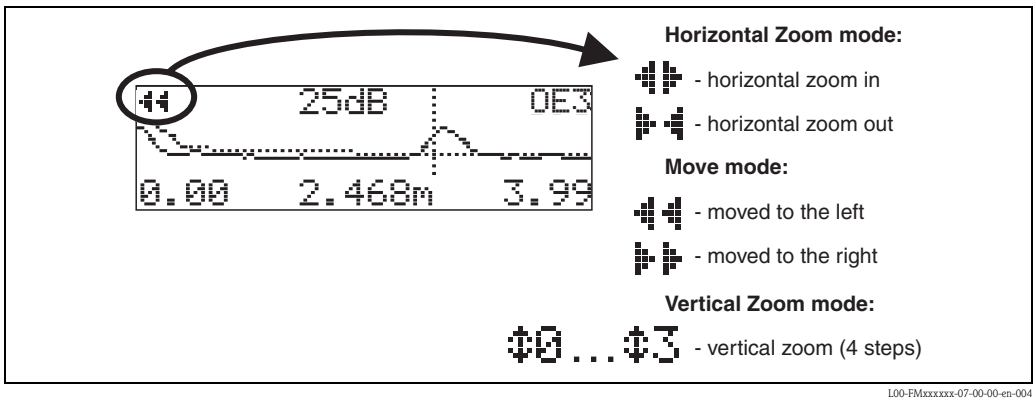
Function "envelope curve display" (0E3)

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



Navigating in the envelope curve display

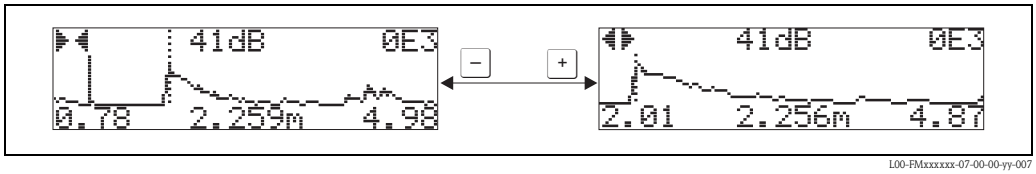
Using navigation, the envelope curve can be scaled horizontally and vertically and shifted to the left or the right. The active navigation mode is indicated by a symbol in the top left hand corner of the display.



Horizontal Zoom mode

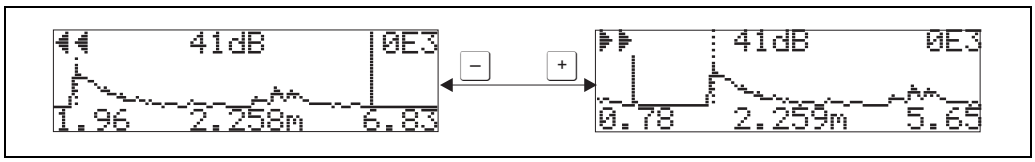
Firstly, go into the envelope curve display. Then press + or − to switch to the envelope curve navigation. You are then in Horizontal Zoom mode. Either ⇹ or ⇸⇷ is displayed.

- + increases the horizontal scale.
- − reduces the horizontal scale.



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.



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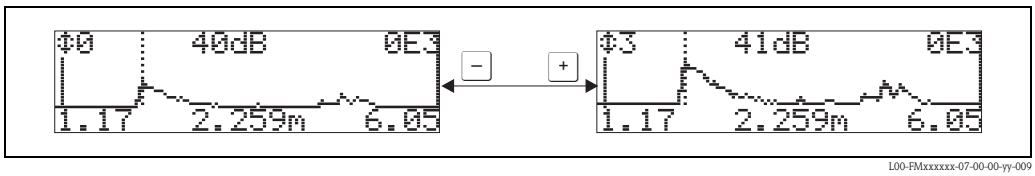
Vertical Zoom mode

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).



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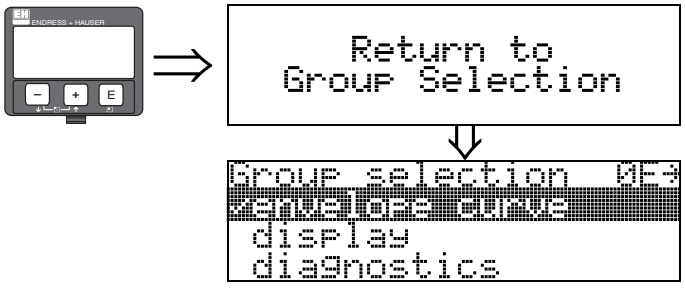
Exiting the navigation

- 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.



After 3 s, the following message appears

6.5 Basic Setup with the Endress+Hauser operating program

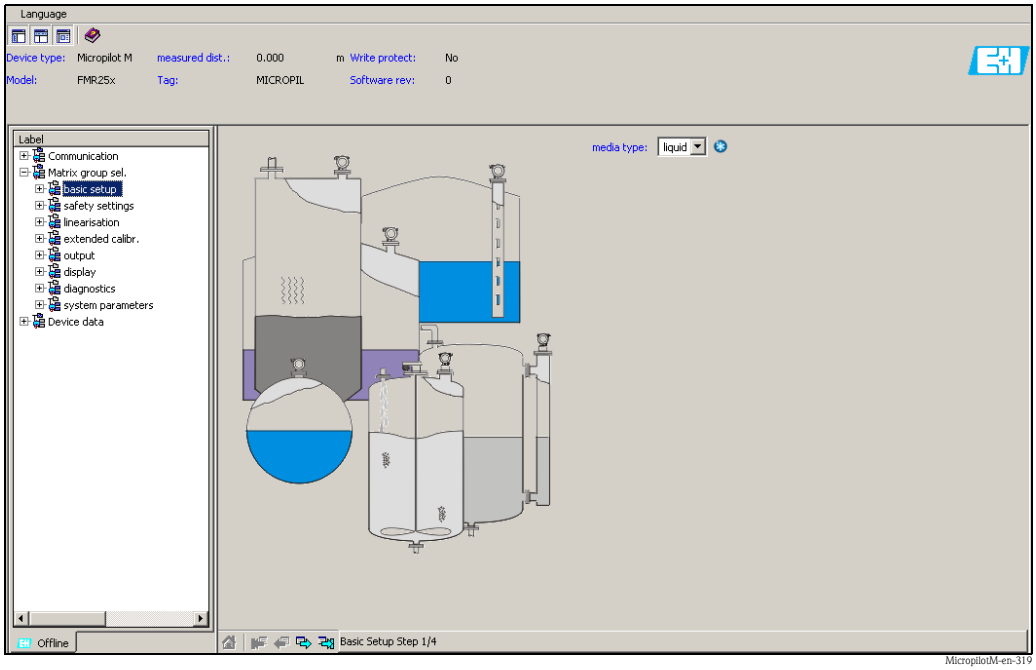
To carry out the basic setup with the operating program, proceed as follows:
- Start the operating program and establish a connection.[3)]
- Select the "**basic setup**" function group in the navigation window.

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!

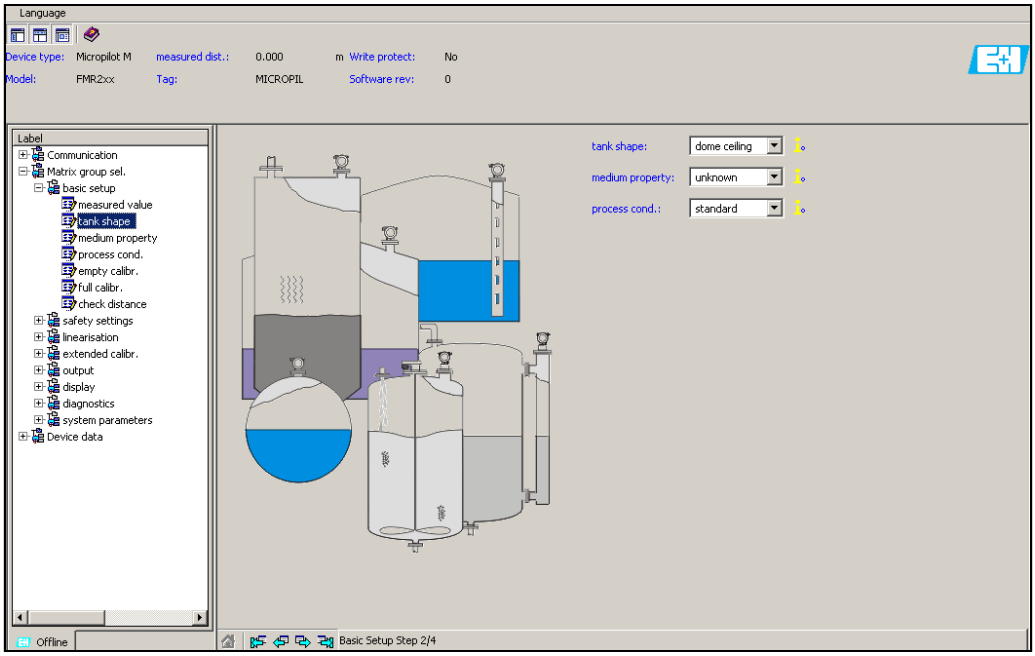


- The "**Next**" button moves you to the next screen display:

3) 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:
  - Tank shape
  - Medium property
  - Process cond.



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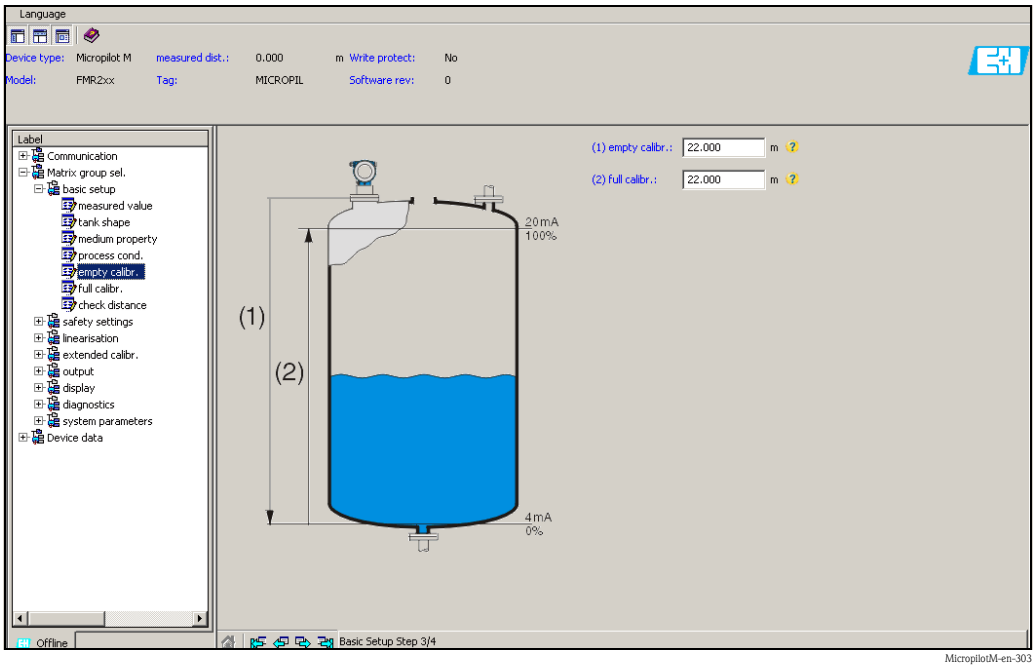
Basic Setup step 3/4:

If "**dome ceiling**", "**horizontal cyl**", "**...**" is selected in the "**tank shape**" function, the following display appears on the screen:

- Empty calibr.
- Full calibr.



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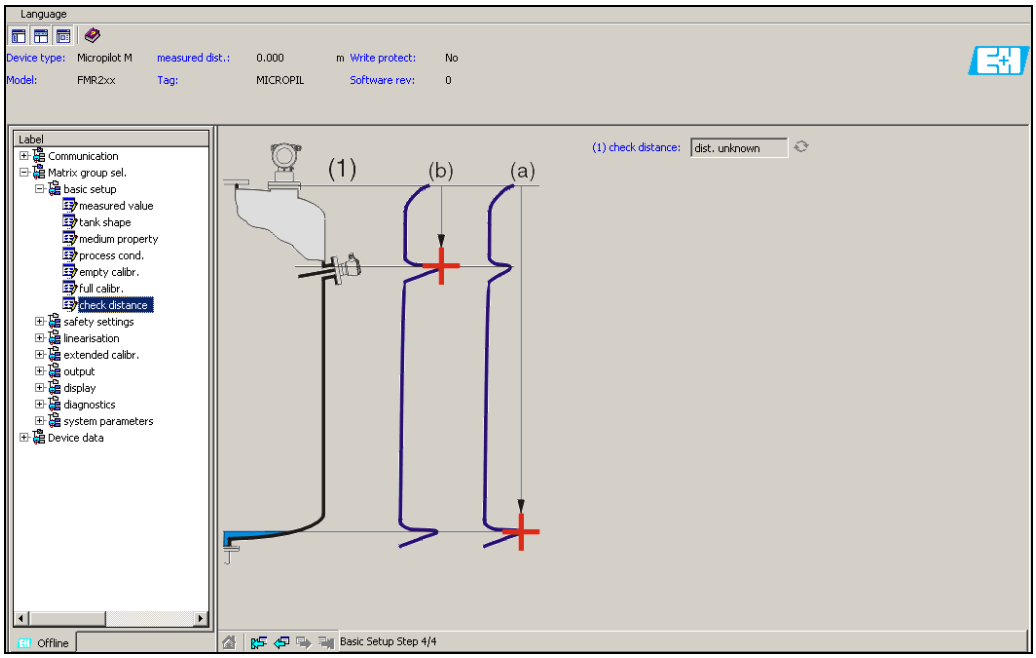
Basic Setup step 4/4:

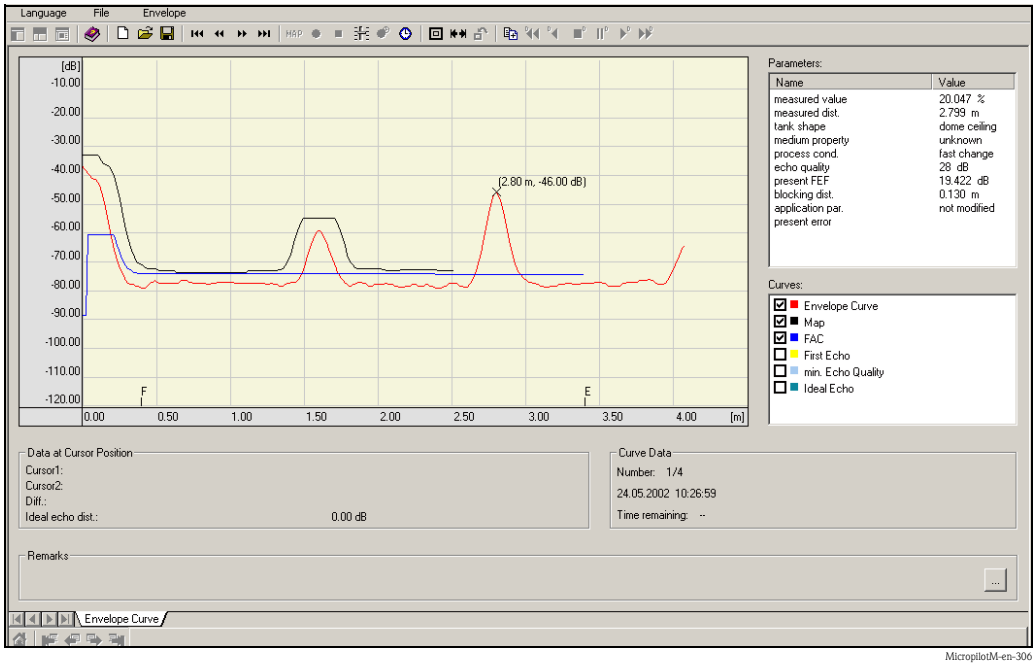
- This step starts the tank mapping
- The measured distance and the current measured value are always displayed in the header



MicropilotM-en-304

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:

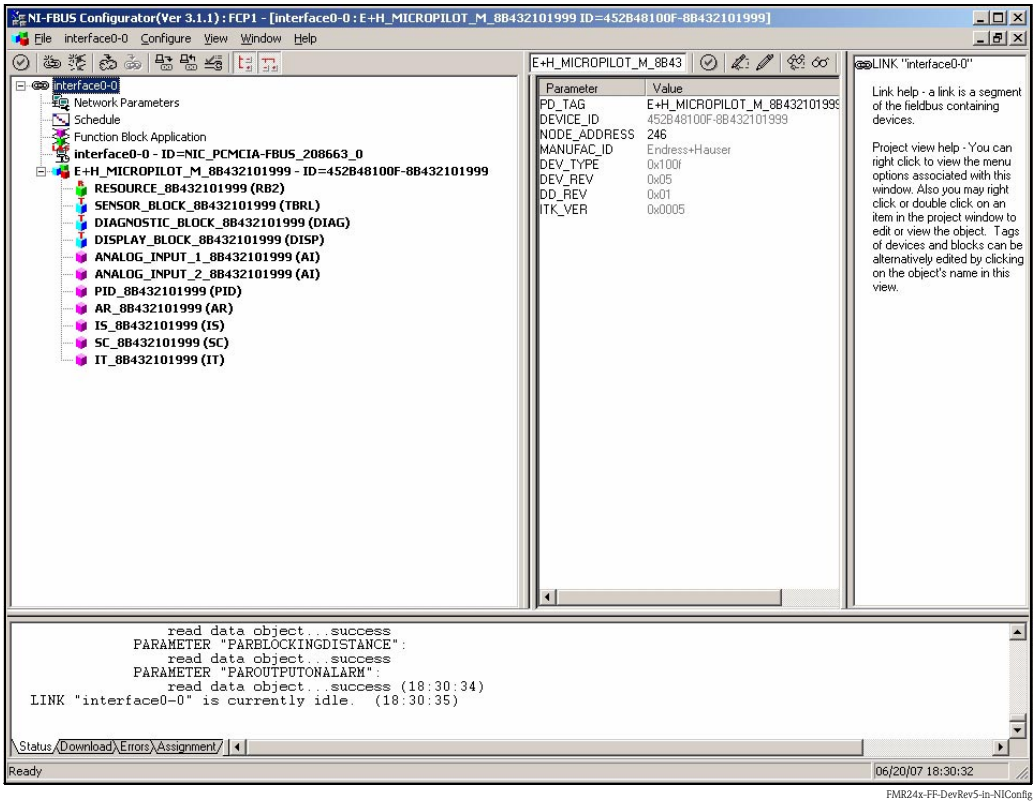
Device_ID = 452B48100F-XXXXXXXX

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 (→ 43).
2. The first time it is connected, the device reports as follows:



FMR24x-FF-DevRev5-in-NIConfig

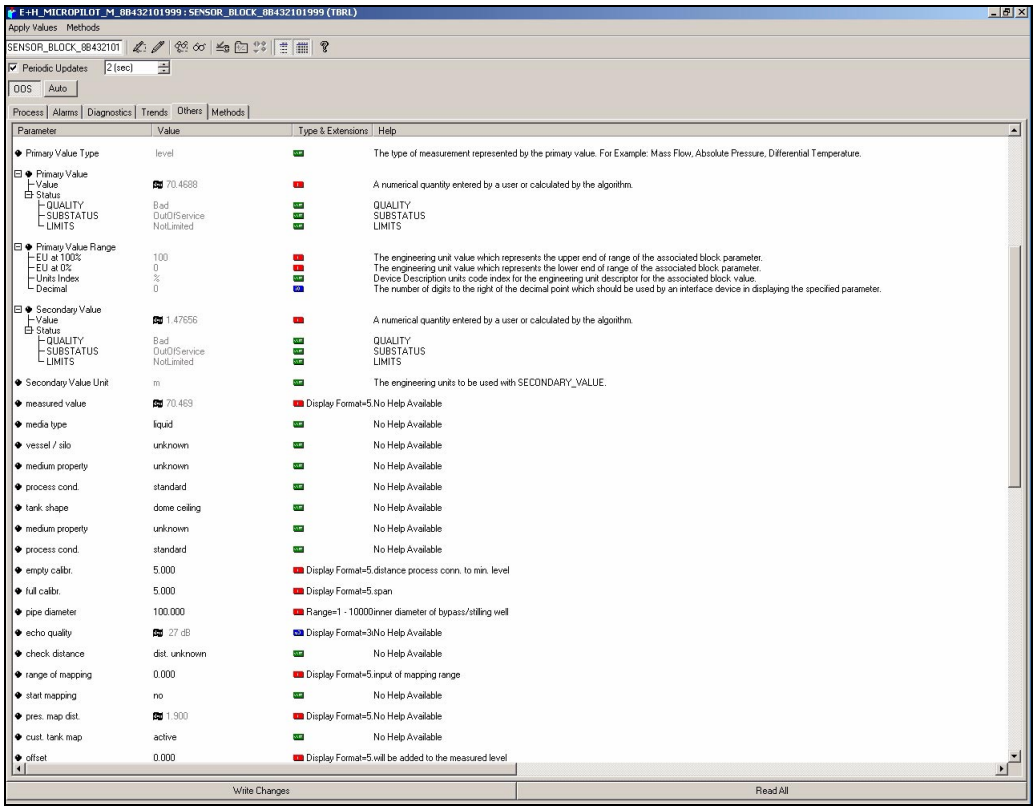
3. Identify the device using the DEVICE_ID and assign the desired field device tag name (PD_TAG).
   Factory setting: PD_TAG = E+H_MICROPILOT_M_XXXXXXXX

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, → 47.
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)

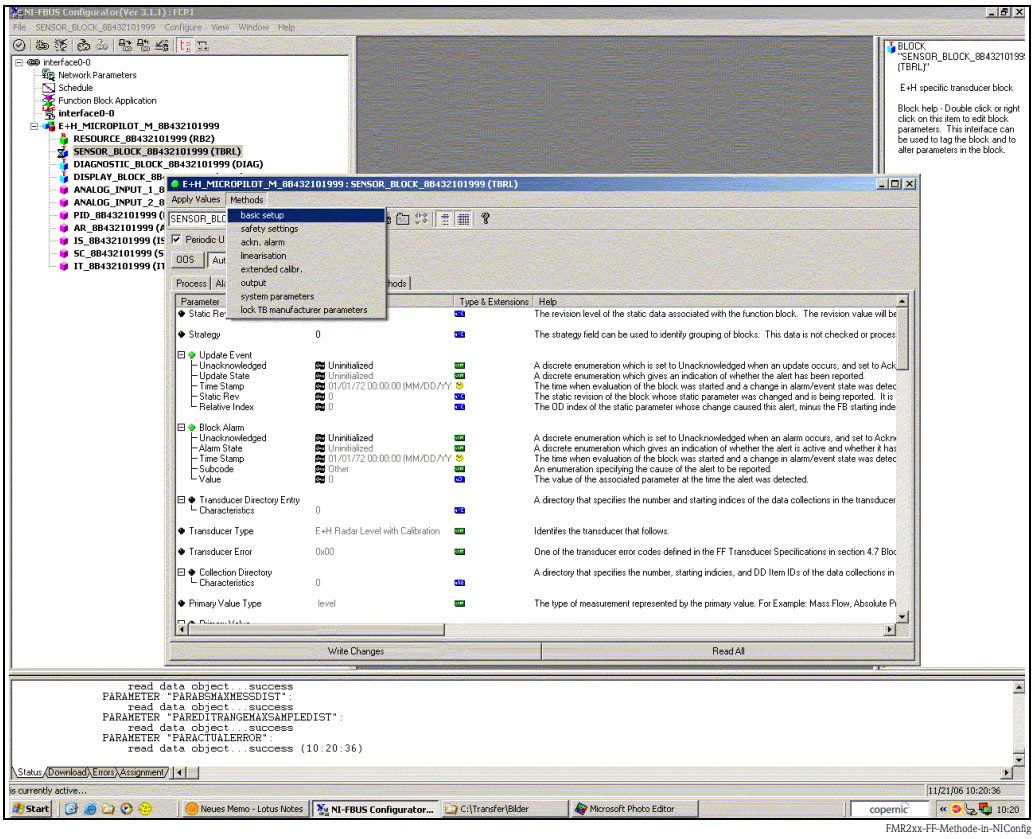
1. Enter the desired block name (optional)
   Factory setting: SENSOR_BLOCK_XXXXXXXX
2. Open the Sensor Block. The following display appears:



FMR24x-FF-DevRev5-Sensorblock-in-NIConfig

Hinweis!
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[4]:
   a. Application parameters (→ 52)
      – 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 (→ 56)
      – PAREMPTYCALIBRATION (empty calibration)
      – PARFULICALIBRATION (full calibration)
   c. Interference echo suppression (→ 58)
      – PARCHECKDISTANCE (check distance)
      – PARSUPPRESSIONDISTANCE (range of mapping)
      – PARSTARTMAPPINGRECORD (start maping)
      – PARPRESMAPRANGE (pres. map. dist.)
      – PARCUSTTANKMAP (cust. tank map)

4) 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 (→ 📄 51)
   – by an Endress+Hauser operating program (→ 📄 64)

6.6.4 Parametrization of the Analog Input Blocks

The instrument 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 → 📄 111, "Analog input block".

   ☝ 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.

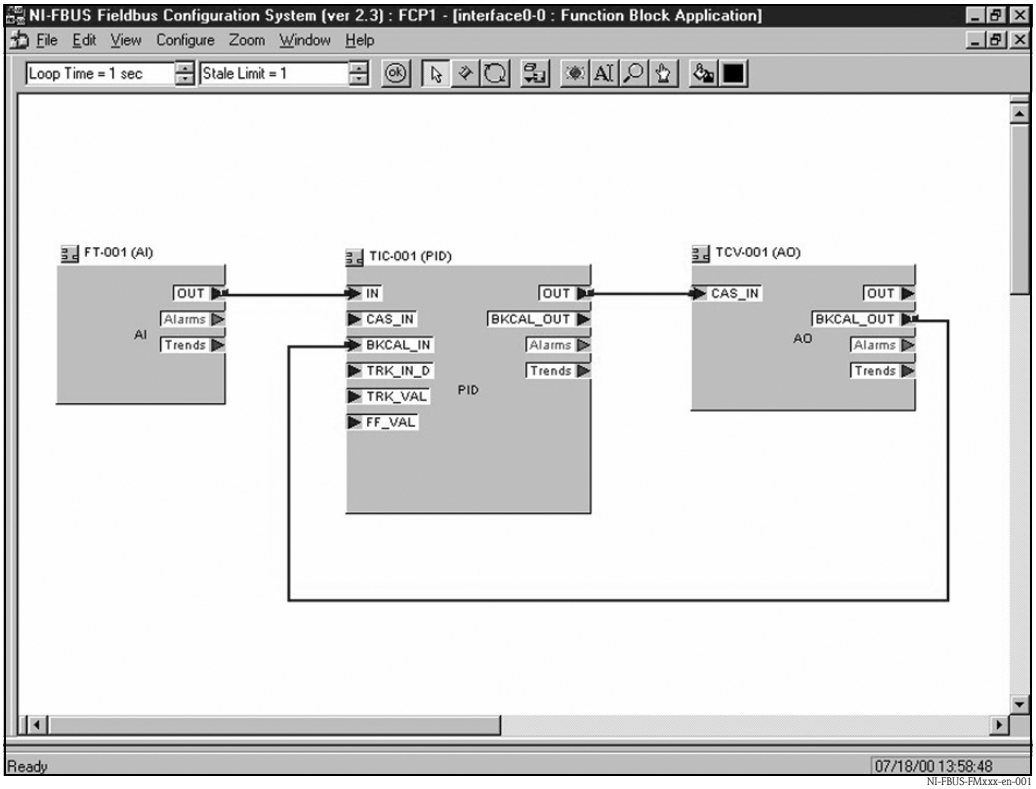
The following settings are to be made:

- 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, → 📄 111, "Analog input block".

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 (→ 📄 70, "Parametrization of the Analog Input Blocks" steps 5 and 6).
   – The Resource Block is in operating mode AUTO.

6.7 Commissioning with the handheld terminal Field Communicator 375, 475

The steps of the commissioning procedure are the same as with a FOUNDATION Fieldbus configuration tool (→ 67). The blocks should be parametrized in the following order:
- the RESOURCE BLOCK
- the SENSOR BLOCK (the "basic setup" method can be used for this, → 46)
- 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 (→ 88, "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 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)

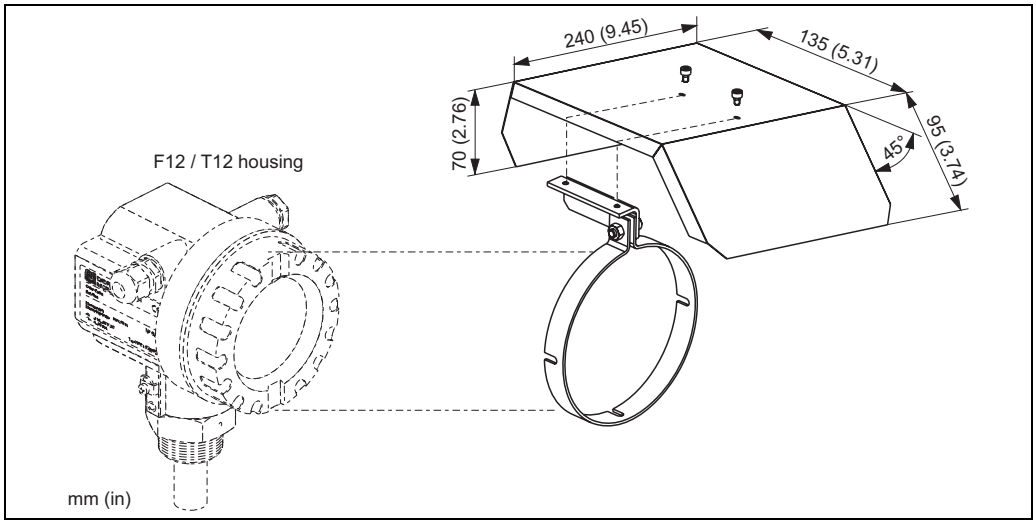
After an antenna component or electronic has been replaced, a new calibration must be carried out. This is described in the repair instructions.

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

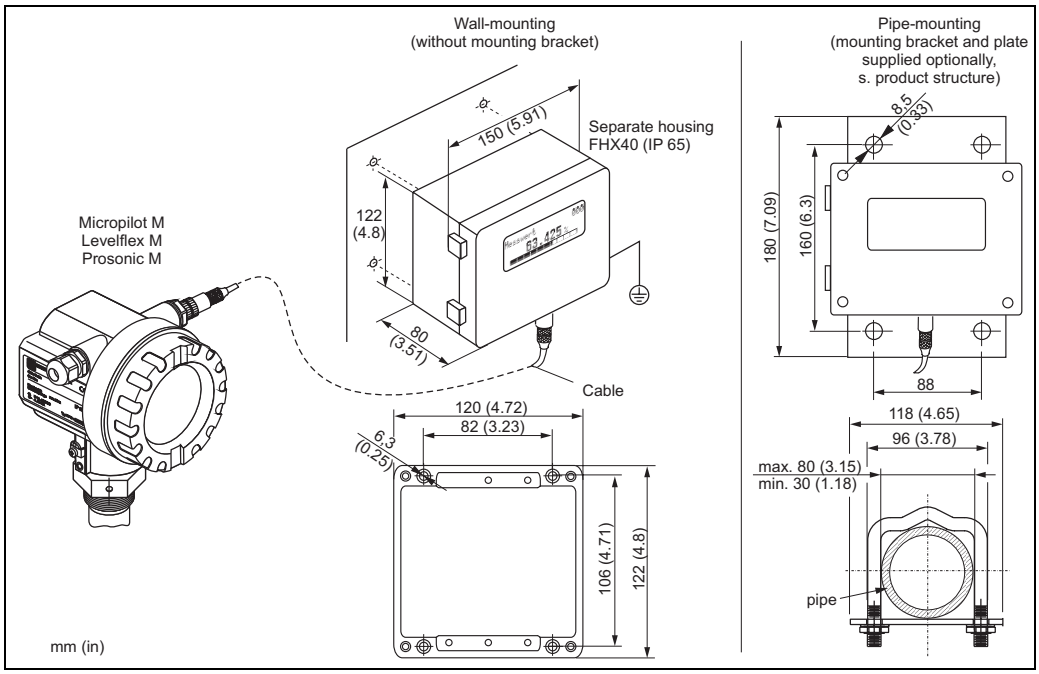
The Commubox FXA291 connects Endress+Hauser field instruments with CDI interface (= Endress+Hauser Common Data Interface) to the USB interface of a personal computer or a notebook. For details refer to TI405C/07/EN.

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 for the instrument. For details refer to KA271F/00/A2.

8.4 Remote display FHX40



Technical data (cable and housing) and product structure:

Max. cable length	20 m (66 ft)
Temperature range	–30 °C to +70 °C (–22 to +158 °F)
Degree of protection	IP65/67 (housing); IP68 (cable) acc. to IEC 60529
Materials	Housing: AlSi12; cable glands: nickle plated brass
Dimensions [mm (in)]	122x150x80 (4.8x5.9x3.1) / 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.

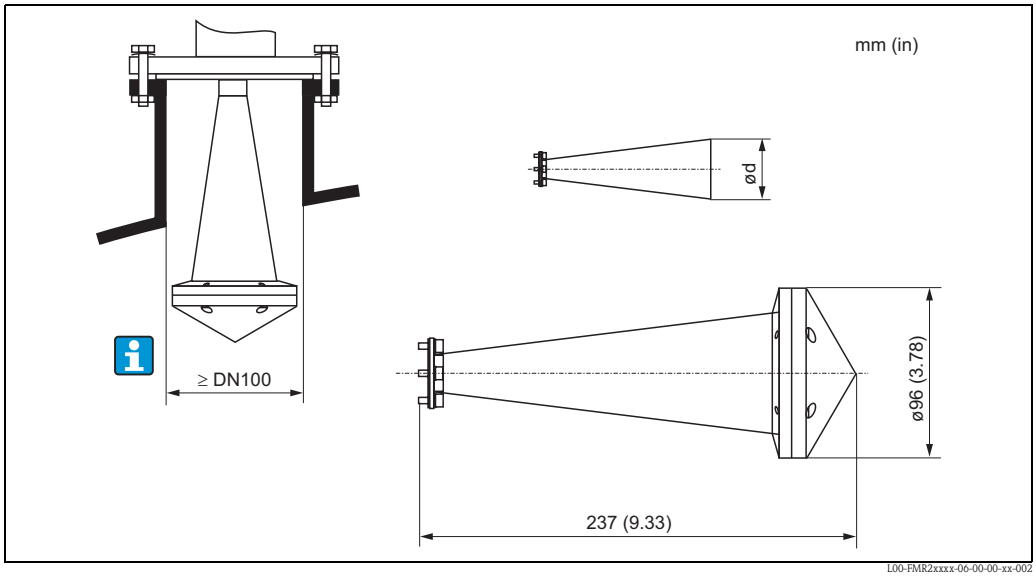
8.5 Horn cover for 80 mm (3") and 100 mm (4") horn antenna

8.5.1 Technical data

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

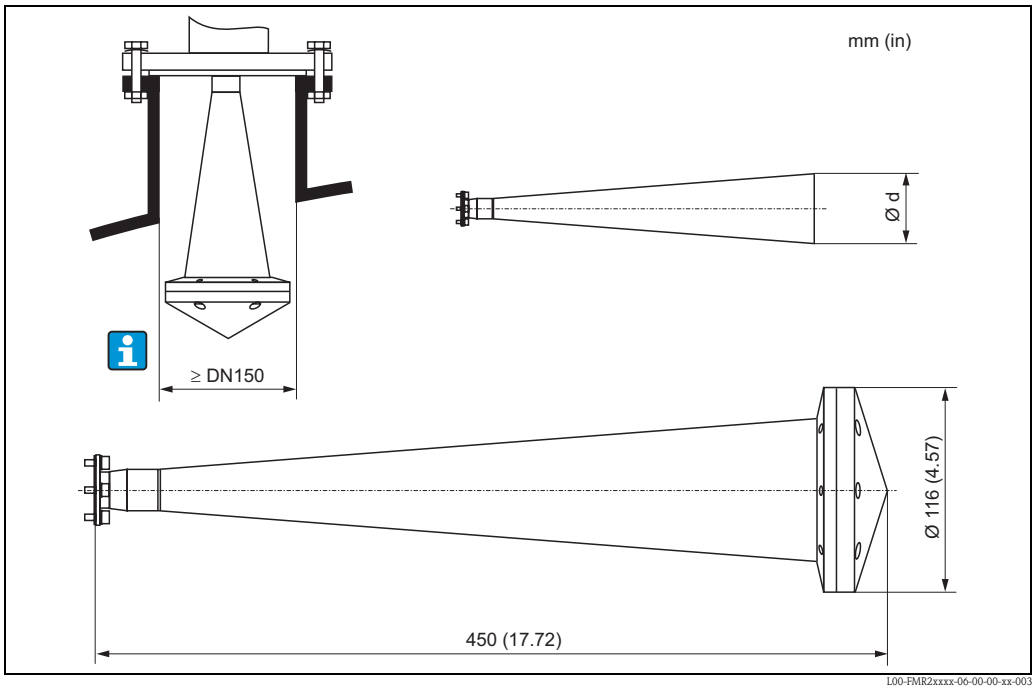
Process conditions	
Vessel pressure max.	0.5 bar (7.252 psi)
Process temperature max.	130 °C (266 °F)

8.5.2 Dimensions



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

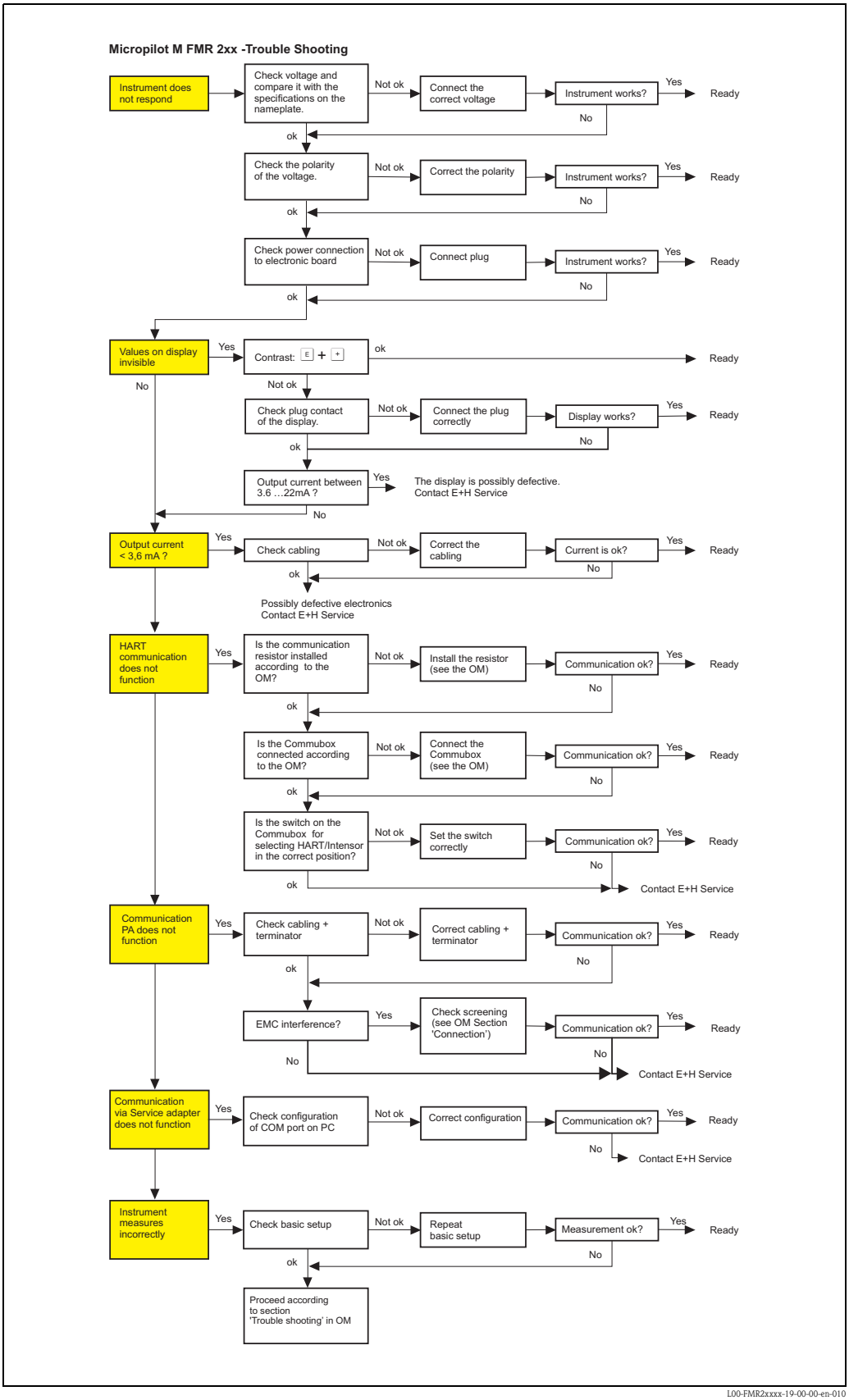
Note!
The horn cover is not allowed to use in areas, where explosion proofed equipment is necessary.

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



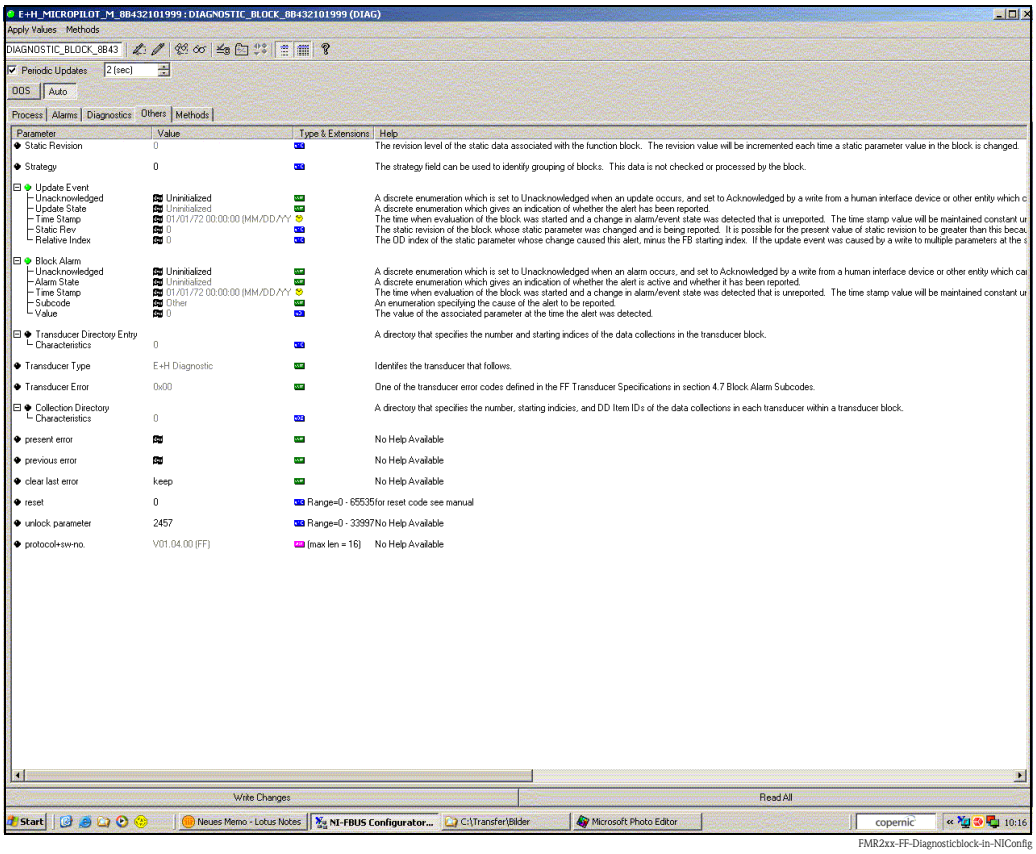
L00-FMR2xxxx-19-00-00-en-010

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

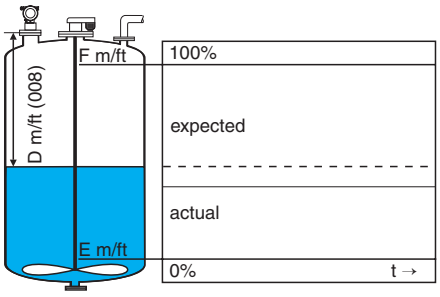
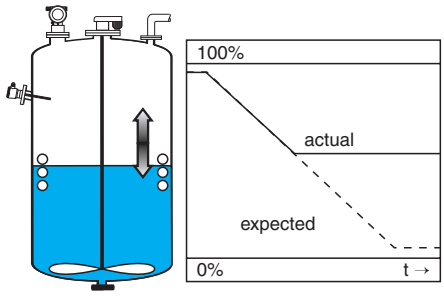
The following table describes the influence of the error codes on the status of the cyclic output values as well as on the parameters BLOCK_ERR and XD_ERROR in the Sensor Block.
The output values are linked to the following measuring values:

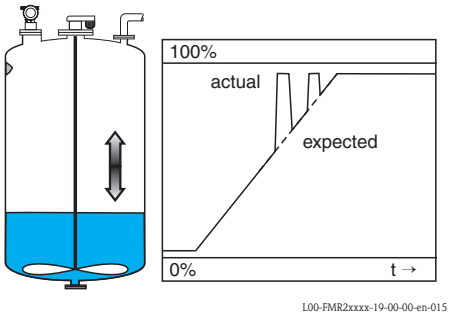
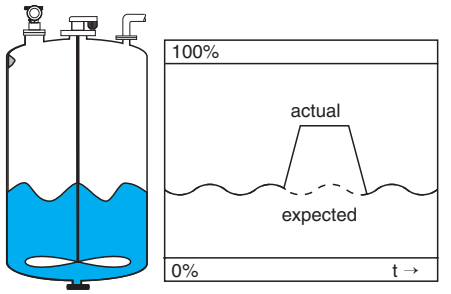
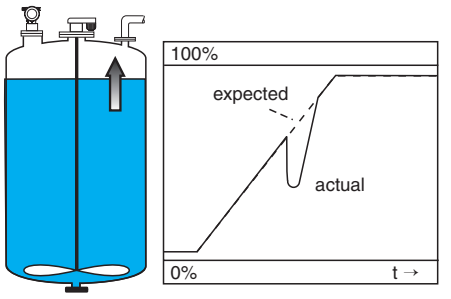
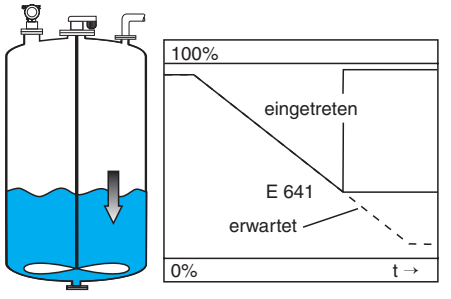
- Primary Value (PV): level/volume
- Secondary Value (SV): distance between sensor membrane and surface of the material measured
- Third Value (TV): sensor temperature

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

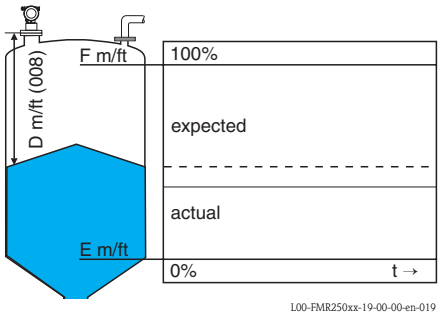
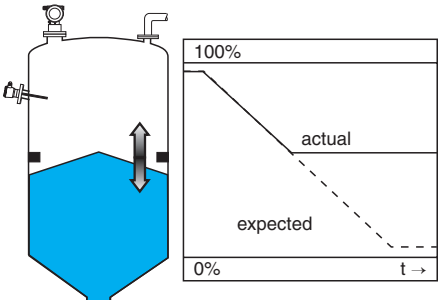
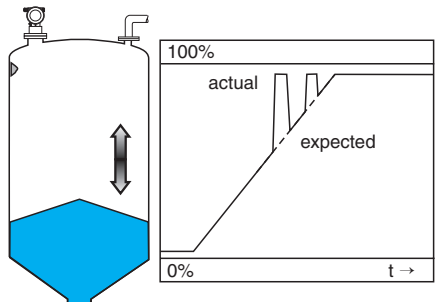
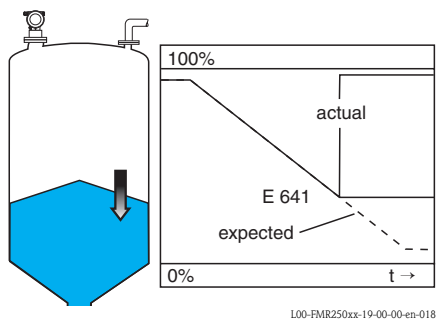
Code	PV Status SV Status	PV Substatus SV Substatus	TV Status	TV Substatus	BLOCK_ER	XD_ERROR
A116	BAD	Device Failure	BAD	Device Failure	Device needs maintenance now	Unspecified Err
A121	BAD	Device Failure	BAD	Device Failure	Memory Failure/ Device needs maintenance now	Electronic Failure
W153	Uncertain	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		1. See table of error messages
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

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	 L00-FMR2xxxx-19-00-00-en-015  L00-FMR2xxxx-19-00-00-en-016	Signal is weakened by the rough surface – the interference echoes are sometimes stronger		1. Carry out tank mapping → basic setup 2. Set the process cond. (004) to "turb. surface" or "agitator" 3. Increase the output damping (058) 4. Optimise the orientation (→ 86) 5. If necessary, select a better mounting position and/or larger antenna
During filling/ emptying the measured value jumps ownwards	 L00-FMR2xxxx-19-00-00-en-017	Multiple echoes	yes →	1. Check the tank shape (002), e. g. "dome ceiling" or "horizontal cyl" 2. In the range of the blocking dist. (059) there is no echo evaluation → Adapt the value 3. If possible, do not select central installation position 4. Perhaps use a stilling well
E641 (loss of echo)	 L00-FMR2xxxx-19-00-00-en-018	Level echo is too weak. Possible causes: ■ Rough surface due to filling/ emptying ■ Agitator running ■ Foam	yes →	1. Check application arameters (002), (003) and (004) 2. Optimise alignment (→ 86) 3. If necessary, select a better installation position and/or larger antenna

9.4 Application errors in solids

Error	Output	Possible cause		Remedy
A warning or alarm has occurred	Depending on the configuration	See table of error messages		1. See table of error messages
Measured value (000) is incorrect		Measured distance (008) OK?	yes →	1. Check empty calibr. (005) and full calibr. (006). 2. Check linearisation: → level/ullage (040) → max. scale (046) → Check table
		no ↓		
		An interference echo may have been evaluated.	yes →	1. Carry out tank mapping → basic setup
No change off measured value on filling/emptying		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) (→ 86) 3. If necessary, clean antenna 4. If necessary, select better mounting position
During filling or emptying the measured value jumps sporadically to a higher level		Signal is weakened (e. g. by fluidisation of the surface, extreme dust formation) – the interference echoes are sometimes stronger		1. Carry out tank mapping → basic setup 2. Increase the output damping (058) 3. Optimise the orientation (→ 86) 4. If necessary, select a better mounting position and/or larger antenna
E641 (loss of echo)		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 (→ 86) 3. If necessary, select a better installation position and/or larger antenna

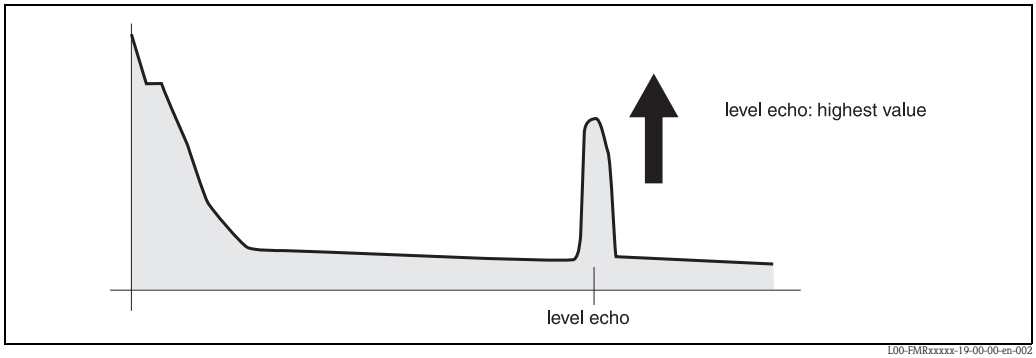
9.5 Orientation of the Micropilot

For orientation a marker is found on the flange or threaded boss of the Micropilot. During installation this must be oriented as follows (→ 10):
- In tanks: to the vessel wall
- In stilling wells: to the slots
- In bypass pipes: vertical to the tank connectors

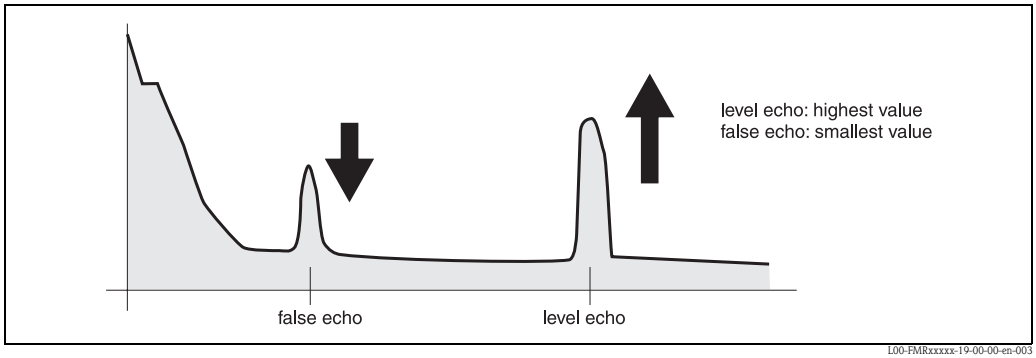
After commissioning the Micropilot, the echo quality indicates whether a sufficiently large measuring signal is obtained. If necessary, the quality can be optimised later. Vice versa, the presence of an interference echo can be used to minimise this by optimum orientation. The advantage of this is that 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.

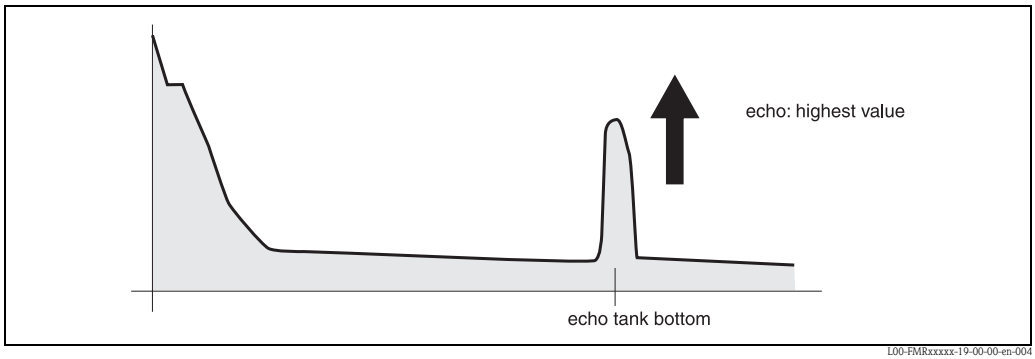
1. It is best to empty the container so that the bottom is just covered. However, alignment can be carried out even if the vessel is empty.
2. Optimisation is best carried out with the aid of the envelope graph in the display or the FieldCare.
3. Unscrew the flange or loosen the threaded boss by a half 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:



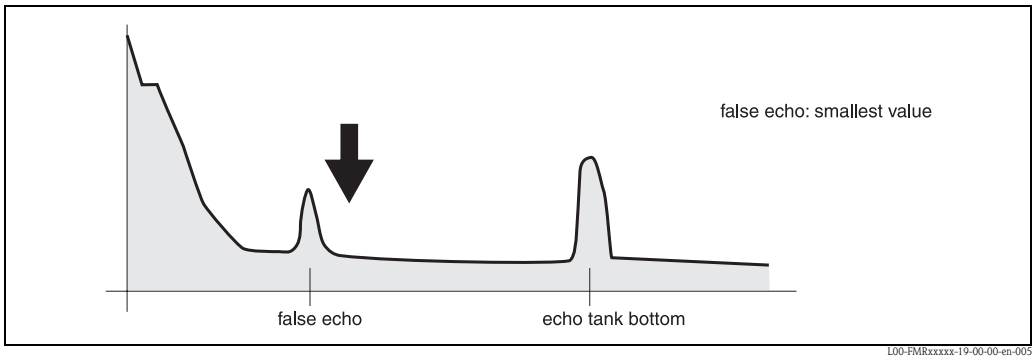
Vessel partly full, no interference echo obtained



Vessel partly full, interference echo obtained:



Vessel empty, no interference echo



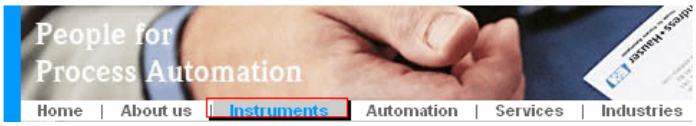
Vessel empty, interference echo obtained

7. Fix the flange or threaded boss in this position. If necessary, replace the seal.
8. Carry out tank mapping, → 📄 58.

9.6 Spare Parts

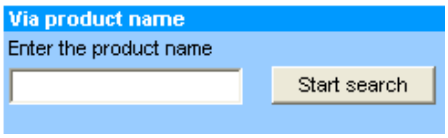
An overview of the spare parts for your device is available in the internet at www.endress.com. To obtain information on the spare parts, proceed as follows:

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

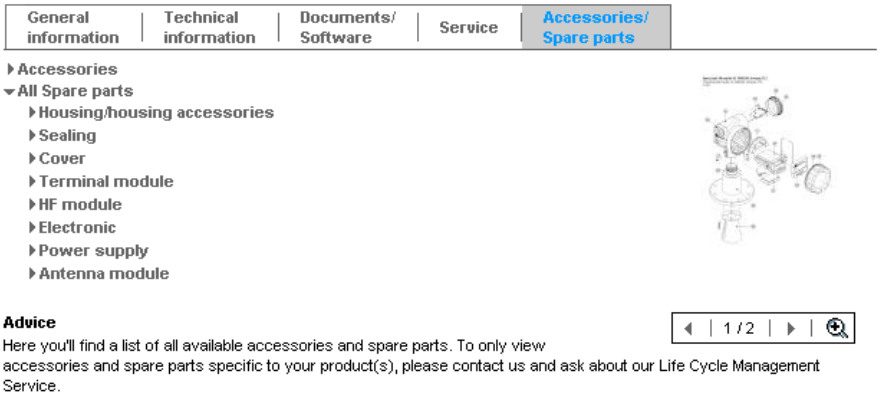


3. Enter the product name into the "product name" field.

Endress+Hauser product search



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
12.2000	01.01.00	Original software. Operated via: – ToF Tool from version 1.5 – Commuwin II (from version 2.07-3) – HART communicator DXR275 (from OS 4.6) withRev. 1, DD 1.	BA221F/00/EN/01.01 52006323
05.2002 03.2003	01.02.00 01.02.02	■ Function group: envelope curve display ■ Katakana (japanese) ■ current turn down (HART only) ■ the customer tank map can be edited ■ length of antenna extension FAR10 can be entered directly Operated via: – ToF Tool from version 3.1 – Commuwin II (from version 2.08-1) – HART communicator DXR375 with Rev. 1, DD 1.	BA221F/00/EN/03.03 52006323
01.2005	01.02.04	Function "echo lost" improved	
03.2006	01.04.00	■ Function: detection windowg Operated via: – ToF Tool from version 4.2 – FieldCare from version 2.02.00 – HART-Communicator DXR375 with Rev. 1, DD 1.	BA221F/00/EN/12.05 52006322
10.2006	01.05.00	Support of additional HF modules integrated. ■ Function: media type	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
Up to 8 Micropilot M transmitters can be installed in the same tank because the transmitter pulses are statistically coded.

Transmitting power

Distance	Average energy density in beam direction	
	max. measuring range = 20 m (66 ft) / 40 m (131 ft)	measuring range = 70 m (230 ft)
1 m (3.3 ft)	< 12 nW/cm^2	< 64 nW/cm^2
5 m (16 ft)	< 0.4 nW/cm^2	< 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 symbol, error code and plain text description on the on-site display
- Status byte of the digital signal input

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 mm (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 ½ NPT
- 7/8" FOUNDATION Fieldbus plug

Supply voltage

- 9 V to 30 V (Ex)[5)]
- 9 V to 32 V (nion 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 arrester1, 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

5) 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 abs. ±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:

- **Not** for max. measuring range = 70 m (230 ft)
  - to 1 m (3.3 ft): ± 10 mm (±0.39 in)
- For max. measuring range = 40 m (131 ft)
  - to 10 m (33 ft): ± 3 mm (±0.12 in)
  - ex 10 m (33 ft): ± 0.03 % of measuring range
- For max. measuring range = 70 m (230 ft)
  - 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: 1mm (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: 2 mm (0.08 in) /10 K, max. 5 mm (0.2 in) over the entire temperature range -40 °C to +80 °C (-40 °F to +176 °F)

Effect of gas phase

High pressures reduce the propagation velocity of the measuring signals in the gas/vapor above the fluid. This effect depends on the gas/vapor and is particularly large for low temperatures. This results in a measuring error that gets bigger as the distance increases between the device zero point (flange) and product surface. The following table illustrates this measured error for a few typical gases/vapors (with regard to the distance; a positive value means that too large a distance is being measured):

Gas phase	Temperature		Pressure				
	°C	°F	1 bar (14.5 psi)	10 bar (145 psi)	50 bar (725 psi)	100 bar (1450 psi)	160 bar (2320 psi)
Air Nitrogen	20	68	0.00 %	0.22 %	1.2 %	2.4 %	3.89 %
	200	392	-0.01 %	0.13 %	0.74 %	1.5 %	2.42 %
	400	752	-0.02 %	0.08 %	0.52 %	1.1 %	1.70 %
Hydrogen	20	68	-0.01 %	0.10 %	0.61 %	1.2 %	2.00 %
	200	392	-0.02 %	0.05 %	0.37 %	0.76 %	1.23 %
	400	752	-0.02 %	0.03 %	0.25 %	0.53 %	0.86 %
Water (saturated steam)	100	212	0.20 %	—	—	—	—
	180	356	—	2.1 %	—	—	—
	263	505	—	—	8.6 %	—	—
	310	590	—	—	—	22 %	—
	364	687	—	—	—	—	41.8 %

Note!
When the pressure is known and constant, this measured error can, for example, be compensated by means of linearization.

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 / IEC68-2-64: ■ FMR230/231; FMR240; FMR245; FMR244 with 40 mm (1½") antenna: 20...2000 Hz, $1(m/s^2)^2/Hz$
Cleaning of the antenna	The antenna can get contaminated, depending on the application. The emission and reception of microwaves can thus eventually be hindered. The degree of contamination leading to an error depends on the medium and the reflectivity, mainly determined by the dielectric constant εr. If the medium tends to cause contamination and deposits, cleaning on a regular basis is recommended. Care has to be taken not to damage the antenna in the process of a mechanical or hose-down cleaning (eventually connection for cleaning liquid). 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 reduces 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

Type of antenna		Seal	Temperature	Pressure	Wetted parts
V	Standard	FKM Viton	-20 °C to +150 °C (-4 °F to +302 °F)	-1 to 40 bar (-14.5 to 580 psi)	PTFE, seal, 316L resp. Alloy C22
E	Standard	FKM Viton GLT	-40 °C to +150 °C (-40 °F to +302 °F)		
K	Standard	Kalrez (Spectrum 6375)	-20 °C to +150 °C (-4 °F to +302 °F)		

↑ → 🖹 7, "Ordering structure"

Dielectric constant

- in a stilling well: $\varepsilon r \geq 1.4$
- in free space: $\varepsilon r \geq 1.9$

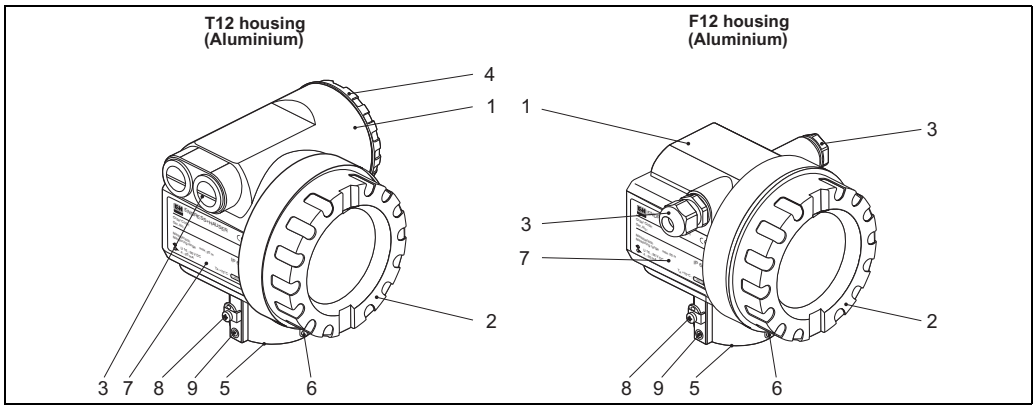
10.1.8 Mechanical construction

Weight

- F12/T12 housing: approx 4 kg (8.82 lbs) + weight of flange
- F23 housing: approx 7.4 kg (16.32 lbs) + weight of flange

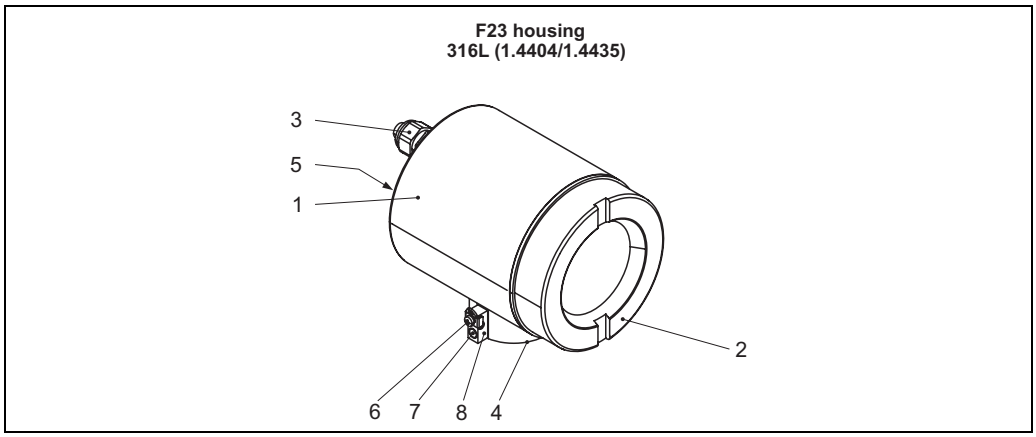
Material
(not in contact with process)

Materials of T12 and F12 housing (seawater-resistant, powder-coated)



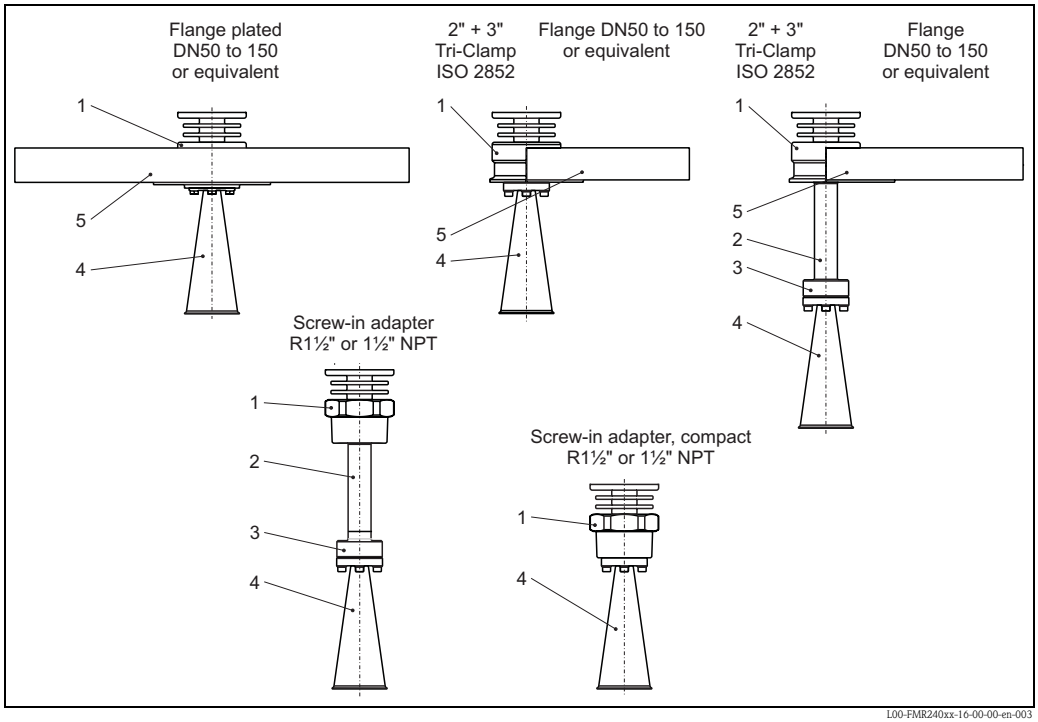
Pos.	Part	Material	
1	T12 and F12 housing	AlSi10Mg	
2	Cover (Display)	AlSi10Mg	
	Sealing	Fa. SHS: EPDM 70pW FKN	
	Window	ESG-K-Glass (Toughened safety glass)	
	Sealing of the glass	Silicone sealing compound Gomastit 402	
3	Sealing	Fa. SHS: EPDM 70 pW FKN	Trelleborg: EPDM E7502
	Cable gland	Polyamid (PA), 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)



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)



Pos.	Part	Material	
1	Adapter	316L (1.4404)	
	Mounting plate		
2	Pipe extension	316L (1.4404)	
3	Process adapter extension	316L (1.4404)	
	Mounting plate		
4	Horn	316L (1.4404)	Hastelloy C22
	Screws	A4	Hastelloy C22
	Spring washer	A4	
5	Flange	316L (1.4404) optional Hastelloy C22 plated	

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
Overspill protection	German WHG, see ZE244F/00/DE, → 🖹 7, "Ordering structure. SIL 2, see SD150F/00/EN "Functional Safety Manual".
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 technology in process industries.

Ex approval

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

Feature		Variant	ZE244F	ZD135F	ZD134F	ZD133F	ZD132F	ZD129F	ZD128F	ZD127F	ZD126F	ZD021F	ZD062F	ZD060F	ZD059F	ZD058F	ZD056F	ZD055F	XC007F	XA406F	XA373F	XA371F	XA370F	XA368F	XA366F	XA364F	XA362F	XA357F	XA356F	XA354F	XA277F	XA233F	XA208F	XA207F	XA204F	XA203F	XA102F	XA101F	XA100F	XA099F
10 Approval:	Non-hazardous area	A																																					
	ATEX II 1/2G, II 1/2D, Alu blind cover, ATEX II 1/2G Ex ia IIC T6, ATEX II 1/2D	B																		X																				
	IECEx Zone 0/1, Ex ia IIC T6	D																						X	X	X	X	X		X										
	IECEx Zone 0/1, Ex d (ia) IIC T6	E																											X											
	Non-hazardous area, WHG [1]	F	X																																					
	ATEX II 3G Ex nA II T6	G																													X									
	ATEX II 1/2G Ex ia IIC T6, ATEX II 3D	H																												X		X	X	X	X	X			X
	NEPSI Ex ia IIC T6	I																			X		X																
	NEPSI Ex d(ia)ia IIC T6	J																				X																	
	TIIS Ex d (ia) IIC T4	L																																					
	CSA General Purpose	N																																					
	NEPSI Ex nAL IIC T6	R																	X																				
	FM IS Cl.I Div.1 Gr.A-D, zone 0, 1, 2	S						X	X	X	X	X				X	X																						
	FM XP Cl.I Div.1 Gr.A-D, zone 1, 2	T													X																								
	CSA IS Cl.I Div.1 Gr.A-D, zone 0, 1, 2	U		X	X	X	X							X	X																								
	CSA XP Cl.I Div.1 Gr.A-D, zone 1, 2	V											X																										
	Special version	Y																																					
	ATEX II 1/2G Ex ia IIC T6	1																														X	X	X	X	X			X
	ATEX II 1/2G Ex em (ia) IIC T6	3																																				X	
	ATEX II 1/2G Ex d (ia) IIC T6	4																																			X		
	ATEX II 1/2G Ex ia IIC T6, WHG	6	X																													X	X	X	X	X			X
	ATEX II 1/2G Ex em (ia) IIC T6, WHG	8	X																																			X	
60 Output; Operation:	4-20mA SIL HART, 4-line display VU331 [2]	A	X			X	X			X	X		X		X	X		X	X	X		X	X	X	X			X	X	X	X		X		X		X	X	X
	4-20mA SIL HART, w/o display [3]	B	X			X	X			X	X		X		X	X		X	X	X		X	X	X	X			X	X	X	X		X		X		X	X	X
	PROFIBUS PA, 4-line display VU331 [2]	C	X	X	X			X	X			X	X	X		X	X		X	X	X	X				X	X	X	X		X	X	X		X		X	X	X
	PROFIBUS PA, w/o display [3]	D	X	X	X			X	X			X	X	X		X	X		X	X	X	X				X	X	X	X		X	X	X		X		X	X	X
	FOUNDATION Fieldbus, 4-line display [2]	E		X	X			X	X			X	X	X		X	X		X	X	X	X				X	X	X	X		X	X	X		X		X	X	X
	FOUNDATION Fieldbus, w/o display [3]	F		X	X			X	X			X	X	X		X	X		X	X	X	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	X		X				X	X	X	X				X			X
	PROFIBUS PA, prepared for FHX40	L	X			X			X			X		X			X		X	X	X	X				X	X	X	X		X	X			X		X		
	FOUNDATION Fieldbus, prepared for FHX40	M				X			X			X		X			X		X	X	X	X				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 [4]	C											X			X						X						X										X	X
	T12 Alu, coated IP65 NEMA4X + OVP [4,5]	D		X		X		X		X		X							X	X	X		X	X		X				X	X	X	X					

1) German WHG only in combination with certificate ZE244F/00/EN.
2) Envelope curve display on site.
3) Via communication.
4) Separate conn. compartment.

10.1.10 Supplementary Documentation

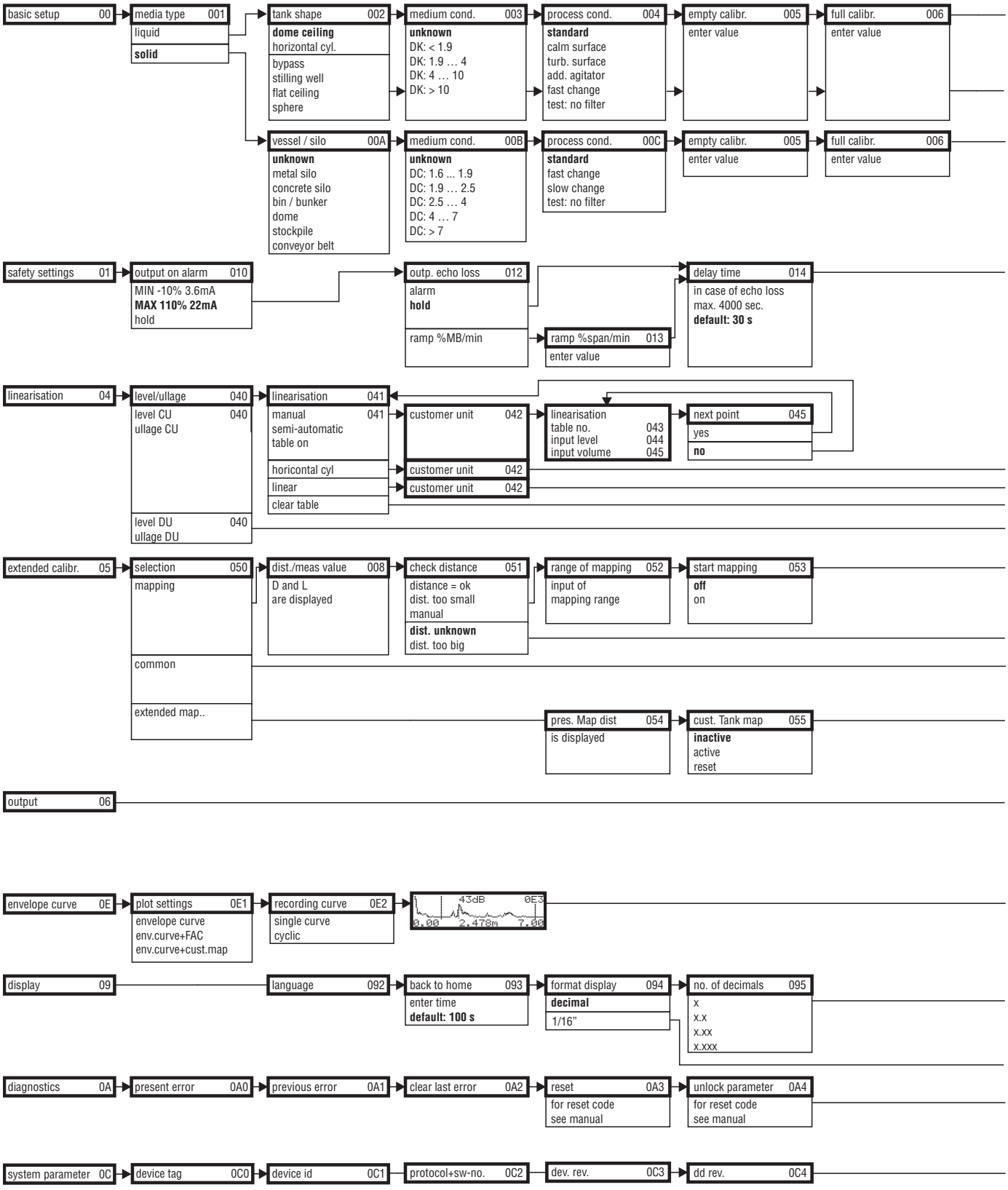
Supplementary Documentation

This supplementary documentation can be found on our product pages on www.endress.com.

- Technical Information (TI345F/00/EN)
- Operating Instructions "Description of instrument functions" (BA291F/00/EN)
- Safety Manual "Functional Safety Manual" (SD150F/00/EN)
- Certificate "German WHG" (ZE244F/00/DE)
- Brief operating instructions (KA1008F/00/EN)

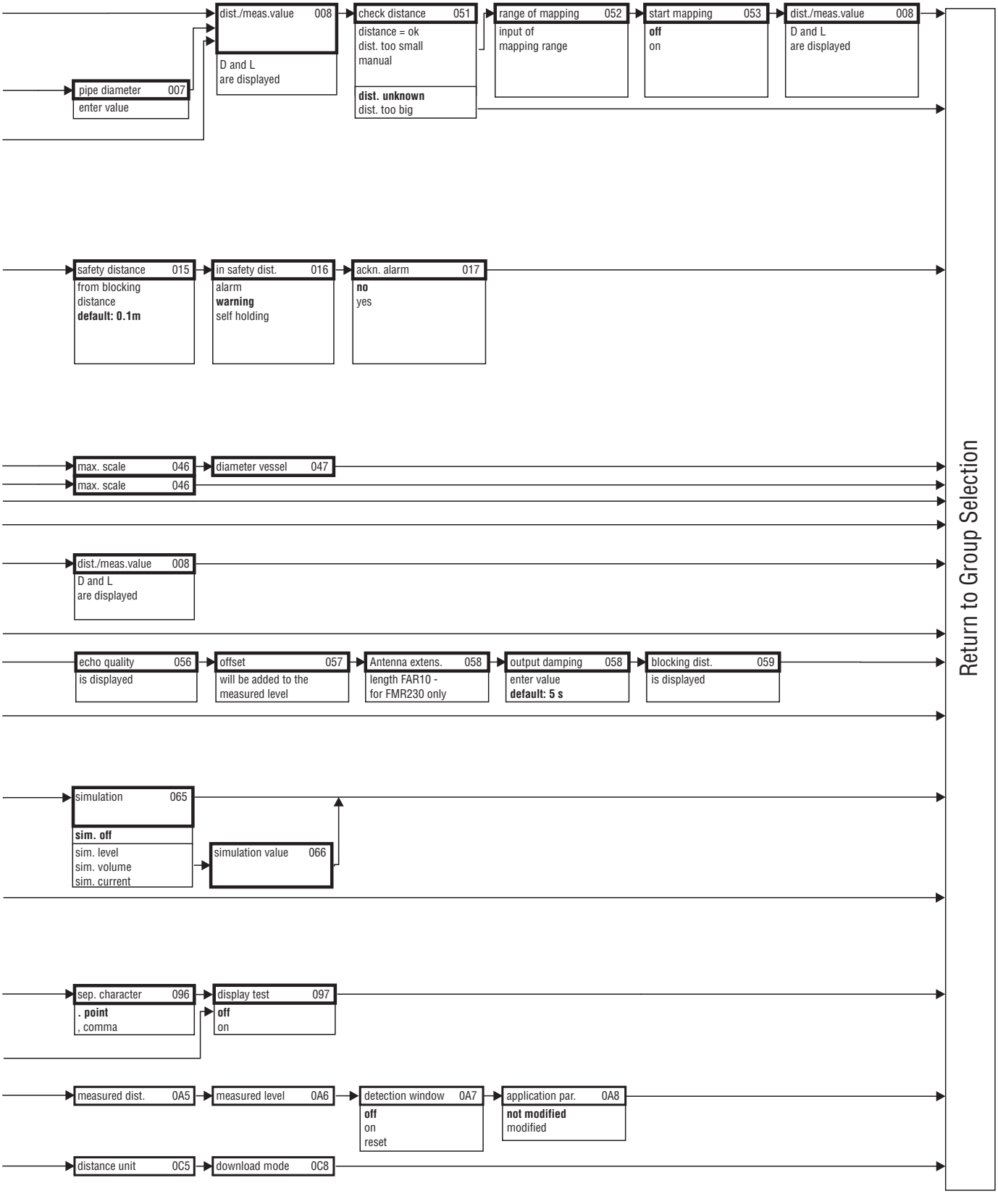
11 Appendix

11.1 Operating menu FOUNDATION Fieldbus



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

L00-FMR250xx-19-00-01-en-038



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

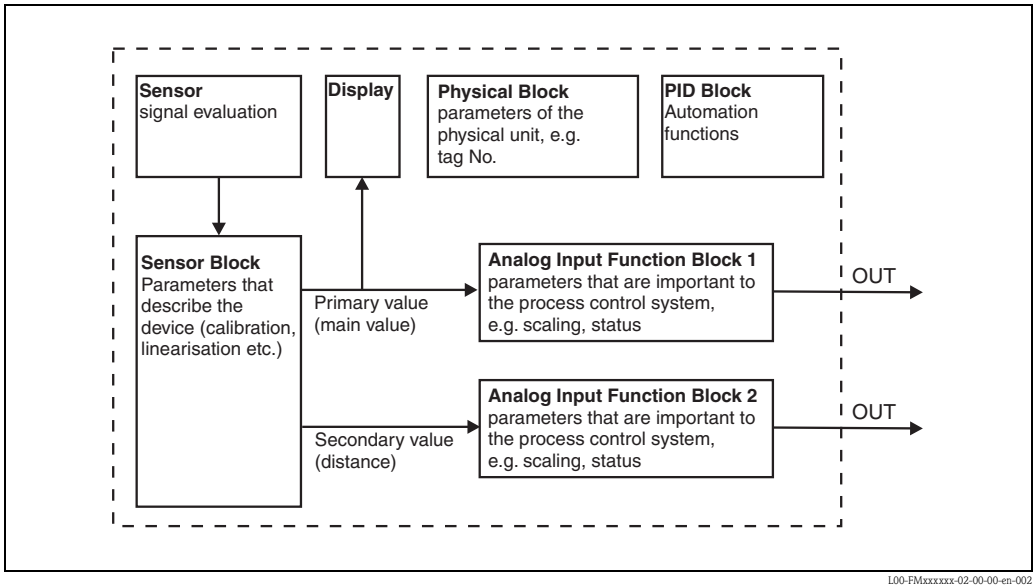
11.2 Block model of the Micropilot M

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.



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 is described, → 47.

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 (→ 51) 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 [6].

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

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.

11.6 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 [7)].

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".

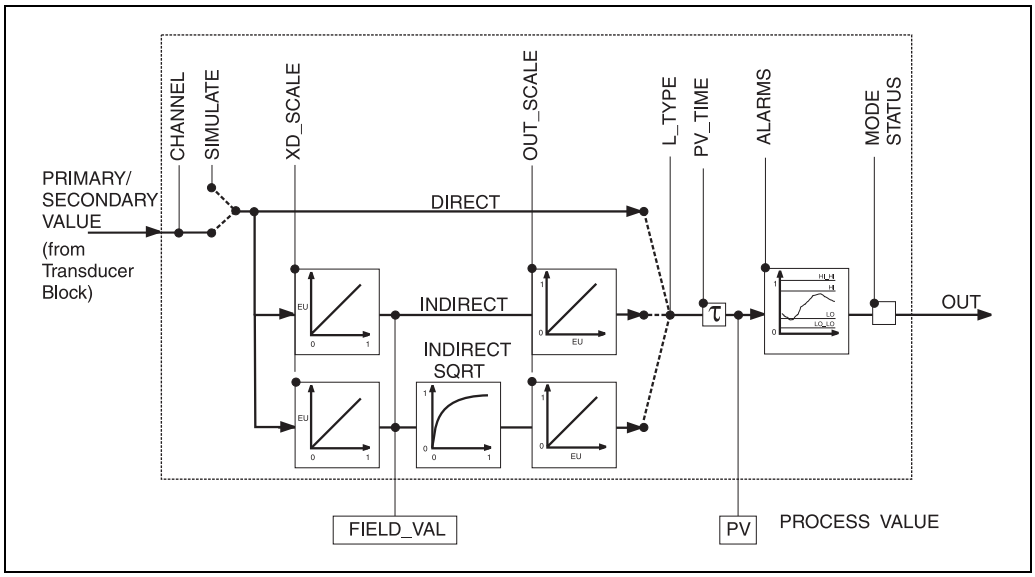
11.6.4 Instrument specific parameters

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

7) 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.



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 is as follows:

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

The L_TYPE parameter influences the signal conversion:
- Direct:

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

- Indirect:

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

- Indirect square root:

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

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

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Endress+Hauser

People for Process Automation

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*)

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